Many folks living in Western Washington may be familiar with our state tree, the majestic western hemlock (*Tsuga heterophylla*), a denizen of the deep forest growing up to 230 feet tall. Adapted to shady and moist conditions, western hemlock is abundant in the lowland forest ecoregion of the Puget Sound and up into the foothills of our western mountains, but it is less well suited to the extremes of alpine life. Up in the higher elevations, our state tree gives way to another member of the hemlock genus, *Tsuga mertensiana*, the mountain hemlock.

Mountain hemlock is an incredible species, able to grow in an environment where conditions alternate between deep winter snows and harsh summer dry spells, and where growing seasons can sometimes be measured in mere weeks. As winter settles in over the Cascade and Olympic Mountains, it’s the perfect time to consider the adaptations that this tree uses to survive in its particular habitat, the benefits it provides to the ecosystem, and the beauty it can also provide in a home landscape.

**The Tree Line**

Climb into the tall mountains, and you will eventually arrive at a point where the forest begins to become sparser, the trees giving way to alpine meadows and bare rock. This is what we refer to as the tree line (or the timberline, if you’re a forester), a
zone of elevation above which the environment is just too difficult for trees to grow.

Above the tree line, the bitter cold gusts of winter dry out any leaves exposed to the air, and snow and avalanches crush down any vegetation that attempts to grow more than a few inches above the surface of the ground. Soils freeze, locking up water so that roots cannot pull moisture into the stem, and dry summers combine with limited soil depth to reduce summer water availability as well.

Mountain hemlock has evolved to grow in the slightly less extreme conditions of the tree line—as well as in more congenial subalpine conditions below it—in a range that extends from the Cook Inlet of Alaska south to the Sierra Nevada Mountains of California and east into the Rocky Mountains. (In the Cascade Mountains, the species grows between elevations of 5200 to 7500 feet.) It is not unusual to find this species growing in places where no other tree can—although, in our region, it is often associated with the subalpine fir (*Abies lasiocarpa*) and whitebark pine (*Pinus albicaulis*).

On very cold, windy sites in the tree line, the growth of mountain hemlock can be stunted. Here, the species can lose its usual conical tree-like form and take on a twisted, gnarled shape called krummholz (from the German for “twisted wood”). Krummholz mountain hemlocks have a shrubby, dense habit with multiple trunks growing together and expanding primarily in a lateral direction rather than vertical one.

In more optimal conditions—including loose, coarse-textured, well-drained soils with adequate moisture—western hemlock can reach well over 100 feet tall (see below).

**Alpine Adaptations**

The biggest pressure on these trees is winter snow, which in some locations can blanket *T. mertensiana* for up to 10 months of the year. Temperatures in the northern part of this tree’s range may plummet to -20 degrees Fahrenheit. On sites where the soil freezes, western hemlock effectively goes dormant during the cold months. It is therefore imperative that many mountain hemlocks make and store the most energy they
possibly can during the short summer growing season. (Note: In subalpine forests, deep snow pack may prevent the soil from freezing, allowing the tree to transpire and photosynthesize in spring. The species has evolved to grow at near-freezing temperatures if its roots are not frozen.)

Unlike its low-elevation cousin, mountain hemlock does best in full sun. To capture as much sunlight as possible, its needle-like leaves grow in what is called a bottlebrush pattern, extending outwards in every direction. These needles also have densely packed stomata—the holes through which plants take in carbon dioxide—allowing for a high rate of photosynthesis. These stomata also provide a wonderful aesthetic beauty to the tree, giving them a cool blueish-green color, which stands out amongst the darker greens of most Northwest conifers.

The limited summer growing season also means that _T. mertensiana_ often grows slowly at the upper limit of its elevational range. And, as with other tree species that grow slowly, mountain hemlocks can attain a great age, sometimes upwards of 800 years. (The oldest specimen was measured at 1400 years old!)

This is not to say that this species cannot attain a respectable size. In favorable conditions, mountain hemlock may reach heights of greater than 150 feet, with diameters of more than seven feet wide. While these larger trees are sturdy enough to survive deep snow fairly easily, smaller individuals must be extremely flexible to avoid being crushed or snapped. To this end, the boughs of the mountain hemlock often droop significantly, and the topmost branch, or leader, curls over in a graceful arc, angling in such a way that lighter snows simply slide right off—though most smaller trees are eventually buried beneath the drifts. When spring comes around, the bent forms of _T. mertensiana_ will spring back upright, occasionally with great vigor.

Reproduction in a harsh environment means that many seeds will fail to establish into new seedlings. Mountain hemlock compensates for this by producing very large seed crops, with trees as young as 20 years old producing viable cones. In larger seeding years, the dark-brown cones are readily visible hanging from the trees in dense clusters, one to three inches in length, and then littering the forest floor once falling. These trees are known to produce well over one million seeds per acre in a single year (although the seeds themselves are quite small), and in Alaska the species is known to reproduce by cloning as well, when branches from mature specimens come into contact with soil and sprout roots of their own.

**Benefits to Wildlife**

Mountain hemlock plays an important role in its montane ecosystem. According to the National Forest Service’s fact sheet on the species:

“Mountain hemlock stands provide good hiding and thermal cover for many wildlife species. Sites dominated by mountain hemlock provide important summer range for deer in Alaska and Vancouver Island because of abundant nutrient-rich forbs available in the understory. In Montana, mountain hemlock habitat types provide summer range for mule deer, elk and bear. Mountain hemlock seeds have been found in the stomachs of crows and grouse.”

Native squirrels and other animals also feed on the seeds. In “Plants of the Pacific Northwest Coast,” Jim Pojar and Andy MacKinnon note that, “On San Juan Ridge, northeast of Jordan River on Vancouver Island, squirrel-made caches of mountain hemlock seed cones have been observed in the deep hoofprints of Roosevelt elk. Once covered with snow, these cones serve as a convenient winter food supply.”

**In Our Landscape**

In her article on small trees for the urban garden in the Winter 2021 “Arboretum Bulletin,” Christina Pfeiffer writes that mountain hemlock is “very adaptable to cultivation at sea level. Its petite size and fine-textured foliage make it an ideal native conifer for smaller gardens. Plant it
in lean, well-drained soil to match the preferred conditions in the tree’s native habitat. The species has a relatively narrow habit and, in lowland cultivation, can be expected to reach about 35 feet in height. Beautiful as a single specimen, mountain hemlock also works well in groups as an evergreen backdrop or for screening.”

The Washington Park Arboretum is home to more than a dozen mountain hemlock specimens, including several planted (just south of Rhododendron Glen, on the path connecting to the Lookout Gazebo) in 1937, just a few years after the Arboretum was founded.

UW Botanic Gardens Curator of Living Collections Ray Larson is a big fan of the tree and is always on the lookout for new specimens to add to the collection, though he concedes the species can be hard to find at your local garden center. He says the trio planted in 1937 are very impressive specimens and relatively easy to spot, with one of them reaching up to 50 feet tall.

Additionally, the park features the cultivar ‘Bump’s Blue,’ which originated in Oregon near Mount Hood. This plant has an even more pronounced powder-blue look than the straight species, as well as denser foliage. Broadly conical in form, it grows at a moderate pace up to about 30 feet tall. A good place to see this cultivar and the straight species is on the east side of Crabapple Meadow, where specimens were recently planted along the service road to screen the Broadmoor Golf Course fence.

‘Bump’s Blue’ can also be found in the Cascadia Entry Garden at Pacific Connections—growing close to the dwarf mountain hemlock cultivar, ‘Sherwood Compact’, which has a somewhat weeping form, silvery-blue needles, and grows slowly up to four feet high and wide. On the south end of Azalea Way, you’ll find another dwarf cultivar, ‘Elizabeth’, which spreads out in a way reminiscent of high-elevation krummholz.

As Christina Pfeiffer indicated, though, due to its slow growth, the straight species can work in most gardens. It grows well in both full and partial sun, its dense foliage providing excellent shade as the tree matures and grows. Additionally, *T. mertensiana* does not have many major insect or disease problems, making for limited long-term care requirements.

If you have the chance, be sure to visit some of the mountain hemlocks in the Arboretum—and if you hike in the mountains, keep your eye out for these wonderful trees in their native habitat.

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## Western Hemlock Ethnobotany

Mountain hemlock produces moderately strong, light-colored wood, but because it grows at such high elevations, harvesting of the tree for timber has been historically limited. Regional tribes use the species medicinally, making poultices from the foliage to treat burns. They use the bark to treat colds, flu and nausea. The bark is also used for tanning hides.

### Sources