Chamaecyparis nootkatensis (D. Don) Spach

Alaska-Cedar

Cupressaceae -- Cypress family

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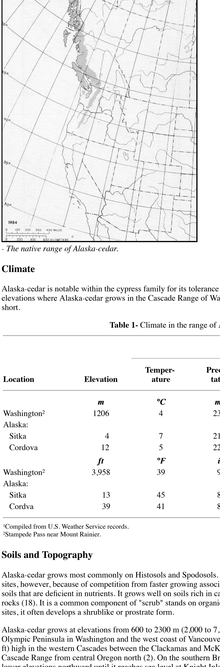
Alaska-cedar (*Chamaecyparis nootkatensis)*, also known as Alaska yellow-cedar, yellow-cedar, Alaska cypress, and Nootka cypress, is an important timber species of northwestern America. It is found along the Pacific coast in Alaska and British Columbia, in the Cascade Range of Oregon and Washington, and at a number of isolated locations (1,10). It is confined to a cool, humid climate. Toward the south, Alaska-cedar rarely grows below 600 m (2,000 ft) in elevation; but north of midcoastal British Columbia, it grows from sea level to tree line. It is one of the slowest growing conifers in the Northwest. The wood is extremely durable and is excellent for specialty uses. Little effort is being made to manage the species to assure a continuing supply.

Habitat

Native Range

Alaska-cedar grows from northern California to Prince William Sound, AK Except for a few isolated stands, it is found within 160 km (100 miles) of the Pacific coast. Isolated stands in the Siskiyou Mountains, CA, near the Oregon border mark its southern limit (2). In Oregon and Washington, Alaska-cedar grows in the Cascade Range and Olympic Mountains; scattered populations are found in the Coast Ranges and in the Aldrich Mountains of central Oregon (8). In British Columbia and north to Wells Bay in Prince William Sound, AK, it grows in a narrow strip on the islands and coastal mainland. An exception in British Columbia is an isolated stand near Slocan Lake about 720 km (450 mi) inland.



- The native range of Alaska-cedar.

Climate

Alaska-cedar is notable within the cypress family for its tolerance of cool and wet conditions. The climate of its natural range is cool and humid. Climatic conditions at elevations where Alaska-cedar grows in the Cascade Range of Washington are somewhat comparable to those at sea level in coastal Alaska (table 1). Growing seasons are short.

Table 1- Climate in the range of Alaska-cedar[1]

		Average Annual			
Location	**Elevation**	**Temper-ature**	**Precipi-tation**	**Snowfall**	**Frost-free period**
	m	***°C***	***mm***	***cm***	***days***
Washington[2]	1206	4	2340	1140	114
Alaska:					
Sitka	4	7	2130	114	149
Cordova	12	5	2260	340	111
	ft	***°F***	***in***	***in***	***days***
Washington[2]	3.958	39	92	450	114
Alaska:					
Sitka	13	45	84	45	149
Cordva	39	41	89	134	111

[1]Compiled from U.S. Weather Service records.
[2]Stampede Pass near Mount Rainier.

Soils and Topography

Alaska-cedar grows most commonly on Histosols and Spodosols. Best growth and development are on slopes with deep, well-drained soils. It is seldom found on the better sites, however, because of competition from faster growing associates. More frequently, it is found on thin organic soils over bedrock and is able to survive and grow on soils that are deficient in nutrients. It grows well on soils rich in calcium and magnesium and frequently on Lithosols developed from andesite, diorite, gabbro, or basaltic rocks (18). It is a common component of "scrub" stands on organic soils at low elevations in Alaska, and on organic subalpine soils. At high elevations and on half-bog sites, it often develops a shrublike or prostrate form.

Alaska-cedar grows at elevations from 600 to 2300 m (2,000 to 7,500 ft) in the Cascade Range in Oregon and Washington and occasionally down to sea level on the Olympic Peninsula in Washington and the west coast of Vancouver Island. In Oregon, most Alaska-cedar grows on ridges and peaks from 1500 to 1700 m (5,000 to 5,600 ft) high in the western Cascades between the Clackamas and McKenzie rivers, but it can grow throughout much of the moisture conditions present at high elevations in the Cascade Range from central Oregon north (2). On the southern British Columbia mainland, it usually grows between 600 and 1500 m (2,000 and 5,000 ft) but is found at lower elevations northward until it reaches sea level at Knight Inlet. From there, north and west to Prince William Sound in Alaska, it is found from sea level to tree line, up to 900 m (3,000 ft) in southeast Alaska and 300 m (1,000 ft) around Prince William Sound.

Associated Forest Cover

Alaska-cedar occasionally grows in pure stands but is usually found singly or in scattered groups mixed with other tree species. Associated species change with latitude. In California, Alaska-cedar may be found with California red fir (*Abies magnifica*), Brewer spruce (*Picea breweriana)*, incense-cedar (*Libocedrus decurrens*), Pacific yew (*Taxus brevifolia)*, and western white pine (*Pinus monticola)*; in Oregon and Washington, with mountain hemlock (*Tsuga mertensiana)*, subalpine fir (*Abies lasiocarpa)*, whitebark pine (*Pinus albicaulis)*, Pacific silver fir (*Abies amabilis)*, noble fir (*Abies procera)*, western white pine, and western hemlock (*Tsuga heterophylla)*; in British Columbia, with Pacific silver fir, western white pine, western redcedar (*Thuja plicata)*, mountain hemlock, western hemlock, and shore pine (*Pinus contorta)*; in Alaska, with western redcedar, western hemlock, mountain hemlock, Sitka spruce (*Picea sitchensis)*, and shore pine.

Alaska-cedar is a component of the following Society of American Foresters forest cover types (5):

205 Mountain Hemlock
223 Sitka Spruce
224 Western Hemlock
225 Western Hemlock-Sitka Spruce
226 Coastal True Fir-Hemlock
227 Western Redcedar-Western Hemlock
228 Western Redcedar

Shrubs commonly associated with Alaska-cedar in Oregon, Washington, and British Columbia are: big whortleberry *(Vaccinium membranaceum)*, ovalleaf whortleberry *(V. ovalifolium)*, Alaska blueberry *(V. alaskaense)*, rustyleaf menziesia (*Menziesia ferruginea)*, Cascades azalea *(Rhododendron albiflorum)*, and copperbush *(Cladothamnus pyroliflorus)*. These shrubs, except *Rhododendron albiflorum* and *Vaccinium membranaceum*, are associates in Alaska as well. Other plant associates include fiveleaf bramble (*Rubus pedatus)*, bunchberry (*Cornus canadensis)*, queenscup *(Clintonia uniflora)*, ferny goldthread *(Coptis asplenifolia)*, deerfern (*Blechnum spicant)*, claspleaf twistedstalk *(Streptopus amplexifolius)*, rosy twistedstalk *(S. roseus)*, and skunkcabbage *(Lysichitum americanum)*.

Recognized vegetative communities from British Columbia south are *Chamaecyparis nootkatensis/Lysichitum americanum* and *Chamaecyparis nootkatensis/Rhododendron albiflorum* (3). In southeast Alaska, a common association in the open conifer forest surrounding bogs is *Pinus contorta-Tsuga heterophylla-Thuja plicata-Chamaecyparis nootkatensis/Vaccinium ovalifolium-V. alaskaense-Ledum groenlandicum/Sphagnum squarrosum* (25).

Life History

Reproduction and Early Growth

Flowering and Fruiting- Alaska-cedar is monoecious. Flowering occurs from April in the southern part of the range to June in the north. The tiny inconspicuous yellow or reddish male pollen-bearing strobili and green female cones are borne on the tips of branchlets. Pollination occurs from mid-April to late May in cones that were initiated the previous summer. Cones generally mature in 2 years, but in the southern part of the range they may mature in 1 year. Both first- and second-year cones occur on the same branch and may easily be confused. Mature cones are about 12 mm (0.5 in) in diameter and globe-shaped. Mature and immature cones are nearly the same size, so care must be taken to collect only mature cones for seed. Immature cones are green and soft, often with purple markings, and are borne near the tips of branchlets. Mature cones are yellow-green and hard, often with brown markings, and are borne farther from the branch tips.

Seed Production and Dissemination- Large crops of Alaska-cedar seed occur at intervals of 4 or more years (12). The proportion of filled seeds from mature cones is generally low and extremely variable. One study in British Columbia showed that the number of seeds per cone averaged 7.2; the proportion of filled seeds was only 29 percent (21). Cleaned seeds average 240,000/kg (109,000/lb) (12). Information is not available on the distance seeds are disseminated by wind. Seeds of Alaska-cedar are heavier than seeds of the closely related Port Orford-cedar and probably are not disseminated beyond the 120 m (400 ft) reported for that species.

Seedling Development- Germination is epigeal, and the rate tends to be low. Warm stratification followed by cold stratification greatly improves germination, but optimum stratification schedules have not been developed. In British Columbia and Alaska, seeds ripen from mid-September to late September and are shed during dry periods in the fall and early winter. Empty cones remain on trees for 1 year or more.

Formation of both pollen cones and seed cones can be induced in juvenile trees by foliar application of gibberellin-A_3 under conditions of long day length. Cones induced by gibberellin-A_3 yield higher percentages of filled seeds with higher rates of germination than cones that develop under natural conditions. Seed orchards should offer the opportunity for treatment and thereby provide a practical means of increasing cone production (22).

Vegetative Reproduction- Alaska-cedar reproduces vegetatively under a variety of natural conditions from low-elevation bogs to krummholz at tree line (1,3,20,23). In southeast Alaska, layering is common on low-elevation bog sites, less common on better drained sites (14). In contrast, from Mount Rainier, WA, southward to California, layering is most common on drier, high-elevation sites (2). The species can also be reproduced from cuttings. Container stock suitable for planting has been produced in the greenhouse in 1 year by potting young cuttings treated with indolebutyric acid (17).

Sapling and Pole Stages to Maturity

Growth and Yield- Alaska-cedar is slow growing and long lived. In Washington, dominant trees on better sites are typically 30 to 38 m (100 to 125 ft) tall; in British Columbia, they are 90 cm (36 in) in d.b.h., and 23 to 30 m (75 to 100 ft) tall; and in Alaska, dominant trees are often 60 cm (24 in) in d.b.h. and 24 m (80 ft) tall, although larger trees are common. The largest tree on record, located in Olympic National Park, WA, has a d.b.h. of 3.7 m (12.0 ft), a height of 37 m (120 ft), and a crown spread of 8.2 m (27 ft) (13). Growth rates of 16 to 20 rings per centimeter (40 to 50/in) are common. In Alaska, suppressed trees 15 cm (6 in) in d.b.h. are frequently more than 300 years old; dominant and codominant trees 60 to 90 cm (24 to 36 in) in d.b.h. are from 300 to more than 700 years old. Trees that are extremely old have been reported; a hollow tree 180 cm (70 in) in d.b.h. had 1,040 growth rings in the 30-cm (12-in) outer shell (1).

Rooting Habit- In bogs, roots of prostrate clumps of Alaska-cedar often tend to be shallow and to develop in complex patterns associated with a long history of branch layering (14). Root systems of krummholz Alaska-cedar apparently the result of root sprouting and layering-have been observed to extend 100 feet (3). Understory trees have shown adventitious rooting the year after partial burial by volcanic tephra (26). Information is not available on the rooting habit of mature trees on well drained sites.

Reaction to Competition- Alaska-cedar is considered tolerant of shade in the southern part of its range but less tolerant toward the north. Overall, it is classed as shade tolerant. South of Mt. Rainier, WA, Alaska-cedar establishes some seedlings and is shade tolerant enough to survive under moderately dense canopies, but forest-grown seedlings fail to develop a strong upright trunk. Most trees on forest sites appear to have been established after disturbance (2). In Alaska, young stands are often even aged, and mixed or nearly pure stands of Alaska-cedar rarely contain seedlings or saplings in the understory. Reproduction of western hemlock is abundant, however, indicating that Alaska-cedar is less tolerant than hemlock (1).

Most Alaska-cedar timber has come from logging mixed old-growth stands in which the species is a minor component. Because of its slow rate of growth in relation to other commercial species, there has been little interest in management of Alaska-cedar for timber on the more productive sites. It may be well suited for planting on cold, wet sites, however, especially at high elevations where other species are less likely to thrive. It survives heavy snow loads because of its narrow, flexible crown and drooping branches, and its flexibility allows it to survive on avalanche tracks. Interest in management of Alaska-cedar is relatively new, and information on growth and yield of young stands is not available. Volume tables are available for old-growth trees (6).

Damaging Agents- Alaska-cedar is relatively free from damage by insects. No infestations of defoliating insects are known (1). Both *Phloeosinus* sp. and the bark-boring, round-headed beetles of the genus *Atimia* are often found under the bark of dead, dying, or weakened trees and occasionally on healthy trees (9). *Phloeosinus cupressi* is a secondary agent that only attacks trees in advanced stages of decline (14). A total of 78 taxa of fungi have been reported on Alaska-cedar throughout its range, including 50 in Alaska (14). The wood, however, is very durable and resistant to fungal attack, partly because of naturally occurring chemicals-nootkatin, chamic acid, and chaminic acid-in the heartwood that inhibit fungal growth at low concentrations (4). Certain "black-stain" fungi are capable of degrading nootkatin, thereby increasing the susceptibility of the heartwood to decay (24). Living trees often attain great age, and over time heart-rotting fungi cause considerable loss and defect in standing trees (15).

Since at least 1880, Alaska-cedar has suffered advancing decline and mortality on more than 100 000 ha (247,000 acres) of bog and semibog land in southeast Alaska. Abiotic factors appear to be responsible, but the primary cause remains unknown (14).

In southeast Alaska, brown bears *(Ursa arctos)* frequently cause basal scarring by biting and stripping bark. Scarring is most common on well drained sites. This wounding results in fungal attack, which in time reduces volume and value of butt logs (14).

Special Uses

Special attributes of Alaska-cedar wood include durability, freedom from splitting and checking, resistance to acid, smooth-wearing qualities, and excellent characteristics for milling (11.23). It is suitable for boatbuilding, utility poles, heavy flooring, framing, bridge and dock decking, marine piling, window boxes, stadium seats, water and chemical tanks, cooling towers, bedding for heavy machinery, furniture, patterns, molding, sash, doors, paneling, toys, musical instruments, and carving. The wood is highly regarded in Japan, and most high-quality logs are exported.

Genetics

Information on genetic variation of Alaska-cedar is not available (10); however, 15 horticultural varieties of Alaska-cedar are recognized. An intergeneric hybrid, *Cupressocyparis x leylandii (Cupressus macrocarpa x Chamaecyparis nootkatensis)*, has been described in Great Britain (16). This hybrid can be propagated from cuttings and has been planted at numerous locations in temperate regions with good results.

Other intergeneric hybrids include *Cupressocyparis x notabilis* Mitchell (*Cupressus glabra x Chamaecyparis nootkatensis)* and *Cupressocyparis x ovensii (Cupressus lusitanica x Chamaecyparis nootkatensis)* (19).

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