

HIGH ELEVATION WHITE OAK FOREST

Concept: High Elevation White Oak Forests are strongly dominated by *Quercus alba* and occur on exposed ridges at higher elevations, without the mixture of canopy species typical of Montane Oak–Hickory Forest.

Distinguishing Features: The High Elevation White Oak Forest type is distinguished from all other high elevation forest types by having *Quercus alba* naturally making up 75% or more of the canopy cover.

Synonyms: *Quercus alba* / *Kalmia latifolia* Forest (CEGL007295).

Ecological Systems: Central and Southern Appalachian Montane Oak Forest (CES202.596).

Sites: High Elevation White Oak Forest occurs on broad ridges, flats, and upper slopes, generally, perhaps exclusively, above 4000 feet.

Soils: Soils associated with this community are not well understood. Baranski (1975) suggests they are relatively deep, and that *Quercus montana* replaces *Quercus alba* on rocky soils. However, some known occurrences seem to have thin soils near rock outcrops, and others are mapped on soil maps as rocky. The most frequently mapped series is Porters, a Humic Dystrudept.

Hydrology: Sites are well-drained and relatively dry due to exposure to wind and convex topography, but they are cooler and presumably less stressed than comparable sites at lower elevations.

Vegetation: This forest is strongly dominated by *Quercus alba*. Sometimes no other canopy species is present, sometimes *Carya glabra* may be abundant, and *Quercus rubra*, *Quercus coccinea*, or *Quercus velutina* may sometimes be present as a significant minority. The trees generally are stunted and relatively short. There may be little understory, but unusually dense *Castanea dentata* sprouts have sometimes been noted, and *Nyssa sylvatica*, *Oxydendrum arboreum*, *Cornus florida*, or *Robinia pseudo-acacia* may be present. The shrub layer is usually dense, dominated by *Kalmia latifolia* or occasionally *Gaylussacia ursina*. Herbs are sparse where shrubs are dense, and usually consist of widespread species such as *Athyrium asplenoides*. One example has a well-developed herb layer dominated by *Euphorbia purpurea*, with a number of species characteristic of rich sites.

Range and Abundance: Ranked G2Q. This community appears very rare in North Carolina, but uncertainty about identification of several examples makes its abundance uncertain. All or almost all examples are south of Asheville, most in the high rainfall area near the Georgia and South Carolina border. The association is attributed to South Carolina, Georgia, and Tennessee, but this too may be confused by issues of circumscription.

Associations and Patterns: High Elevation White Oak Forest usually occurs as fairly small patches, most well under 100 acres. They are often associated with High Elevation Red Oak Forest. At least a couple are associated with High Elevation Granitic Domes.

Variation: Substantial variation exists in known examples, but the community is not well enough understood to define variants. The example on Riley Knob, on amphibolite substrate and with a rich herb layer, probably warrants a distinct variant.

Dynamics: The high elevation exposed position of this community makes it particularly subject to damage by wind, lightning, and ice. Barnaski (1975) noted that trees in these areas often had small yellowish leaves, gnarled shape, and numerous epicormic branches, and attributed this to frost damage. Fire dynamics are probably similar to those of High Elevation Red Oak Forest.

Comments: This remains one of the most problematic community types, with few known well-developed examples and uncertainty as to how distinct it is from other types. Variation in circumscription by different users have led to some confusion of the concept and uncertainty about plot assignment. Some of the few descriptive reports have only limited description of this community.

The concept of a high elevation white oak forest owes much to Whittaker's (1956) study of the Great Smoky Mountains, where he reported a distinct break between low elevation *Quercus alba* forest and those of high elevations. He suggested there were actually two distinct populations or ecotypes of the species. He apparently was not alone. Baranski (1975) quotes a 1952 letter by W.H. Camp to H.J. Oosting, talking of the existence of two ecotypes separated from each other by at least 1500 feet in elevation. Whittaker (1956) described a community with *Quercus alba* strongly dominant, though with *Quercus rubra* usually present, with an open canopy and small trees, above 4500 feet. Carter et al., (2000) too, in their analysis of old-growth plots in the high rainfall area around Highlands, found *Quercus alba* indicative of higher elevations (above 4000 feet) in their data set of old-growth forests, along with *Castanea dentata* and *Gaylussacia ursina*. *Quercus rubra*, in contrast, was indicative of mid elevations, below 4000 feet.

Baranski (1975) addressed the question of ecotypes, demonstrating that *Quercus alba* as a species ranges continuously in elevation, without a break elsewhere in North Carolina, and even on the North Carolina side of the Great Smoky Mountains. He did confirm that Whittaker's primary study area, in the central and western Tennessee side, lacks the species at mid elevations. Baranski's focus was on the species and its overall abundance in broad areas, and he did not always note how it fit into specific communities. But he did note that above 4000 feet it became more prominent and that open flat ridgetops and open slopes could support almost pure *Quercus alba* stands. These trees were small and stunted looking and had smaller leaves and acorns, which he attributed to weather conditions rather than ecotypic variation.

Whittaker's concept of a montane white oak forest was adopted by a number of observers. The concept was expanded to accommodate lower elevations and more mixed communities that were found in North Carolina. The recognition of the Montane Oak–Hickory Forest with the 3rd Approximation led to narrowing the montane white oak forest concept to something more like its original intent. It thus is narrowly defined here, limited to elevations above 4000 feet and to forests strongly dominated by *Quercus alba*.

Since Montane Oak–Hickory Forests, with mixed canopy composition, can also range to similarly high elevations, occur in similar sites, and overlap in the range of dominants in lower strata, further

study is needed into how distinct High Elevation White Oak Forest is, even with a narrow definition. It is retained at present because some examples that seem to fit it well can be found. Other records are described in ways that make it hard to tell which community they represent. Further investigation is particularly needed here.

Rare species: Vascular plants – *Euphorbia purpurea*, *Rhododendron vaseyi*.

References:

Baranski, M.J. 1975. An analysis of variation within white oak (*Quercus alba* L.). NC Agricultural Experiment Station Tech. Bul. No. 236.

Carter, R.E., Jr., N.J. Myers, V.B. Shelburne, and S.M. Jones. 2000. Ecological land classification of the high rainfall belt of the Southern Appalachian Mountains. *Castanea* 65: 258-272.

Whittaker, R.H. 1956. Vegetation of the Great Smoky Mountains. *Ecol. Monogr.* 26: 1-80.