Forest Service

United States Department of Agriculture

FS-240

Western Hemlock

An American Wood

Western hemlock is an important commercial softwood species in the Western United States and Canada. The largest stands are found in the humid coastal regions of Oregon, Washington, British Columbia, and Alaska. The wood is used for structural lumber, molding, roof decking, veneer, and paper.

F-308993

Western Hemlock
(Tsuga heterophylla (Raf.) Sarg.)

James M. Cahill[1]

Distribution

Western hemlock grows along the Pacific coast from the Kenai Peninsula in Alaska to northwestern California (fig. 1). Inland from the coast, it is found on the western slopes and upper eastern slopes of the Cascade Range of Washington and as far south in Oregon as the Siskiyou Mountains.

Farther inland, western hemlock grows on the west side of the Continental Divide from just east of Prince George, British Columbia, south through northern Idaho and northwestern Montana. About 80 percent of its distribution in the Rocky Mountains is in British Columbia.

The fastest growing stands are found in the humid coastal regions of Oregon, Washington, British Columbia, and Alaska, and on the lower slopes of the Cascade Range in Washington and Oregon. In the Rocky Mountain region, dry summers limit western hemlock to primarily northerly slopes and moist creek bottoms.

Western hemlock is usually subordinate in stands that include Sitka spruce *(Picea sitchensis)* and Douglas-fir *(Pseudotsuga menziesii),* but it sometimes dominates and is found in pure stands in coastal areas. The pure western hemlock forest is a true climax type and follows the subclimax types of Sitka spruce and Douglas-fir west of the Cascades and western white pine *(Pinus monticola)* in the northern part of its inland range.

Description and Growth

Western hemlock is the largest of the four American hemlocks and, under the

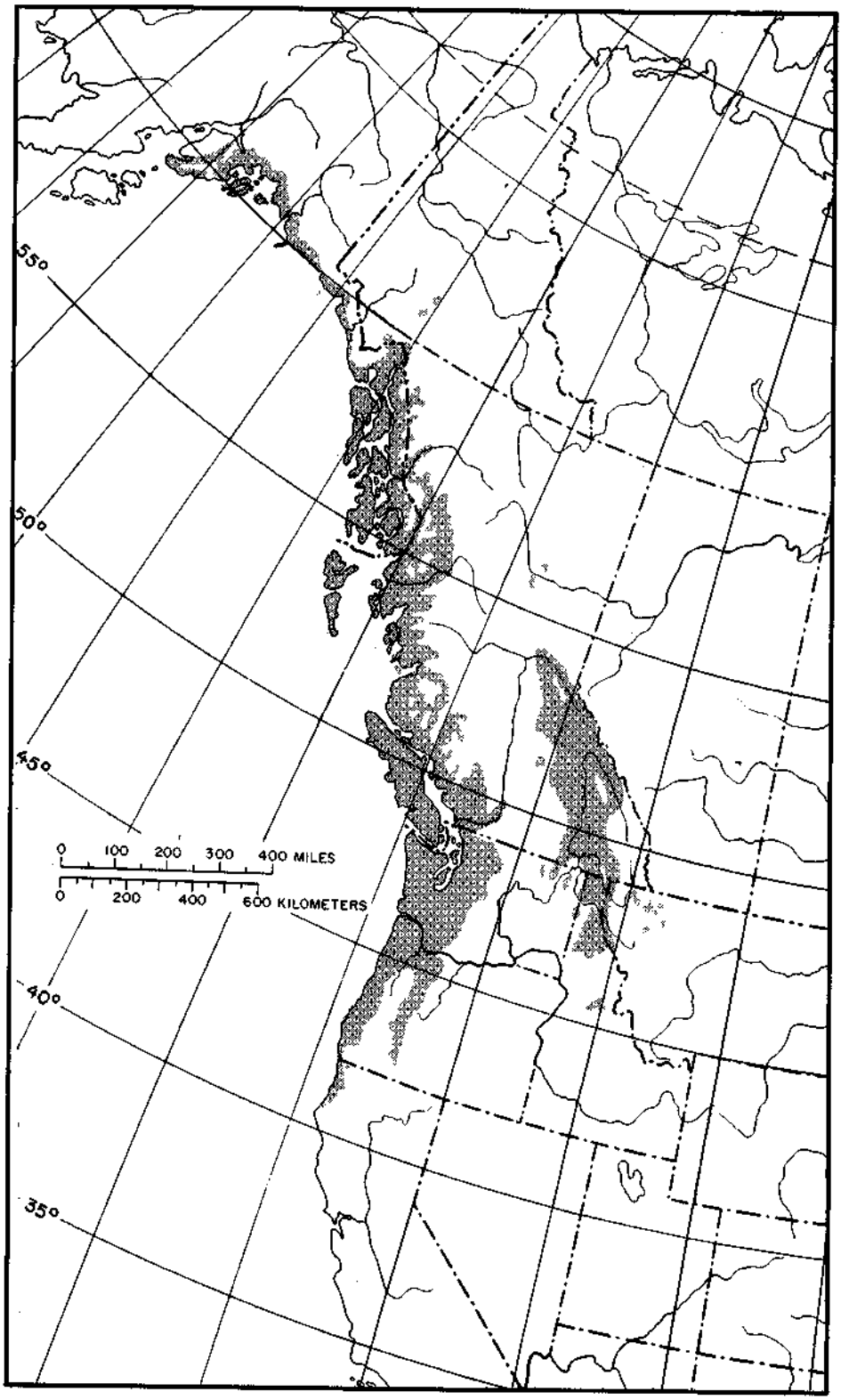

Figure 1–Natural range of western hemlock.

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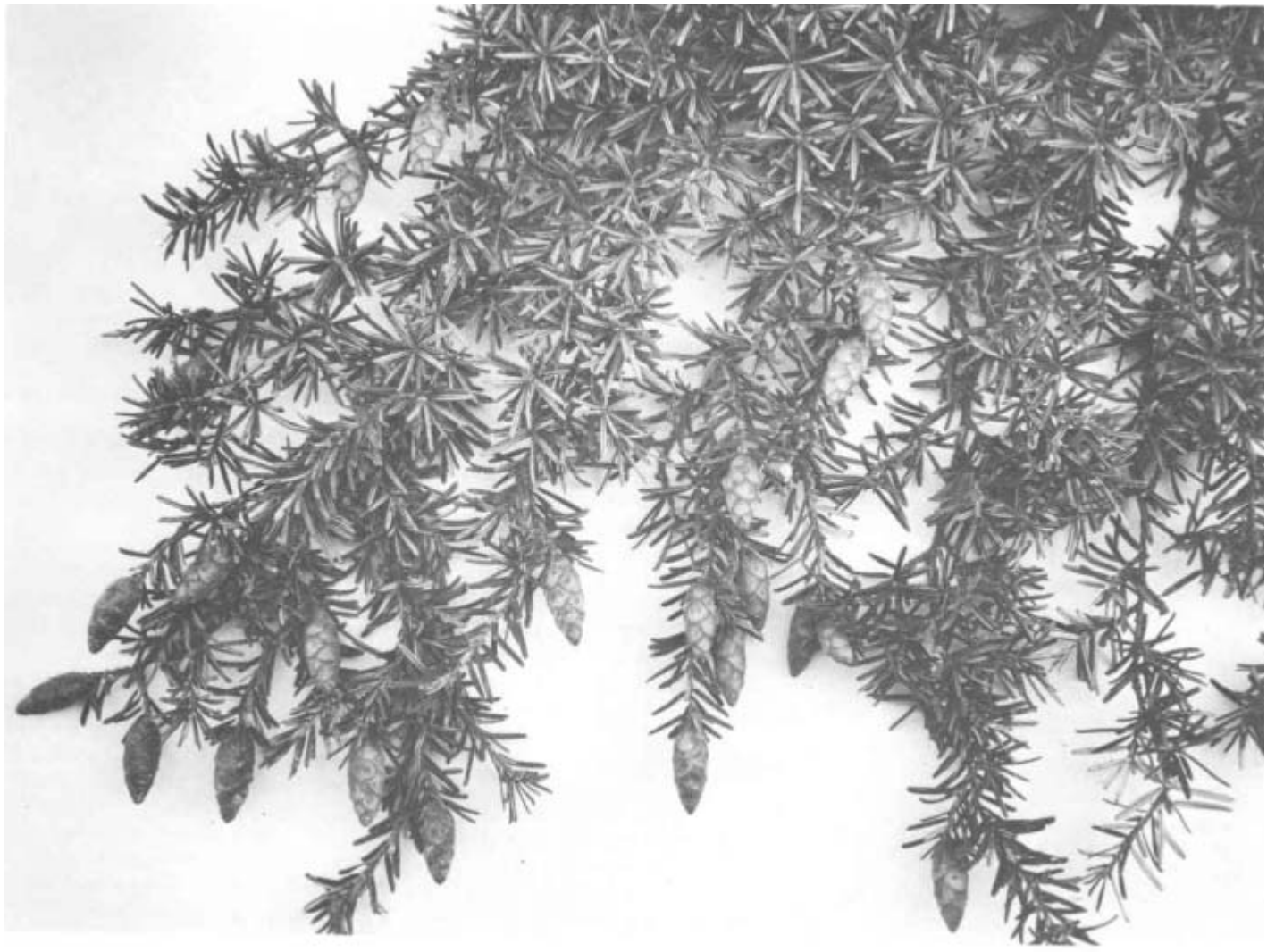

Figure 2–Needles and cones of western hemlock. **F-308997**

best growing conditions, can reach more than 3 feet in diameter and 225 feet in height. Forest-grown western hemlock trees produce long, clear symmetrical boles and shallow, wide-spreading root systems. The crown length of old-growth trees and of young, tightly spaced trees is usually short. As with all hemlocks, the terminal shoot normally droops, giving it a characteristic look that provides a quick method of identification. The needles are 1/4 to 3/4 inches long, flattened, and dark, shiny green (fig. 2). The bark is relatively thin, even on old trees, and deeply fissured with broad, flat, russet-brown ridges. The inner bark is streaked with purple.

Western hemlock is a prolific seeder. It produces some seed every year and heavy seed crops at least every 8 years. Cones can be found on trees less than 20 years old, but, in general, cone production begins between 25 and 30 years. Cones ripen in late summer and early fall. At maturity, they are 3/4 to 1 1/4 inches long and hold 30 to 40 seeds per cone. The seeds are only 1/16 inch long and average 300,000 per pound. Wind is the main factor in seed dissemination; some seeds are blown more than a mile from their source.

With adequate moisture, germination is excellent on a diverse range of material including moss, humus, decaying litter, and mineral soil. In coastal regions, where the forest floor is often densely covered with vegetation, hemlock grows from decaying stumps and logs.

Western hemlock is very tolerant of shade and survives under a variety of seedbed conditions. Natural regeneration can be obtained through harvesting methods that vary from individual tree selection to clearcutting.

The main causes of hemlock mortality are wind, fire, and snow. Losses from snowbreak are most severe in the inland range, whereas significant losses from windthrow occur in the coastal areas. The shallow root system of western hemlock contributes to its susceptibility to fire and wind damage.

Several trunk, butt, and root rots are found on western hemlock *Fomitopsis annosus, F. pinicola, Phellinus pini, P. weirii, Ganoderma applanatum, Poria subacida, Echinodontium tinctorium, Armillariella mellea,* and *Polyporus circinatus. Echinodontium tinctorium* (Indian paint fungus) causes extensive decay in standing trees and is one reason western hemlock is classified as an inferior species in its inland range. Dwarf mistletoe *(Arceuthobium campylopodum)* is a common parasite and is thought to reduce annual growth, lower wood quality, and increase mortality. The presence of flutes, or deep vertical grooves with ingrown bark, in the bole is a problem in southeast Alaska. Extensive fluting decreases yields of fiber and limits use of trees for sawtimber. Insects that attack western hemlock include western hemlock looper *(Lambdina fiscellaria lugubrosa),* western black-headed budworm *(Acleris gloverana),* western larch roundheaded borer *(Tetropiun velutinum),* and the hemlock sawfly *(Neodiprion tsugae).*

Common Names

Western hemlock has been known by several common names, including west coast hemlock, hemlock spruce, Pacific hemlock, western hemlock spruce, western hemlock fir, gray fir, silver fir, and Alaska pine. Currently, it is usually referred to as hemlock or western hemlock.

Related Commercial Species

Published information on timber volume often includes western hemlock with other species. Estimates of net sawtimber volume, for example, usually include mountain hemlock *(Tsuga mertensiana).* Hemlock lumber is usually marketed in species groups such as "Hem-Fir" which includes California red fir *(Abies magnifica),* grand fir *(A. grandis),* noble fir *(A. procera),* Pacific silver fir *(A. amabilis),* and white fir *(A. concolor).*

Supply

The sawtimber volume (trees greater than 9 inches in diameter) of western hemlock growing in the United States was estimated to be 256.9 billion board feet in 1977. About 45 percent of this volume was in Alaska, 35 percent in Washington, 17 percent in Oregon, and 3 percent in Idaho and Montana. Mountain hemlock is included in these estimates but accounts for only a small percentage of the total volume.

Production

In the last decade, western hemlock accounted for more than 20 percent of the total lumber production in Washington and Oregon, and more than 50 percent of the total Alaska production. Figure 3 shows the yearly production for Washington and Oregon combined and for Alaska.

Primary products produced in Oregon and Washington include dimension lumber, molding stock, and cants (squared-off timbers) for export. Alaska production is predominantly cants.

Western hemlock is the major species exported from Washington and Oregon and accounted for more than 50 percent of all log exports in 1980. The export market is second only to lumber production in log use. Most exported logs are cut from private lands and lands managed by the State of Washington. Exporting logs cut on Federal and State or Oregon lands is prohibited by Federal and State laws, with minor exceptions.

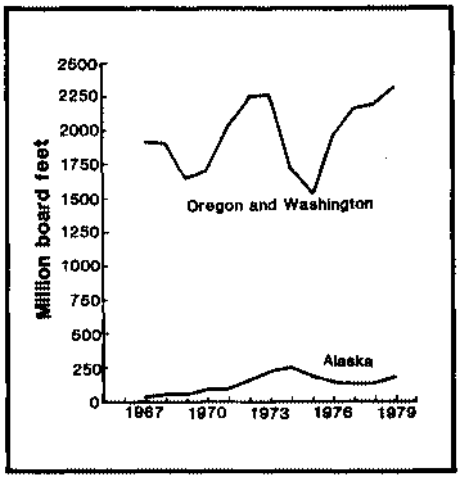

Figure 3–Yearly lumber production of western hemlock, 1967 to 1979.

The paper industry uses hemlock as a source of pulp. In Washington and Oregon, hemlock makes up more than 50 percent of the volume consumed by the paper industry. Hemlock logs are also an important source of veneer bolts. In 1976 hemlock accounted for about 5 percent of the total volume peeled for veneer in Oregon and about 15 percent of the volume in Washington.

Characteristics and Properties

The heartwood of western hemlock is almost white, with a purplish tinge. The sapwood is sometimes lighter in color. It varies in thickness from 1 to 3 inches and is usually difficult to distinguish from heartwood. Western hemlock wood is moderately light in weight and moderate in strength, hardness, stiffness, and shock resistance. Shrinkage is moderately large–about equal to that of Douglas-fir. The average specific gravity is 0.42 based on ovendry weight and green volume; the average weight at 12-percent moisture content is 31 pounds per cubic

foot. Green western hemlock contains considerably more water than Douglas-fir and requires a longer period of drying to reach the same moisture content.

Ring shake, or the separation of wood cells in the outer part of the latewood (denser wood, formed late in the growing season), is more common in hemlock than in other softwoods. Typically, shake is found in the basal portion of large hemlock trees and causes considerable loss of lumber and veneer.

Western hemlock trees frequently contain some wetwood, which means that parts of the standing wood have unusually high moisture levels. Wetwood, generally, is difficult to dry to a consistent moisture content. Wetwood is also sometimes associated with ring shake.

Cell wall thickness in the annual ring of western hemlock shows no distinct change from the wood formed early in the growing season to wood formed later. This characteristic makes western hemlock a preferred species over its major competitors for industrial lumber and for finish lumber where even-wearing and good machining characteristics are important.

In both nail-holding ability and tendency to split when nailed, western hemlock has an intermediate rank. In paint-holding ability, it ranks below the cedars and white pines but above Douglas-fir. The wood is free from resin and is classed as nondecay-resistant. It contains many small, black knots that are generally tight. The dark streaks sometimes seen in hemlock lumber result from activities of the hemlock bark maggot in living trees.

Principal uses

Western hemlock is used to produce a wide variety of products. The light color of the wood, lack of pitch, and ability to take a varnish finish well make hemlock the major source of roof decking, particularly in exposed ceilings. It is also excellent for laminating stock, moldings, and architectural trim where the light color is desirable for natural finishes. Western hemlock is preferred over Douglas-fir where a minimum of grain raise, splintering, or annual-ring delamination is important. Western hemlock ranks only slightly behind Douglas-fir and western larch in strength, which is one of the reasons it is widely used in construction.

The light-colored heartwood makes excellent newsprint because minimum bleaching is required to establish the desired brightness of paper. Also, the lack of resin in hemlock makes the wood easily pulped by the sulphite process, which is sensitive to resin content.

When used in the manufacture of plywood, western hemlock veneer is generally used for inner plys.

The bark of western hemlock is often used for decorative horticultural purposes. As such, it is often preferred over the bark of Douglas-fir, which contains needlelike fibers and causes discomfort to handlers.

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