

## Silver Firs in UBC Botanical Garden

The forty or so species in the genus *Abies* Miller are distributed widely around the Northern Hemisphere, with centres of diversity occurring in southern Europe, Asia, the Himalayas and western North America. UBC Botanical Garden has a small but significant collection consisting primarily of local and Asian species, but has identified the genus as one of its target groups and there are plans to expand the collections. As a group, the silver firs are easily recognizable; they are mostly densely pyramidal in youth, with conspicuously whorled branches, flattened needles and neat, upright cones, which are produced with the greatest frequency on older plants. The common name derives from the often highly visible whitish, wax-covered stomatal bands on the undersides of the needles of many species.

Primarily montane and subalpine species, silver firs are not usually considered good garden subjects. With a few notable exceptions, they are mostly trees of deep soils and many are adapted to rain or heavy snow, requiring cool temperatures and high humidity. Conditions at UBC Botanical Garden have been described (see climatic summaries in **Davidsonia**), but in short, the climate is a mild maritime regime with moderately warm, dry summers. The garden is situated on Vancouver's western edge (Point Grey) where the prevailing winds bring clean, cool, humid air directly off Georgia Strait. As a result, silver firs (and conifers in general) adapt well here. The soils that characterize the site are acid, relatively thin, overlaying unconsolidated glacial deposits, providing mostly sharp drainage, limited moisture storage and minimal fertility. Disturbed, deeper, amended soils are common at the garden and numerous *Abies* species are planted in them, though it's not yet clear whether the thinner native soils with their intact mycorrhizal networks are ultimately superior.

### The Collections

Native western North American trees are scattered over the Botanical Garden site. The biggest concentration of natives is in David C. Lam Asian

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Garden, as it is a natural second-growth forest regenerated since being clear-cut in ca. 1915. The Asian Garden was developed, beginning in the early 1970s, by minor selective clearing of the stand and under planting with plants of Asian origin. The most common native tree species in this forest include *Abies grandis* (Figures 4, 12.) (grand fir), *Acer macrophyllum* (bigleaf maple), *Alnus rubra* (red alder), *Pseudotsuga menziesii* (Douglas fir), *Rhamnus purshiana* (cascara), *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock). The majority of the conifers at this site are at least 30m tall, and many of the *A. grandis* exceed 45m and 1m diameter at breast height (dbh). We estimate that many of these trees are between 120 and 150 years old.

Grand fir is among the most shade-tolerant of the eight or nine western North American *Abies* species, exhibiting long, broad needles arranged in two distinct flattened ranks. Young trees are popular Christmas tree subjects, as they are broadly pyramidal with shining, dark green needles, but importantly, well adapted to repeated shearing and nursery culture in general. The strong, grapefruit-and-balsam scent is overwhelming to some. While older trees are narrowly columnar, they are often massive, exhibiting little discernable taper for much of their straight, clear trunks. At around 30m, or sometimes below, the main stem forks and re-forks, creating an irregular tufted crown.

*Abies grandis* is less common in the more exposed, drier BC Native Garden. When timber was cut from this site, conditions were better for the regeneration of Douglas fir and its associates. Here, there are specimens of the native *A. amabilis* (Pacific Silver or amabilis fir), but these have been planted in prepared sites. Locally, amabilis fir is a mountain-dweller, usually growing only above the 1000m mark in deep, moist soils. Near the outer coast, such as along the west side of Vancouver Island, *A. amabilis* grows near to sea level. A beautiful ornamental species, its needles are bright dark green above and striking silver below. In cultivation, amabilis fir is sometimes confused with other species, but the unusual needle arrangement - those carried on the upper part of the shoot lie flat and point forward, while the remaining needles form two flattened ranks - and the clearly identifiable tangerine scent of its bruised needles set it apart.

The E.H. Lohbrunner Alpine Garden is home to the third BC native fir, *A. lasiocarpa* (Figure 5). Here, on dry, well-drained exposed slopes, subalpine fir grows slowly - not unlike it does just below tree line in the local mountains. Despite the strictly high elevation provenance, the species initially grows

well on richer ground in the Vancouver area, where it develops a somewhat inflated pyramidal habit in youth. Its grey-green rubbery needles smell strongly of balsam, much like its close relative, *A. balsamea*. UBC collections include wild derived accessions from a variety of British Columbia locales, as well as a small number of cultivars, including 'Aurea', 'Compacta' and the very dwarf (and much sought after) 'Duflon'. Cultivars of *A. lasiocarpa* are located in the BC Native Garden, the Alpine Garden and in the dwarf and slow-growing conifer collection.

The Alpine Garden is also home to a number of European and Asian species, including a particularly fine 30-year-old specimen of *A. pinsapo* (Figure 6, back cover) (Spanish or hedgehog fir). This species, with its distinctive bottlebrush shoots of short, sharp needles is sometimes seen on well-drained soils in gardens around Vancouver. Again, the rocky, nutrient-poor soil in this part of the garden contributes to a reduction in overall vigour, and the tree stands with three main stems at just over 4m in height. Spanish fir is widely recognized as one of the more garden adaptable silver firs, tolerating lime and droughty soils better than most. In commerce, the majority of specimens are selected blue-needled forms; these are typically sold as a cultivar 'Glauca'. A striking, golden-needled form (*A. pinsapo* 'Aurea'), shrubby, and slow growing, was planted on the hillside below in 1998. Another mounded shrub in the Alpine Garden is *A. cephalonica* (Greek fir), which is a massive tree in habitat, known for ship-building in ancient Greece. Juvenile thus far, its needles are characteristically short and sharp and arranged all around the shoot like the related Spanish fir.

Close by the Botanical Garden on UBC Forestry research land, a larger Greek fir was cut down and used as a Christmas tree a few years ago. This was done (apparently) to save other more valuable trees, but the decapitation of *Abies* species to provide illicit Christmas trees is not uncommon on campus. On the same site, good stands of *A. balsamea* (balsam fir), *A. grandis*, *A. amabilis* and *A. procera* (noble fir) and a specimen of *A. bracteata* (bristlecone fir) were planted by the locally famous UBC dendrologist and forester John Worrall. Balsam fir is a North American boreal species and the most common Christmas tree species east of the Rocky Mountains. It is also the source of Canada balsam, a compound used for among other things, optical mounting cement, an oil paint additive, turpentine, glue for birch bark canoes, soaps, and a number of medicinal products. The exceptionally rare *A. bracteata* is

an extraordinary species because of its long, sharp needles and remarkable spiny-bracteate cones, but also for its natural range, which is restricted to the Santa Lucia Mountains in southern coastal California. Bristlecone fir is also noteworthy because it is apparently unrelated to any extant *Abies* species.

Noble fir is native to the mountains of the Pacific Northwest, but its range does not quite reach Canadian territory. It is a widely grown, high-value Christmas tree in the area, however, since it is easily cultivated and produces a symmetrically pyramidal, tiered crown. This species and the related *A. magnifica* (California red fir) are noted for their high quality timber. *Abies concolor* (white fir) is another western North American native, and perhaps the most widely grown ornamental species. White fir is so named because of its grey-green to grey-blue needles, and the specific epithet (Latin: *concolor* = uniformly clouded) denotes that they are same both above and below. Its native range is bisected by the Great Basin, with those plants of the southern Rocky Mountains smaller with more glaucous needles (var. *concolor*), and those from California and southern Oregon (var. *lowiana*) showing affinities to *A. grandis*. Most cultivated material is derived from var. *concolor* and UBC has two accessions in the dwarf and slow-growing conifer collection. Ours are grafted cultivars where the understocks have unfortunately overwhelmed their respective scions and these are now forming respectable trees.

Elsewhere in the Alpine Garden are the dwarfs, *A. balsamea* ‘Nana’ (a commonly cultivated witches-broom) and *A. koreana* ‘Prostrata’, a neat shrub that from an exceptionally early age produces miniature cones along its horizontal branches. *Abies koreana* (Figure 7.) (Korean fir) itself, considered one of the most beautiful of all conifers because of its neat habit and small but amply produced blue cones, is situated near the entrance to the David C. Lam Asian Garden. A specimen of the related *A. sachalinensis*, Sakhalin fir, from wild collected seed in Hokkaido, Japan, has formed a dense, rounded bush in the 25 years since its planting. This species grows to 40m in habitat (Hokkaido, Sakhalin and the Kurile Islands) and would perhaps have formed a proper tree given different siting.

Venturing back to the Asian Garden with its forest cover and comparatively deeper, richer soils, a number of non-native *Abies* species stand out. In particular, the 12m specimens of Shensi fir, *A. chensiensis* (Figure 8, front cover), are much admired by garden visitors. Shaped like gigantic beehives, these plants have exceptionally lush foliage right to the ground and contrasting

yellow-green cones in their upper crowns. A trio was planted in 1979 at the northwestern boundary of the Botanical Garden at the top of a stream bank, where they have grown to magnificent proportions. The species is native from the Himalayas to the mountains of northern China. Through a mix-up, these plants, originally derived from seed from Beijing Botanical Garden, were initially labelled *A. fargesii* (Figure 9.). That species, planted some 50 m away - not surprisingly labelled *A. chensiensis* until recently - is thriving, despite the drier soil and more exposed site. At UBC, Farges fir is exceptionally handsome with its beautiful purple-blue, resin streaked cones and irregular branching. Adding to its appeal, the branch tips ascend, which displays the silver undersides of the shining, blunt-tipped needles.

A pair of *A. homolepis* (Nikko fir) grows close by. *Abies homolepis* is a close relative of Shensi fir, but native to southern Japan. It is noteworthy for its silver-backed needles and violet-blue cones, which are produced around the whole crown, not only in the upper parts of the tree, as in other species. In the same area, plants of *A. delavayi* (Figure 10.) (Delavay fir) and *A. holophylla* (Manchurian fir) are reaching five or six metres in height and are beginning to cone and show mature bark characteristics. One specimen of *A. delavayi* is grown from seed collected in Yunnan Province, China, at the western extremity of its range. Delavay fir is a beautiful species known for its pyramidal, horizontally layered crown and large, royal blue cones. Two more accessions (also from Yunnan) are newly planted out in the garden this year. Near them is a specimen of *A. kawakamii* (Formosa fir). This species, from the mountains of the island of Formosa (Taiwan), has short, lustrous needles arranged brush-like, except for a prominent v-shaped groove along the top of the shoot. The light brown flaking bark contrasts beautifully with the dark green foliage of this species. Both Formosan and Delavay fir are known to be among the most tender of Asian *Abies* species (Zone 8), but this determination was probably made in the UK, where late frost is a complicating factor. UBC seldom suffers late frost and many so-called tender plants thrive here and throughout the maritime Pacific Northwest.

Two other closely related silver firs merit discussion. *Abies forrestii* (Forrest fir) and *A. densa* (Figure 11.) (Sikkim fir) both inhabit summer rainfall areas (*A. forrestii* is from northwest Yunnan and southeast Tibet, *A. densa* is native to eastern Nepal, Bhutan and the Indian states of Sikkim and Arunachal Pradesh), but have adapted well to the opposite regime at UBC. Our single

specimen of Forrest fir is a spectacular icy blue; its short, notched needles are upswept on each shoot (much like those of the greener *A. nobilis*), and present their stark glaucous under-surface to anyone looking across to the tree. Also noted for striking stomatal bands, Sikkim fir is somewhat more modest, requiring the observer to view the silvered needles from below. Its blunt, soft needles are luxuriously produced all around the shoot and the whole plant smells strongly of tangerines. Our collection of *A. densa* is from seed collected at two localities in the Kingdom of Bhutan. Plants are only 10 years in the ground, but they are growing very strongly and now producing velvety blue, 15cm tall cones in the upper branch tiers.

### The Future

Missing from our collections are a number of notable species, particularly those we have identified as within our collections mandate with outstanding ornamental appeal. Such species as *A. veitchii*, (Veitch fir), *A. squamata* (flaky bark fir), and *A. pindrowi* (Pindrow or west Himalayan fir) are notable by their absence from any public collection that has a climate appropriate for their growth. More scientifically significant reasons compel us to acquire these plants, however, including conservation of rare or endangered narrow endemics such as the Chinese *A. beshanzuensis*, Moroccan *A. tazaotana* and Mexican *A. hidalgensis*. Our priorities are to first complete the Asian collections, with emphasis on the Japanese, Himalayan and Chinese species and their segregate taxa. We are fortunate to have both a significant undeveloped (still forested) land base within the David C. Lam Asian Garden and opportunities for collaborative plant exploration in Asia. For example, UBC is a member of the North American China Plant Exploration Consortium (NACPEC), an association of private and public botanical institutions that regularly sponsors expeditions to China. Recently, UBC also signed a memorandum of understanding with Kunming Institute of Botany, Chinese Academy of Sciences that promotes joint research initiatives between the two institutions.

Our next priority is to extend the western North American collections to include many of the more southern species in an expanded “Cascadian” Native Garden, perhaps with connection to an extended North American section of the Alpine Garden. Here, we could bring together species from the Pacific Northwest, California and the highlands of Mexico - together

these areas are considered one of the richest temperate conifer floras in the world. Moving even further south into the mountains of Central America are species - *A. guatemalensis*, *A. bickelii* and *A. religiosa* (sacred fir) - reported to be hardy to Zone 8 or 9, climatic tolerances well within UBC's capabilities. These conifers would be enormous assets to the garden as they are poorly known, especially in gardens, and assumed to form natural groups with the other western North American silver firs. Such a collection would have great amenity and teaching value, but would also provide excellent material for research.

Finally, there are numerous opportunities for planting on the greater UBC campus; indeed, compared with the garden's holdings, there are many more microclimatically diverse university sites available for planting. Here we could easily locate Mediterranean species, such as the adaptable, but rarely cultivated *A. numidica* (Algerian fir), and the western Asian *A. bormuelleriana* (Bornmüller fir), which is also considered an excellent garden plant. A fine specimen of the beautiful *A. nordmaniana* (Caucasian fir) exists at Vancouver's sister botanical institution, VanDusen Garden, indicating its amenability for this area. As is practiced at the botanical garden, creative early training would have to be employed to deter Christmas time vandalism, but it seems mean not to spread the beauty of silver firs beyond the garden.

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Photo: UBC Botanical Garden Archives

Figure 4. *Abies grandis*. Note the two-ranked arrangement of the needles.



Photo: Daniel Mosquin

Figure 5. *Abies lasiocarpa* on the shores of Helm Lake, Garibaldi Provincial Park.



Figure 6. *Abies pinsapo* cone and shoots. The blunt and stiff 1.5cm needles surrounding the shoot give the hedgehog fir its name.



Photo: Daniel Mosquin

Figure 7. *Abies koreana*. The structure in the background is the “ting” at the end of the UBC Botanical Garden entrance boardwalk.



Scan: Douglas Justice

Figure 8. *Abies chensiensis* (2×). Note the broad, wax-covered stomatal bands and notched tips of the needles.



Photo: Daniel Mosquin

Figure 9. *Abies fargesii*. The upturned branch tips expose the needles' silvery stomatal bands.



Photo: Douglas Justice

Figure 10. *Abies delavayi* is a striking species especially when viewed from below.



Figure 11. *Abies densa*.

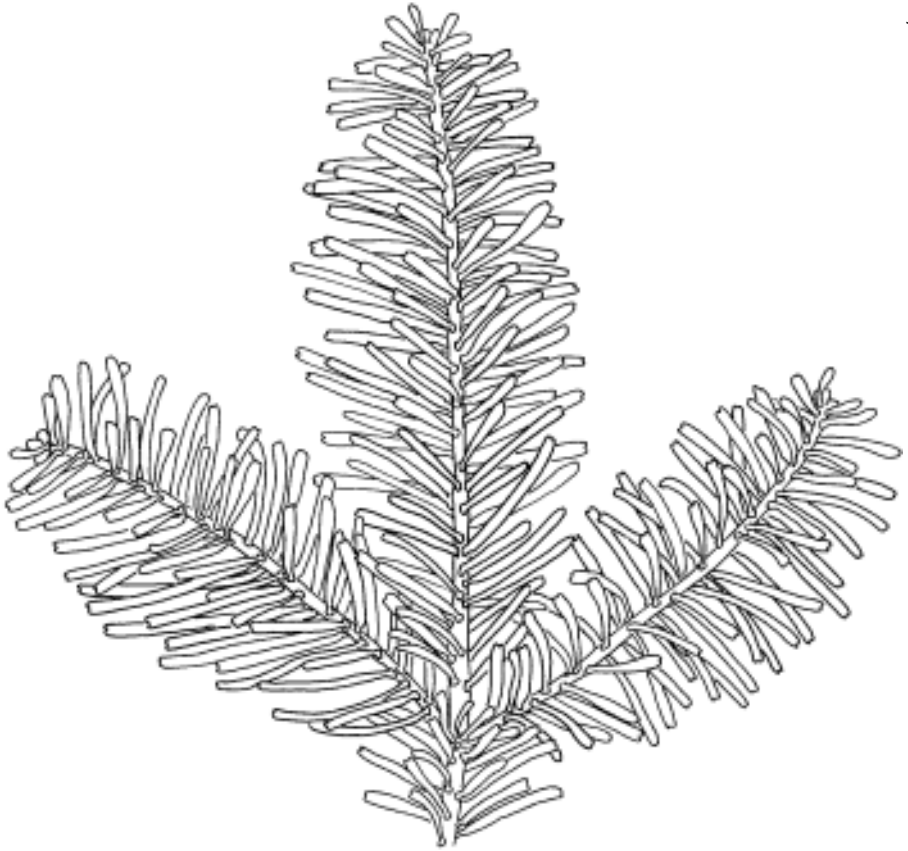


Figure 12. *Abies grandis*.