SILVICAL CHARACTERISTICS of BIGLEAF MAPLE

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COVER: A 100-year-old stand of bigleaf maple on bottomland in western Oregon. A sample tree is 20 inches in diameter and 74 feet tall.

SILVICAL CHARACTERISTICS OF BIGLEAF MAPLE

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Bigleaf maple (Acer macrophyllum),[3/] also known as Oregon maple and broadleaf maple, is the only large commercially important maple in the Pacific Coast region. Its range extends from the San Bernardino Mountains of southern California, northward through the western parts of Oregon, Washington, and British Columbia as far as the southern tip of Alaska (fig. 1). Best development of bigleaf maple is on good alluvial soils in western Oregon and western Washington (20),[4/] where it occasionally forms practically pure dense stands over limited areas.

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[3/] Scientific and common names of trees in this publication follow: Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U. S. Dept. Agr. Handb. 41, 472 pp. 1953.

[4/] Underscored numbers in parentheses refer to Literature Cited.

Figure 1.--Range of bigleaf maple.

HABITAT CONDITIONS

Climatic

Optimum growing conditions for bigleaf maple are found in the humid and superhumid climates of western Oregon, where the mean annual temperature is above 50° F. with little seasonal variation. This climate is characterized by relatively cool summers, long frost-free seasons, and abundant precipitation, especially during the winters. The southernmost fringe of bigleaf maple lies in the climatic type described by Thornthwaite (21) as moist subhumid, with summer moisture deficiency. Here the tree exists on permanent water locations. The northern edge of bigleaf maple habitat lies in Thornthwaite's climatic type described as superhumid, with adequate moisture during all seasons. Probably the factor most limiting the southern extension of bigleaf maple is moisture insufficiency. The northern range of bigleaf maple is probably limited by temperature.

Edaphic

Bigleaf maple is found on a variety of soils, ranging from deep loams to thin soils on rocky slopes. For good development, however, it must have access to adequate soil moisture; and the best stands are found on deep alluvial soils near streams. In fact, the species has sometimes been called water maple (14). The affinity of bigleaf maple for permanent water courses is most conspicuous in the southern part of its range, where it is usually limited to banks of rivers and streams and to moist swales on north and east slopes. In the coast range near the San Francisco bay area, for example, bigleaf maple is restricted almost entirely to banks of permanent streams (4, 13).

In the Pacific Northwest, bigleaf maple is a common shade tree, but maintaining a lawn under its broad, dense crown is difficult because of heavy demands by this species on soil moisture and nutrients (22). In British Columbia, bigleaf maple is sometimes found as pioneer growth on hillsides laid bare by slides or fire (25). In the Oregon coast range and on the western slopes of the Cascades, it frequently invades logged and burned areas, particularly in moist locations.

Physiographic

In coastal British Columbia, bigleaf maple rarely occurs at elevations exceeding 1,000 feet. Moving south, however, upper elevational limits gradually increase to 1,500 feet on the Olympic Peninsula; 3,400 feet in the central part of the Coast Range in California; 5,500 feet on the west slope of the Sierra Nevada; and a maximum of 7,000 feet in the coastal mountains of southern California and on the north slopes of the San Gabriel Mountains. Lower limits range from slightly above sea level in the north to 3,000 feet in the south (1, 4, 5, 9, 17, 18, 19, 25).

Biotic

Bigleaf maple occurs principally in the transition life zone, with some overlap into the Upper Sonoran zone (16). Occasional pure stands are found in moist soils near streams, but as a rule the trees are scattered or in small groves with other species. At lower elevations bordering the Willamette Valley in Oregon, bigleaf maple is an important component of Douglas-fir (Pseudotsuga menziesii) stands. It is the principal forest tree in some areas of southwestern Oregon (11).

Common associates of bigleaf maple in the northern part of its range are red alder (Alnus rubra), Douglas-fir, western redcedar (Thuja plicata), grand fir (Abies grandis), western hemlock (Tsuga heterophylla), black cottonwood (Populus trichocarpa), Oregon white oak (Quercus garryana), and Oregon ash (Fraxinus latifolia). In the southern part of its range, common associates include California-laurel (Umbellularia californica), redwood (Sequoia sempervirens), willows (Salix spp.), Pacific madrone (Arbutus menziesii), white alder (Alnus rhombifolia), California live oak (Quercus agrifolia), and California sycamore (Platanus racemosa).

LIFE HISTORY

Seeding Habits

Bigleaf maple first produces flowers at about 10 years of age, with open-grown specimens producing more abundantly and earlier in life than trees in dense stands. Mature, open-grown trees often bear tremendous crops of seed year after year (9, 20). Flowers--in yellow, scented racemes--develop from the same buds as the

leaves and grow rapidly to maximum size. Leaves are inconspicuous at first, only the flowers being noted by the casual observer. Over the central part of its range in Oregon and Washington, the buds of bigleaf maple usually burst into activity in early April. At high elevations, however, flower growth may be delayed until May. Insects are attracted to the blossoms in great numbers and are responsible for pollination (5), which usually occurs within 2 to 4 weeks after bud bursting in the spring.

The fruit, a double or occasionally triple samara, is green at first, later turning to brown as it ripens. It appears as conspicuous elongated clusters on the trees. Seed reaches maturity from late August to October. Bigleaf maple seeds can be distinguished from seeds of other maples by the hairy seed cover. Seed dispersal is by winds of late fall and early winter (23), but occasional seeds persist on the tree all winter.

There are approximately 3,100 seeds per pound. Of this number, about 2,700 (87 percent) will be sound. Germination ranges from 32 to 90 percent (23, 24). Regeneration is often so prolific near bigleaf maple shade trees that seedlings need to be weeded out of flower beds and from around shrubbery. This species, however, is the only known maple whose seeds cannot be successfully stored for even short periods of time at either room or low temperatures (23). Seed, therefore, should be fall sown. Maple seedlings are difficult to transplant from the nursery (14).

Throughout its range, bigleaf maple seeds are readily taken by mice and wood rats. Where present, the Douglas squirrel (Tamiasciurus douglasii), chipmunks (Tamias spp.), flying squirrels (Glaucomys spp.), and the California ground squirrel (Citellus beecheyi) are persistent seed eaters. The western evening grosbeak (Hesperiphona vespertina brooksi) (10, 24) and many finches (Carpodacus spp.) also eat the seed, particularly during winter.

Vegetative Reproduction

Bigleaf maple sprouts vigorously from the stump and reproduction by the coppice method is worthy of trial. Although considerable volumes of bigleaf maple have been harvested in Oregon and Washington, there are few examples of forest stands managed for maple production, and very little silvicultural information is available to provide a basis for sound management practices.

Seedling Development

Natural regeneration of bigleaf maple is usually adequate, and in mixed stands maple will sometimes encroach on land formerly dominated by other species. In mixed bigleaf maple—Douglas-fir stands of western Oregon, for example, removal of Douglas-fir will often result in a heavy stand of maple that dominates the site to the exclusion of fir seedlings. Bigleaf maple is a more prolific and consistent seed producer than Douglas-fir. Initial height growth of maple is also greater, which gives it an added advantage. In some situations, maple seedlings can become established and survive for a number of years under fully stocked stands of Douglas-fir.[5/]

Maple seedlings germinate profusely in the spring, but there is considerable variation between areas in the number that survive the first summer drought period. Surviving seedlings are usually 1 to 6 inches tall at the end of the first growing season.

Sapling Stage to Maturity

Growth of bigleaf maple is rapid during the first 40 to 60 years (11). It is classified as a tolerant tree (3) but less tolerant than most maples (6). Tolerance seems to decrease with age. During early life, bigleaf maple can endure considerable shade, but it requires top light for best growth. Dense side shade results in development of narrow crowns and long boles 100 feet or more tall and free of limbs for one-half to two-thirds their length (11, 2). Even though bigleaf maple makes rapid early growth, it is often overtopped and eventually shaded out by competing conifers (9).

Bigleaf maple varies greatly in size and form, ranging from short-stemmed, crooked trees 25 to 30 feet tall at the extremities of its geographic range (13) to a giant tree in Lane County, Oreg., 8.9 feet in diameter with a crown spread of 66 feet (2). Over most of its range, mature trees average about 50 feet tall and 1.5 feet in diameter. The boles of open-grown trees fork into stout ascending branches and form broad, rounded crowns (7, 9). Growth of bigleaf

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5/ Yoder, Ray A. Bigleaf maple as a forest management problem in western Oregon. 1956. (Office rpt. Copy on file Forest Expt. Sta., Oregon State Col., Corvallis.)

maple decreases later in life and maturity is reached between 150 and 300 years (7, 11, 20). Old trees are often defective, and large burls--used for high-quality furniture--sometimes develop along their boles and at their bases. In almost all habitats, bigleaf maple develops a shallow, wide-spreading root system (11).

In the sapling stage, bigleaf maple is an important browse plant for black-tailed and mule deer (Odocoileus spp.) and in some areas for elk (Cervus canadensis) (24). Maple leaves are cropped by cattle and horses with fairly good or good relish but have only fair to poor palatability for sheep (8).

Bigleaf maple is subject to a wilt disease (Verticillium sp.), and a disease of unknown cause has been observed in California that kills leaves and twigs. Bigleaf maple trees, particularly in the older age classes, are subject to heart rot by several different decay-causing fungi. A wide variety of insects also attack the species, including caterpillars that mine out seeds, leaf chewing and sucking insects, twig and limb borers and girdlers, woodboring beetles, and carpenter moths (15). None of these insects, however, are known to cause extensive damage. Only individual trees or small groups are usually affected. The western evening grosbeak also nips off leaf and flower buds at the time they swell in the spring (9).

RACES AND HYBRIDS

A proposed variety of bigleaf maple, fairly common in the vicinity of Longview, Wash., is known as Kimball maple (Acer macrophyllum var. kimballi) (12). Kimball maple is easily distinguished by the very deep indentations between the major lobes and by the lacerated leaf margins.

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This is the final report in a series of Station releases that bring together existing knowledge on the range, habitat conditions, and life history of 13 important forest trees in the Pacific Northwest. The series numbers and species covered are as follows:

Silvical Series Number	Species
1	red alder (Alnus rubra)
2	California-laurel (Umbellularia californica)
3	western hemlock (Tsuga heterophylla)
4	Pacific silver fir (Abies amabilis)
5	noble fir (Abies procera)
6	Pacific madrone (Arbutus menziesii)
7	Port-Orford-cedar (Chamaecyparis lawsoniana)
8	Sitka spruce (Picea sitchensis)
9	Douglas-fir (Pseudotsuga menziesii var. menziesii)
10	Oregon white oak (Quercus garryana)
11	mountain hemlock (Tsuga mertensiana)
12	western juniper (Juniperus occidentalis)
13	bigleaf maple (Acer macrophyllum)

This information was compiled as part of a nationwide project by the Forest Service, U. S. Department of Agriculture. The final product will be a manual on the silvical characteristics of important forest trees of the United States, now in preparation. Meanwhile, regional forest experiment stations are issuing releases on the silvical characteristics of individual species to make this information readily available. Silvical reports for some species important in other parts of the West, as well as in the Pacific Northwest, are being issued by other western forest experiment stations.


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