GRAND FIR AND WHITE FIR

Abies grandis and *A. concolor* var. *lowiana* or *A. lowiana**, Pine family—Pinaceae

Grand fir, white fir, and their hybrid forms collectively occupy low- and midelevation forests throughout most of the Northwest, west of the Continental Divide. They can be distinguished by differences in their foliage, bark, and the chemical makeup of their resin, and hybrids are intermediate in these characteristics. Grand firs often stand out in woodland pastures as solitary trees limbed nearly to the ground with down-swept, flattened branches. Both grand fir and white fir are also abundant in moist mountain forests east of the Cascade crest. Crowded thickets of these firs with stiff horizontal branches fill many a forest understory. Some grand fir and white fir forests have suffered epidemics of insects and diseases that killed most of the trees, leaving whitened snags.

*Note: White fir's scientific name is not agreed upon (see *www.conifers.org*).

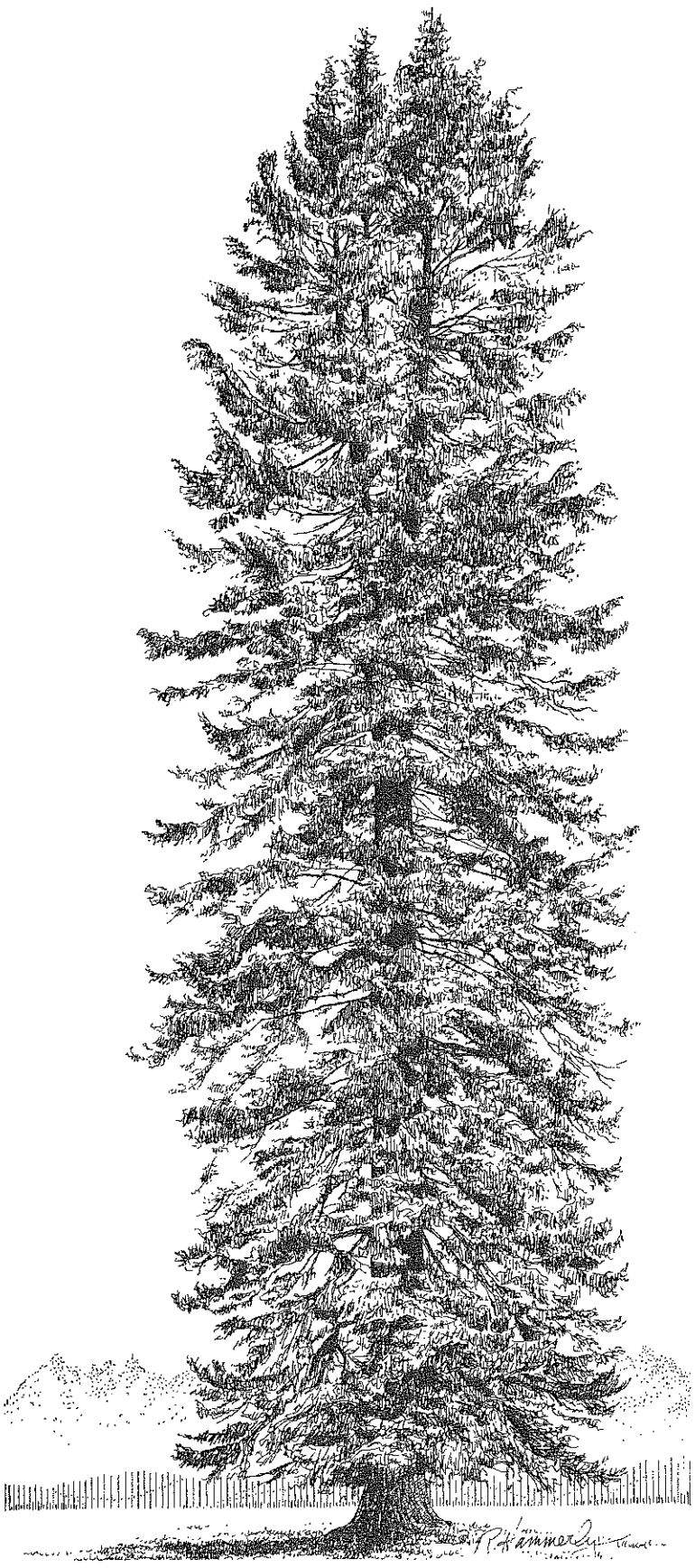
Where They Grow

Grand fir grows in coastal lowlands from northern California's redwood belt through Oregon and Washington and along the east side of Vancouver Island and the British Columbia mainland to the latitude of Campbell River. In western Washington, grand fir is usually confined to valleys below 1500 feet (450 m) in elevation. Grand fir is more abundant and broadly distributed in moist forests on the eastern slope of the Cascades southward to northern Oregon. Also, it is plentiful between 1800 and 5500 feet (550 and 1700 m) in moist areas of eastern Washington, northern Idaho, northwestern Montana, and southern British Columbia in the vicinity of Kootenay Lake. East of the Cascades, habitats supporting grand fir usually receive an average of 25 inches (640 mm) or more of annual precipitation but are too dry for or beyond the range limits of western hemlock and western redcedar.

The white fir found in the Greater Northwest is more drought-tolerant than grand fir and is able to occupy a broader range of forests. Its stronghold is the mountains of California, but it extends north into southern Oregon inland from the coast. Hybrid forms of grand fir and white fir predominate in the mountains of central and eastern Oregon and west-central Idaho, south nearly to Boise. The Rocky Mountain white fir (*A. concolor* var. *concolor* or simply *A. concolor*, depending upon the botanical authority), native to the middle and southern Rockies, is the most commonly cultivated form of this tree, prized for its light blue-green foliage. Contrary to some published range maps, this tree does not extend north into southeastern Idaho (Little 1971; Johnson 1995).

Comparative Appearance

Saplings and young trees of grand fir, white fir, and their hybrids have conical crowns composed of regular whorls of stiff, horizontal branches. These trees retain lower branches longer than accompanying Douglas-fir, and even in a mature forest they often support a live crown extending at least halfway to the ground. Trees in openings retain a thick, full-length canopy. Dominant old trees in the Cascades and inland Northwest often attain diameters of 30 to 40 inches (75 to 100 cm) and heights of 100 to 150 feet (30 to 45 m). Grand firs in coastal river valleys grow larger. Some of them scattered among giant Douglas-firs in northern and eastern valleys of Washington's Olympic



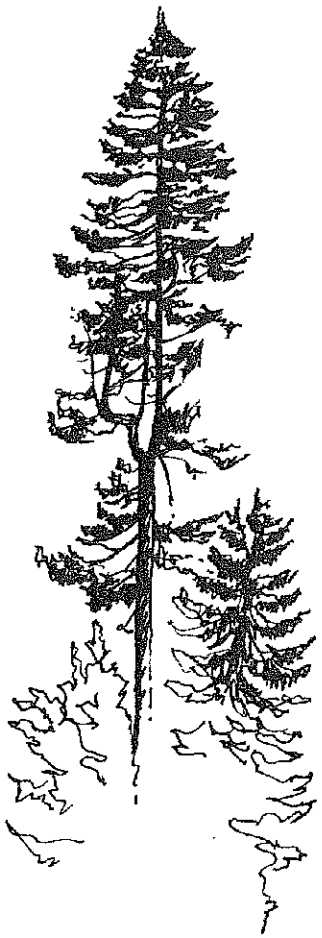
grand fir

National Park are 5 feet (1.5 m) thick and well over 200 feet (60 m) tall.

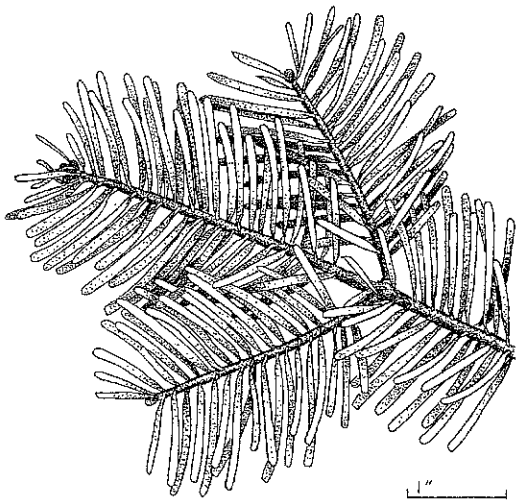
When the tip of an old grand fir or white fir dies, the tree unlike many other conifers readily sprouts new leaders. A conspicuous forked top develops, sometimes resembling a candelabrum. Two to several leaders of similar size arise from upper branches and stand erect, side by side. The visual effect is even more interesting when the multiple tops are loaded with upright cones. Similarly, grand fir and white fir readily sprout large quantities of epicormic branches from dormant buds if light and space suddenly become available, thus replacing live limbs that were broken or sawed off or died due to shading. This phenomenon is often seen where tall firs are trimmed along a powerline or roadway.

The bark on mature trees can be used to differentiate grand fir and white fir. Grand fir bark is about 2 inches (5 cm) thick, furrowed and divided into narrow, flat plates. It is gray or reddish brown outside but purple when sliced. Mature white firs have very thick bark—4 inches (10 cm) or more. It is hard and heavily furrowed and has a texture similar to that of old Douglas-fir trees. White-fir bark is ashy gray on the surface and has light- and dark-brown layers inside. Hybrid trees are intermediate in bark and foliage characteristics.

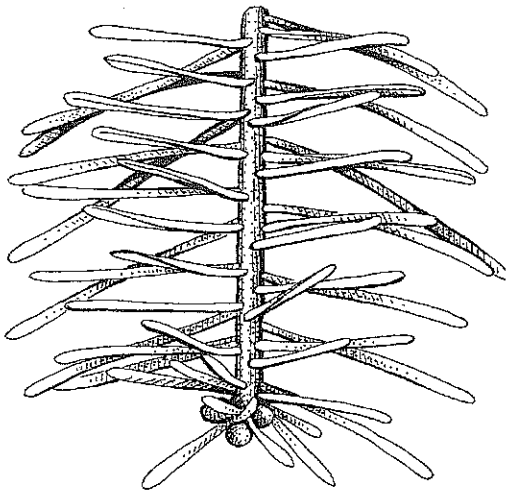
Grand fir foliage is easy to identify, except for foliage near the treetop. The lower boughs have flat, blunt needles, the longer ones



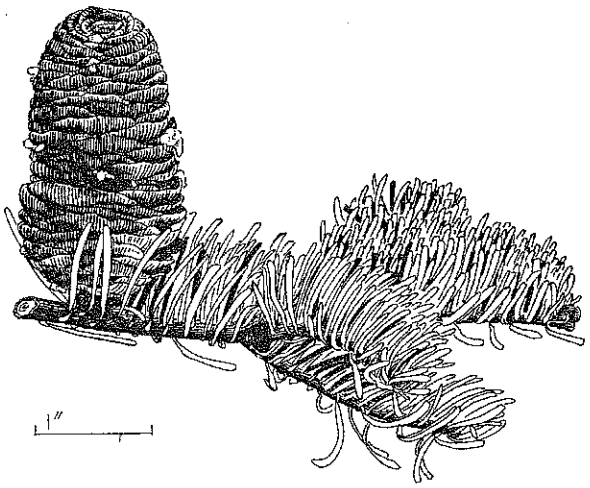
forked crown of a grand fir



grand fir needle detail, from lower branch



white fir needle detail, from lower branch



grand fir: cone and upper foliage

being 1½ to 2¼ inches (3.5 to 6 cm) long. These spread in two regular, comblike rows from opposite sides of the twig, producing flat branches. The needles and branches are shiny dark green above and whitish on the underside.

White fir foliage is also distinctive. The longer needles on lower boughs are 2 to 3 inches (5 to 7.5 cm) long. They are only somewhat two-ranked, and many are upturned so the branchlets aren't flat, although they may appear V-shaped. White fir needles have a whitish bloom on both upper and lower surfaces that makes them appear pale grayish green. The scientific species name, *concolor*, means "of the same color," which applies to the needles.

Cones of grand fir and white fir are similar, averaging about 4 inches (10 cm) long, green to reddish and covered with smooth scales. They sit upright in the trees except that they sometimes bend the branch tips as much as 90 degrees with their weight before they dry out and disintegrate.

Ecological Role

Grand fir and white fir are more shade tolerant than Douglas-fir (and thus able to displace it) but less shade tolerant than western hemlock or western redcedar. West of the Cascades from the Willamette Valley northward, grand fir is most common in river valleys on deep soils where it grows rapidly and faces less competition from hemlock. In these sites, its growth rate sometimes exceeds that of coastal Douglas-fir, although the tree is relatively short-lived and therefore doesn't attain the mammoth size of old-growth Douglas-fir (Van Pelt 2001). One exceptional grand fir on Vancouver Island attained a height of 140 feet (43 m) at an age of only fifty years.

East of the Cascade crest, grand fir occupies vast areas of moderately moist forestland. When historical fire cycles were interrupted by fire suppression, grand fir proliferated in forests formerly dominated by more fire-resistant species such as ponderosa pine, western larch, inland Douglas-fir, and western white pine. Grand fir and white fir saplings are capable of surviving under shady conditions and grow very slowly for decades until larger trees die or are cut, creating openings that allow some of the saplings to grow fast and take over the vacant space.

In these east-side forests, grand fir is susceptible to a number of defoliating insects and rotting fungi. Under historic conditions, grand fir often attained 250 to 280 years, but in modern stands, crowded, stressed grand fir often succumb within 100 years. In the late 1980s and early 1990s, large areas of dense grand fir and hybrid fir forests in the eastern Cascades and Blue Mountains suffered massive mortality from epidemics of western spruce budworm (*Choristoneura occidentalis*) and other defoliators. Some mountainsides had a light gray cast for many years due to the predominance of weathered, dead trees.

Dead branch stubs or scrapes from falling trees provide a point of entry for fungi, partially because grand fir (unlike pines) does not exude pitch over wounds, nor does it contain decay-inhibiting properties in the wood (as does western redcedar). One study found that rot readily entered 90 percent of the grand firs that were scraped during a logging operation.

Historically, rot entered through scars caused by low-intensity fires.

East of the Cascade crest, grand fir is heavily infected by the trunk-rotting Indian paint fungus (*Echinodontium tinctorium*). This fungus is detected by sighting "conks" or fruiting bodies, which are large brackets or hoof-shaped growths attached to the trunk, often high above ground. The conk of Indian paint fungus can be identified by the grayish spines that make up its lower surface. The interior of the conk is rust-red and was used by native peoples as a pigment. The presence of an Indian paint conk indicates that the tree has a rotten core, and in some areas most grand firs are infected by age sixty or so. Large, rotten grand firs are often saturated with water, and during subzero weather (–18 C or colder), this freezes and produces a vertical frost crack running up the trunk.

White fir differs ecologically from grand fir, and hybrids tend to be intermediate in their attributes. Wherever grand fir grows east of the Cascades, it is associated with inland Douglas-fir, which also occupies drier and colder sites and is more fire-resistant. In contrast, inland Douglas-fir is absent from California and southern Oregon, and white fir seems to expand its range to occupy habitats where inland Douglas-fir might be expected. White fir inhabits both drier and colder sites than grand fir. It is also more resistant to heart rot and generally lives longer than grand fir. White fir has much thicker bark than grand fir and is fire-resistant. However, without occasional understory fires to thin out saplings, both white fir and grand fir tend to develop thickets that constitute a fuel ladder, promoting crown fires.

Human History

Grand fir, white fir, and their intermediate forms were used by Native peoples primarily for diverse medicinal purposes (Moerman 1998). Most often mentioned were compounds using powdered bark or pitch for treatment of tuberculosis or dermatological problems. Thompson River tribes of southwestern British Columbia used the bark to cover lodges and to make canoes. The flat branches provided bedding and floor mats that were changed every two to three days. Lewis and Clark also mention this use of boughs among the tribes at the mouth of the Columbia River where the Corps of Discovery spent the winter of 1805–06.

Grand fir was first described scientifically by David Douglas and was cultivated in 1830 from seeds he brought back to Great Britain. Both grand fir and white fir are handsome trees with luxuriant full-length canopies when cultivated in a favorable climate. Both do well when planted west of the Cascades and in other moist areas of the Northwest. White fir are commonly used as wild Christmas trees in California. Grand fir also makes a beautiful Christmas tree but is not favored commercially because the long, stiff, horizontal branches do not allow it to be packed economically. Because of grand fir's fine symmetry and beautiful foliage, some communities west of the Cascades (for example, Tracyton and Silverdale, Washington) have maintained living grand fir Christmas trees that are up to 100 feet (30 m) tall.

The soft, white wood of grand fir and white fir makes pulp suitable for high-quality papers and is also used in construction applications where strength is not a major concern. Grand fir and white fir also provide habitat for wildlife. Pileated woodpeckers make impressive excavations in search of larvae and ants and for nesting sites. Large firs with rotten centers serve as home sites for many species of birds and mammals, including black bears. Hikers also find that the large, spreading canopy of a grand fir serves as a splendid rain shelter, since the flat, down-swept boughs shed water as a tent would. However, one shouldn't utilize such a lightning-prone site during an electrical storm!