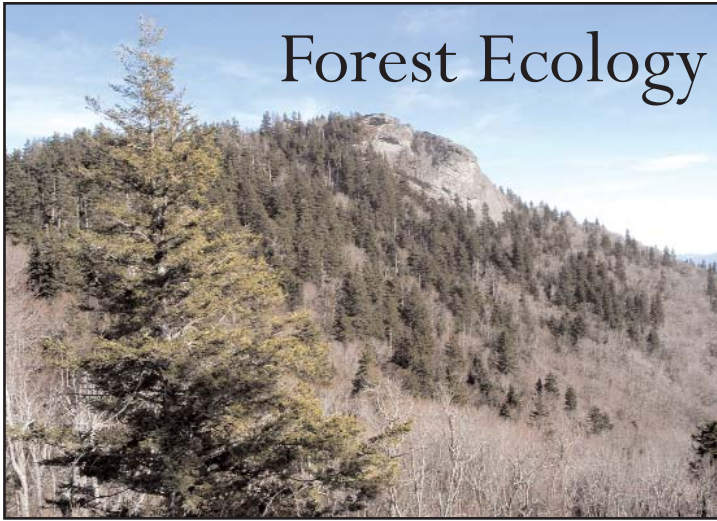


Forest Ecology of the Blue Ridge



A spruce - fir forest on the Blue Ridge Parkway

When people get together to talk about different geographic areas and the plants that grow there they need a way to describe what they are seeing. Taxonomists, botanists, biologists and people just interested in plants and where they grow and why have developed a vocabulary that enables them to do this in an organized manner. Although much conversation is centered around the finer points of what plant fits where and where one area starts and the other one ends, this system allows a certain area or group of plants to be described in just a few words.

The three large provinces of the southern Appalachians are described in geological terms. These descriptions are based on ancient events that formed these mountain areas.

Within these provinces, specific areas are described as forest types, natural communities or plant communities. All of these terms are an effort simply to describe what the area looks like - plants and features that are dominant in a certain area are generally used to describe that area.

A **forest type** is a term generally used by the USFS and mainly describes trees growing in a closed canopy type forest although it may also refer to shrubs and some herbaceous plants. A **plant community** generally refers to the plants that are dominant in a certain area. The term **natural community** is a multi-dimensional approach that differs from a plant community in that it describes not just dominant plants but also physiognomy, animals and other organisms, topography, substrates, hydrology and soil characteristics.

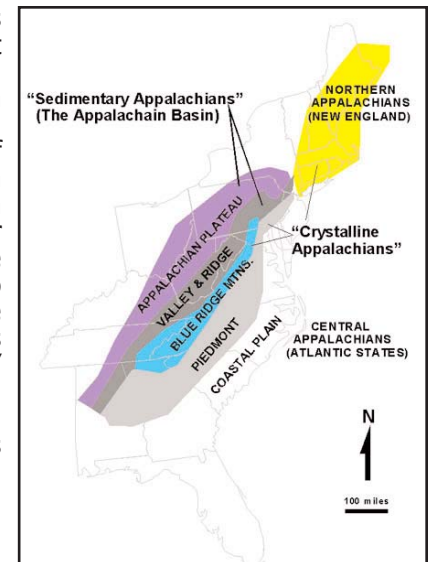
The Southern Appalachian Region includes the mountainous areas of Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, and Alabama, where elevations generally exceed 1000 ft. above sea level.

This region is described as three separate provinces: the **Blue Ridge**, the **Ridge and Valley** and the **Cumberland Plateau**.

The Southern Highlands Reserve plant collection policy refers to "plants of the Blue Ridge Mountains with an emphasis on high elevation communities".

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The Blue Ridge is the easternmost range and escarpment of the Southern Appalachians, and the only province of the three found in North and South Carolina. Farther east lies the Piedmont province, to the west lie the mountain provinces of "Ridge and Valley" and "Cumberland Plateau". As opposed to The Blue Ridge's acidic soils which support forests leaning heavily to oak, birch, hemlock, and shrubs of the Ericaceae family, these western provinces exhibit mesophytic forests lying over rock substrates predominately of limestone or sandstone.



Southern Appalachian Provinces

Elevations in the Blue Ridge range from about 1000 ft. to a maximum of 6684 ft. At elevations of about 4000 ft., northern hardwood forests prevail, giving way to spruce-fir forests at about 5500 ft. Considerable variation in forest composition occurs, however, due to slope aspect and steepness of topography.

At lower and middle elevations, mixed hardwood forests are typical in moist sites such as coves, sheltered slopes, and along streams and river bottoms. Oaks tend to become more dominant with increases in soil acidity, decreases in soil moisture, or on more exposed sites. Oak-pine or pine forests often grow on fire-susceptible sites, or on previously disturbed areas.

Following the elimination of the American chestnut (*Castanea dentata*) from the region's forests, and due to other man-caused disturbances, almost all of our present-day forests are in some state of transition or stage of succession. Some major forest communities of the Blue Ridge are as follows:

Oak-dominated forests

Northern red oak forest: at middle to high elevations (1275-2000 meters or 3500-5500 ft.), on exposed slopes and mountain ridgetops. The dominant canopy member is northern red oak (*Quercus rubra* var. *borealis*). Higher stands may have a grassy herb layer with few shrubs. Lower sites may have dense shrub layers of ericaceous species. Ice storms are a frequent disturbance in these forests, and in



This autumn photo at Linville Gorge shows oak forests and pine-oak forests on the ridges with mixed hardwoods on the slopes and coves. There is a stand of hemlock on the shady exposure near the foot of the mountain.

some sites the forest can appear dwarfed or contorted. Beyond the southern range of spruce-fir forests, these oak stands often extend to the highest peaks.

Chestnut oak forest: on ridge tops and steep, rocky, acidic slopes up to about 1458 meters (4000ft.). The chestnut oak (*Quercus montana*) or scarlet oak (*Q. coccinea*) are the most common canopy trees. This forest occupies much of the region's steep, sunny slopes and dry ridges at low and middle elevations. A dense ericaceous shrub layer is commonly present.

White oak forest: on broad ridges or flats between 1275-1458 meters (3500-4000 ft.), in soils that may be circumneutral or where other factors favor the dominance of white oak (*Q. alba*) in the canopy. This oak is overall most commonly associated with the next forest community.

Mixed oak forest: at lower and middle elevations. This forest is also known as the montane oak-hickory forest, but the hickory component may not be reliably dominant. This is the common forest of white and red oaks (*Q. alba*, *Q. coccinea*, *Q. velutina*, and some *Q. montana*, *Q. rubra*), frequently with red maple (*Acer rubrum*), hickories (*Carya*), blackgum (*Nyssa sylvatica*), pines (*Pinus*), and sourwood (*Oxydendrum arboreum*) associated.

Pine-oak-heath forest: on low peaks, knobs, or steep, exposed slopes. These are xeric (dry) sites very susceptible to fire, with a canopy of yellow pines (*Pinus rigida*, *P. pungens*, *P. echinata*) and oak, especially *Q. coccinea*. The understory is usually heavy in ericads (*Gaylussacia*, *Vaccinium*, *Kalmia*, and occasionally *Rhododendron minus*).

Mixed hardwood forests

Northern hardwood forest: on high elevation slopes and coves, generally above 1450 meters (4000 ft.). Canopy species are predominately birch (*Betula allegheniensis*), beech (*Fagus grandifolia*), buckeye (*Aesculus flava*), basswood (*Tilia heterophylla*), maple (*Acer rubrum*, *A. saccharum*), cherry (*Prunus serotina*), ash (*Fraxinus americana*), and red spruce (*Picea rubens*). This is a moist, diverse forest quite similar to many cove forests of middle elevations, but usually with more abundance of boreal forest species, and transitions to the spruce-fir forest zone. One variant is the "beech gap", where clonal stands of beech develop in gaps or saddles of high ridges. These beech gaps are beset by severe winds and extreme weather, and may appear dwarfed.

Rich cove forest: on sheltered slopes and coves of lower to middle elevations, where soils are moist, fertile, and circumneutral or nearly so. The diverse canopy typically includes ash (*Fraxinus americana*), basswood (*Tilia heterophylla*), sugar maple (*Acer saccharum*), buckeye (*Aesculus flava*), magnolia (*Magnolia acuminata*, *M. fraseri*), tuliptree (*Liriodendron tulipifera*), hickory (*Carya cordiformis*, *C. glabra*), oak (*Quercus rubra*), beech (*Fagus grandifolia*), cherry (*Prunus serotina*), and birch (*Betula lenta*). Many other species may also occur, depending on factors of elevation, soils, and prior disturbance



A photo of a rich cove forest - the yellows are poplar, hickory, maple and basswood.

history. The shrub and herbaceous layer is also diverse, but generally does not include large quantities of ericads.

Acidic cove forest: on sheltered slopes and coves, gorges and ravines, with acidic soils. The canopy is heavy in oak (*Q. rubra*, *Q. montana*), tuliptree (*Liriodendron*), birch (*B. lenta*), red maple (*Acer rubrum*), hemlock (*Tsuga canadensis*), silverbell (*Halesia tetraptera*), and beech (*Fagus*). The shrub layer is often dense, of rhododendron (*R. maximum*) or dog-hobble (*Leucothoe fontanesiana*). The herbaceous layer is usually not as diverse as in rich cove forests.

Alluvial forest: on low elevation bottomlands subject to occasional flooding. The canopy often contains some mesophytic trees typical of cove forests, but more characteristic is the abundance of sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), boxelder (*Acer negundo*), and green ash (*Fraxinus pennsylvanica*). Black willow (*Salix nigra*) occurs where there is ample sunlight. The shrub layer often has hazelnut (*Corylus americana*), spicebush (*Lindera benzoin*), or cane (*Arundinaria gigantea*). Exotic plants such as privets (*Ligustrum*) can be severe invasives.

Basic mesic forest: on low elevation slopes and coves over limestone, dolomite, or marble. Very rare in the Blue Ridge, this circumneutral to calcareous soil type supports a forest of elm (*Ulmus americana*, *U. rubra*, *U. alata*), hackberry (*Celtis occidentalis*), walnut (*Juglans nigra*), sugar maple (*A. saccharum*), ash (*F. americana*), and chinquapin oak (*Q. muhlenbergii*). These trees are much more characteristic of forests west of the Blue Ridge, in areas of limestone substrates.

Conifer-dominated forests

Spruce-fir forests: generally over 2000 meters (5500 ft.) elevation, with the red spruce (*Picea rubens*) dominating. Some northern hardwood species are also present, and mountain-ash (*Sorbus americana*), mountain maple (*Acer spicatum*), serviceberry (*Amelanchier laevis*), and yellow birch (*Betula allegheniensis*) being especially abundant. This forest has now generally replaced some of the original Fraser fir forest, which was prevalent above 2200 meters (6000 ft.) elevation. The Fraser fir (*Abies fraseri*) formed nearly pure stands on the highest peaks in the Blue Ridge, but due to an attack by the balsam woolly adelgid (an insect) in the 1970's, virtually all of these forests have been destroyed or altered. Air pollution is suspected as a causal agent of declining health of these forests, as well. Soils are acidic and moist- average annual precipitation is 80-90 inches.



Near Richland Balsam in spring - a spruce-fir forest on top with remnants of a dead fir forest on the very tip still visible in this 1984 photo. Below the spruce-fir is a northern hardwood forest with some northern red oak forest (the pinkish area) which will leaf out later.

Hemlock forests: on slopes and coves where soils are acidic, grove-like stands of eastern hemlock (*Tsuga canadensis*) may occur. The Carolina hemlock (*Tsuga caroliniana*) is endemic to the Blue Ridge, but occurs less often in groves; more often scattered on slopes, bluffs, and gorges.

Pine-oak forests: these are potentially oak-dominated forest, but through incidence of fire or other disturbance the hardwood component has been curtailed and the conifers dominate. Seedling regeneration of yellow pines (*P. echinata*, *P. rigida*, *P. pungens*, *P. virginiana*) are improved following disturbances to hardwood canopies. The eastern white pine (*P. strobus*) is more tolerant of shade in its regeneration and growth, and may be found in high frequency on some sites in mixture with mature hardwoods. Pine-dominated forests of lower elevations are usually due to reforestation efforts, or disturbances that favor the development of pines.

Thinly-forested or non-forested plant communities

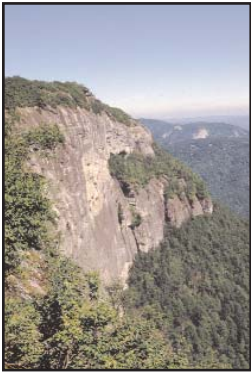
Grass balds: on gentle slopes, domes and ridgetops, in high elevations. This is a successional phase community, with grasses, sedges, and forbs being the principal members. Trees or shrubs commonly occur in patches, or are scattered throughout. Ultimately, woody plants will regain the sites if some form of management does not favor an arrest of succession. The origin of balds are not entirely clear. Storms, fire, and grazing have all been suggested. Early white settlers utilized some balds for livestock grazing, so these areas were present in some extent prior to settlement.



Two views of the grassy bald at Black Balsam on the Blue Ridge Parkway

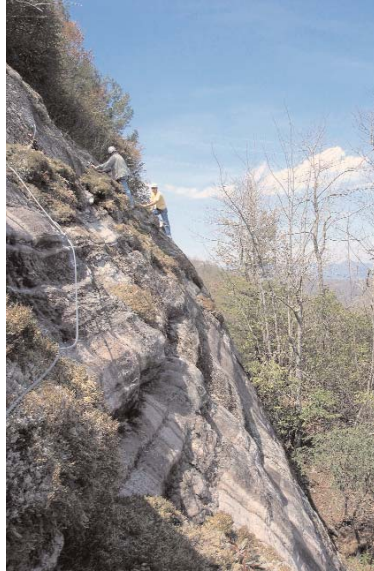
Heath or shrub balds: On exposed sharp ridges, steep slopes and peaks of elevations mostly above 1458 meters (4000 ft.), the heath balds may form a continuous and tangled cover so thick that tree establishment is excluded. These are also known as "slicks" or "laurel hells", and are composed mostly of Catawba rhododendron (*R. catawbiense*), Carolina rhododendron (*R. minus*), or Mountain-laurel (*Kalmia latifolia*). Rosebay rhododendron (*R. maximum*) may be a component at lower elevational limits. Where the heath shrubs are not so continuous as to form a "slick", the shrub balds may include other species of ericaceous shrubs and trees. These open shrub balds are sometimes the next successional step after grass balds are protected from fire or grazing.

Boulderfields: on steep slopes at the heads of coves or sides of ridges or peaks, usually in high elevations. Relicts of periglacial action, these rockpiles are essentially talus slopes with little soil available for normal tree growth, often covered by mosses and ferns on sheltered aspects, and lichens on drier slopes. Canopies are mostly of yellow birch (*Betula allegheniensis*), basswood (*Tilia heterophylla*), buckeye (*Aesculus flava*), or mountain maple (*Acer spicatum*).



Whiteside Cove

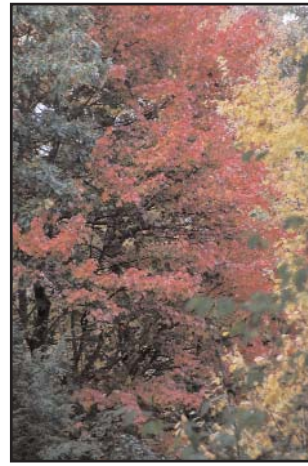
Rock outcrops: on high peaks, steep mountainsides and gorge walls, and occasionally flat expanses at lower elevations. The type of vegetation varies greatly as to the type of rock substrate and condition of its surface, as well as elevation. Some outcrops support many of the region's rare and endangered plant species.



Southern Highlands Reserve

Bogs: at all elevations, extensive wetlands are not common in the Blue Ridge.

Southern Appalachian bogs are generally not forested, and are over 1 acre in size, with sphagnum-dominated soil cover. Several of the region's rare and endangered plants are found in bogs, since this habitat is so scarce. The more forested wetlands are called "Swamp forests" or a "Bog forest complex", as these more represent a forest with some boggy sites beneath. Canopy species differs with elevation; red spruce (*Picea rubens*) at higher sites, red maple (*Acer rubrum*) at middle and lower elevations. Tangles of shrubs such as alder (*Alnus serrulata*), Rhododendron (*R. maximum*), dog-hobble (*Leucothoe fontanesiana*), and *Vaccinium* may be common, especially as deposition of leaves and other organic matter contributes to soil building and the true bogs undergo succession to a more woody type of cover.



area to another. The most common oak in the canopy is northern red oak. Additionally, red maple is overall such a conspicuous associate canopy member that the descriptive term "oak-maple" forest is probably more applicable to the forests of the Reserve, as a whole. Other common canopy associates are Fraser magnolia, blackgum, black locust, black cherry, and eastern hemlock.

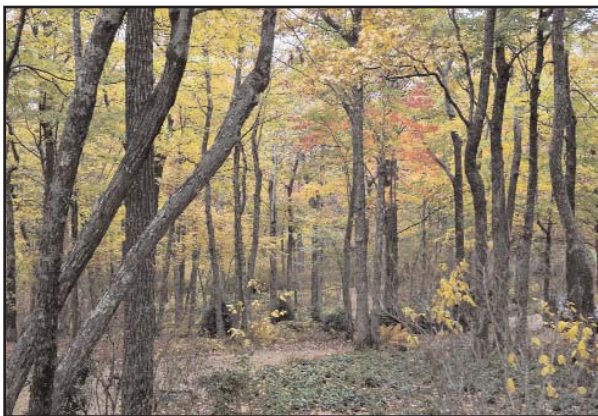
Rock outcrops are communities not characterized by any forest description, since trees are usually absent. Shrubs and herbaceous species grow where there is sufficient soil, but outcrop communities are generally based on elevation. The high elevation rock outcrops of the Reserve harbor diverse plant species not able to survive the more shaded forest understories. Rock types here are schists and metamorphosed granite, offering little buffering of soils overlying these rocks-keeping all the pH situations acidic in the vicinity.



Additionally, when streams cascade over rock outcrops, Spray-Cliff communities are seen. These are miniature communities of plant growth, kept wet by the splashing and drifting mists of falling water. The rarest plants of the Reserve can be found here, as they can survive nowhere else but in these protected, static environments. Plants such as sundew, grass-of-parnassus, and minute tropical ferns grow on rock surfaces, soil pockets, and grottos within the spray-cliff community.



VARIATIONS OF PLANT COMMUNITIES FOUND AT THE SOUTHERN HIGHLANDS RESERVE



The prevailing forest cover of the Southern Highland Reserve is oak forest. Northern red oak, chestnut oak, scarlet oak, and white oak are all represented, although they vary greatly in abundance from one