

NORTHERN HARDWOOD FOREST (RICH SUBTYPE)

Concept: Northern Hardwood Forests are the mesophytic forests of higher elevations, occurring on exposed or somewhat sheltered sites, and generally dominated by *Betula alleghaniensis*, *Fagus grandifolia*, *Acer saccharum*, or *Aesculus flava*. The Rich Subtype encompasses the rare examples on mafic or calcareous rock substrates, which contain flora of rich soils, including many species shared with Rich Cove Forest.

Distinguishing Features: Northern Hardwood Forests may be distinguished from High Elevation Red Oak Forests, Red Spruce, and Red Spruce–Fraser Fir Forests by the predominance of mesophytic hardwood species over *Quercus rubra*, *Picea rubens*, or *Abies fraseri*. High Elevation Birch Boulderfield Forest also is dominated by mesophytic hardwoods but has over 90% cover of boulders, with substantial open space beneath them. The ground cover vegetation in boulderfields is dominated by plants rooted on rock and shallow soil pockets rather than in deep soil. Though Northern Hardwood Forest sites may be very rocky, most plants are rooted in deep soil and the rocks do not visibly change the nature of the vegetation.

The Rich Subtype is distinguished from the other subtypes of Northern Hardwood Forest by having several canopy and herbaceous species indicative of richer soil conditions. *Fraxinus americana*, *Tilia americana* var. *heterophylla*, *Prunus serotina*, *Carya ovata*, and *Magnolia acuminata* are typically indicative. Herbs characteristic of the Rich Subtype and not of other subtypes include *Actaea racemosa*, *Actataea pachypoda*, *Caulophyllum thalictroides*, *Collinsonia canadensis*, *Osmorhiza claytonia*, *Hydrophyllum virginianum*, and a number of other species.

The boundary between the Rich Cove Forest and Northern Hardwood types is particularly difficult to define for the Rich Subtype. The overlap of species is much greater than for other subtypes. Some of the species that are confined to lower elevations on more typical acidic substrates, such as *Magnolia acuminata* and *Ostrya virginiana*, extend to higher elevation in the Rich Subtype. *Liriodendron tulipifera* is confined to Rich Cove Forest, while the presence of high elevation species such as *Picea rubens*, *Viburnum lantanioides*, or *Sambucus racemosa* var. *pubens* is indicative of Northern Hardwood Forest. Further analysis is needed to clarify additional indicators to distinguish these communities. The transition tends to occur around 4000 feet elevation, but may be shifted uphill or downhill in response to slope aspect, exposure, and latitude.

Synonyms: *Aesculus flava* - *Betula alleghaniensis* - *Acer saccharum* / *Acer spicatum* / *Caulophyllum thalictroides* - *Actaea podocarpa* Forest (CEGL004973).

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

Sites: Northern Hardwood Forest (Rich Subtype) occurs on high elevation convex to concave slopes and ridges which are underlain by mafic or calcareous rock. Most examples are above 3600 feet, and they can range to 5600 feet or higher. At all but the highest elevations, most examples are on north or east-facing slopes, concave slopes, or otherwise sheltered sites.

Soils: Soils in the Rich Subtype are influenced by mafic or, much less frequently, calcareous rock. They have higher pH and base saturation than typical soils in the region. Most are mapped as the

same series of Typic Haplumbrepts, Humic Dystrudepts, and Typic Humadepts as in the Typic Subtype.

Hydrology: Sites are well drained but are mesic due to cool temperatures and high rainfall at their high elevations. Northern Hardwood Forests are more moist than oak forests at the same elevations, because they occur on cooler slope aspects.

Vegetation: The Rich Subtype has a diverse canopy that contains the characteristic Northern Hardwood Forest species *Acer saccharum*, *Aesculus flava*, and *Betula alleghaniensis* along with several other species shared with Rich Cove Forests. Additional trees with high constancy in CVS plots data are *Prunus serotina*, *Fagus grandifolia*, *Tilia americana* var. *heterophylla*, and *Fraxinus americana*. Also at least fairly frequent are *Quercus rubra*, *Carya cordiformis*, *Betula lenta*, and *Magnolia acuminata*. The understory may be dominated by *Acer pensylvanicum* or, less often, *Acer spicatum* or *Ostrya virginiana*. *Cornus alternifolia* is also frequent. The shrub layer is sparse to moderate in density. *Hydrangea arborescens* is the only species with fairly high frequency in plot data, but *Viburnum lantanoides*, *Ilex montana*, and *Sambucus racemosa* var. *pubens* sometimes occur. The herb layer is diverse and often dense and lush and shares a large pool of species with Rich Cove Forest. *Laportea canadensis* can dominate in late summer, but otherwise there usually are not clear dominant species. Highly constant species in CVS plot data are *Arisaema triphyllum*, *Polystichum acrostichoides*, *Maianthemum racemosum*, *Laportea canadensis*, *Prosartes lanuginosa*, *Caulophyllum thalictroides*, *Trillium erectum*, *Actaea racemosa*, *Impatiens pallida*, *Stellaria pubera*, *Tiarella cordifolia*, *Polygonatum biflorum*, *Dryopteris intermedia*, *Eurybia divaricata*, *Solidago curtisii*, and *Osmorhiza claytonia*. Additional frequent species include *Angelica triquinata*, *Athyrium asplenoides*, *Lilium superbum*, *Viola rotundifolia*, *Allium tricoccum*, *Hydrophyllum canadense*, *Viola canadensis*, *Huperzia lucidula*, *Oclemena acuminata*, *Galium triflorum*, *Carex pensylvanica*, *Anemone quinquefolia*, *Parathelypteris noveboracensis*, *Actaea podocarpa*, *Streptopus lanceolatus* var. *lanceolatus*, *Collinsonia canadensis*, *Dioscorea villosa*, *Dryopteris marginalis*, *Monarda didyma*, *Botrypus virginianus*, *Actaea pachypoda*, *Ageratina altissima* var. *roanensis*, *Festuca subverticillata*, and *Veratrum parviflorum*. A large number of additional species are present at frequencies below 30%.

Range and Abundance: Ranked G3. The Rich Subtype is scattered throughout the high mountain of North Carolina, but with fewer sites and much less acreage than the Typic Subtype. The related association, as defined, ranges not only Georgia, Tennessee and Virginia, but into West Virginia.

Associations and Patterns: The Rich Subtype occurs as a large patch or small patch community. It may be associated with the Typic Subtype and may give way to High Elevation Red Oak Forest or Montane Oak–Hickory Forest on warmer slope aspects. As with the Typic Subtype, it may grade upslope to Red Spruce–Fraser Fir Forest. It may potentially contain embedded High Elevation Birch Boulderfield, Grassy Bald, Heath Bald, High Elevation Rocky Summit, Rich Montane Seep, High Elevation Boggy Seep, or other small patch communities, though no cases are known for some of these associations. The Rich Subtype may grade the Typic Subtype with a change in substrate.

Variation: Examples may vary in the apparent richness of the site as reflected by the flora. It is possible that there could be variants analogous to those in the Typic Subtype, but these have not been clarified.

Dynamics: Dynamics of the Typic Subtype are similar to those of the theme as a whole.

Comments: Rohrer (1983) noted that substrate (metabasalt vs. arkose) shifted the boundary between Northern Hardwood Forest (this subtype) and High Elevation Red Oak Forest. This suggests that the soil nutrient status or soil texture may interact with moisture conditions and the effects of topography.

It is particularly difficult to distinguish the Rich Subtype from Rich Cove Forest in literature, as it is in the field. Many regional study areas, such as the Joyce Kilmer-Slickrock Wilderness and Shining Rock Wilderness studied by Newell (1997), and the Great Smoky Mountains (Whittaker 1956), have little of the appropriate geology to support the Rich Subtype. The Black and Craggy Mountains do have a broad range of geology, and the presence of the Rich Subtype may have contributed to McLeod's (1988) choice not to distinguish distinct Northern Hardwood Forest. Ulrey (2002) distinguished two high elevation groupings of rich cove forest plots, which appear to partially overlap this subtype of Northern Hardwood Forest.

Rare species: Vascular plants – *Aconitum reclinatum*, *Brachyelytrum aristosum*, *Cardamine clematitidis*, *Dendrolycopodium dendroideum*, *Geum geniculatum*, *Glyceria nubigena*, *Lilium grayi*, *Lonicera canadensis*, *Meehania cordata*, *Platanthera grandiflora*, *Pyrola elliptica*, *Rhododendron vaseyi*, *Saxifraga caroliniana*, *Scutellaria saxatilis*, *Spiranthes ochroleuca*, *Streptopus amplexifolius*. Nonvascular plants – *Drepanolejeunea appalachiana*, *Gymnoderma lineare*, *Metzgeria temperata*, *Plagiochila austinii*.

Animals – *Aegolius acadicus*, *Certhia americana*, *Coccyzus erythrophthalmus*, *Desmognathus organi*, *Empidonax alnorum*, *Glaucmys sabrinus coloratus*, *Inflectarius downieanus*, *Inflectarius downieanus*, *Paravitrea andrewsae*, *Plethodon aureolus*, *Plethodon cheoah*, *Plethodon welleri*, *Sorex dispar blitchi*, *Sphyrapicus varius*, *Ventridens collisella*.

References:

- Rohrer, J.H. 1983. Vegetation patterns and rock type in the flora of the Hanging Rock Area, North Carolina. *Castanea* 48: 189-205.
- McLeod, D.E. 1988. Vegetation patterns, floristics, and environmental relationships in the Black and Craggy Mountains of North Carolina. Ph.D. Dissertation, University of North Carolina, Chapel Hill.
- Newell, C.M. 1997. Local and regional variation in the vegetation of the Southern Appalachian Mountains. PhD Dissertation, University of North Carolina, Chapel Hill.
- Ulrey, C.J. 2002. The relationship between soil fertility and the forests of the Southern Appalachian region. PhD dissertation, North Carolina State University.

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