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The Ecology and Silviculture of Bigleaf Maple

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Why Manage for Bigleaf Maple?

Recent trends are encouraging greater utilization and management of broadleaf trees, because of increased recognition of their important contributions to the vigour, diversity, and sustainability of British Columbia's forest ecosystems.

Bigleaf maple (*Acer macrophyllum* Pursh.) is the only tree-size maple in British Columbia, and it is one of five major broadleaf species in the province: aspen, red alder, cottonwood—balsam poplar, paper birch, and bigleaf maple.

Bigleaf maple has potential as a commercial tree species and its wood is used for furniture, face veneers, and container construction. Responsible management and utilization of this resource could provide employment opportunities in forestry and value-added sectors. In addition, it is a desirable ecosystem component, adding to the structural and species diversity of British Columbia's coastal forests. Bigleaf maple's presence can also lead to improved site productivity, long-term sustainability, and forest health.

Where Does Maple Grow?

In British Columbia, bigleaf maple grows mainly in the southern Coastal Western Hemlock biogeoclimatic zone, with a limited occurrence in the subcontinental Interior Douglas-fir zone at Seton Portage near Lillooet and at Siska in the Fraser Canyon. Sullivan Bay, on Broughton Island near the mouth of Kingcome Inlet, is recorded as its northwesterly limit (50°51′ N; 126°45′ W). Bigleaf maple is a common component in coastal Douglas-fir forests, which are described as the most productive on the mainland and Vancouver Island.

Bigleaf maple has distinctive, large leaves (in extreme cases 60 cm wide) with long petioles. Leaf blades are deeply lobed, with a few irregular blunt teeth along the margin. Maple's root system is shallow and wide spreading. When grown in the forest, maple has a narrow crown with a bole free of branches for one-half or more of its length. Open-grown trees tend to have many large, spreading, and ascending limbs that originate fairly close to the ground. Maple can attain a height of 42 m, an age of 250 years, and trunk diameters of 100 cm.

Ecosystems where bigleaf maple is prominent are characterized by soils with high nutrient concentrations, high cation exchange capacities, high base saturation, and low C:N ratios. Maple occurs on a relatively wide range of soils but grows best on sites of fluvial origin and at the base of colluvial slopes. It is often found on coarse, gravelly, moist soils in mixtures with red alder, black cottonwood, Douglas-fir, western redcedar, or western hemlock. Maple has a high resistance to temporary

flooding and can survive well on nutrient-rich floodplains.

During growth, bigleaf maple absorbs and retains large quantities of nutrients, much of which are returned to the surrounding site via its decomposing leaf litter. Maple's nutritional requirements are very high, especially for calcium, magnesium, nitrogen (mainly as nitrates), potassium, and phosphorus.

Managing Maple

There is an estimated net volume of 2 million m^3 (gross volume less decay, waste, and breakage) of bigleaf maple, most of which occurs in the Fraser and Sunshine Coast Timber Supply Areas (Figure 1). The estimated potential annual harvest of bigleaf maple is 80 000 m^3, compared to 448 000 m^3 for red alder, and 31 000 m^3 for cottonwood. However, present inventory data probably underestimate bigleaf maple's prominence in coastal forests, and does not include private lands.

Bigleaf maple grows rapidly for 40–60 years. On favourable sites, growth of juvenile maple often exceeds 1 m per year, and, between 15 and 30 years of age, maple can sustain an annual height increment of 0.3–0.6 m.

On good to medium sites, bigleaf maple is as tall as Douglas-fir (32 m) at age 50 years, and taller than red alder, Sitka spruce, western redcedar, western hemlock, and black cottonwood. In managed stands, a rotation age of 40–50 years may be realistic on good sites.

A fully stocked 42-year-old bigleaf maple stand in western Oregon had an average volume of 137 m^3/ha and a gross annual increment of about 9.8 m^3/ha (Niemiec et al. 1995). A 70-year-old stand of pure bigleaf maple in British Columbia had a reported yield of approximately 315 m^3/ha (Kerbes 1968).

Bigleaf maple has several characteristics that are of interest to the forest manager:

- plentiful seed production
- vigorous resprouting after cutting
- rapid early growth
- reasonable growth in low-light stands
- potential improvement of soil fertility
- possible alternative species on root-rot pockets
- 40- to 60-year timber rotation

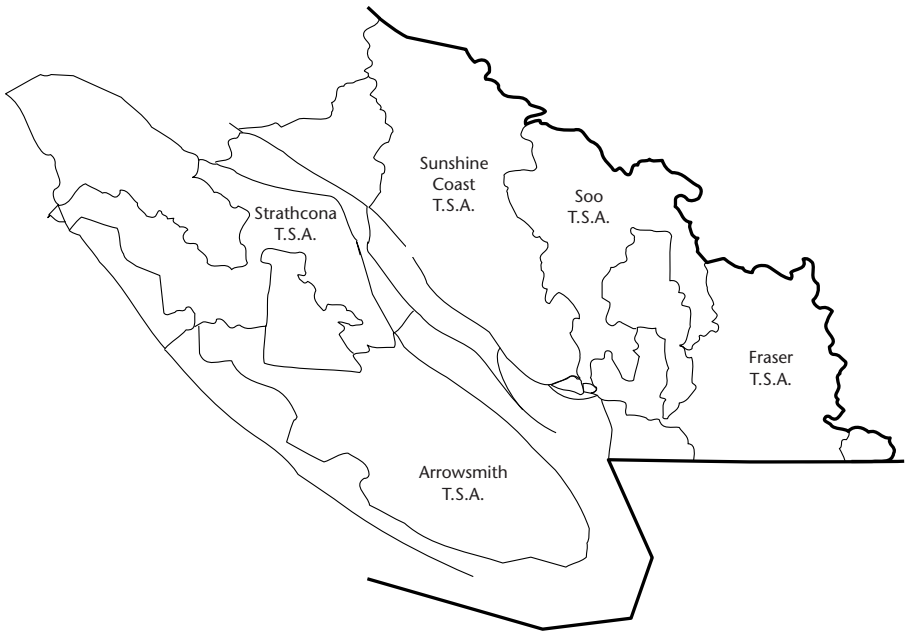

FIGURE 1 *Timber supply areas in south coastal British Columbia where bigleaf maple is found.*

Regeneration from Seed

Bigleaf maple produces flowers and seeds at about 10 years of age, and seed crops are produced almost every subsequent year. The fruit is a samara 30–40 mm long and is dispersed by wind in the autumn months, but some can remain on the trees until late winter. Provided there is adequate moisture during the growing season, seeds that are viable germinate in the first year on either mineral or organic seedbeds.

The most successful establishment of bigleaf maple seedlings is following canopy thinning and prior to herb and shrub establishment. As a result, naturally regenerated seedlings tend to be absent from clearcuts because of dense competition from herbs and shrubs, poor seed dispersal, and seed predation.

Regeneration from Seedlings

Outplanting of nursery-grown seedlings is the only reliable method for establishing maple plantations. However, some out-planted seedlings enter periods of growth-check for reasons not yet known. This appears to occur more often on upland sites than on moist, highly productive sites. Presently, commercial supplies of maple seedlings are not consistently available, although some forest nurseries are producing supplies on a trial basis.

Seedling survival is dependent on canopy density. Results from an Oregon study found that first-year survival of seedlings was highest in clearcuts (36%), intermediate in pole-sized stands with sparse understories and canopies (30%), and lowest in old stands with dense understories (14%) and young

stands with dense canopies (4%). Maple seedlings are very susceptible to browsing, and require some form of protection in areas with large populations of elk or deer. Browsing can predispose maple seedlings to weed competition problems, as well as cause poor stem form. In combination, these two factors can seriously delay maple establishment.

The morphology of bigleaf maple seedlings is strongly affected by planting density. At low densities, branches develop along the entire stem; at high densities, branch development is suppressed. Moderate crowding is therefore necessary to limit branching and forking and induce self-pruning. Initial planting densities of 1200–1600 stems/ha are more than likely adequate for good growth. Pre-commercial thinning may be desirable, between 5 and 15 years, to accelerate growth of merchantable stems. Presently, there are no stocking standards for bigleaf maple and research is needed to help define appropriate planting densities.

Regeneration from Coppices

Bigleaf maple sprouts prolifically from dormant basal buds following cutting, burning, or injury (Figure 2). There is considerable potential to manage these coppices for both fibre and timber. A further advantage to coppice management is that little or no site preparation is needed.

Large stumps tend to produce more and taller sprouts but all sizes of stumps regenerate vigorously. These sprouts can grow 1–3 m/yr and attain heights of 5 m and crown diameters of 6.5 m in as little as 3 years. Over time, the number of bigleaf maple stems declines due to self-thinning and breakage of lateral shoots and mature trees, of coppice origin, average about four stems per coppice. By controlling the number of sprouts, forest managers can concentrate growth and improve the form of the remaining stems. This area of maple regeneration is not well researched.

Mixed-Stand Management

Bigleaf maple rarely occurs in pure stands and is most often present singly or in small patches in mixture with other species (Figure 3). These patches can be groups of maple coppices or clusters of seedlings in forest openings.

Bigleaf maple is relatively shade tolerant and can be grown in any crown position in mixture with conifers or in uneven-aged stands, provided there are suitable light levels. Bigleaf maple is resistant to root diseases, and is commonly found in gaps created by root disease. It should be considered as a suitable species for regenerating infected sites. Maple grows at about the same rate as red alder, and is often a component of south coastal red alder stands.

Although retaining a component of bigleaf maple is desirable and can increase availability of soil nutrients to conifers, maple can be a serious competitor with slower-growing trees such as Douglas-fir, Sitka spruce, western redcedar, western hemlock, and grand fir. Maple competes for light, its leaf litter can smother small conifers, and its stems and branches can cause physical damage to the smaller conifers. In some situations, light levels under individual coppices can be less than 1% of full sunlight. In the absence of any management, 200 well-distributed maple coppices per hectare can completely dominate a site within 10 years following harvest.

FIGURE 2 *Rapidly expanding maple coppice 4 years after cutting.*

FIGURE 3 *Maple is moderately shade tolerant and is a frequent understorey species in west coast forests.*

On sites where control of bigleaf maple is desired, a variety of methods, including manual cutting and herbicide treatments, can be effective. However, due to vigorous resprouting following manual cutting, re-treatment is usually necessary within 2 to 3 years. A promising option for decreasing both resprouting vigour and competition for light is to reduce the number of shoots within a coppice by thinning them to one shoot per 25 cm of stump circumference. Herbicides can also be used to control resprouting maple. Effective treatments include: cut stump applications of triclopyr ester, 2,4-D, or glyphosate; basal bark applications of triclopyr ester; and foliar applications of glyphosate.

FIGURE 4A *Rocking chair (an example of a value-added specialty product made from bigleaf maple (made by R. David, Sidney, B.C.).*

FIGURE 4B *High-value bowl turned from bigleaf maple burl (an example of a value-added specialty product made from bigleaf maple (made by R. David, Sidney, B.C.).*

Maple Products

Bigleaf maple has fine-grained wood of moderate weight and hardness with good strength and turning properties. Maple wood is used for furniture, veneer, pallets, and specialty products. There are growing markets for veneer and figured wood (wavy, quilted, or fiddle-back patterns) from which craftsmen and artists make specialty, value-added products (Figures 4a and 4b). Other possible end uses could be fibre or flakeboard produced from rapidly growing plantations of maple. Figured wood and clear lumber obtain the best prices, therefore maple should be managed in moderately dense stands or in the understorey to promote growth of a single stem with few branches.

Biodiversity

Bigleaf maple, along with other broadleaf species in British Columbia, is receiving greater consideration for its contribution to maintaining diverse, productive, and resilient ecosystems. Bigleaf maple is recognized for its contribution to food, cover, and nesting sites for insects and other animals, for enhancing visual resources, and for broadening the diversity of species and structure in forests (Figure 5). Management of forest sites to meet biodiversity and riparian zone guidelines under the Forest Practices Code in south coastal British Columbia involves bigleaf maple as well as red alder and black cottonwood.

Bigleaf maple frequently has cavities in live trees and snags that provide good nesting sites for woodpeckers. Other bird species subsequently use these cavities as secondary nesting sites. Maple branches are also favorite daytime perching sites for bald eagles.

The moss and lichen communities that develop on stems and branches of bigleaf maple have been emphasized by many researchers as a remarkable feature in coastal mixed-species forests. These epiphytic communities are a rooting medium for other plants, and a food source for arthropod communities. Epiphytic mosses growing in maple-dominated ecosystems are sometimes harvested for marketable botanical products.

FIGURE 5 *Maple provides important biodiversity values during its late successional place in coastal ecosystems.*

Further Reading

For more detailed information on managing bigleaf maple, please refer to the Maple Managers' Handbook for British Columbia (in press).

References

Kerbes, E.L. 1968. Broadleaf maple in British Columbia. Can. For. Serv., For. Prod. Lab., Vancouver, B.C. Inf. Rep. VP-X-38.

Massie, M.R.C., E.B. Peterson, N.M. Peterson, and K.A. Enns. 1994. An assessment of the strategic importance of the hardwood resource in British Columbia. B.C. Min. For. and For. Can., Victoria, B.C. FRDA Rep. 221.

Minore, D. and J.C. Zasada. 1990. *Acer macrophyllum* Pursh — Bigleaf maple. Aceracea. Maple family. *In* Silvics of forest trees of the United States. R.M. Burns and B.H. Honkala (technical coordinators). USDA For. Serv., Agric. Handb. 654. pp. 33–40.

Niemiec, S.S., G.R. Ahrens, S. Willits, and D.E. Hibbs. 1995. Hardwoods of the Pacific Northwest. Oreg. State Univ., For. Res. Lab., Corvallis, Oreg. Res. Contrib. 8. pp. 12–21.

Peterson, E.B., N.M. Peterson, P.G. Comeau, and K.D. Thomas. [1998]. Bigleaf Maple Managers' Handbook for British Columbia. B.C. Min. For., Victoria, B.C. In press.

Thomas, K.D. and P.G. Comeau. 1998. Effects of bigleaf maple (*Acer macrophyllum* Pursh) on growth of understorey conifers and the effects of coppice spacing on the growth of maple (MOF EP 1121.02). Extension Note 24. B.C. Min. For., Victoria, B.C.

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