# *Acer macrophyllum* Pursh Bigleaf Maple

**Aceraceae Maple family**

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Bigleaf maple *(Acer macrophyllum),* also called broadleaf maple or Oregon maple, is one of the few commercial hardwood tree species on the Pacific Coast. It is small compared with its conifer associates. Most mature bigleaf maples are about 15 m (50 ft) tall and 50 cm (20 in) in d.b.h. (5). Large trees often reach heights of 30 m (100 ft) and diameters of 90 to 120 cm (36 to 48 in). True to its common name, bigleaf maple usually bears leaves up to 30.5 cm (12 in) across, and exceptionally large leaves may attain widths of 61 cm (24 in) (2). They are borne on rounded crowns supported by short, branching boles if open-grown, but trees growing in dense stands are often well formed and free of branches for half to two-thirds of their height (fig. 1). Bigleaf maple is an excellent shade tree. The wood is used for furniture, especially piano frames, and the sap can be made into syrup.

**Figure** l-Young bigleaf maples in western Oregon, showing the good form and clean stems typical of dense stands.

## Habitat

### Native Range

The native range of bigleaf maple (fig. 2) extends from latitude 33" to 51" N., always within 300 km (186 mi) of the Pacific Ocean. This maple is not found in southeastern Alaska or on the Queen Charlotte Islands *(34),* but it does grow on Vancouver Island at least as far north as Port Hardy (25). On the mainland, the range is a continuous belt from near Sullivan Bay, BC, to within 16 km (10 mi) of San Francisco Bay, CA-a belt that includes the western slopes of the Coast Ranges of British Columbia, the Olympic Peninsula in Washington, the Coast Ranges of Oregon and California, and the western slopes of the Cascade Range in Oregon and Washington. The species is less common south of San Francisco Bay, but extensive stands are found in the Santa Cruz and Santa Lucia Mountains. Isolated groves are scattered along the southern California coast to San Diego County. Bigleaf maple is common on the western slopes of the Sierra Nevada north of the Yuba River and is present in less abundance as far south as Sequoia National Park *(11).*

Most of the estimated volume of standing sawtimber is found in Washington (about 19.6 million $m^3$ or 3.43 billion fbm) and Oregon (about 18.0 million $m^3$ or 3.16 billion fbm). Almost half this timber is in Lewis and Whatcom Counties in Washington and Douglas and Lane Counties in Oregon ***(17).*** The estimated 1.1 million $m^3$ (200 million fbm) of bigleaf maple in British Columbia is found on the south coast and Vancouver Island *(16).*

### Climate

Bigleaf maple grows over a wide range of temperature and moisture conditions, from the cool, moist, marine climate of coastal British Columbia to the warm, dry, growing seasons of southern California (table 1). Springs, streams, and other permanent sources of water are often associated with bigleaf maple in southern California, but it also grows on eastern and northern slopes in California where more than 600 mm (24 in) of annual rainfall occurs ***(15).*** It receives abundant moisture in the coastal redwood region of northern California *(36).* Bigleaf maple is not, however, limited to moist sites in southwestern Oregon, where it is found from moist stream bottoms to dry hillsides. Nocturnal moisture stresses of more than 2.0 M Pa (20 bars) have been recorded on some of those hillsides in southwestern Oregon. This maple also grows on hot, dry sites in the central-western Cascade Range in Oregon and does not seem to be limited by moisture deficiencies there

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**Table** l-Climatic variation in northern and southern portions of the native range of bigleaf maple

| Areas | Mean temperature | | | Frost-free period | Mean precipitation | |
|---|---|---|---|---|---|---|
| | Annual | Maximum | Minimum | | Annual | Growing season |
| | | °C | | days | mm | |
| British Columbia[1] | 8 to 10 | 18 to 26 | 12 to 2 | 140 to 270 | 700 to 6600 | 300 to 1170 |
| California[2] | 13 to 15 | 24 to 27 | 2 to 6 | 270 to 350 | 560 to 1470 | 50 to 130 |
| | | °F | | days | in | |
| British Columbia | 46 to 50 | 64 to 79 | 28 to 36 | 140 to 270 | 27 to 260 | 12 to 46 |
| California | 55 to 59 | 75 to 81 | 36 to 43 | 270 to 350 | 22 to 58 | 2 to 5 |

[1]Latitudes 49° to 51° N. *(20).*
[2]Latitudes 35° to 37° N. *(29).*

*(40).* Moisture deficiencies seldom occur in western valleys of the Olympic Peninsula or in coastal British Columbia *(25,32).* Temperature probably limits the northern distribution of bigleaf maple (29).

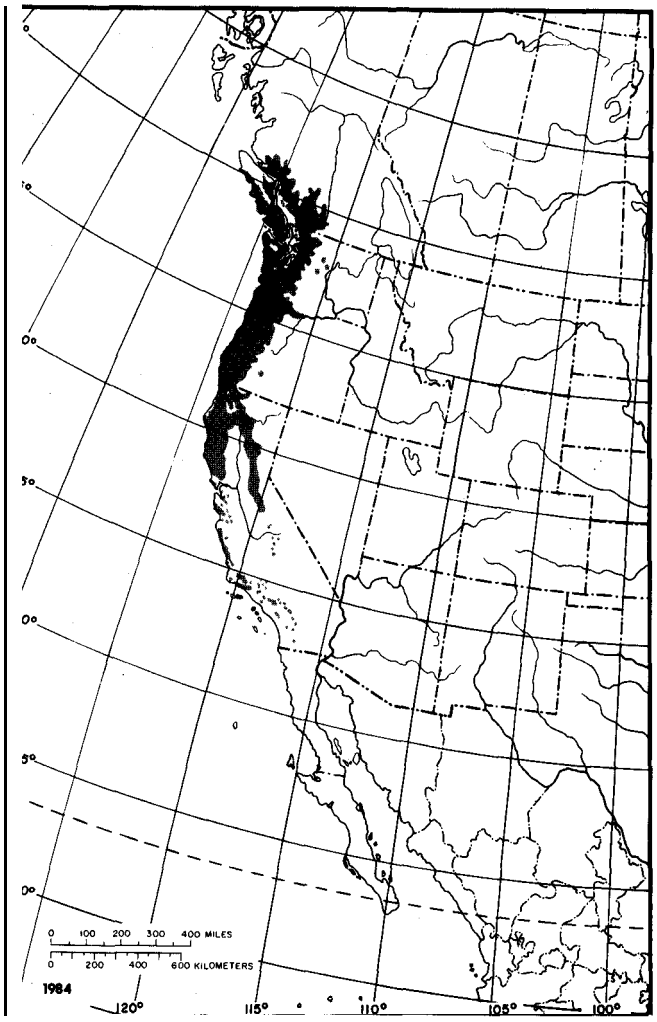


**Figure** 2-The native range of bigleaf maple.

## Soils and Topography

Well drained alluvial and colluvial soils are well suited to bigleaf maple. Abundant moisture and a deep, gravelly profile produce the best growth—usually on river terraces, flood plains, and seepage sites (25). Growth is poorer on shallow, rocky soils, but bigleaf maple is frequently found on such soils. In the Coast Ranges of Oregon and the north Cascade Range in Washington, it even grows on steep talus slopes *(1,5).*

Bigleaf maple is associated with many soil groups *(5,25).* On upland sites, these groups include the moist but well drained Brown Soils (Haplumbrepts and Dystrochrepts); Reddish Brown Lateritic soils (Haplohumults); Podzols (Haplorthods); both fine- and coarse-textured dry soils (Haploxerolls and Xeropsamments); and shallow, dry soils (Lithic Xerumbrepts). Soil groups associated with bigleaf maple in lowland areas include flood plain alluvium (Udifluvents); alluvial pumice deposits (Vitrandepts); wet, gley soils (Aqualfs); and cool, acid, well-drained soils (Boralfs). These soil great groups and suborders are found in the soil orders Inceptisols, Ultisols, Spodosols, Mollisols, Entisols, and Alfisols.

Bigleaf maple does not require high concentrations of soil nutrients *(36),* but it is very sensitive to toxic concentrations of soil boron (9). Litter-fall weights are greater under bigleaf maple than under Douglas-fir, and bigleaf maple leaves and litter contain high concentrations of potassium, calcium, and other macro- and micro-nutrients *(6,33).* Bigleaf maple is a soil-building species that benefits the sites on which it grows.

Bigleaf maples grow at low elevations on the north side of Santa Cruz Island *(27)* but are usually found on riparian sites above 915 m (3,000 ft) in southern California, where the maximum elevation at which they grow is 2135 m (7,000 ft). Farther north in California, maximum elevations decrease to 1675 m (5,500 ft) in the Sierra Nevada and 1035 m (3,400 ft)

in the Coast Ranges (29). In central and northern California, bigleaf maple becomes less riparian and more widely distributed *(11),* sometimes growing as shrubby clumps on the steepest north-facing canyon walls ***(15).*** This maple does not grow in the Central Valley of California *(11).* It is found above 310 m (1,017 ft) in steep-sided ravines and on mesic slopes in the Klamath Mountains ***(31)*** and at elevations of 1220 m (4,000 ft) on the Cascade Range in southern Oregon.

The topography occupied by bigleaf maple in Oregon and Washington includes flat interior valleys, gently sloping stream bottoms, and moderate to steep slopes. It grows on both moist, fertile stream bottoms and arid, precipitous, south-facing rock outcroppings with slopes greater than 100 percent in the Coast Ranges of northwestern Oregon ***(1).*** On the Olympic Peninsula in Washington, the maximum elevation at which it grows is 455 m (1,500 ft). Bigleaf maple is seldom found above 305 m (1,000 ft) in coastal British Columbia, but it has been observed above 350 m (1,150 ft) on the east coast of southern Vancouver Island (25).

### Associated Forest Cover

Characteristic trees, shrubs, and herbs associated with bigleaf maple in five portions of its native range are listed in table 2. Douglas-fir, Pacific madrone, Pacific dogwood, swordfern, and prince's-pine grow with bigleaf maple in most environments. Bigleaf maple communities often present on moist sites include willow-black cottonwood-bigleaf maple and red alder-bigleaf maple/salmonberry. The bigleaf maple/snowberry ***(Symphoricarpos albus)*** community is found on dry sites (5). Bigleaf maple is present but is not a dominant species in several other plant communities-western hemlock/western swordfern/ Oregon oxalis and Douglas-fir/oceanspray (western Washington and Oregon), Sitka spruce/devilsclub-stink currant ***(Ribes bracteosum)*** (British Columbia), and white fir/Oregongrape (California), for example.

Bigleaf maple is present in the following forest cover types (3): Red Alder (Society of American Foresters Type 221), Black Cottonwood-Willow (222), Sitka Spruce (223), Western Hemlock-Sitka Spruce (225), Pacific Douglas-Fir (229), Douglas-Fir–Western Hemlock (230), Port-Orford-cedar (231), Redwood (232), Oregon White Oak (233), Douglas-Fir-Tanoak-Pacific Madrone (234), Pacific Ponderosa Pine-Douglas-Fir (244), and Pacific Ponderosa Pine (245).

Bigleaf maple supports several epiphytic plants in moist climates. This support is particularly evident in the "rain forest" on the west side of the Olympic Peninsula, where epiphytes weigh nearly four times as much as the leaves of host bigleaf maples ***(19).*** Some of those maples, heavily laden with rain-soaked epiphytes, are more susceptible to windthrow than trees with less luxuriant epiphytic growth *(32).* A club moss ***(Selaginella oregana)*** and the mosses ***Hylocomium splendens, Leucolepis menziesii, Isothecium stoloniferum,*** and *Neckera* ***menziesii*** are the most abundant epiphyte species, but lichens ***(Cladonia, Nephroma,*** and ***Crocynia*** spp.) and the licorice fern ***(Polypodium glycyrrhiza)*** are also common *(5,32).*

## Life History

### Reproduction and Early Growth

**Flowering and Fruiting-Bigleaf** maple begins to produce seed at about 10 years of age and continues every year thereafter *(23).* It is polygamous, and both staminate and perfect flowers are mixed in the same dense, cylindrical racemes. Flowers are greenish yellow and scented, and they appear before the leaves-from March, at low elevations and in the southern part of the range, to June, at high elevations and in the north. Pollination by insects usually occurs within 2 to 4 weeks after the buds burst (29). Pubescent double samaras result, with 3.5- to 5-cm (1.4- to 2-in) wings that diverge at less than a 90" angle. They ripen in September and October.

**Seed Production and Dissemination-Seeds** are abundant almost every year, but production by individual trees and stands can vary from year to year (7). Although most of the seeds are dispersed by the wind between October and January, some seeds can be found on trees as late as March. Bigleaf maple seeds are large and generally triangular or oval. They are 4 to 12 mm (0.16 to 0.47 in) long and 4 to 9 mm (0.16 to 0.35 in) thick. At field moisture content, filled-seed weights range from 5,200 to 7,900 seeds/kg (2,400 to 3,600 seeds/lb) for individual trees in the Oregon Coast Range. Seed coat comprises 60 to 70 percent of the seed weight (39).

Seed moisture content reaches a minimum of 10 to 20 percent (dry weight basis) before the autumn rains begin in western Oregon. After the rains begin, seed moisture content varies among individual trees, but it increases by 140 to 200 percent. The pubescent seed coat appears to be effective in holding water and raising seed moisture content quickly. Seed collection and storage are best done when minimum moisture content is reached before the start of the autumn rains. Seeds in this condition can be stored without further drying for at least 1 year at 1" C (34" F) with

**Table** S-Characteristic trees, shrubs, and herbs associated with bigleaf maple in five portions of its native range

| TREES | SHRUBS | HERBS |
|---|---|---|
| **SIERRA NEVADA** | | |
| White fir *(Abies concolor)* | Greenleaf manzanita *(Arctostaphylos patula)* | Trailplant *(Adenocaulon bicolor)* |
| Pacific madrone *(Arbutus menziesii)* | Deerbrush *(Ceanothus integerrimus)* | Princes-pine *(Chimaphila umbellata)* |
| Chinkapin *(Castanopsis chrysophylla)* | Snowbrush *(Ceanothus velutinus)* | Hooker's fairybells *(Disporum hookeri)* |
| Pacific dogwood *(Cornus nuttallii)* | Baldhip rose *(Rosa gymnocarpa)* | Whitevein pyrola *(Pyrola picta)* |
| Sugar pine *(Pinus lambertiana)* | | Pioneer violet *(Viola glabella)* |
| Ponderosa pine *(Pinus ponderosa)* | | |
| Douglas-fir *(Pseudotsuga menziesii)* | | |
| California black oak *(Quercus kelloggii)* | | |
| Canyon live oak *(Quercus chrysolepis)* | | |
| **CALIFORNIA NORTH COAST RANGES** | | |
| Pacific madrone | Blueblossom *(Ceanothus thyrsiflorus)* | Oregon oxalis *(Oxalis oregana)* |
| Chinkapin | California hazel *(Corylus cornuta)* | Western swordfern *(Polystichum munitum)* |
| Pacific dogwood | Western poison-oak *(Toxicodendron diversilobum)* | Bracken *(Pteridium aquilinum)* |
| Tanoak *(Lithocarpus densiflorus)* | Box blueberry *(Vaccinium ovatum)* | Whipple vine *(Whipplea modesta)* |
| Ponderosa pine | Pacific rhododendron *(Rhododendron macrophyllum)* | |
| Douglas-fir | | |
| California black oak | | |
| Canyon live oak | | |
| Coast redwood *(Sequoia sempervirens)* | | |
| California laurel *(Umbellularia californica)* | | |
| **KLAMATH MOUNTAINS (SOUTHWESTERN OREGON AND NORTHERN CALIFORNIA)** | | |
| White fir | Greenleaf manzanita | Trailplant |
| Pacific madrone | California hazel | Princes-pine |
| Chinkapin | Salal *(Gaultheria shallon)* | Hoker's fairybells |
| Pacific dogwood | Cascade hollygrape *(Berberis nervosa)* | Mountain sweetroot *(Osmorhiza chilensis)* |
| Incense-cedar *(Libocedrus decurrens)* | Western poison-oak | Western swordfern |
| Tanoak | Baldhip rose | Whitevein pyrola |
| Ponderosa pine | California dewberry *(Rubus ursinus)* | Whipple vine |
| Douglas-fir | Oceanspray *(Holodiscus discolor)* | |
| Canyon live oak | | |
| Oregon white oak *(Quercus garryana)* | | |
| California black oak | | |
| Pacific yew *(Taxus brevifolia)* | | |
| California laurel | | |
| **WESTERN WASHINGTON AND OREGON (CASCADE RANGE, COAST RANGES, AND OLYMPIC PENINSULA)** | | |
| Grand fir *(Abies grandis)* | Saskatoon serviceberry *(Amelanchier alnifolia)* | Maidenhair fern *(Adiantum pedatum)* |
| Vine maple *(Acer circinatum)* | Cascade hollygrape | Princes-pine |
| Red alder *(Alnus rubra)* | Salal | Twinflower *(Linnaea borealis)* |
| Pacific madrone | Box blueberry | False lily-of-the-valley *(Maianthemum dilatatum)* |
| Pacific dogwood | American devilsclub *(Oplopanax horridum)* | Mountain sweetroot |
| Sitka spruce *(Picea sitchensis)* | Western poison-oak | Oregon oxalis |
| Black cottonwood *(Populus trichocarpa)* | Pacific rhododendron | Western swordfern |
| Douglas-fir | Thimbleberry *(Rubus parviflorus)* | Ladyfern *(Athyrium filix-femina)* |
| Pacific yew | Salmonberry *(Rubus spectabilis)* | |
| Western redcedar *(Thuja picata)* | Rustyleaf menziesia *(Menziesia ferruginea)* | |
| Western hemlock *(Tsuga heterophylla)* | | |
| **BRITISH COLUMBIA** | | |
| Grand fir | Saskatoon serviceberry | Maidenhair fern |
| Red alder | Cascade hollygrape | Western swordfern |
| Pacific madrone | Salal | Deerfern *(Blechnum spicant)* |
| Pacific dogwood | Rustyleaf menziesia | Twinflower |
| Sitka spruce | Devilsclub | False lily-of-the-valley |
| Black cottonwood | Thimbleberry | Princes-pine |
| Douglas-fir | Salmonberry | |
| Western redcedar | Box blueberry | |
| Western hemlock | Red huckleberry *(Vaccinium parvifolium)* | |

only a slight loss in viability. Seeds collected after the moisture content has increased are usually killed by redrying, but they can be stored for up to 6 months at the field moisture content with a 30- to 40-percent reduction in viability. Seeds stored in this way produce vigorous seedlings when planted in nursery beds (39).

**Seedling** Development-Germination is epigeal. It begins in late January or early February under field conditions and is usually completed by April or May in the Oregon Coast Range. Seeds germinate completely at 1" C (34" F) under laboratory conditions, beginning at about 60 days and completing their germination after 90 to 120 days (39). Because of this low temperature threshold for germination, seeds germinate early under natural conditions if moisture is not limiting. Germination during stratification can be used as a means of screening seeds before sowing. **If** seeds are stratified for 60 days and then germinated, the optimum temperature for germination is 15" C (59" F) *(10).* Exogenous gibberellin, cytokinin, or ethylene do not overcome the stratification requirement *(10).* A small number of seeds have been found germinating on trees in December before dispersal (39).

Seed germination is excellent on mineral soil and organic substrates *(7,25,39),* and seedling establishment is best when those substrates do not dry excessively during the growing season. Bigleaf maple seedling emergence is not affected by Douglas-fir canopy density in coastal Oregon under conditions that vary from young-and-dense to old-and-open stands, but emergence is better under all of these stand conditions than it is in clearcut areas (7). An average 30 to 40 percent of the viable seeds germinate if they are protected from predators, and occasional seed lots attain 80 percent germination (7). All bigleaf maple seeds germinate during the late winter and spring after seed dispersal. Delayed germination does not occur in subsequent years (7).

Bigleaf maple seedlings have a high juvenile growth potential, exceeding that of Douglas-fir and other conifers *(38,39).* When open-grown under conditions of adequate moisture and nutrients, seedlings reach heights of 1 to 2 m (3.3 to 6.6 ft) in one growing season. Competition affects growth, however, and first-season height is reduced by more than 50 percent when seedling density is increased from 1 to about 600 seedlings/m' (0.1 to 55.7 seedlings/ft$^2$). Seedling weight is even more sensitive to competition than seedling height, and an increase in density from 1 to 60 seedlings/m$^2$ (0.1 to 5.6 seedlings/ft$^2$) can result in a 50-percent decrease in seedling dry weight (39).

The morphology of young seedlings is strongly influenced by density. At low density, branch development begins in the buds associated with the cotyledons and moves up the stem as height growth progresses. At high densities, branch development is suppressed and the few branches that develop soon die. Internode length is highly responsive to density, and the longest internodes are produced at intermediate densities during the first year of growth.

The growth potential of bigleaf maple is rarely achieved in the field under normal conditions of light, moisture, competition, and browsing intensity (7). A survey of bigleaf maple seedlings in western Oregon showed that the tallest seedlings were 5 m (16.4 ft) tall and 20 to 30 years old. The height distribution of all seedlings in a stand most commonly resembled an inverted J, with 0 to 25 cm (0 to 10 in) tall, 1- to 4-year-old seedlings, most numerous. Normal and bimodal height distributions were also observed in the western Oregon survey. Although these seedlings were all growing in the understories of Douglas-fir stands, shapes of the height-distribution curves did not seem to be associated with stand conditions. Few seedlings were found in clearcuts (7). Browsing by deer probably is the most important factor influencing the height and stem morphology of bigleaf maple seedlings (7).

Temporary flooding is common on riparian sites, and the seedlings are able to survive short periods of inundation. Bigleaf maple is not as tolerant of flooding as red alder, Oregon ash *(Fraxinus latifolia),* black cottonwood, Sitka spruce, and western redcedar, however; flooding for 2 months during the growing season kills both maple seedlings and mature trees (35).

**Vegetative Reproduction-Bigleaf maple** sprouts profusely after being cut. The large stumps produce more and taller sprouts, but all sizes regenerate vigorously Sprout clumps have achieved heights of 5 m (17 ft) and crown diameters of 6.5 m (21.5 ft) in 3 years, with as many as 67 sprouts around a single stump (28). This sprouting vigor probably could be used in reproducing pure stands of bigleaf maple by the coppice method. It creates undesirable competition for the conifers being managed on most sites. Unlike vine maple *(Acer circinatum),* bigleaf maple does not appear to reproduce by layering. It can, however, be propagated from stem cuttings .

### Sapling and Pole Stages to Maturity

**Growth and Yield-Rapid** height growth of bigleaf maple continues through the sapling stage, but it slows as the trees grow from pole to sawtimber size. Diameter growth is proportional to leaf area,

and trees with large crowns develop more sapwood than trees with small crowns *(37).* The volume of individual trees ranges from 0.11 $m^3$ (4 $ft^3$) at 15 cm (6 in) in d.b.h. to 6.5 $m^3$ (230 $ft^3$) at 91 cm (36 in) in d.b.h. *(24).* The largest bigleaf maple known in 1977 grew in western Oregon and had a circumference of 1064 cm (419 in) at breast height, a height of 30.8 m (101 ft), and a crown spread of 27.4 m (90 ft) *(26).* The oldest attain ages of 200 years or more *(2).*

Pure, 'IO-year-old stands of bigleaf maple have yielded about 315 $m^3$/ha (4,500 $ft^3$/acre). Under intensive management, rotations of 50 years or less could probably be used *(16).*

**Rooting** Habit-Bigleaf maple has a shallow, widespreading root system well suited to the shallow or saturated soils on which it often grows. It probably has a competitive advantage over deeper-rooted species under such conditions.

**Reaction to Competition-Bigleaf** maple is not a pioneer species that rapidly invades disturbed areas; however, it is often present in undisturbed stands and is able to respond with vigorous sprout growth after disturbance. Maple seedling establishment is most likely to occur in Douglas-fir stands after the start of natural thinning and before the dense understory characteristic of older stands develops. Light or other factors related to stand density apparently limit establishment. Increases in light from 0 to 20 percent of that in the open result in increases of from 0 to 60 percent in survival, but additional increases in light are not beneficial. Seedlings often occur in clusters, with various age distributions, suggesting that conditions favoring establishment vary from year to year *(7).* The presence of bigleaf maple in undisturbed stands and its potential for rapid growth suggest that it can respond quickly to gap formation or overstory removal.

Maple seedlings often appear in intermediate or late seral communities. Bigleaf maple frequently follows willow *(Salix* spp.) or red alder in riparian seres *(4,13),* and sometimes it replaces oaks or Pacific madrone on upland sites.

Silviculture of bigleaf maple usually involves control rather than culture. Bigleaf maple does not aggressively invade clearcut units, but vigorous stump sprouting is a problem when it occurs in the harvested stand. Sprouting can be controlled by applying water-soluble amines or potassium salts of phenoxy herbicides around the sapwood perimeter on freshly cut stumps *(21).* Girdling the uncut trees is ineffective, for girdled bigleaf maples survive for several years and sprout. Aerial spraying of herbicides and other foliar applications are also ineffective-herbicide translocation is inadequate and the roots are not killed *(22).* Basal bark treatments overcome this problem. They are effective when ester-in-oil formulations of the phenoxy herbicides are applied *(21).*

Dry sites with bigleaf maple overstories should not be clearcut if conversion to Douglas-fir is attempted. Seedling survival will be better if the Douglas-fir is underplanted, preferably after the overstory maples are killed with a basal spray of phenoxy ester in oil *(20).*

When bigleaf maple is harvested as a crop rather than killed as a weed, often only trees that will yield a minimum log size (3.7 m by 25 cm, or 12 ft by 10 in) are harvested *(16).* Merchantable trees are usually scattered, limbing is laborious, and logs are short. Felling, yarding, and milling costs therefore tend to be higher for bigleaf maple than for conifers. Mill waste is also high-as much as 30 percent in slabs, sawdust, trim, and defect *(16).*

**Damaging Agents-Fungi** are responsible for much of the defect in bigleaf maple. Decay is seldom a serious problem in young undamaged trees, but stem and branch wounds are invaded by wood-rotting fungi such as ***Heterobasidion annosum, Fomitopsis pinicola, Polyporus berkeleyi,*** and ***Inonotus dryadeus*** that can reduce the tree to a hollow shell. Overmature bigleaf maples are often decayed by root rot *(Armillaria* spp.) and butt rots ***(Ganoderma applanatum*** and ***Oxyporus populinusj.*** Verticillium wilt *(Verticillium albo-atrum)* occasionally kills forest trees, but it is most serious on ornamental bigleaf maples *(14).*

The carpenter worm ***(Prionoxystus robiniaej*** may seriously damage living maples. It attacks trees of all sizes, particularly those that are open-grown. The resulting larval tunnels degrade the lumber cut from affected stems. Dead trees and maple products are damaged by powder-post beetles *(Hemicoelus, Melalgus, Polycaon, Ptilinus, Scobicia,* and ***Xestobium*** spp.), and a roundheaded borer ***(Synaphaeta guexij*** makes large burrows in dead or dying trees *(8).*

Bigleaf maple twigs and young stems are browsed by deer and elk. They are also clipped by mountain beavers. The roots are sometimes attacked by nematodes ***(Meloidogyne*** spp.) *(14).* A high percentage of seedling mortality also results from predation by rodents and grazing by slugs and other invertebrates (7).

Seed predation by small mammals is high, and it may be related to overstory condition. Seedling emergence on artificially seeded plots in the Oregon Coast Range is from 7 to 100 times greater on plots protected from birds and rodents than on un-

protected plots. The highest rate of predation is in young (20- to 40-year-old) and old (80- to 250-year-old) stands with lower rates in clearcuts and in pole-size stands (40 to 80 years old) *(7)*.

## Special Uses

Bigleaf maple is an excellent shade tree. Its wood is used in the furniture industry, but it is neither as hard nor as strong as the wood of sugar maple *(Acer saccharum) (16)*. Like sugar maple, it has sweet sap that can be made into syrup. The flow of sap is adequate for syrup production in January and February, but the syrup is of a lower quality than that made from sugar maple *(30)*.

Bigleaf maple is a preferred wood for piano frames. It is excellent for decorative face veneer and makes good container material but is not suitable for flooring *(16)*. The amounts of bigleaf maple being marketed for fuelwood are increasing as the use of wood stoves increases. Bigleaf maple has about 70 percent of the fuel value of Oregon white oak and 115 percent of the fuel value of red alder wood.

Bigleaf maple is usually harvested in conifer stands along with the conifers. These trees generally originate from sprouts and are of poor quality. Higher quality trees could be produced by managing maple stands that originate from seed or planted seedlings.

## Genetics

The Kimball maple *(Acer macrophyllum* Pursh var. *kimballi* Harrar), a rare variety of bigleaf maple, occurs in the Washington counties of Snohomish, Cowlitz, and Pierce. It differs from *Acer macrophyllum* var. *macrophyllum* in having much more deeply lobed leaves, often tricarpellate flowers, and frequent triple samaras *(12)*.

*Acer macrophyullum* Pursh forma *rubrum* Murray is an even rarer form of bigleaf maple. First noticed at Berkeley, CA, in 1968 and later found in the Coast Ranges north of San Francisco, it has red leaves *(18)*. The young leaves of an early German cultivar, 'tricolor,' are also red. Tricolor leaves are rose-red, however, and they later become marked with white.

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