Western hemlock (Hw) - *Tsuga heterophylla*

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BC Distribution of Western hemlock (Hw)

Range of Western hemlock

An exceptionally well-formed western hemlock on a moist, medium SNR, montane site in the Coast Mountains

Geographic Range and Ecological Amplitudes

Description

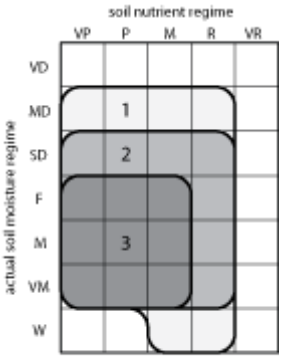
Western hemlock is one of the most common and important timber species of Pacific North America. It is a medium- to large-sized (nearly to 80 m tall), evergreen conifer, at maturity with a narrow upper crown, drooping leader, overall dense, conical crown, long branches, and dark reddish-brown, furrowed bark with flat-topped scaly ridges. The wood of western hemlock is used for both pulp and lumber.

Geographic Range

Geographic element:
Western North American/mainly Pacific and less Cordilleran

Distribution in Western North America:
north, central, and south in the Pacific region; central in the Cordilleran region

Ecological Amplitudes



generalized edaphic amplitude of western hemlock according to actual soil moisture and nutrient regimes

Climatic amplitude:
(subalpine boreal - montane boreal) - **cool temperate - cool mesothermal**

Orographic amplitude
submontane - montane - (subalpine)

Occurrence in biogeoclimatic zones:
(lower MH), (SBS), (IDF),**ICH**, (CDF), CWH

Edaphic Amplitude

Range of soil moisture regimes:
(moderately dry) - slightly dry - **fresh - moist - very moist** - (wet)

Range of soil nutrient regimes:
very poor - poor - medium - rich; oxylophyte

Western hemlock (as well as common douglas, western redcedar, grand fir, Sitka spruce, and western white pine) is adapted to a long growing season. This is why it grows well in humid mesothermal and subhumid to humid

temperate climates. However, in temperate climates much of the precipitation is in the form of snow (25 to 50% compared to <15% in mesothermal climates). It is because of the shorter growing season that western hemlock can grow without as much precipitation as would occur during a longer growing season.

Western hemlock is infrequent in montane boreal or subalpine boreal climates, however, it does occur in the areas adjacent to the ICH, MH and ESSF zones. Its vigor is reduced if repeated frost damage takes place. This frost damage is not easily detectable because damaged western hemlock leaves are shed quickly.

Western hemlock does not tolerate a frozen forest floor in which its rhizosphere is mainly embedded. If the ground is covered by snow before freezing, western hemlock tolerates considerable frost; only the crown above the snow is slightly affected. This is why its distribution is limited to areas where the ground is well-covered by snow before the soil can freeze. Because rhizospheres of common douglas are expanded into the subsoil, frost cannot affect it as easily as it does western hemlock.

Western hemlock tolerates very poor soils. It grows best with a well-balanced supply of nutrients in small quantities and with a continuous supply of water. It commonly regenerates on acid (Mor) forest floors and especially on coniferous decaying wood, which retains high moisture content. Such well-decayed coniferous wood is frequently the only suitable substrate for the successful germination and growth of western hemlock on nutrient rich sites. Fire or any other removal of coarse woody debris may decrease the chance for productive growth of western hemlock.

Because western hemlock regenerates best on acid organic materials, it is probably adapted to a supply of ammonium or amino acids. Experimentally, it has been found that western hemlock easily survives any deficiency treatment better than other conifers, with the exception of mountain hemlock, which reacts in a similar way to Western Hemlock (Brooke et al. 1970). Western hemlock may grow in sand cultures without any supply of nitrates for more than two years. However, when some nitrates are added the growth is improved (Krajina 1969, Krajina et al. 1973).

Tolerance and Damaging Agents

Root System Characteristics

Western hemlock is a shallow-rooting species which does not develop a tap root. The fine roots are nearly entirely confined to the surface organic layer and are associated with both ecto- and endo-mycorrhizae..

Tolerances

tolerance to	tolerance class	comments
low light	H	about the same tolerance as Pacific silver fir and western redcedar
frost	L	very low in coastal populations, low in interior populations
heat	L	protection-requiring on warm and dry sites
water deficit	L	protection-requiring on dry and warm sites; higher tolerance than that of Pacific silver fir
water surplus	M	on wet sites, it grows usually on mounds
nutrient (mainly N) deficiency	H	frequent on very poor sites

Damaging Agents

damaging agent	resistance class	comments
snow	L - M	low in coastal populations, intermediate in interior populations
wind	L	very low resistance to windthrow
	risk class	
fire	L - H	low in coastal populations, high in interior populations
insect	L - H	not a major concern in coastal populations, high in interior populations: western hemlock looper, hemlock sawfly, western blackheaded budworm

fungi	M	root and butt rots (e.g., Indian paint fungus, annosus root and butt rot, red ring rot, laminated root rot, Armillaria root disease, Schweinitzii butt rot, black stain root disease), Douglas-fir needle cast can be a major concern
other agents	H	dwarf mistletoe (Arceuthobium tsugense (Rosendahl) Jones)

Associated tree species and successional role

In British Columbia, western hemlock grows in pure, even-aged (usually after windthrow or wildfires) or uneven-aged stands or in a variety of mixed-species stands. It is present in early, mid-, and late stages of secondary succession; a major component in old-growth stands in the ICH and CWH zones.

associated tree species	occurance class	major area of occurance
pacific silver fir	H	one of the most common associates; mainly montane CWH
sitka spruce	H	forming the most productive stands in hypermaritime CWH
common douglas	H	one of the most common associate; southern CWH and ICH
western redcedar	H	one of the most common associates; CWH and ICH
red alder	M	CWH
alaska yellow-cedar	M	montane CWH
subalpine fir	L	upper ICH zone and the lowest ESSF
paper birch	L	mainly in SBS, IDF, and ICH
western larch	L	southern ICH
engelmann spruce	L	upper ICH and lower ESSF
white spruce (& hybrids)	L	mainly central and northwestern ICH

	lodgepole pine	L	mainly ICH

	characteristic	interpretive class	comments
Silvical Characteristics	reproduction capacity	H	cone production begins after an age of 20 years; a prolific seed producer
	seed dissemination capacity	H	most seeds fall within 500 m from the source; maximum distance over 2 km
	potential for natural regeneration in low light	H	regenerates well on organic substrates; the potential decreases from Mors to Moders to Mulls
	potential for natural regeneration in the open	H	very high, especially in wet climates
	potential initial growth rate (<5 years)	M	two-year old seedlings are often <20 cm tall, later they may grow >60 cm/yr
	response of advance regeneration to release	H	diameter response is immediate, height growth response is delayed
	self-pruning capacity in dense stands	H	providing initial stand density is high
	crown spatial requirements	M	varies with density
	light conditions beneath closed-canopy, mature stands	L	associated with poorly developed understory vegetation
	potential productivity	H	site index (50 yr @ bh) close to 40 m on the most productive coastal sites
	longevity	H	typically less than 500 years, reported maximum ages >700 years

Genetics and Notes

Genetics

Western hemlock frequently hybridizes with mountain hemlock [*Tsuga x jeffreyi* (Henry) Henry], especially in the ecotone between the CWH and MH zones.

Notes

Western hemlock is an easy species to regenerate. It may be grown in pure stands or, preferably, together with Sitka spruce or western redcedar. Its timber provides all-purpose raw material suitable for construction and pulp. More detailed silvics information is given by:

Packee, E.C. Tsuga heterophylla. Pp. 613-622 in R.M. Burns and B.H. Honkala (technical coordinators) Silvics of North America, Vol. 1. Agri. Handbook 654, USDA For. Serv., Washington, D.C.

Ruth, P.H. and A.S. Harris. (compilers) 1979. Management of western hemlock - Sitka spruce forests for timber production. GTR-PNW-88, USDA For. Serv., Northwest Forest and Range Exp. Station, Portland, Oregon.