Culturally modified tree. The bark of *Thuja plicata* has many traditional uses, from the manufacture of rope to waterproof hats, nappies and other kinds of clothing. Careful, modest, bark stripping has little effect on the health or longevity of trees. (see pages 24 to 35)

photograph © Douglas Justice

Tree of the Year : *Thuja plicata* Donn ex D. Don

In this year's Tree of the Year article **DOUGLAS JUSTICE** writes an account of the western red-cedar or giant arborvitae (tree of life), a species of conifers that, for centuries has been central to the lives of people of the Northwest Coast of America.

"In a small clearing in the forest, a young woman is in labour. Two women companions urge her to pull hard on the cedar bark rope tied to a nearby tree. The baby, born onto a newly made cedar bark mat, cries its arrival into the Northwest Coast world. Its cradle of firmly woven cedar root, with a mattress and covering of soft-shredded cedar bark, is ready.

The young woman's husband and his uncle are on the sea in a canoe carved from a single red-cedar log and are using paddles made from knot-free yellow cedar. When they reach the fishing ground that belongs to their family, the men set out a net of cedar bark twine weighted along one edge by stones lashed to it with strong, flexible cedar withes. Cedar wood floats support the net's upper edge.

Wearing a cedar bark hat, cape and skirt to protect her from the rain and

Opposite, A grove of 80- to 100-year-old *Thuja plicata* in Queen Elizabeth Park, Vancouver. Western red-cedars are common constituents of parks and gardens throughout northwestern North America.

Right, Pole carving, Haida Heritage Centre, Haida Gwaii (Queen Charlotte Islands). *Thuja plicata* is the species most commonly used for traditional poles. The faces depicted usually represent people, animals or mythological figures, and often indicate clan affiliations or stories.

photograph © Daniel Mosquin

the cold, the baby's grandmother digs into the pebbly sand of the beach at low tide to collect clams. She loads them into a basket of cedar withe and root, adjusts the broad cedar tumpline across her forehead and returns home along the beach.

The embers in the centre of the big cedar plank house leap into flame as the clam gatherer's niece adds more wood. Smoke billows past the cedar rack above, where small split fish are hung to cure. It curls its way past the great cedar beams and rises out through the opening between the long cedar roof planks. The young girl takes red-hot rocks from the fire with long tongs, dips them into a small cedar box of water to rinse off the ashes, then places the rocks into a cedar wood cooking box to boil water for the clams her aunt has gathered.

Outside the house stands a tall, carved cedar memorial pole, bearing the prestigious crests of her family lineage. It has been raised with long, strong cedar withe ropes and validated with great ceremony. The house chief and noblemen had taken out their ceremonial regalia from large storage chests of cedar wood, dancers had worn cedar wood masks adorned with cascades of soft-shredded cedar bark, and performed in front of screens made of cedar planks. Guests had been served quantities of food from huge cedar wood bowls and dishes, wiping their hands clean on soft-shredded cedar bark.

A young slave woman coils two fresh diapers from soft-shredded cedar

Emily Carr
Red Cedar, 1931
Oil on canvas.
Collection of the Vancouver Art Gallery, Gift of Mrs. J. P. Fell.

bark and goes to tend a crying baby, while the child's father prepares long, slender cedar withes to lash a stone hammer head to its shaft. When the hammer is finished, he uses it to pound wedges into a cedar log to split off a plank for a tackle box to fit in the bow of his canoe. He will use the other withes he prepared to sew the corner of the box once he bends the plank into shape. In a year or more he will make a cedar wood cradle in a similar fashion for his sister's new baby, when it grows too big for its woven cedar root cradle. He smiles at the reassuring cries of the newborn infant resounding through the forest."

Stewart, Hilary. Excerpt from "People of the Cedar" *Cedar: Tree of Life to the Northwest Coast Indians*. Vancouver: Douglas & McIntyre, 1984. 17-18. Print. Reprinted with permission.

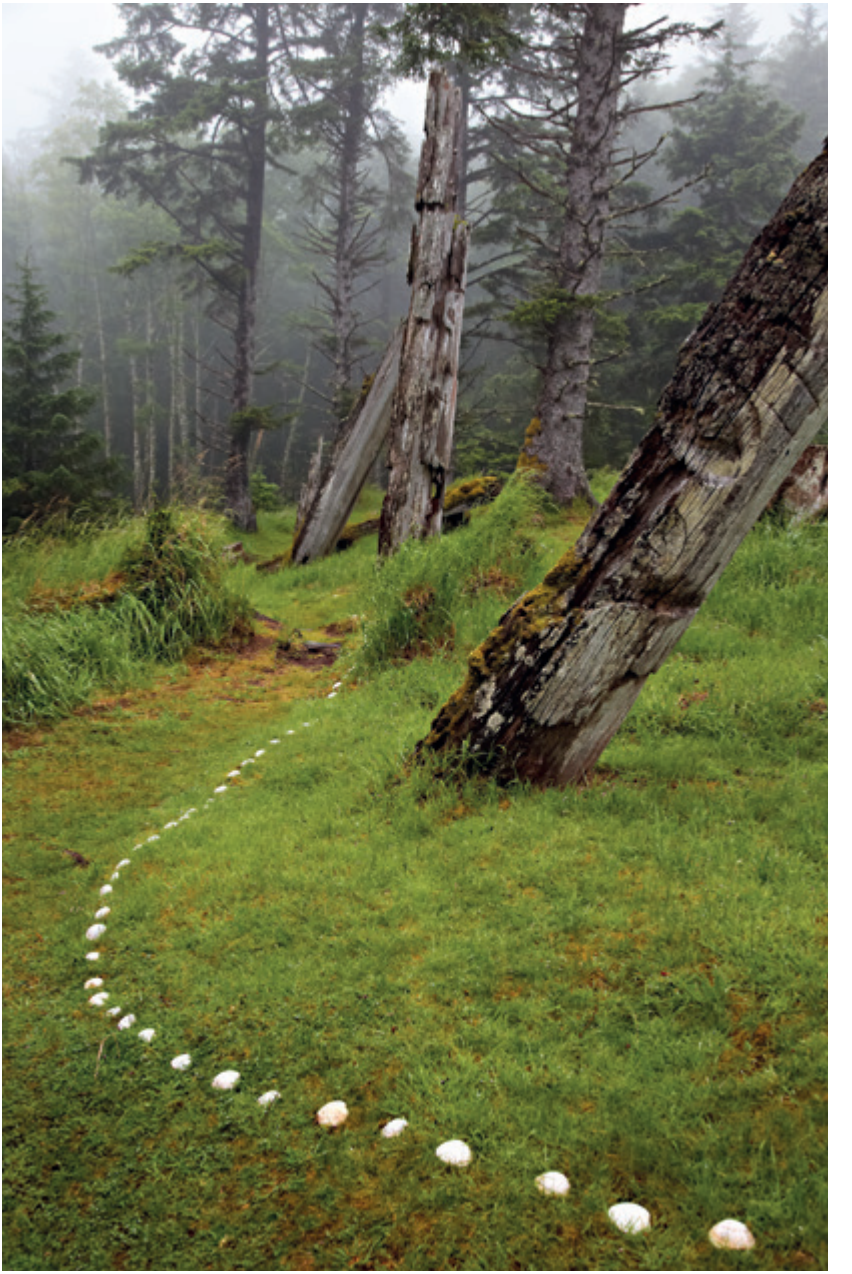
The genus *Thuja* L. consists of five species, all from mesic environments in the northern hemisphere. *Thuja koraiensis* (Korean arborvitae) is native to North Korea and adjacent China, *T. standishii* (Japanese arborvitae) to Japan, and *T. sutchuenensis* (Sichuan arborvitae) to Sichuan, China. Eastern white cedar, *T. occidentalis* is native to eastern North America. *Thuja plicata* is the largest species and the only *Thuja* in western North America. The closest relatives of *Thuja* are *Chamaecyparis* (false cypress) and *Thujopsis* (hiba arborvitae), to which there are many ecological and morphological similarities.

Thuja plicata is native along the Pacific coast from northern California to southern Alaska, with habitats from sea level to 2300 m elevation. It is most abundant in western Oregon and Washington, and in southwestern British Columbia. The species also has a limited distribution in moist habitats in the valleys west of the Rocky Mountains north of central Idaho. In all of these areas of western North America, *T. plicata* is known as western red-cedar, thuja, or simply, cedar. Elsewhere, it is known under a variety of names, including canoe cedar, giant cedar, shinglewood, and giant or western arborvitae. The name arborvitae, which is regularly used for other species of *Thuja*, particularly in the literature, means "tree of life," an entirely appropriate appellation, though most gardeners in western North America would be unfamiliar with that name. The name 'red cedar' is frequently hyphenated red-cedar.

Western red-cedar is an exceptionally long-lived species in the wild. Eight hundred to one thousand year-old specimens are not rare in the humid, maritime valleys and mountainsides of the Pacific Northwest, and trees can probably exceed fifteen hundred years in areas not regularly visited by forest fires. The largest standing trees are on the west coast of Vancouver Island in British Columbia, and on the Olympic Peninsula in Washington State. In both places there are several individuals more than 50 m tall and with a circumference of more than 18 m. Old trees often have broken tops and look somewhat fang-toothed with multiple dead leaders, but trees are known to grow to 65 m or more in height. Prior to the mid 1800s, before extensive logging over much of the species' range, staggeringly large trees were common. Because the wood is rot resistant, stumps of these old giants are still occasionally found, and show not only the magnificent buttresses typical of the species, but also notches for springboards, which were inserted at a height sufficient to allow sawing above the widened base. Western red-cedar is still a valuable timber species, logged extensively both for dimensional lumber and shingles. It is the provincial tree of British Columbia.

As noted, western red-cedar grows with a broad, often buttressed, and fluted trunk. Trees can be very broad, with long sweeping boughs with upturned tips, and measure up to 15 m wide or more at ground level. The drooping, curtain-like side branches–more tent like, closer to the branch tips–are well adapted to shedding rain and snow. *Thuja plicata* normally grows straight, with a single dominating stem and well spaced lateral branches

photograph © Daniel Mosquin



Old poles, Skedans Village, Haida Gwaii. Throughout Northwest Coast aboriginal culture, carved cedar poles are never righted or repaired in any way, but are left to decay naturally.

Thuja plicata 'Zebrina'

that most children know are excellent for climbing. With age, a second leader frequently develops, creating a somewhat broader conical head. Larger lateral branches can also sometimes assume apical dominance and compete with the central leader but, in general, trees maintain an excurrent (typical, Christmas tree-like) habit. Secondary and tertiary branches that originate along the long swooping laterals within the shaded crown (known as withes) loop downwards, the lower ones in ever more descending curves. In the open, trees retain their branches to the ground for many years, while under crowded conditions, shaded lower branches are readily shed.

The individual leaves of thujas are tiny (1-3 mm long), flattened and scale like, and each leaf base extends down (i.e., is decurrent on) the stem and overlaps the leaf base above it, with only the acute tip diverging slightly from the shoot. Although branches and branchlets are alternately arranged, the leaves are symmetrically arranged in pairs, with subsequent pairs borne at right angles to them along the stem. In western red-cedar, the exposed portion of each leaf often has a mucro (a small abrupt point) at the apex. The mucro and smooth margin are rimmed with translucent pale yellow tissue, particularly obvious when the leaves are young. Thus, the conspicuously four-ranked (decussate) leaf arrangement is accentuated at the branch tips by the subtly contrasting leaf margins. Such a strongly decurrent, decussate leaf arrangement is common to a number of cypress relatives (e.g., *Chamaecyparis*,

Cupressus, *Thujopsis*) and is arguably one of the most ornamental features of these plants.

The flattened branchlets of western red-cedar are rhomboidal to lanceolate in outline and up to 15 or 20 cm long, with numerous alternating asymmetrical lateral shoots. These branchlets are collected into larger elliptic sprays, which are densely borne and hang curtain like along the exposed branches, especially so under shaded conditions. Flattened branchlets display two kinds of leaves: facial leaves, which lie flat on the stem, and lateral leaves that are sharply folded around the stem. A third type of leaf occurs on the sturdier, terete leading shoots. These are much like facial leaves, but are longer (to 15 mm) and more acuminate, and only barely overlap on expanded stems. A fourth type of leaf, represented by leaves on seedling plants, is unlike those already mentioned. Like the juvenile leaves on many other cypress relatives, they are awl shaped and more or less squarrose (diverging at right angles to the stem); however, seedlings start to produce the more familiar, flattened sprays of scale-like overlapping leaves within a few months of germination.

As with other cypress relatives, the current season's branchlets on *Thuja plicata* show white waxy deposits in the leaves' stomatal regions, which are normally restricted to the abaxial (undersides) of the sprays. Stomatal waxes often mark out striking patterns on the abaxial shoots of cypress relatives – such as we see in *Thujopsis dolobrata* and *Thuja koraiensis* – but in *T. plicata*, as in most other *Thuja* species, it appears that wax is both stingily and haphazardly applied to the leaves. In summer, three-year-old and older branchlets turn brown or red before being shed. This behaviour (losing branchlets, rather than individual leaves), known as *cladoptosis*, is characteristic of the Cupressaceae, but often causes concern among gardeners who think that it is a sign of declining health.

Notwithstanding the finer aspects and patterning of *Thuja plicata* foliage, the overall look of the species is rather subdued, though not so dull as its usual coniferous associates in the wild – *Tsuga heterophylla* (western hemlock) and *Pseudotsuga menziesii* (Douglas-fir), for example – which tend to absorb more than reflect light. Western red-cedars are certainly dark green, but with subtle yellowish-green highlights in the sun. Trees are more monochrome dark green in the shade, and in winter, the leaves generally take on an even darker green to bronze-purple hue. The waxy scale leaves are nearly always lustrous, however, which makes light play in the curtain-like foliage. One of the advantages of conifers in the landscape is that from a distance they are more or less texturally and chromatically uniform – the perfect foil for lighter-coloured plants that may stand in front. *Thuja plicata* excels in this regard, especially as even large trees may be clothed with foliage to the ground. The beautifully tiered branches and white bracted flowers of *Cornus nuttallii* (Pacific dogwood) look particularly agreeable against a background of western red-cedar, for example. This is a common combination in the wild, but in gardens,

magnolias, rhododendrons, climbing roses and other exotic fare can stand in admirably for the dogwood.

Thujas are monoecious conifers (i.e., with separate-sex cones occurring on the same tree) and pollen cones are produced on the lower branches on the tips of the previous year's branchlets in spring. They are red-brown and generally unnoticed because of their small size, but their apparent insignificance belies their great numbers and capacity to produce a vast amount of sulphur-coloured pollen, which is shed in great wafting mists, usually in March or April. *Thuja* pollen is considered a moderate allergen for hay fever sufferers. The egg-shaped seed cones are also small – usually 8 to 16 mm long – and are generally located above the male cones, mid-way and higher up the tree. Female cones are borne in small, loose clusters on short twigs at the base of the previous season's growth. Each cone is comprised of five or six pairs of imbricate, initially green scales. The cones stand erect, becoming woodier as they mature, the scales eventually separating in late summer to expose the tiny winged seeds. Each of the cone scales has a recurved spiny tip, which clearly distinguishes western red from eastern white cedar with its smooth cone scales. Seeds germinate easily in the autumn they are shed, as long as they come to rest in organic rich duff above moist soil. Seedlings normally establish themselves before winter.

Like other plants in Cupressaceae, thujas have wood that is soft, straight-grained, aromatic and oily. This makes the lumber workable and exceptionally rot resistant, and thus excellent for weather-exposed building materials, such as shingles and fence posts or, as Hilary Stewart's essay conveys, for furnishing implements and objects that describe a prosperous and resonant life on the land. Little wonder that *Thuja plicata* is known as the cornerstone of northwest coast First Nations culture. The wood and foliage of western red-cedar is strongly and pleasantly aromatic – smelling of pineapple to some, and easily differentiating the species from other similar-looking conifers. The chemical compounds responsible for the agreeable aroma include thujone (one of the principal constituents of cedarleaf oil), with lesser amounts of carvacrol (a component of oil of oregano), pinene, sabinene and fenchone. Although their concentrations are small, pinene lends somewhat higher, more refreshing notes to the aroma, while sabinene (a major fragrance element in the phytochemistry of Norway and other spruces) adds a somewhat peppery aroma, and fenchone imparts lime and camphor elements. Besides providing a delicious olfactory bouquet, these compounds confer significant fungal resistance to the tissues. Cedarleaf oil derived from *T. plicata* has recently been promoted for its antimicrobial properties, even in the alleviation of sick-building syndrome, but also in herbal medicine for its immune-system stimulating effects. Indeed, the name tree of life (*arbor-vitae*) derives from the use of *T. occidentalis* to treat European sailors suffering from scurvy in the mid sixteenth century. It should be noted, however (lest dendrologists start a program of chewing on thujas), that extracts of *Thuja* are also known to cause convulsions, as well as liver and

photograph © Daniel Mosquin

brain damage when ingested.

Carvacrol, which is more abundant in the heartwood of *T. plicata*, and also present in the wood of a variety of other cypress relatives (*Thujopsis*, *Juniperus*, etc.), is a powerful antiseptic (e.g., it is commonly used in dental preparations). It is also an effective aromatic larvacide, which explains why red-cedar balls and chips are recommended for ridding closets of clothing moths. Despite the presence of known phytotoxic phenolic compounds (such as thujaplicin) in western red-cedar wood, shavings are routinely used in small-container nursery production as a top dressing (with no apparent ill effects) to prevent the establishment of liverwort and other troublesome weeds on the soil-media surface.

The aromatic nature of *Thuja plicata* explains one part of the common name: cedar is from the Greek *kedros*, which is the traditional name for trees with fragrant wood–originally applied to junipers, but also to *Cedrus*, the genus for which the name "true" cedar is generally applied. The thin bark on older stems is red-brown and peels in strips, and the wood is streaked red, hence

photograph © Douglas Justice

Opposite, Old growth *Thuja plicata* with *Acer circinatum* (vine maple) in Sumallo Grove, Manning Provincial Park, British Columbia.

Right, *Thuja plicata* with seed cones.

red cedar. In North America, *Juniperus virginiana*, which has even darker red-streaked, aromatic wood, would have historical priority for the name "red cedar," having been first described by Europeans some 70 years before. The name *Thuja* is derived from the Greek, *thuia,* for a kind of aromatic tree (probably a juniper), and the specific epithet *plicata* describes the lateral leaves, which are neatly folded around the edges of the flattened shoots (plicate = folded). Alternately, plicate can suggest "plaited," which aptly describes the braided look of the miniature scales along the flattened shoots.

Western red-cedars are plants best cultivated in moist, fine-textured soils, though they are famously tolerant of a wide range of soil types, moisture regimes and pHs. Like all *Thuja* species, *T. plicata* is tolerant of both sun and shade and revels in humid conditions, but usually requires good drainage for robust growth. The roots of thujas are exceptionally resilient, fibrous and extensive, and easily out-compete other plants for moisture. Western red-cedar cultivation is thus straightforward, but gardening around the trees is often challenging, especially when soil moisture is limited, or the soil is shallow. This is more than obvious with plants in the wild, as there is often bare ground for some distance around established trees. Nevertheless, older, established thujas are known to expire with surprising speed when there are changes to underground moisture patterns.

Cultivars

Compared with *Thuja occidentalis*, there are relatively few cultivars of *T. plicata*, but they run much the same gamut of dwarf, variegated and gold tinged variations. Shrubby and coloured leaf cultivars of *Thuja plicata* seem more popular in European than in North American gardens. The most common cultivars of these sorts are **'Zebrina'**, **'Canadian Gold'**, **'Irish Gold'**, **'Stoneham Gold'**, **'Aurea'**, **'Rogersii'**, **'Cuprea'**, **'Hillieri'** and **'Whipcord'**. Golden

yellow from a distance, the shoots of 'Zebrina' display alternating narrow green and white to yellow bands. 'Zebrina' is exceptionally vigorous and tends to retain its lower branches, so is frequently used for hedging. 'Zebrina' is sometimes confused with the less commonly grown 'Irish Gold' (a.k.a. 'Zebrina Extra Gold'), which has more drooping, golden-yellow branch tips and a more natural-looking, open-pyramidal crown profile. Another full-size cultivar is 'Canadian Gold', which is similar to (and perhaps the same as) 'Sunshine'. It is a conical tree, golden yellow on the sunny side, but turning dirty bronze in the winter. Among the smaller growing cultivars, 'Stoneham Gold' is probably the most popular. It is more or less conical, but only grows to about 2.5 m tall. The bright golden yellow branchlet tips are displayed year-round. 'Aurea' is somewhat larger growing and more columnar, with branchlets that are a more subdued burnished gold.

It is recognized that dwarf conifers are known to be an irritant to people who prefer to see tree species express their arborescent potential. Indeed, an exploration of miniature western red-cedars might seem a particular dendrological abomination, but fortunately, there are relatively few truly dwarf cultivars available to describe. 'Rogersii' has miniature sprays and a dense globose to pyramidal habit to about 1 m tall. 'Rogersii' is tinged golden yellow, while the similar 'Cuprea' is more coppery. A slightly more robust cultivar is 'Hillieri', which grows slowly to 2 m across and tall with tight, irregularly arranged bright green and bronzy sprays of foliage. One of the most unusual dwarf *T. plicata* cultivars is 'Whipcord', which is also known as 'Filifera' for its resemblance to the threadleaf cypress, *Chamaecyparis pisifera* 'Filifera'. It is a mop-headed bush with pendulous side branches, the individual stems marginally stockier, smoother and longer than those of threadleaf cypress, and the plants always stay shrubby. Most people are fooled, unless familiar with the distinctive aroma of *T. plicata* (*C. pisifera* smells of celery).

Full sized plants include **'Excelsa'**, a plant that was originally found in a Berlin cemetery. 'Excelsa' is a fast-growing selection that quickly attains tree-size proportions. It has dense, ascending branches, and a tendency to retain its lower limbs. These characteristics make it ideal as a large hedge plant, but the uniformity of its crown structure, dense habit and billowing lower branches make it look inelegant and out of place when cultivated as a solitary tree, especially in native or naturalistic plantings.

Thuja plicata **'Atrovirens'** has bright, glossy, dark green foliage and strongly upright branching. Even the branchlets tend to stand up rather than droop. Left to its own devices, 'Atrovirens' forms a conical crown, perhaps somewhat denser than that of a wild seedling. The unusual posture of its sprays makes 'Atrovirens' and other similar cultivars highly susceptible to the fungus disease, keithia blight (*Didymascella thujina*). In western North America, keithia blight is a common problem on thujas under nursery conditions, where overhead watering and tight row-spacing are the norm,

though the disease seldom significantly affects trees in the landscape.

Among other popular full-size cultivars, **'Green Sport'** ('Watnong Green'), which stays green all year, and **'Gelderland'**, are relatively recent introductions. Both are somewhat more compact than seedling western red-cedars. Naturally slender-crowned cedars are known from the wild in southwest Washington and adjacent northwest Oregon. A natural stand of particularly narrow individuals on Hogan Road in Gresham, Oregon, is the genesis for the name "Hogan" (also known as **'Fastigiata'**), though plants sold under these names are typically seed-grown, not clonal, and so technically, should not be given a cultivar name. Nevertheless, in the industry in western North America, "Hogan" reliably identifies narrow variants of the species. The best of these maintain a crown diameter of no more than 3 or 4 m at the base of a 15-m-tall tree. *Thuja* **'Green Giant'** (also known, erroneously, as *T. plicata* 'Emerald Giant') is a hybrid of *T. standishii* and *T. plicata*. Most people would be hard-pressed to recognize it as anything other than a vigorous, densely foliaged selection of western red-cedar, but it does have shorter, slightly less flattened sprays, which is certainly reminiscent of the Japanese species and less than typical for a western red. 'Green Giant' is used primarily for hedging, but when planted in the open as a specimen, develops into a relatively uniform, narrowly pyramidal tree 10 to 15 m tall after 30 years.

Native peoples of the northwest coast of North America recognized the enormous value of *Thuja plicata*. Besides the aforementioned materials and implements made from cedar, the list of traditional First Nations' use of *T. plicata* is impressively long. As well, the numerous medicinal applications (notably, treating colds and rheumatism and reducing fevers) are increasingly being studied by western science, and the artistic use of cedar, which was seamlessly integrated into household and religious objects, is now renowned around the world. Perhaps the most extraordinary aspect of western red-cedar to modern, western culture is that the harvesting of materials was carefully planned to maintain living trees whenever possible. Culturally modified trees, often of great age but still healthy, are a redolent reminder of how different the utilization of "resources" by one culture can be to our own. Such practices seemed primitive and quaint to the early settlers, and even today, a scorched-earth harvesting mentality is prevalent. Thankfully there are still giant red cedar trees and protected areas where they can be seen and venerated.

Further reading

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