Sitka spruce (Ss) - *Picea sitchensis*

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BC Distribution of Sitka spruce (Ss)

Range of Sitka spruce

On the most productive sites in the hypermaritime forest, Sitka spruce growth performance is far superior to that of other associated species. Excellent vigour of Sitka spruce is found on sites such as this moist, very rich alluvial terrace on western Vancouver Island.

Geographic Range and Ecological Amplitudes

Description

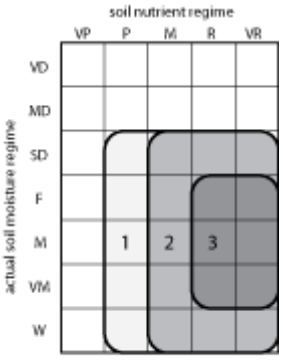
Sitka spruce is the largest spruce in the world (reaching a height of 100 m in, for instance, the Carmanah River Valley). At maturity it has a massive stem, often buttressed at base; relatively wide, compact crown, with horizontal branches, and a thin reddish-brown bark broken into large loose scales. Sitka spruce is a very productive, valuable timber species for lumber, pulp, and many other special uses.

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 Sitka spruce according to actual soil moisture and nutrient regimes

<u>Climatic amplitude</u>:
(subalpine boreal) – (cool temperate) – **wet cool mesothermal**

<u>Orographic amplitude</u>:
submontane – montane – (subalpine)

Occurrence in biogeoclimatic zones:
(lower MH), (northern subcontinental BWBS),(ICH), (CDF), **wetter hypermaritime** (maritime and submaritime) **CWH**

It has been stated that Sitka spruce is dependent on fog, commonly occurring in the Pacific coast fog belt. This association with fog may be important along the southern coast, but along the central and northern coast it is probably a coincidence, as the species may grow successfully outside this belt.

<u>Edaphic Amplitude</u>

Range of soil moisture regimes:
slightly dry – **fresh – moist – very moist** – wet

Range of soil nutrient regimes:
(poor) – medium – **rich – very rich**; tolerant of salt spray and soils influenced by brackish water

The most productive growth of Sitka spruce occurs on moist and rich hypermaritime sites; therefore, it could be concluded from those field observations and experimental studies carried out by Krajina and his students (Cordes 1968, 1972; Krajina 1969) that Sitka spruce requires considerable amounts of both calcium and magnesium, possibly favoring magnesium. This is why it benefits (tolerates), to some degree, from calcium and magnesium inputs in brackish water or ocean spray. Sitka spruce also requires greater quantities of phosphorus than common douglas, western redcedar, or western hemlock. Ocean spray is a good external source of phosphorus.

Normally, calcium-rich soils provide a relatively favorable medium for nitrification, so it is rather surprising that Sitka spruce tolerates ammonium compounds when they replace nitrates and are the only source of nitrogen in the sand cultures. Nevertheless, in the complete Hoagland solution, applied in sand cultures, where nitrates prevail over ammonium compounds, Sitka spruce grows still better.

Sitka spruce tolerates sodium inputs from ocean spray or brackish water. Therefore, along the Pacific coast, where ocean spray has a strong influence on vegetation, pure stands of Sitka spruce may develop because other trees do not tolerate strong ocean spray. Another common name – tideland spruce – suggests this tolerance of salinity.

Tolerance and Damaging Agents

Root System Characteristics

Root habit of Sitka spruce is very variable- ranging from shallow, plate-like roots in the soils with a root-restricting layer to deep (up to 200 cm), wide-spreading roots in the deep, well-aerated soils. Roots of Sitka spruce are associated with both ecto- and endo-mycorrhizae.

Tolerances

tolerance to	tolerance class	comments
low light	M	survives under hardwood (black cottonwood, red alder) overstories
frost	L	frost is unusual in hypermaritime climates
heat	L	extreme heat is unusual in hypermaritime climates
water deficit	L	absent on very dry and moderately dry sites
water surplus	H	grows on waterlogged sites and floodplains; tolerant of prolonged flooding and strongly fluctuating water table
nutrient (mainly N) deficiency	L	absent on very poor sites

Damaging Agents

damaging agent	resistance class	comments
snow	L	absent or infrequent in snowy climates
wind	L	low resistance when exposed and in partially cut stands
	risk class	
fire	L	not a major concern in hypermaritime climates
insect	H	white pine weevil and spruce beetle
fungi	L	root and butt rots (e.g. Armillaria

root disease and annosus root and butt rot)

Associated tree species and successional role

In British Columbia, Sitka spruce grows in pure and mixed-species stands, which are prevailingly even-aged. Pure stands usually follow disturbance by wind, and occur on tidal flats, and on sites affected by ocean spray. Sitka spruce is present in early, mid-, and late stages of secondary succession along ocean shores, on floodplains and on upland sites; a major or minor component in old-growth stands in hypermaritime and maritime climates.

associated tree species	occurance class	major area of occurance
western hemlock	H	the most common associate in hypermaritime climates
western redcedar	M	Hypermaritime climates
black cottonwood	M	high floodplain benches
red alder	M	hypermaritime climates and coastal floodplains
mountain hemlock	L	hypermaritime climates
alaska yellow-cedar	L	hypermaritime climates
white spruce (& hybrids)	L	northern and central coast-interior ecotone

Silvical Characteristics

characteristic	interpretive class	comments
reproduction capacity	H	cone bearing at an age of 20-40 years
seed dissemination capacity	H	seed dispersion approaching 1,000 m from the parent tree on high ground
potential for natural regeneration in low light	L	mainly developed in canopy gaps; higher in hardwood stands
potential for natural regeneration in the open	H	especially on mineral soil seedbeds
potential initial growth	M	low (<10 cm/yr) in the first two

rate (<5 years)		years, high (>50 cm/yr) thereafter
response of advance regeneration to release	na	advance regeneration does not develop in the absence of adequate light and seedbed
self-pruning capacity in dense stands	H	but dense stands are infrequent
crown spatial requirements	H	widest crowns among native spruce species, particularly in tidal populations
light conditions beneath closed-canopy, mature stands	M	usually associated with a moss understory
potential productivity	H	site index (50 yr @ bh) approaching 45 m; timber yields of Sitka spruce-western hemlock mixtures close to 2,000 m3 per ha in 100 years on the most productive sites; growth rates of these mixtures are highest in North America
longevity	H	possibly to 800 years

Genetics and Notes

Genetics

Genetic variation in Sitka spruce is clinal, primarily along a latitudinal gradient. Sitka spruce may hybridize with white spruce (Picea x lutzii) (Roche 1969) and with Engelmann spruce. Such natural hybrids may be found in the Nass and Skeena River areas and along the coast-interior ecotone, respectively. Sitka spruce has very long branches, but the hybrids with Engelmann spruce have rather narrow crowns.

Notes

Sitka spruce is a desirable component in hypermaritime forests in pure or mixed-species stands, either with other conifers or hardwoods (nurse species in spruce weevil-prone areas), except on water and nutrient deficient-sites. The success of natural regeneration is often inconsistent, consequently planting is usually required if a high component of Sitka spruce is desired in new stands. More detailed silvics information is given by:

Harris, A.S. 1990. Picea sitchensis. Pp. 2260-267 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.