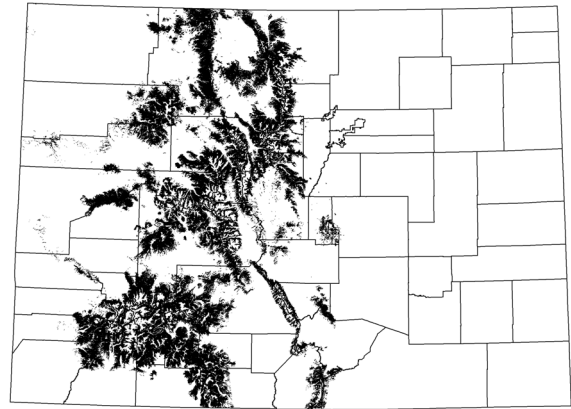


ROCKY MOUNTAIN SUBALPINE DRY-MESIC AND MESIC SPRUCE-FIR FOREST AND WOODLAND



R. Rondeau



extent exaggerated for display

- ABIES LASIOCARPA - PICEA ENGELMANNII FOREST ALLIANCE
 - Abies lasiocarpa* - *Picea engelmannii* Ribbon Forest
 - Abies lasiocarpa* - *Picea engelmannii* Tree Island Forest
 - Abies lasiocarpa* - *Picea engelmannii* / *Acer glabrum* Forest
 - Abies lasiocarpa* - *Picea engelmannii* / *Carex geyeri* Forest
 - Abies lasiocarpa* / *Carex rossii* Forest
 - Abies lasiocarpa* - *Picea engelmannii* / *Arnica cordifolia* Forest
 - Abies lasiocarpa* - *Picea engelmannii* / *Ribes (montigenum, lacustre, inerme)* Forest
 - Abies lasiocarpa* - *Picea engelmannii* / *Vaccinium caespitosum* Forest
 - Abies lasiocarpa* - *Picea engelmannii* / *Vaccinium myrtillus* Forest
 - Abies lasiocarpa* - *Picea engelmannii* / *Vaccinium scoparium* Forest
 - Abies lasiocarpa* / *Erigeron eximius* Forest
 - Abies lasiocarpa* / Moss Forest
 - Abies lasiocarpa* / *Rubus parviflorus* Forest
- ABIES LASIOCARPA KRUMMHOLZ SHRUBLAND ALLIANCE
 - Abies lasiocarpa* Krummholz Shrubland
 - Abies lasiocarpa* / *Salix brachycarpa* Shrubland
 - Abies lasiocarpa* / *Salix glauca* Shrubland
- ABIES LASIOCARPA SEASONALLY FLOODED FOREST ALLIANCE
 - Abies lasiocarpa* - *Picea engelmannii* / *Calamagrostis canadensis* Forest
 - Abies lasiocarpa* / *Ledum glandulosum* Forest
- ABIES LASIOCARPA WOODLAND ALLIANCE
 - Abies lasiocarpa* / *Juniperus communis* Woodland
- ABIES LASIOCARPA - POPULUS TREMULOIDES FOREST ALLIANCE
 - Populus tremuloides* - *Abies lasiocarpa* / *Juniperus communis* Forest
- PICEA ENGELMANNII FOREST ALLIANCE
 - Picea engelmannii* / *Geum rossii* Forest
 - Picea engelmannii* / *Hypnum revolutum* Forest
 - Picea engelmannii* / Moss Forest
 - Picea engelmannii* / *Polemonium pulcherrimum* Forest
 - Picea engelmannii* / *Ribes montigenum* Forest
 - Picea engelmannii* / *Trifolium dasyphyllum* Forest
 - Picea engelmannii* / *Vaccinium caespitosum* Forest
 - Picea engelmannii* / *Vaccinium myrtillus* Forest
 - Picea engelmannii* / *Vaccinium scoparium* Forest

Overview: Spruce-fir dry-mesic forest and spruce-fir moist-mesic forest ecological systems form the primary matrix systems of the montane and subalpine zones of the Southern Rocky Mountains ecoregion. These systems comprise a substantial part of the subalpine forests of the Cascades and Rocky Mountains from southern British Columbia east into Alberta, south into New Mexico and the Intermountain region. Despite their wide distribution, the tree canopy characteristics are remarkably similar rangewide, with *Picea engelmannii* and *Abies lasiocarpa* dominating either mixed or alone. Disturbances include occasional blow-down, insect outbreaks and stand-replacing fire.

Characteristic species: *Picea engelmannii* and *Abies lasiocarpa* dominate the canopy, either mixed or alone. *Pinus contorta* is common in many occurrences and patches of pure *Pinus contorta* are not uncommon, as well as mixed conifer/*Populus tremuloides* stands. Xeric species may include *Juniperus communis*, *Linnaea borealis*, *Mahonia repens*, or *Vaccinium scoparium*. Mesic understory shrubs include *Rhododendron albiflorum*, *Amelanchier alnifolia*, *Rubus parviflorus*, *Ledum glandulosum*, *Phyllodoce empetriformis*, and *Salix* spp. Herbaceous species include *Actaea rubra*, *Maianthemum stellatum*, *Cornus canadensis*, *Erigeron eximius*, *Saxifraga bronchialis*, *Luzula glabrata* var. *hitchcockii*, or *Calamagrostis canadensis*.

Pine martens (*Martes americana*) are primarily a spruce-fir obligate species that require a healthy and sizeable occurrence of mature forest and are an indicator of a healthy and viable occurrence of the spruce-fir system.

Environment: These are the matrix forests of the subalpine zone, with elevations ranging from 5,000-11,000 ft (1,525 to 3,355 m). Sites within this system are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpacks are deep and late-lying, and summers are cool. Frost is possible almost all summer and may be common in restricted topographic basins and benches. In some areas, such as Wyoming, *Picea engelmannii*-dominated forests are on limestone or dolomite, while nearby codominated spruce-fir forests are on granitic or volcanic rocks.

Moist-mesic occurrences are typically found in locations with cold-air drainage or ponding, or where snowpacks linger late into the summer, such as north-facing slopes and high-elevation ravines. They can extend down in elevation below the subalpine zone in places where cold-air ponding occurs; northerly and easterly aspects predominate. These forests are found on gentle to very steep mountain slopes, high-elevation ridgetops and upper slopes, plateaulike surfaces, basins, alluvial terraces, well-drained benches, and inactive stream terraces.

Dynamics: *Picea engelmannii* can be very long-lived, reaching 500 years of age. Fire is an important disturbance factor, but fire regimes have a long return interval and so are often stand-replacing. *Picea engelmannii* can rapidly recolonize and dominate burned sites, or can succeed other species such as *Pinus contorta* or *Populus tremuloides*. Due to great longevity, *Pseudotsuga menziesii* may persist in occurrences of this system for long periods without regeneration. Old-growth characteristics in *Picea engelmannii* forests will include treefall and windthrow gaps in the canopy, with large downed logs, rotting woody material, tree seedling establishment on logs or on mineral soils unearthed in root balls, and snags.

Fire, spruce-beetle outbreaks, avalanches, and windthrow all play an important role in shaping the dynamics of spruce-fir forests. Fires in the subalpine forest are typically stand replacing, resulting in the extensive exposure of mineral soil and initiating the development of new forests. Stand replacing fires are estimated to occur at intervals of about 300 years for dry-mesic areas, and longer (350-400 years) for more mesic sites (Romme and Knight 1981). Fire return intervals, intensity, and extent will of course depend on a variety of local environmental factors. Fire is much less important in krummholz communities (Crane 1982). Depending on site conditions, spruce and fir may share the post-fire site with shade-intolerant species such as lodgepole pine, limber pine, and quaking aspen. Many stands in the subalpine zone of the Colorado Front range are of post-fire origin from about the mid 1700's (Veblen 1986).

Spruce beetle (*Dendroctonus rufipennis*) outbreaks may be as significant as fire in the development of spruce-fir forests. In addition to fires and beetle kill, wind disturbance in spruce-fir forests has been well documented (Schaupp et al. 1999). Blowdowns involving multiple treefalls add to the mosaic of spruce-fir stands.

Under a natural disturbance regime, subalpine forests were probably characterized by a mosaic of stands in various stages of recovery from disturbance, with old-growth just one part of the larger forest mosaic (Peet 1981). This mosaic was constantly changing and highly variable from place to place, so the extent of presettlement old-growth forest is uncertain. The current subalpine landscape is perhaps more homogeneous (in terms of stand age) than in the presettlement era, mainly due to the synchronizing effect of very extensive, regional disturbance (e.g., fires in the mid 1700s, beetle outbreak in the mid to late 1800's (Peet 1981)).



S. Spackman

Variation: Individual community types may be matrix or large patch in character, though most typically occur as a mosaic of large patches across the landscape. Spruce-fir dominated stands occur on all but the most xeric sites above 10,000 ft (3,100 m), and in cool, sheltered valleys at elevations as low as 8,200 ft (2,500 m). The relative dominance of the two canopy tree species and the understory composition vary substantially over a gradient from excessively moist to xeric sites (Peet 1981). The mesic spruce-fir type occurs on cool, sheltered, but well-drained sites above 8,850 ft (2,700 m) and is one of the most widespread forest types in the subalpine zone. Open slopes above 9,850 ft (3,000 m) are typically characterized by Peet's (1981) xeric spruce-fir type, with varying amounts of lodgepole and limber pine. Towards lower elevations, the spruce-fir types give way, often along abrupt fire-induced boundaries, to lodgepole pine or aspen-dominated forests.

Spruce-fir forest also exhibit changes with latitude including treeline elevation, species composition, and dominance. *Abies lasiocarpa* decreases in importance relative to *Picea engelmannii* with increasing distance from the region of Montana and Idaho where maritime air masses influence the climate. Fir increases in importance with increasing latitude, and shares dominance with spruce at tree line over the northern half of the Southern Rocky Mountains ecoregion. Treeline occurs at over 12,450 ft (3800 m) at the southern end of the Southern Rocky Mountain ecoregion, whereas it does not exceed 11,150 ft (3400 m) at the northern end (Peet 1978). Possible explanations for this geographic variation include a genetic differentiation in *Abies* at the southern end of the ecoregion and variation in moisture or exposure conditions experienced by these high-elevation forests. That the degree of dominance by *Abies* could, in part, reflect the degree of drought stress or exposure of the site is suggested by the absence of *Abies* in the forests of Pikes Peak, a xeric mountain (Peet 1978).

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Schaupp W. C. J. F. M. and S. Johnson. 1999. Evaluation of the spruce beetle in 1998 within the Routt Divide blowdown of October 1997, on the Hahns Peak and Bears Ears Ranger Districts, Routt National Forest, Colorado. USDA Forest Service, Renewable Resources, Rocky Mountain Region, Lakewood, CO. 15 pp.

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Rank:	A	B	C	D
① SIZE				
Acres	>90,000	50,000-90,000	30,000-50,000	< 30,000
② CONDITION				
<p>Community structure</p> <p>Note: Young (< 25 years old) even aged stand of spruce or fir are seral to climax spruce-fir forest and <u>must</u> be represented within an ecoregional portfolio. Therefore, a site should be large enough to hold a mosaic that would have at least 10-20% of the mosaic in early seral stage).</p>	<p>A mature stand (transitional to climax stage) of spruce-fir forest characterized by large-diameter trees (mainly spruce), abundant large snags and logs, and multistoried vegetation. Multiple canopies exist with a wide range of canopy heights, with moderate class diversity. Approximately 10 trees per acre with a minimum DBH of 16 inches and the minimum age of approx. 150 years. Usually this is an uneven aged stand with approximately 2 dead standing trees per acre with a minimum DBH of 10 inches.</p>	<p>Majority of stand is >150 years old, may show evidence of selective logging that has altered their structure. Although most of the occurrence is comprised of mature stands, some 20% or less is in early seral stages resulting from natural disturbances (e.g., fire, beetle kill, windthrow).</p>	<p>Stands that have regenerated naturally after logging or young to mature stands with significant history of selective logging disturbance that altered composition or structure. with very low species diversity.</p>	
<p>Invasive exotics with major potential to alter structure and composition</p>	Absent.	Absent.	Likely to be present.	Present.
<p>Other non-native spp.</p>	<1% cover, native species dominant in understory.	<3% cover, native species dominant in understory.	Non-native species may be uncommon to frequent but do not dominate or co-dominate understory (5-10% cover).	
<p>Disturbance</p>	a large, intact, unfragmented occurrence with few to no roads or trails. Although most of the occurrence is comprised of mature stands, some 10% is in early seral stages resulting from natural disturbances (e.g., fire, beetle kill, windthrow). Logging, if present is limited to less than 10% of occurrence.	The occurrence is relatively unfragmented with few to no roads. Little to no evidence of past logging disturbance over a major proportion of the occurrence, but may show evidence of selective logging that has altered stand structure.	Roads or trails may be scattered throughout the occurrence.	Highly fragmented from roads, logging, ski development, mining, or other human activities. Soil loss/erosion is high and therefore negatively impacts the water quality within the immediate watershed.
③ LANDSCAPE CONTEXT				
<p>Surrounding land</p>	Occurrence surrounded by a large area of natural vegetation. A few small roads may exist in the surrounding landscape.	Occurrence surrounded by at least 80% natural or semi-natural vegetation.	Occurrence surrounded by a mosaic of agricultural or semi-developed areas and natural or semi-natural vegetation, the latter composing 25-80% of the landscape, or landscape is dominated by very young tree plantations (cut within last 20 years).	Occurrence surrounded primarily by urban or agricultural landscape, with <25% landscape cover of natural or semi-natural vegetation.
<p>Fire regime</p>	Fire suppression in surrounding ecological systems are minimal to moderate.	Fire suppression in surrounding ecological systems may be moderate.		