

## NORTHERN HARDWOOD FOREST (BEECH GAP SUBTYPE)

**Concept:** The Beech Gap Subtype encompasses forests strongly dominated by *Fagus grandifolia* at very high elevation, usually as small areas around ridge top gaps surrounded by spruce–fir forest, but sometimes on open peaks in areas that lack spruce and fir.

**Distinguishing Features:** The Beech Gap subtype is distinguished from other high elevation forests by having a canopy strongly dominated by *Fagus grandifolia*, with *Aesculus flava* being the only other common species. The trees are generally stunted, sometimes strikingly so, and the overall floristic composition is low in diversity. The herb layer may be either a lawn of *Carex pensylvanica* or a moderate to dense bed of forbs. The Beech Variant of Northern Hardwood Forest (Typic Subtype) is generally less strongly dominated by *Fagus*, has larger tree stature, and is somewhat more diverse. The Beech Gap Subtype is a narrowly defined extreme community with distinctive structure and appearance.

**Synonyms:** *Fagus grandifolia* / *Carex pensylvanica* - *Ageratina altissima* var. *roanensis* Forest (CEGL006130).

Ecological Systems: Southern Appalachian Northern Hardwood Forest (CES202.029).

**Sites:** The Beech Gap Subtype characteristically occurs in south-facing ridge top gaps or on exposed peaks and open ridges in mountain ranges that lack spruce and fir. Most examples are above 5000 feet in elevation, but a few occurrences attributed to the subtype occur at to 4000 feet or lower. Russell (1953) noted that Great Smoky Mountains beech gaps had more several microclimate, with larger temperature extremes, than surrounding forests.

**Soils:** The Beech Gap Subtype likely has soils similar to those of the Typic Subtype, and is generally mapped as the same series of Typic Haplumbrepts, Humic Dystrudepts, and Typic Humadepts. Russell (1953) noted that beech gaps had less litter accumulation and high pH than surrounding spruce-fir forests. This probably results from the lack of coniferous litter rather than being a cause of vegetation differences.

**Hydrology:** Sites are mesic due to cool temperatures and high rainfall at their high elevations. They presumably are well drained but those on concave slopes and in gaps may be less so than the other subtypes of Northern Hardwood Forest.

**Vegetation:** Beech Gap Subtype forests have short canopies, often gnarled and appearing stunted. *Fagus grandifolia* generally strongly dominates, but small numbers of *Aesculus flava*, *Betula alleghaniensis*, *Picea rubens*, or *Acer saccharum* may be present. These forests generally have limited understory cover, which most often includes *Acer spicatum* and as well as species from the canopy. Shrubs generally are sparse, with saplings of *Fagus* and other trees typically most abundant in the stratum. If the canopy has been disturbed, *Rubus alleghaniensis* or *Rubus canadensis* may be abundant. The herb layer generally is dense. *Carex pensylvanica* characteristically strongly dominates. Other frequent species reported by Russell (1953) include *Laportea canadensis*, *Poa alsodes*, *Athyrium asplenioides*, *Carex debilis*, other *Carex* spp., *Stellaria pubera*, and *Trillium erectum*. Additional herbs highly constant or frequent in CVS plot data include *Arisaema triphyllum*, *Solidago curtisii*, *Dryopteris intermedia*, *Eurybia chlorolepis*,

*Oclemena acuminata*, *Angelica triquinata*, *Maianthemum racemosum*, *Maianthemum canadense*, *Smilax herbacea*, and *Epifagus virginiana*.

**Range and Abundance:** Ranked G1. Examples are scattered in the higher mountains. The equivalent association also occurs in Tennessee and possibly in Georgia.

**Associations and Patterns:** The Beech Gap Subtype may occur either as small patch community surrounded by spruce-fir forest or as a large patch community occupying the tops of mountains and grading downslope to other subtypes of Northern Hardwood Forest or to High Elevation Red Oak Forest.

**Variation:** Two variants are recognized, based on the two characteristic landscape patterns more than vegetation, and warranting further study of differences:

1. Gap Variant occurs in ridge top gaps surrounded by spruce–fir forest. This is the original concept of beech gap, as described by Russell (1953) and Whittaker (1956).
2. Ridge Variant occurs on peaks and ridge top, generally in areas without spruce–fir forest. It may occupy a larger range of environments because of the lack of competition with spruce and fir.

**Dynamics:** These communities are apparently stable climaxes under current climatic conditions. Trees may be quite old, although small. The forest may be periodically damaged by severe wind or ice storms. These sites are marginal environments for the occurrence of the dominant tree species, and growth and reproduction are relatively slow. Most reproduction may be by clonal sprouts rather than seeds. In the last decade or two, beech bark disease has killed patches of *Fagus* canopy. Such stands appear to be regenerating from root sprouts, but the long term fate of these areas is uncertain.

The question of why these high elevation sites are not occupied by spruce and fir has been of interest to ecologists. Pavlovic (1981), sampling across a red spruce – beech gap ecotone, found a relatively sharp boundary and found that the Beech Gap received spruce and birch seed rain. Russell (1953) concluded that cold and high winds were responsible for the occurrence of Beech Gaps and that their sites experienced more extreme temperature fluctuations than surrounding sites. Fuller (1977) suggested several other factors, including allelopathic effects of beech litter on spruce and seed predation under beech litter.

**Comments:** The concept of the beech gap community appears to have originated in the Great Smoky Mountains and to have been limited to what is here called the Gap Variant. As with many narrowly defined, extreme communities, there is a risk of losing sight of a distinctive phenomenon by broadening its concept. The addition of what is here called the Ridge Variant recognizes another extreme community but one that is more difficult to distinguish from other Northern Hardwood Forests. Further investigation is needed into whether these two variants belong together.

A separate forb-dominated Beech Gap community was recognized in earlier versions of the 4<sup>th</sup> approximation guide, as well as in the NVC. This distinction has been dropped, as most examples

appear to be mixes of sedges and forbs. The former association, *Fagus grandifolia* / *Ageratina altissima* var. *roanensis* Forest (CEGL006246), has been lumped into this one.

**Rare species:** Vascular – *Lilium grayi*, *Platanthera grandiflora*, *Spiranthes ochroleuca*.

**References:**

Fuller, F.D. 1977. Why does spruce not invade the high elevation beech forests of the Great Smoky Mountains? M.S. Thesis, University of Tennessee, Knoxville.

Pavlovic, N.B. 1981. An examination of the seed rain and seed bank for evidence of seed exchange between a beech gap and a spruce forest in the Great Smoky Mountains. M.S. Thesis, University of Tennessee, Knoxville

Russell, N.H. 1953. The beech gaps of the Great Smoky Mountains. *Ecology* 34: 366-374.

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