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SILVICAL CHARACTERISTICS
of PACIFIC MADRONE
by ROBERT F. TARRANT



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PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION

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x SILVICAL CHARACTERISTICS OF PACIFIC MADRONE y

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Pacific madrone (Arbutus menziesii) is one of the most widely occurring tree species native to the Pacific Coast. Known commonly as madrone, madrona, or madrono, this member of the Ericaceae (heath family) grows as a narrowly oblong to broadly round-topped, broadleaf evergreen with a mature height of about 80 feet on good growing sites (figs. 1 and 2).

Northern limits of the tree's range are at about latitude 50° N., in the vicinity of Seymour Narrows on the eastern coast of Vancouver Island, British Columbia (fig. 3). From this point south, Pacific madrone is of fairly common occurrence west of the Cascade Range in Washington and Oregon. It extends south into coastal mountain ranges of southern California (4, 10).^{1/}

Although madrone is not considered a major tree species from an economic viewpoint, it does have limited use as a source of high-grade charcoal and as a finish wood. It is potentially most desirable for use wherever a fine-grained, attractive, and easily machined wood is required, either for furniture or specialty uses. Madrone wood has a specific gravity of 0.65 and weighs about 45 pounds per cubic foot at a moisture content of 12 percent (9).

^{1/} Underscored numbers in parentheses refer to Literature Cited.



Figure 1. --Broad, round-topped development is typical of Pacific madrone growing on a good site in the absence of overstory competition.

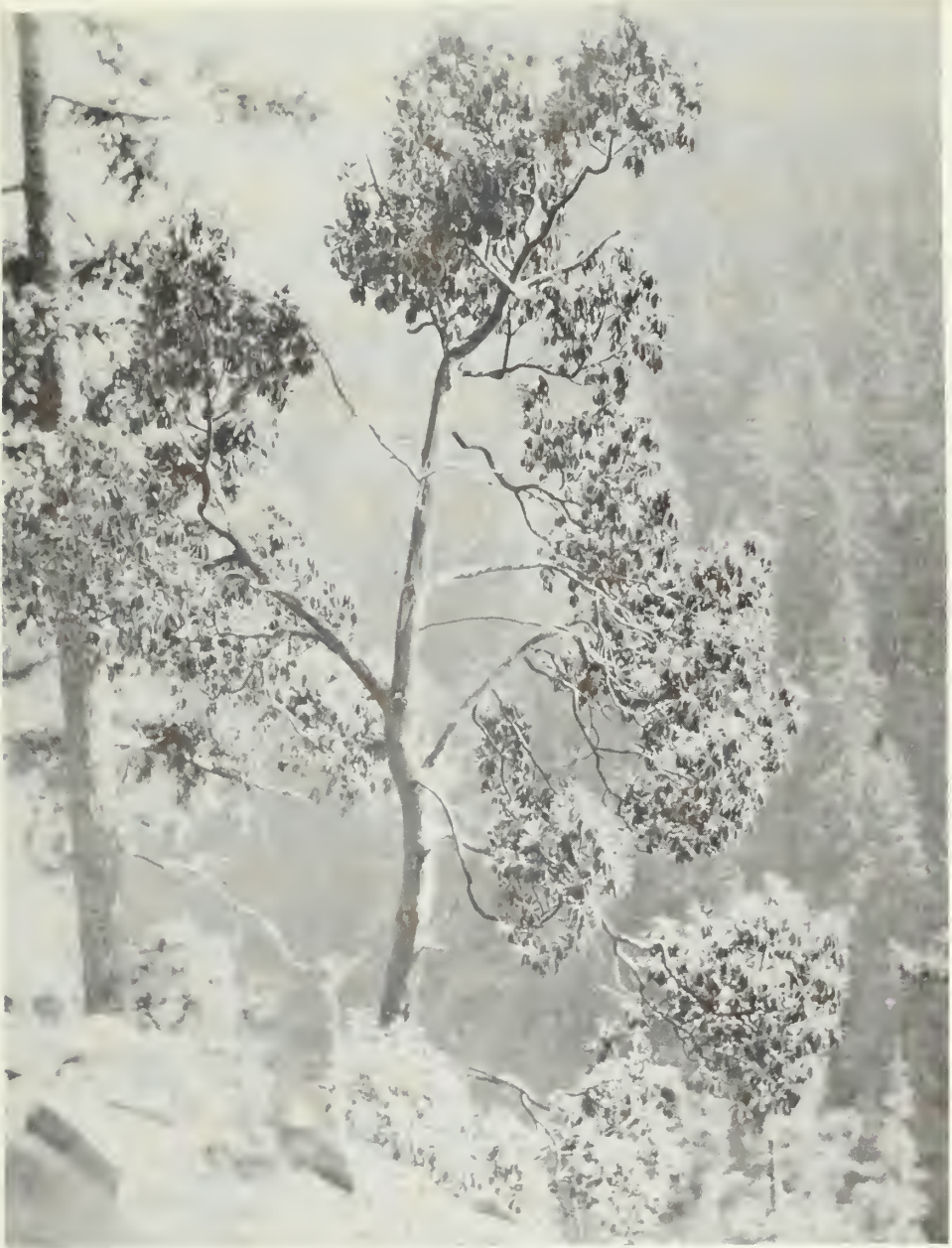


Figure 2. --Diffuse branching and crooked stem are typical of Pacific madrone growing on a thin, rocky soil in competition with conifers.



Figure 3. --Range of Pacific madrone.

HABITAT CONDITIONS

Climatic

The climatic environment under which Pacific madrone can grow is exceedingly variable. Within the range of this tree, annual rainfall may be as great as 166 inches or as little as 18 inches. Growing season precipitation (April-September) varies from as high as 40 inches to less than 1 inch. Extremes in temperature are also wide, varying from a low of -6° F. to a high of 115° F.

Climate of the area in which the tree may grow ranges through superhumid, humid, and moist subhumid, according to Thornthwaite's classification (15). This same area is classed as humid transition by Benson (3).

Edaphic

In its northern occurrence, Pacific madrone is found most often on glacial till or thin rocky soils. It is found also on single-grained sandy soils adjacent to coastal dunes along the Washington and Oregon seacoast. Again, it may be found thriving on fine-textured soils ranging from loam to clay loam in texture. In its southern occurrence, it may be found on granitic or quartz diorite materials, on sandstones and shales, or on soils derived from igneous rock. No definite soil association is evident, although presence of Pacific madrone most often suggests a site in which soil moisture is low during most of the summer.

Under Pacific madrone cover, soil reaction values range from about pH 4.5 through 7.0. Soil series associated with this species include Everett, Spanaway, Hoodspout, Olympic, Astoria, Melbourne, Siskiyou, and Holland, to name only a few.

Physiographic

Pacific madrone is found on many different types of terrain. Sudworth (14) describes occurrence of this species as follows: "Foot-hill and low mountain slopes of every aspect, borders of streams, cool canyons and valleys; . . . best growth near sea under influence of fogs." There appears to be no definite physiographic preference for this tree because of its ability to thrive under a wide range of temperature and moisture conditions.

Altitudinal limits range from sea level to 6,000 feet, at latitude 43° N.

Biotic

Pacific madrone occurs as an understory species in many instances. Where it grows in mixture with tree species associated with subhumid climate, it may at times assume a position of codominance. It grows as a component of the following forest types (12):

- Pacific Douglas-fir
- Douglas-fir--western hemlock
- Port-Orford-cedar--Douglas-fir
- Redwood
- Oregon white oak
- Oak--madrone
- Ponderosa pine--sugar pine--fir
- Pacific ponderosa pine--Douglas-fir
- Canyon live oak
- Digger pine--oak

LIFE HISTORY

Seeding Habits and Vegetative Reproduction

Systematic phenological observations are lacking for Pacific madrone, but some general characteristics can be summarized:

	<u>Southern range</u>	<u>Northern range</u>
Leaf bud swelling begins	February	Late March
Flower bud swelling begins	March	May
Flowering begins	March	May
Full bloom	April	June
Second-year leaves fall	June	June-July
Bark exfoliates	June-July	July-Sept.
Fruits mature	Sept. -Oct.	October

Small white flowers, resembling lilies-of-the-valley, appear in showy clusters from March to May. In late summer, a brilliant orange-red fruit is borne as a many-seeded berry with granular structure. Each berry contains from 25 to 30 seeds (5).

Little information is available on seed production. The seed is heavy, averaging about 2,000 per pound (16). Dissemination by

wind, therefore, is not great, and the influence of birds and animals in seed distribution is believed to be a major factor. Good seed crops appear to be produced regularly.

The species sprouts freely from stumps and is commonly found in clumps as a result of this habit (8). Ease of propagation by cuttings is fair, but the practice is confined to commercial nurseries.

Seedling Development

Pacific madrone prefers a moist but well-drained soil in which to establish itself from seed. Seedlings are not abundant, however, and sprouts form the major type of reproduction (5).

Moisture requirements for survival of Pacific madrone are low, but it makes best growth in warm, fairly moist locations such as the fog belt of northern California. The time and period of seed germination varies from February to April, according to the climate. Temperature requirements are not rigid.

Moist soil, covered seed, and absence of heavy grazing favor germination, early survival, and growth (14).

Sapling Stage to Maturity

Tree height at maturity on good sites is about 80 feet; on medium sites, 30-60 feet; and on poor sites, only 15-25 feet. The largest specimen reported (1955) had a circumference of 27 feet, 8 inches, at a height of 4.5 feet from the ground (1). Volume per acre is low since Pacific madrone does not grow in pure stands.

Pacific madrone is considered intermediate in tolerance (2). Its response to release is good, and it grows well as an understory member of lightly stocked timber stands. It is resistant to high temperatures, and also to wet, freezing conditions since the glossy leaves prevent water from remaining on them, thus protecting the tree from ice damage (7). Once established, the species is very drought resistant.

Fire damage is common, but burned trees often regenerate from root sprouts. Insect damage is not a major influence, although several species of caterpillars and wood borers commonly feed upon Pacific madrone (6). Various leaf diseases have been identified. Root and crown rots, especially those caused by *Phytophthora* canker (11, 13), also have been found.

SPECIAL FEATURES

Special anatomic features include thin, reddish-brown bark with loose scales on lower trunk. Bark on upper stems, limbs, and twigs is very thin, smooth and red, and peels off in thin, irregular flakes. The leaves are thick and leathery, smooth and shiny on the upper side, whitish below, and 2-1/2 to 5 inches long (fig. 4) (14).



Figure 4. -- Thin, smooth bark and thick, leathery leaves are typical of Pacific madrone.

No races of Pacific madrone are recognized, although existence of races is possible due to the wide geographical and climatic range of the species.

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