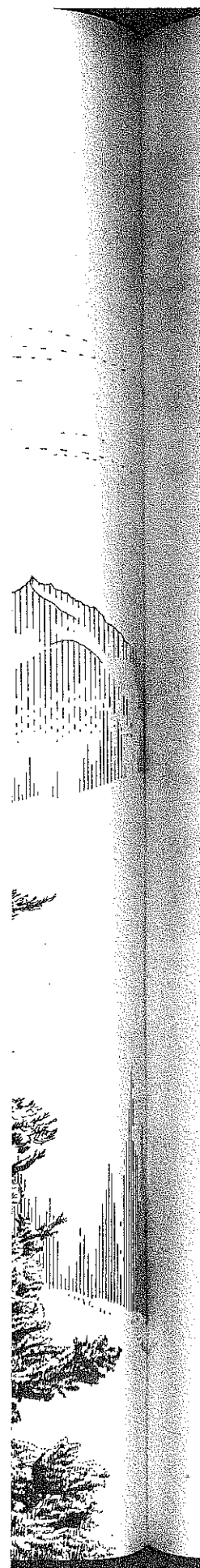


## SUBALPINE FIR

*Abies lasiocarpa* and *A. bifolia*, Pine family—Pinaceae



Subalpine firs are the trees shaped like narrow cathedral spires that adorn high-country parklands throughout the Greater Northwest. Their short, stiff, horizontal branches extend to the ground and produce such a slender, conical form that only a limited amount of winter snow can pile up on them. Clusters of these sylvan pinnacles beautify our most popular subalpine parklands, including Paradise and Sunrise on Mount Rainier, the Beartooth Scenic Highway near Yellowstone National Park, Going-to-the-Sun Road in Glacier National Park, and the Icefields Parkway in Banff and Jasper national parks.

Casual visitors who recognize subalpine fir only in high-mountain settings might conclude that it is a scarce, highly specialized tree. Actually, it is a generalist that takes on many growth forms and has adapted remarkably well to a broad range of forest habitats in western North America, including some at relatively low elevations. Although this species is the smallest fir, it is an effective competitor in the inland mountains and can displace most other species in the absence of fire or other major disturbances.

### Where It Grows

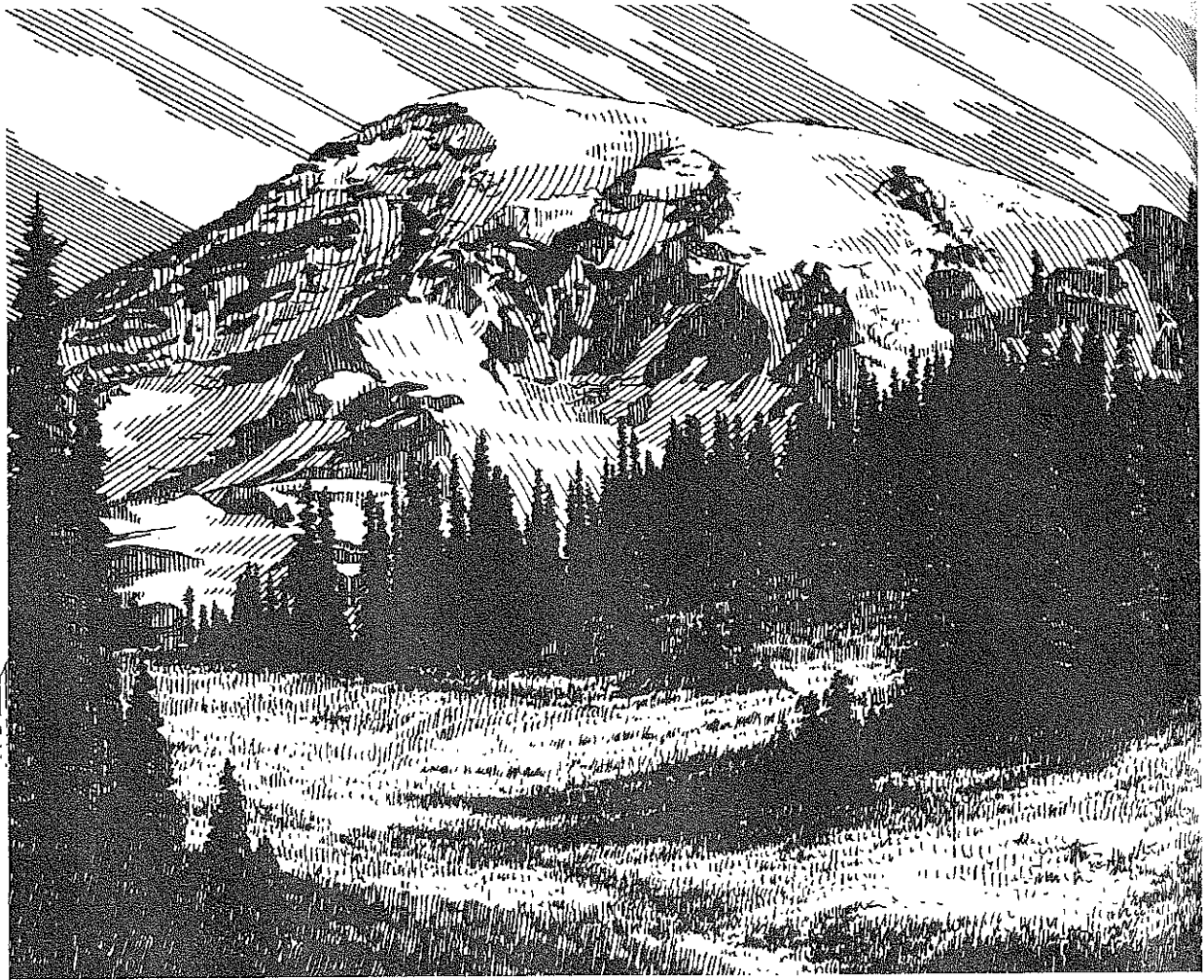
Subalpine fir grows atop some of the isolated peaks that rise high above the deserts of Arizona and New Mexico, and it colonizes the lofty terrain of the Rockies northward to the Yukon Territory. It occupies nearly all the high inland and coastal mountains of the Northwest; however, except for a couple of spots in the Siskiyou, this tree doesn't extend southward into California.

West of the Cascade crest, subalpine fir becomes most abundant near timberline and is mostly found between elevations of 4000 and 6500 feet (1200 and 2000 m). East of the

crest and in many of the inland ranges, it doesn't have to compete with more shade-tolerant hemlocks or Pacific silver fir. Perhaps as a result, it expands to occupy a broad zone at mid- and high elevations. For instance, in western Montana it is common between about 5000 and 8800 feet (1500 and 2700 m) and extends much lower in frost-prone valleys. In the U.S. Northern Rockies, subalpine fir occupies more forest habitat types than any other tree except inland Douglas-fir (Pfister and others 1977). Subalpine fir is abundant in coastal mountain habitats receiving more than 150 inches (3800 mm) of annual precipitation, including a deluge of snowfall, but it also occupies inland sites that get only 25 inches (650 mm) of precipitation yearly, including just a modest snowfall. Although its high-elevation haunts have cool summers, it also inhabits some inland valleys where summer maximum temperatures approach 100 degrees F (38 C).

**Identification difficulties.** Considering the remarkable array of habitats it occupies and its sprawling geographic range, one might wonder if there are grounds for dividing subalpine fir into two or more species. The form of subalpine fir found in Arizona and New Mexico, commonly known as corkbark fir because of its distinctive thick bark, has long been recognized as a separate variety or even a species (*A. arizonica*). However, morphological differences among subalpine firs from Colorado to the Yukon and the coastal Northwest seem minor.

During the 1990s, a taxonomist proposed splitting these populations into two species—one in coastal mountains (*A. lasiocarpa*), and the other (*A. bifolia*) occupying inland areas (see [www.conifers.org](http://www.conifers.org)). The principal differences are in chemical constituents and a microscopic



*subalpine fir on the flanks of Mount Rainier*

characteristic. Perhaps the only feature readily distinguished by nonspecialists is the color of scars left when the oldest needles are removed: red in the coastal form and light brown in its inland counterpart. Time, perhaps aided by additional evidence, will tell if the split into two species will be universally accepted.

#### **Appearance**

Subalpine fir's exceptionally slender, spire-like profile can be recognized from afar; from somewhat closer, the very short, stiff, horizontal branches are apparent. In all but the densest stands, the canopy or at least some live limbs extend nearly to the ground. In the timberline

zone, and on exceptionally wind-exposed or rock-pile sites, subalpine fir develops a skirt of luxuriant, long lower limbs within about 3 feet (1 m) of the ground. It also takes on a variety of stunted, multistemmed, and shrublike forms—more than any other Northwest tree. On relatively moist, sheltered sites at moderate elevations, subalpine fir, often accompanying the larger Engelmann spruce, can grow straight and tall, often exceeding 24 inches (60 cm) in diameter and 100 feet (30 m) in height by age 200 or so, when further growth becomes negligible.

Subalpine fir's bark is thin, smooth, and light gray with conspicuous resin blisters. Near the base of old trees, the bark develops shallow

vertical fissures. The tree's foliage is rather deep green and the needles have fine white bands of microscopic pores on all surfaces. The blunt needles are about 1 inch (2.5 cm) long and grow out from all sides of the twig, making a brush-like bough. Heavily shaded lower branchlets have sparser foliage more like that of Douglas-fir. Most true firs (genus *Abies*), however, have small, blunt, wax-covered buds, unlike Douglas-fir's large, brown pointed ones.

Subalpine fir's cones are easily viewed on the stunted trees near timberline. They are 2½ to 4 inches (6 to 10 cm) long and deep purple, and they stand upright on the short, rigid boughs in the pointed treetop. The cones are often covered with an icing of glistening resin. They are pretty to look at but not worth touching, as anyone who has gotten the sticky pitch on their hands can attest!

#### Ecological Role

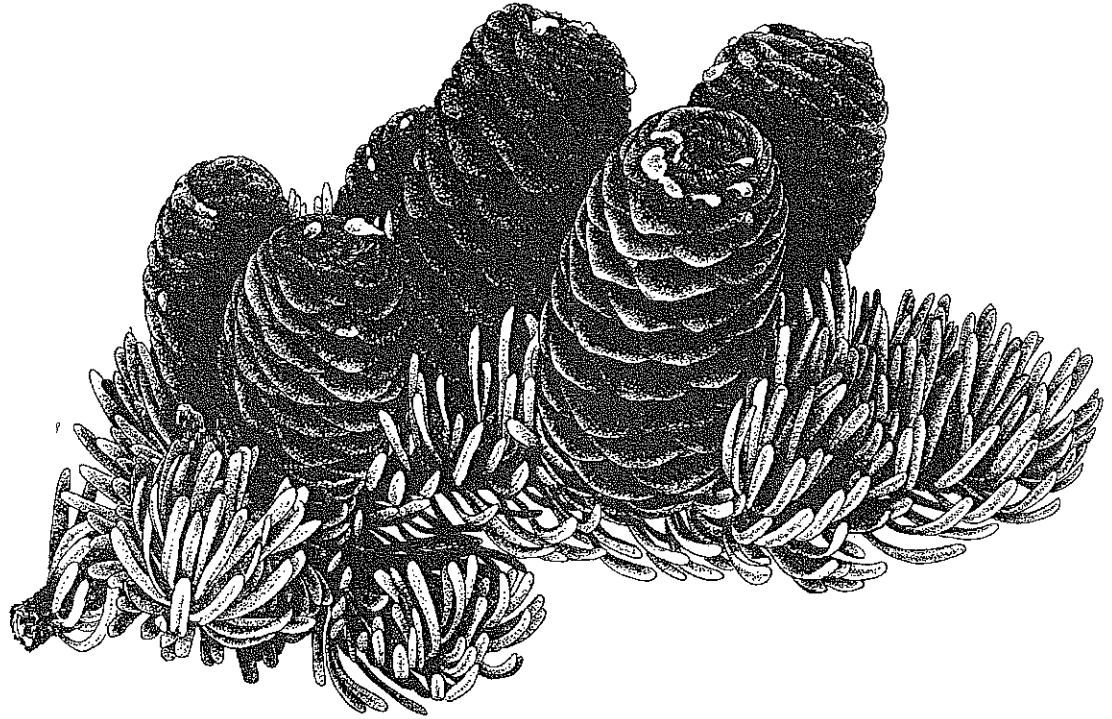
The most obvious characteristics of subalpine fir are those that adapt it to survival in cold, snowy environments. Its slender, conical shape and dense foliage make its crown like an A-frame ski cabin that prevents accumulation of heavy snow loads. Still, a moderate quantity of snow collects on the branches, which helps protect them from high winds, intense radiation, and temperature extremes in winter. The apparent effectiveness of this tree's growth form is illustrated by its success in snowy timberline habitats despite having wood that is lightweight and weak compared to other conifers.

Subalpine fir's ability to take on different growth forms also allows it to succeed under extremely harsh growing conditions. Climbing upward through the timberline zone, an observer witnesses a continuum of change in the

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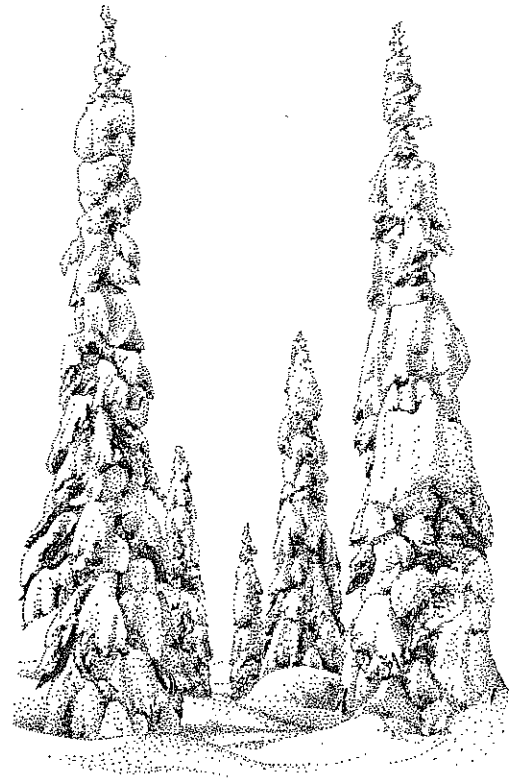


subalpine fir groves in a mountain landscape

*subalpine fir*

height and shape of subalpine firs. At the lower edge of this parkland, the trees are tall, symmetrical cones. Ascending the slope, the firs become shorter, are more confined to clusters, and develop skirts of lower limbs that extend out several feet beyond the conical canopy. The skirts lie sheltered in snowpack throughout the long winter and are protected from damaging winds. In summer, they occupy a warmer, sheltered microclimate near the ground.

Climbing higher up the slope, the hiker will note that fir trunks are smaller and closer together in tight clusters, and some of the skirts seem to have upright "sprouts." When the lower boughs become compressed against moist, duff-covered ground, some will take root and then send up a vertical leader, which can become a new trunk. Subalpine fir does this vegetative reproduction, called layering, extensively at timberline. Layering allows new trees to get

*young, snow-laden subalpine fir*



high-elevation subalpine fir: clusters (timber atoll); exposed, windswept forms (flagged *krummholz*)

established while connected to and benefiting from the root system of the parent tree.

At timberline, a single subalpine fir occasionally gets established from seed. If it succeeds against long odds and becomes an erect tree, its skirt of lower limbs may be able to produce a cluster of younger trees through layering. As these mature, the original tree in the center will die and decay, leaving a hollow center in the cluster, which is then called a timber atoll—because its appearance is likened to atolls in the South Pacific, which are ring-shaped coral islands. Often a hardier tree such as whitebark pine serves as the progenitor of a subalpine fir timber atoll. Higher yet on the slope, firs grow mostly as cushion *krummholz* (the low, shrubby form described in the whitebark pine chapter). Occasional erect stems manage to survive in a wind-battered form called flagged *krummholz*.

Some species have adapted to the adverse conditions at timberline by developing extreme hardiness—for example, whitebark pine and alpine larch, which are able to grow erect on sites where subalpine fir forms cushion *krummholz*. In contrast, subalpine fir demonstrates a mastery of adaptation by exhibiting different life forms and means of reproduction to succeed where cold, wind, and snow prevent normal tree growth. Subalpine fir has weaker wood and is shorter lived than whitebark pine, alpine larch, mountain hemlock, or Engelmann spruce at timberline, but its many growth forms and propensity for vegetative reproduction help it prevail anyway.

Subalpine fir's success in the dense middle-to high-elevation forests east of the Cascades may also seem surprising, since this tree is slow growing, short lived, and highly susceptible to fire. When intense fire or logging removes a forest, subalpine firs often seed in along





*subalpine fir intergrowing with alpine larch*

with faster-growing species such as lodgepole pine, western larch, Douglas-fir, and Engelmann spruce. These other species attain dominance, but subalpine fir perseveres and slowly increases in the forest understory. Without another disturbance in the next couple centuries, subalpine fir will begin to displace its competitors. The other species fail to establish a new generation of trees in the dense forest, while subalpine fir can do so because it is highly tolerant of shade and crowded conditions. When the other trees succumb in old age, hastened by crowding, young subalpine firs grow up and control the vacated space. Historically in the

inland mountains, fires were frequent enough to favor lodgepole pine, western larch, and the other competitors, but now that most fires are suppressed, subalpine fir is able to dominate larger expanses of mountain forest.

Subalpine fir clusters and *krummbolz* are used by many animals, ranging from grouse to mountain goats, for shelter from the elements and protection from predators. Firs act as a snow fence, accumulating snow that then melts gradually into summer, providing soil moisture that may sustain small meadows where otherwise there would be only dry, rocky habitats.

### Human History

Native peoples made many uses of subalpine fir (Moerman 1998). They burned the needles in their lodges for incense or curative vapor. They used needles as a deodorizer, solutions of powdered bark or other fir components as a cold remedy, gummy resin as a wound dressing or chewed for pleasure or to sweeten bad breath, and boughs as bedding and floor mats.

Explorers Lewis and Clark made note of this species during their perilous journey across the snow-covered Bitterroot Mountains in September 1805. On their return trek over this rugged route, on June 25, 1806, Lewis described how their Nez Perce guides set fire to trees that almost certainly were subalpine firs, which when mature have highly flammable foliage and lichens:

*last evening the indians entertained us with seting the fir trees on fire. they have a great number of dry limbs near their bodies which when set on fire creates a very suddon and immense blaze from bottom to top of those tall trees. they are a beatifull object in this situation at night. this exhibition reminded me of a display of fireworks. the natives told us that their object in seting those trees on fire was to bring fair weather for our journey (Moulton 1993, vol. 8, p. 50).*

Because of its weak wood, small limby trunks, and frequent heart rot, subalpine fir is seldom used for lumber. It is suitable for wood pulp, although it is harvested only incidentally when growing with other more-valuable species.

This species is a favorite of horticulturists because of its pinnacle shape and brushlike foliage. It tends to do well in cultivation west of the Cascades and in irrigated and moderately cool places in the inland Northwest. It can be grown as a bonsai, but a dwarfed tree transplanted from a wild setting is likely to either die or respond with vigorous growth.

One remarkable subalpine fir tree has both a wildlife and a human connection. In 1963 my small party was hiking cross-country through a remote, high basin in Olympic National Park when we encountered a subalpine fir so outsized that we could hardly believe our eyes. This tree, nearly 7 feet (2.1 m) thick and 129 feet (39 m) tall, has reigned ever since as the largest known of the species. But equally surprising, the tree's base looked like an elf's house. A neatly fashioned little door sealed off a cavity in the trunk, evidently for use as a cache site. It turned out that the couple who a decade earlier made the pioneering Walt Disney documentary *The Olympic Elk* stored food or equipment in this tree while they backpacked through the subalpine fir parklands, capturing this enchanting habitat and its animal life on film.

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