

RED SPRUCE–FRASER FIR FOREST (BOULDERFIELD SUBTYPE)

Concept: The Boulderfield Subtype covers *Picea*-dominated boulderfields. Well-developed boulderfields have near 100% ground cover of large rocks, with soil present only as small pockets on top of rock. Plants capable of rooting in moss mats or shallow soil make up most of the community. This subtype is transitional to the High Elevation Birch Boulderfield Forest type of lower elevations, but is more similar to other spruce–fir forests than lower elevation boulderfields are to Northern Hardwood Forests.

Distinguishing Features: The Boulderfield Subtype is distinguished from all other subtypes by having large rocks covering most of the ground (more than 90 percent) and with an herb layer consisting primarily of boulderfield plant species such as *Polypodium appalachianum* and mosses. While many spruce–fir forests of all subtypes are rocky and have shallow soil, this subtype is reserved for the rare extreme setting of well-developed boulderfields.

Synonyms: *Picea rubens* / *Ribes glandulosum* Forest (CEGL007128).

Ecological Systems: Central and Southern Appalachian Spruce–Fir Forest (CES202.028).

Sites: Boulder-covered slopes at high elevations, generally steep. Boulderfields are either talus beneath large outcrops or colluvial deposits, apparently the result of periglacial processes during the Pleistocene.

Soils: Soils probably represent an unnamed series. Boulders, often up to several meters across, cover all of the surface, and generally are piled several deep. There are voids between the boulders below the surface. Soil is limited to shallow accumulations of organic matter on top of rocks or small accumulations at contacts between them.

Hydrology: Mesic to wet due to high rainfall, long periods bathed in fog, and low temperatures; however, water-holding capacity is low in the excessively drained boulderfields, and conditions may become dry in even short periods of drought.

Vegetation: The forest is dominated by *Picea rubens* and *Betula alleghaniensis*, sometimes with small numbers of *Abies fraseri* or *Tsuga canadensis*. The understory is dominated by *Acer spicatum*, with *Sorbus americana* the only other likely species other than canopy species. There may be a very open shrub layer, with *Viburnum lantanooides* the most constant and abundant species. Other shrubs sparsely present may include *Vaccinium erythrocarpum*, *Rhododendron catawbiense*, and *Ribes cynosbati* or *Ribes glandulosum*. The herb layer consists primarily of species able to live on bare rock. There is often extensive moss cover. *Polypodium appalachiana* is extensive in most known examples. Other herbs typical of spruce–fir forests are present in favorable soil pockets, including *Dryopteris campyloptera*, *Dryopteris intermedia*, *Oxalis montana*, and *Huperzia lucidula*,

Dynamics: Dynamics are similar to the Spruce–Fir Forest theme in general, but canopy gaps can be expected to persist longer because of the difficulty of tree establishment. The extent of the ground surface where tree seedlings can establish is limited, though it is sufficient to lead to a full forest canopy. The boulderfields seem to be stable but shifting or falling of rocks may occur occasionally and lead to local disturbance.

Range and Abundance: Ranked G1. This may be the rarest of Spruce–Fir Forest subtypes. Extensive examples are known only from Grandfather Mountain, but it apparently is present in the Smokies and possibly on Roan Mountain.

Associations and Patterns: Grades to other subtypes of Red Spruce—Fraser Fir Forest.

Variation: Varies with the transition to adjacent communities.

Comments: This is one of the least studied spruce-fir subtypes, and was not included in any of the earlier published literature. It has been observed by the author, several CVS plots document it, and it was recognized in Watson-Cook (2017) based on these plots. The data table presented in Watson-Cook (2017) appears to have errors, as it contains high covers for *Rhododendron maximum* and *Kalmia latifolia*, which are not characteristic of this subtype and which are not abundant in any of the individual plot data.

Recognition of well-developed boulderfields is easy in person, where the near total cover of moss- and fern-covered rocks is very distinctive and the near impossibility of walking is obvious. They can be difficult to recognize in both qualitative descriptions and plot data, since many spruce-fir sites have abundant boulders and since boulderfield communities can have many species of deeper soils present in small numbers.

Though *Ribes* was mentioned in earlier drafts of the 4th approximation and is included in the NVC association name, no species of *Ribes* is abundant in any of the plots or known examples of this community.

Rare species: Though not well studied, this subtype presumably may harbor rare small mammals characteristic of other boulderfields.

References:

Watson-Cook, E.L. 2017. Characteristics and classification of southern Appalachian spruce-fir forests. M.S. Thesis, UNC-Chapel Hill.