

## RED SPRUCE–FRASER FIR FOREST (HERB SUBTYPE)

**Concept:** Red Spruce—Fraser Forest covers high mountain forests in which *Picea rubens* (or occasionally *Sorbus americana*), with or without *Abies fraseri* or hardwoods, are naturally dominant. The Herb Subtype covers the most common examples with canopies of primarily *Picea rubens*, with or without *Abies fraseri*, only minor amounts of other trees, and lower strata consisting of deciduous shrubs, herbs, and mosses.

**Distinguishing Features:** The Herb Subtype is distinguished from the Rhododendron Subtype and Low Rhododendron Subtype by dominance of the lower strata by herbs or deciduous shrubs, rather than by *Rhododendron* spp. It is distinguished from the Birch Transition Subtype by having less than 33 percent *Betula alleghaniensis* cover in the canopy, counting gaps recently occupied by now-dead *Abies fraseri*. The Herb Subtype is distinguished from the Boulderfield Subtype, which also has a deciduous shrub, herb, and moss undergrowth, by having boulder cover less than 90 percent, having a richer herb layer, and having *Ribes* spp., *Polypodium appalachianum*, and other boulderfield species present in no more than small numbers.

**Synonyms:** Synonyms: *Picea rubens* - (*Abies fraseri*) / *Vaccinium erythrocarpum* / *Oxalis montana* - *Dryopteris campyloptera* / *Hylocomium splendens* Forest (CEGL007131).

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

SAF 34: Red Spruce-Fraser Fir (in part).

**Sites:** This community occurs on ridge tops and slopes at high elevations, generally 5500-6200 feet.

**Soils:** Any of the soils typical of high mountains may support this community.

**Hydrology:** Typical of the theme.

**Vegetation:** In a natural state, this community is a closed forest, except for small to medium canopy gaps. It is dominated by *Picea rubens* with varying amounts of *Abies fraseri*, *Betula alleghaniensis*, and *Sorbus americana*, with *Betula cordifolia* and other species being present only in small numbers. *Betula alleghaniensis* is usually present, but comprised less than 33% of the canopy in unaltered stands. *Abies* is usually present but may be absent. Watson-Cook (2017) found an average of 25-50% cover each of *Picea* and *Abies* in the cluster of typical plots of this community. *Betula alleghaniensis* averaged 10-25% cover; *Sorbus* average cover was very low. The understory is sparse except in canopy gaps. All three main canopy dominants may be fairly abundant in the understory. Other species may include *Acer spicatum*, *Acer rubrum*, *Acer pensylvanicum*, *Fagus grandifolia*, and *Amelanchier arborea*. The shrub layer may be sparse to dense. Sometimes saplings of spruce or fir dominate it. *Vaccinium erythrocarpum*, *Vaccinium corymbosum*, *Vaccinium simulatum*, *Viburnum lantanoides*, *Viburnum cassinoides*, and *Sambucus racemosa* var. *pubens* are reported as relatively frequent and abundant in most site descriptions. *Rubus canadensis* has become frequent and often abundant after widespread canopy opening from a variety of causes. However, Watson-Cook (2017), analyzing plot data generally from the 1990s-2000s, found *Rhododendron maximum* to be the most constant shrub species, and the most abundant on average. The other shrub species were less constant and had

lower average abundance. The herb layer may range from nearly absent to a lush cover of ferns or forbs over a thick bed of moss. Most often dominant species are *Dryopteris campyloptera*, *Dryopteris intermedia*, *Athyrium asplenioides*, *Dennstaedtia punctilobula*, *Oclemena acuminata*, *Oxalis montana*, *Ageratina altissima* var. *roanensis* and, in the Smokies, *Rugelia nudicaulis*. Other frequent and abundant herbs include *Carex intumescens*, *Circaea alpine*, *Chelone glabra*, *Eurybia chlorolepis*, *Glyceria melicaria*, *Clintonia borealis*, *Viola blanda*, *Tiarella cordifolia*, *Huperzia lucidula*, *Solidago glomerata* and *Dryopteris intermedia* (Watson-Cook 2017, Crandall 1958, Whittaker 1956, Pittillo 1984 [keep?]). Bryophytes are usually particularly prominent in these communities. *Hylocomium splendens*, *Ptilimnium crista-castrensis*, *Polytrichum*, and *Atrichum* may form dense beds, alone or beneath fern or forb cover. Epiphytic mosses and liverworts are also characteristic, with several species specialize for bark of mature fir trees.

**Range and Abundance:** Ranked G2. This appears to be the most widespread of the spruce-fir communities but it is still extremely limited by the scarcity of land area at high elevation and by losses in the early 1900s. The bulk of the global range of this community and corresponding NVC association is in North Carolina; it extends into Tennessee and Virginia. The southern limit is Richland Balsam and the central Smoky Mountains; the northern limit is Mt. Rogers in Virginia, but some disjunct stands farther north are also attributed to the association. Spruce-fir forests of all subtypes are absent from several mountain ranges within their geographic and elevation range, such as the Craggy Mountains and Elk Knob.

**Associations and Patterns:** The Herb Subtype is usually associated with other subtypes of Red Spruce-Fraser Fir Forest, grading to the Rhododendron Subtype around rock outcrops, to the Birch Transition Herb and Birch Transition Shrub Subtypes at lower elevation. It grades to Fraser Fir Forest at higher elevations. Northern Hardwood Forest (Beech Gap Subtype) may occur in the same elevational range, on upper south-facing concave slopes.

**Variation:** This is the most broadly defined of the spruce-fir subtypes, representing the most common version in the middle range of its environment. As such, there is substantial variation in vegetation, especially in the lower strata. Variation is now confused because of widespread alteration caused by balsam woolly adelgid, and variable recovery since that time. There are floristic and vegetational differences among Red Spruce--Fraser Fir Forest in different mountain ranges (Pittillo 1984; Schwartzkopf 1974), but most such differences are much less than the variation within single stands. Crandall (1958), working in old-growth forests of the Smokies before balsam woolly adelgid disturbance, described five undergrowth types in spruce-fir forests of the Smokies, three of which would fall within this subtype. Her *Oxalis-Hylocomium* and *Viburnum-Vaccinium-Dryopteris*, said to be associated with different elevational ranges, do not seem to be readily distinguishable throughout the range of the community. Her third, *Cacalia rugelia* (= *Rugelia nudicaulis*) type is distinctive for biogeographic reasons. Watson-Cook (2017), analyzing CVS data representing most sites other than the Smokies, post-adelgid, found four floristic clusters within this subtype that she chose to recognize. One is transitional to the Birch Transition Herb Subtype, one is transitional to the Rhododendron Subtype, and one represents a more herbaceous/less shrubby set, relative to the fourth, classic version. The numbers of plots representing those other than the classic is small – generally three, and the level of difference seems too small to recognize as variants, though further consideration is warranted.

Thus, two variants are recognized:

1. **Typic Variant:** Having variable deciduous shrub, forb, fern, and moss dominance in the lower strata.
2. **Ragwort Variant:** Having *Rugelia nudicaulis* as the predominant herb. This species occurs only in the Great Smoky Mountains, where it often dominates the herb layer. This variant co-occurs with the Typic Variant in the Smokies, and occurs nowhere else.

**Dynamics:** All of the dynamics discussed in the theme description apply to this subtype.

**Comments:** Most of the extensive study of Spruce-Fir Forests in general has been carried out in examples of this subtype.

**Rare species:** Vascular -- *Abies fraseri*, *Betula papyrifera* var. *cordifolia*, *Botrychium oneidense*, *Rugelia nudicaulis*, *Calamagrostis canadensis*, *Cardamine clematidis*, *Carex projecta*, *Cinna latifolia*, *Geum geniculatum*, *Glyceria nubigena*, *Phegopteris connectilis*, *Poa palustris*, *Rhododendron vaseyi*, *Stachys clingmanii*, *Streptopus amplexifolius*, *Streptopus roseus* var. *roseus*; nonvascular -- *Bazzania nudicaulis*, *Brachydontium trichodes*, *Frullania oakesiana*, *Harpanthus drummondii*, *Leptodontium excelsum*, *Leptoscyphus cuneifolius*, *Lophozia attenuata*, *Metzgeria temperata*, *Nardia scalaris*, *Plagiochila corniculata*, *Sphenolobopsis pearsonii*.

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