Umbellularia californica (Hook. & Am.) Nutt.
California-Laurel

Lauraceae **Laurel family**

William I. Stein

California-laurel *(Umbellularia californica)* is the most valued and best publicized hardwood species in the Western United States. It is a monotypic, broad-leaved evergreen with many common names, including bay, laurel, California-bay, Oregon-myrtle, myrtlewood, Pacific-myrtle, spice-tree, and pepperwood *(50)*. The names are derived from leaf, fruit, or wood characteristics and also from some similarities often mistaken for relationships with the myrtle and laurel trees of the Mediterranean area *(12,25)*. Decorative items made from the hard, beautifully grained wood are widely marketed as myrtlewood.

Habitat

Native Range

The range of California-laurel (fig. 1) spans more than 11° of latitude, from below the 44th parallel in the Umpqua River Valley of Douglas County, OR, south beyond the 33d parallel in San Diego County, CA. In the Coast Ranges, the southern limit is on eastern slopes of the Laguna Mountains, a short distance from the Mexican border *(19)*. In the Sierra Nevada, it extends as far south as the west slope of Breckenridge Mountain in Kern County (58). Eastward from the coast, California-laurel extends to the foothills of the Cascade Range in Oregon and California, into the western Sierra Nevada for its entire length, and to the inland side of the Coast Ranges south of San Luis Obispo, CA. Its farthest extent inland, about 257 km (160 mi), is in the southern Sierra Nevada.

Climate

California-laurel grows in diverse climates, ranging from the cool, humid conditions found in dense coastal forests to the hot, dry atmospheres found inland in open woodlands and chaparral. Records from 38 climatic observation stations within or bordering its range indicate that California-laurel has endured temperature extremes of -25° to 48° C (-13° to 118° F) *(41,46,59)*. Average annual temperatures

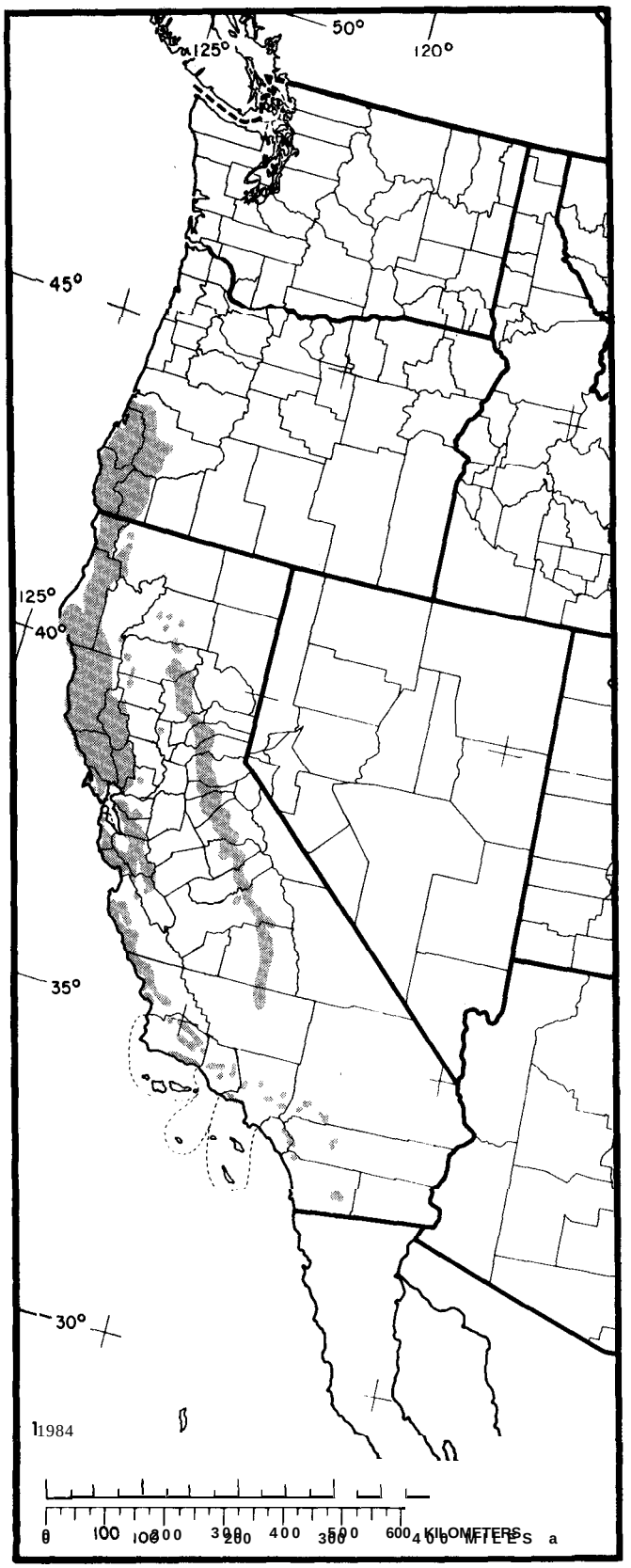

Figure *1-The native range of California-laurel.*

The author is Plant Ecologist, Pacific Northwest Research Station, Portland, OR.

range from 8° to 18" C (46" to 64" F); average temperatures in January, from -1" to 10" C (31" to 50" F); and in July, from 13" to 29" C (56° to 84" F).

Average annual precipitation ranges from 338 mm (13.3 in) at Lemon Cove in the southern Sierra Nevada to 2118 mm (83.4 in) at Gold Beach by the mouth of the Rogue River in Oregon. Average annual snowfall ranges from zero at some coastal locations to 742 cm (292 in) at Blue Canyon in Placer County, CA. Average precipitation in the growing season (April through September) ranges from 18 to 432 mm (0.7 to 17.0 in). Length of average frost-free season (above 0" C or 32" F) ranges from 139 to 338 days. Clearly, California-laurel demonstrates broad ecologic versatility.

Soils and Topography

California-laurel grows to tree size in a wide variety of topographic locations and kinds of soil if moisture conditions are favorable. It grows on steep mountain slopes, exposed ridges, coastal bluffs, and rocky outcrops, as well as in protected valleys, alluvial flats, deep canyons and ravines, and low hills. In Oregon and most of California, it grows from sea level to 1220 m (4,000 ft). Near the southern end of the species' range, the lower altitudinal limit rises to 610 m (2,000 ft) on south slopes of the San Bernardino Mountains, and the upper limit approaches 1520 m (5,000 ft) on the west slopes of the San Jacinto Mountains. In the Sierra Nevada, the upper limit reaches 1520 m (5,000 ft) in Kaweah Basin west of Sequoia National Park *(24)*.

Even in dry, hot climates it can become a large tree on moist sites; specimens of unusual height, diameter, crown spread, and age can be found in many California counties (43). Distribution is more restricted in such climates, however, and the species is most common on alluvial deposits or gravelly outwashes at the mouths of canyons, on protected slopes, along and near watercourses, near springs and seeps, and in spring-watered gulches. Under very adverse conditions, California-laurel grows as an understory shrub, as a common component of chaparral, or even as a prostrate mat near the ocean *(24,47)*.

In tree or shrub form, California-laurel grows in soils derived from alluvial deposits, from sedimentary rocks, from volcanic flows of the Cascades and Sierra Nevada, and from old formations in the Klamath and Siskiyou Mountains. It grows on soils of three or more orders; principal among these are Inceptisols, Mollisols, and Ultisols. Specific soils supporting growth of California-laurel include the Ben Lomond, Felton, Gazos-Sweeney, Gazos-Calera, Hugo, Hugo-Josephine, Los Gatos, Los Gatos-Maymen, Maymen, Montara, and Soquel series in the Santa Cruz Mountains *(61)*; the Los Osos adobe clay in the Berkeley Hills (35); alluvium and the Galice, Umpqua, and Tyee sedimentary formations in coastal California and Oregon *(22,62)*; and gabbro, peridotite, and serpentine in the Siskiyou Mountains *(22,63)*. Best development and most rapid growth occur on deep, well-drained alluvial benches and valley bottoms subject to occasional inundation. Growth is also good on well-watered soils of coastal slopes and along higher foothill streams.

The pH of several surface soils supporting pure or mixed stands of California-laurel was found to range from 5.7 to 7.4 *(34,61,62,63)*. Soil properties under California-laurel crowns in central California generally did not differ significantly from those under crowns of the nearest associate species *(61)*.

Associated Forest Cover

California-laurel is more commonly found in mixture with other species than in pure stands. Choice pure stands were eliminated when coastal and inland valleys were cleared for agriculture, and only scattered groves and tracts of large mature trees remain-many in parks or preserves (40). Pure stands of tall young growth are also limited (fig. 2), but pure stands of shorter trees, thickets, or prostrate mats are common on coastal bluffs, in canyons, and elsewhere in California *(19,24,35,61)*.

California-laurel is listed as an associated species in six forest cover types: Port Orford-Cedar (Society of American Foresters Type 231), Redwood (Type 232), Oregon White Oak (Type 233), Douglas-fir–Tanoak-Pacific Madrone (Type 234), Canyon Live Oak (Type 249), and California Coast Live Oak (Type 255) *(13)*. Its prominence in these types, as well as in several others for which it is not specifically listed, varies widely.

Many trees, shrubs, and herbaceous plants are associated with California-laurel in different parts of its extensive range (table 1). The listing in table 1 is not exhaustive; it indicates the variety of associated species. Usually, fewer species and fewer individuals per species are found under the California-laurel canopy than under the canopy of associated trees, and the area bare of all vegetation is greater. In the Coast Ranges south of San Francisco Bay, an average of 36 species per site, mostly perennials, was found under the California-laurel canopy, 55 species beneath the canopy of other trees *(61)*. Distances bare of vegetation along transects ranged from 9 to 48 percent of the total under California-laurel, 0 to 10 percent under other trees. Where the laurel

Figure *2-A pure stand of California-laurel about 90 years old near Roseburg, OR. Tree crowns form a dense exterior border.*

canopy is particularly dense and extensive, understory vegetation may almost be limited to mosses, ferns, and laurel seedlings *(7,51)*.

Life History

Reproduction and Early Growth

Flowering and Fruiting-California-laurel flowers regularly and often profusely. The pale yellow, perfect flowers, 15 mm (0.6 in) in diameter, grow on short-stemmed umbels that originate from leaf axils or near the terminal bud. Flower buds develop early; those for the following year become prominent as current-year fruits are maturing. Flowering within the long north-south range of California-laurel has occurred in all months from November to May, beginning before new leaves appear *(24,25,29,61)*. The flowering period may stretch into late spring and summer by the occasional appearance of flowers originating in axils of developing leaves (48). California-laurel flowers at an early age; flowers have been observed on short whiplike shrubs and on l-year-old sucker growth that originated on a long broken stub *(50)*. Small insects appear to be the chief pollinators (25).

The fruits-acrid drupes each containing a single, thin-shelled, nutlike seed 15 mm (0.6 in) in diameter-ripen in the first autumn after flowering (52). As drupes mature, their thin, fleshy hull changes from medium green to speckled yellow-green, pale yellow, or various other hues from yellow-green tinged with dull red or purple through purplish brown to purple. Ripe drupes may be yellow-green on one tree, dark purple on an adjacent tree *(11)*.

Seed Production and Dissemination-Seed crops are abundant in most years. Although umbels bear four to nine flowers each, generally only one to three fruits set (24). The age when a tree first bears fruit, the age for maximum production, and the average quantity produced have not been determined. Seeds are produced in abundance after trees are 30 to 40 years old (20).

Drupes fall stemless to the ground in late autumn or winter and are dispersed by gravity, wind, animals, and water (34). Fallen drupes are easily gathered by hand. The drupes are large and heavy; 454 g (1 lb) of drupes may yield about 300 cleaned seeds (39).

Under favorable natural conditions, seeds on the ground retain viability over winter, but, under adverse conditions, viability may prove very transient. Viability has been maintained for 6 months when seeds were stored at 3" C (37" F) in wet, fungicide-treated vermiculite *(34)*.

Fresh, untreated seeds germinate indoors or outdoors in peat moss, sawdust, vermiculite, or light-textured soil but may require 3 months or longer *(25,39,60)*. Germination can be speeded by scarifying, cracking, or removing the endocarp, or stratifying the seed, but up to 2 months may still be required *(25,34,60)*. In comparison tests made in petri dishes, California-laurel germination was highest in 30 days under a temperature regime of 16" C (61" F) day, 7" C (45" F) night, and when evaporative stress was minimal (34). Germination did not appear to be affected by light level but was highest in soil with moisture tension at 4 to 10 atmospheres.

Seedling Development-Germination occurs naturally in autumn soon after seedfall, or in late winter and spring (52). Covered seeds germinate best, but the large seeds are not buried readily without ground disturbance or silt deposition by high water. Seedling establishment is not common in the drier parts of California except in protected areas and where ground is disturbed (24). California-laurel seedlings invade grasslands and brushlands in the Berkeley Hills; similar capabilities were observed in the Santa Cruz Mountains *(34,61)*.

Germination is hypogeal, and the fleshy cotyledons remain within the endocarp and attached to the seedling until midsummer, when the plant may be 15 to 20 cm (6 to 8 in) tall *(25,48)*. Generally there

Table l-Trees, shrubs, and herbs associated with California-laurel in different parts of its range[1]

Trees	Shrubs	Herbs
Abies grandis	*Adenostoma fasiculatum*	*Actaea rubra*
Acer circinatum	*Amelanchier* spp.	*Adiantum pedatum*
Acer macrophyllum	*Arctostaphylos canescens*	*Antennaria suffrutescens*
Acer negundo	*Arctostaphylos columbiana*	*Arnica spathulata*
Aesculus californica	*Arctostaphylos hispidula*	*Aster radulinus*
Alnus rhombifolia	*Arctostaphylos mariposa*	*Balsamorhiza deltoides*
Alnus rubra	*Arctostaphylos nevadensis*	*Blechnum spicant*
Arbutus menziesii	*Arctostaphylos patula*	*Boykinia* spp.
Castanopsis chrysophylla	*Arctostaphylos tomentosa*	*Cheilanthes siliquosa*
Ceanothus thyrsiflorus	*Arctostaphylos viscida*	*Chimaphila umbellata*
Cercis occidentalis	*Artemisia californica*	*Chlorogalum pomeridianum*
Chamaecyparis lawsoniana	*Baccharis pilularis*	*Convolvulus polymorphus*
Cornus nuttallii	*Berberis* spp.	*Diplacus aurantiacus*
Corylus cornuta	*Ceanothus* spp.	*Disporum* spp.
Eucalyptus globulus	*Cornus californica*	*Dryopteris arguta*
Fraxinus dipetala	*Eriodictyon californicum*	*Eriophyllum lanatum*
Fraxinus latifolia	*Garrya buxifolia*	*Erythronium oregonum*
Garrya elliptica	*Garrya fremontii*	*Fragaria californica*
Heteromeles arbutifolia	*Gaultheria shallon*	*Galium* spp.
Libocedrus decurrens	*Holodiscus discolor*	*Hieracium cynoglossoides*
Lithocarpus densiflorus	*Juniperus communis*	*Hierochloe occidentalis*
Myrica californica	*Juniperus sibirica*	*Horkelia sericata*
Picea sitchensis	*Lonicera hispidula*	*Iris* spp.
Pinus attenuata	Lotus scoparius	Juncus spp.
Pinus contorta	*Lupinus albifrons*	*Linnaea borealis*
Pinus coulteri	*Myrica hartwegii*	*Lomatium* spp.
Pinus jeffreyi	*Pickeringia montana*	*Lupinus nanus*
Pinus lambertiana	*Quercus dumosa*	*Marah fabaceus*
Pinus monticola	*Quercus durata*	*Mimulus guttatus*
Pinus ponderosa	*Quercus sadleriana*	*Osmorhiza chilensis*
Pinus sabiniana	*Quercus vaccinifolia*	*Oxalis oregana*
Platanus racemosa	*Rhamnus californica*	*Pellaea mucronata*
Populus trichocarpa	*Rhamnus crocea*	*Pityrogramma triangularis*
Prunus ilicifolia	*Rhododendron californicum*	*Polypodium vulgare*
Pseudotsuga menziesii	*Rhododendron macrophyllum*	*Polystichum munitum*
Quercus agrifolia	*Rhododendron occidentale*	*Pteridium aquilinum*
Quercus chrysolepis	*Rhus diversiloba*	*Pyrola dentata*
Quercus douglasii	*Ribes* spp.	*Sanicula crassicaulis*
Quercus garryana	*Rosa gymnocarpa*	*Satureja douglasii*
Quercus kelloggii	*Rubus laciniatus*	*Scrophularia californica*
Quercus lobata	*Rubus parviflorus*	*Selaginella bigelovii*
Quercus wislizeni	*Rubus procerus*	*Senecio bolanderi*
Robinia pseudoacacia	*Rubus spectabilis*	*Smilacina stellata*
Salix spp.	*Rubus ursinus*	*Stachys rigida*
Sambucus spp.	*Rubus vitifolius*	*Synthyris reniformis*
Sequoia sempervirens	Symphoricarpos *albus*	*Trientalis latifolia*
Taxus brevifolia	*Symphoricarpos mollis*	*Trillium ovatum*
Thuja plicata	*Symphoricarpos rivularis*	*Vicia* spp.
Torreya californica	*Vaccinium* spp.	*Viola* spp.
Tsuga heterophylla	*Whipplea modesta*	*Xerophyllum tenax*

[1]Sources: *2,7,10,14,15,22,32,35,38,47,51,55,61,63*

are two large cotyledons, sometimes three, and no endosperm. Seedlings produce leaves of several transitional forms as they develop and do not branch until they are 2 or 3 years old unless induced to do so by removal of the terminal bud. They soon develop a moderately stout taproot and are difficult to transplant if more than 1 year old unless grown in containers. Recovery after transplanting is often slow, and height growth may be limited for several seasons.

Young California-laurel seedlings appear flexible in their growth requirements. In the first 120 days, seedlings potted in vermiculite grew well at several levels of temperature, evaporative stress, soil moisture, and soil nutrients (34). Seedlings grown at 18 percent or more of full sunlight produced the most dry weight.

Vegetative Reproduction-California-laurel can be reproduced by cuttings *(60)*, but techniques need further development. Under natural conditions, it may sprout prolifically from the root collar, stump, and trunk. Sprouts and suckers develop wherever a canopy opening admits strong light from the side or overhead. Stumps ringed with root-collar sprouts and both fallen and standing live trunks entirely enveloped in new green sucker growth are common (24). Crowns formed by clumps of sprouts growing in the open typically assume a distinctive, very dense, and symmetrically rounded shape *(12,50)*.

Sapling and Pole Stages to Maturity

Growth and Yield-Over much of its range, California-laurel attains heights of 12 to 24 m (40 to 80 ft) and diameters of 46 to 76 cm (18 to 30 in). On protected bottom lands of southwestern Oregon and northern California, mature trees are 91 to 183 cm (36 to 72 in) in d.b.h. and 30 m (100 ft) or more in height *(20,24)*. A maximum d.b.h. of 404 cm (159 in) *(1)* and a maximum height of 53.3 m (175 ft) have been reported (49).

California-laurel occurs as a noncontiguous forest type on about 76 080 ha (188,000 acres), 9 712 ha (24,000 acres) in Oregon and 66 368 ha (164,000 acres) in California *(4,17)*. As a component of conifer or other hardwood types, it occurs on an additional 437 060 ha (1,080,000 acres) in California and an undetermined additional acreage in Oregon. Total growing stock volume is approximately 14.7 million m^3 (520 million ft^3). In California, the mean stand growing-stock volume in the type is 117 m^3 per ha (1,677 ft^3/acre), with a maximum of about 218 m^3 per ha (3,125 ft^3/acre).

The growth rate of California-laurel varies greatly because of the many climatic, soil, and competitive conditions in which it occurs. Several observers report its height growth is slow, about 0.3 m (1 ft) per year, but on good sites in southern Oregon, height growth averages between 0.3 and 0.6 m (1 to 2 ft) per year *(3,12,51)*. Growth of trees from seed to 38 or 41 cm (15 or 16 in) diameter in 50 years has been reported (57). Total number of stems 10 cm (4 in) in d.b.h. or larger in California and Oregon stands with a large component of California-laurel ranged from 245 to 2,402/ha (99 to 972/acre) (fig. 3); reported basal areas ranged from 34.0 to 167.4 m^2/ha (148 to 729 ft^2/acre) *(51,61,62)*.

Multiple trunks frequently develop in both open-grown and closed stands of California-laurel. Trees in the open often attain a crown spread greater than their height and may not develop a well-defined upper trunk. Many forest-grown trees also fork repeatedly; forking within 3 m (10 ft) of the ground is common (fig. 3). Generally each fork grows vertically and side branches die. Adjacent forked and unforked trees make similar height growth.

Rooting Habit-The root system of California-laurel has been described as fleshy, deep, and widespreading (49). Several exceptions have been noted, however. Root wads of windthrown trees from alluvial soil in southern Oregon were limited in extent and without a prominent taproot *(50)*. Root systems of seedlings and young trees dug near Berkeley, CA, had relatively shallow root systems, as did some fallen older trees (28). Over half the roots in representative California-laurel stands in the Berkeley Hills were distributed in the top 30 cm (12 in) of Los Osos adobe clay and all were in the top 90 cm (36 in) (34). In contrast to the paucity of information on the shape and extent of the root system of California-laurel, its root structure has been thoroughly investigated *(26,27)*.

Reaction to Competition-California-laurel is generally classed as shade tolerant, but the tolerance level is not well defined. A very dense canopy is formed by its thick evergreen leaves, which persist 2 to 6 years. The presence of many small seedlings but no saplings under some closed canopies and the development of long boles clear of live limbs indicate that laurel is not always tolerant of its own shade (fig. 4). These indicators are no criteria of tolerance relative to other species, however, and laurel trees are common among moderately dense conifers.

In some localities, California-laurel appears to be the climax vegetation *(7,24,34,61)*. It is relatively long lived, reproduces from both seeds and sprouts,

Figure 3-One uigorous, *90-year-old* stand of *pure* California-*laurel averaged 712 stems per hectare (288/acre) 18 cm (7 in) in d. b. h. or larger.*

forms dense pure canopies, and appears to have few serious natural enemies. California-laurel reproduces itself at natural light intensities of 1 to 5 percent of full sunlight; the most dry weight in one experiment was produced at 18 percent of full sunlight, but growth was also reasonable at 8 percent *(34,61)*.

Allelopathic influences have been suspected as the cause of more bare ground under canopy of California-laurel than under canopy of associated trees. Bioassay experiments showed that the leaf and litter volatiles, leachates, and extracts of laurel are capable of inhibiting germination and growth of several test species *(56,61)*.

The distribution of California-laurel in the Coast Ranges south of San Francisco appears to represent a vegetational continuum *(61)*. About the same mixture of understory plants was found under California-laurel canopies as under associated trees, but California-laurel and some of its associates seemed to have a greater tendency to spread to other communities than species from those communities to invade California-laurel woodland.

Damaging Agents-Wind and snow cause appreciable destruction and deformation in California-laurel stands. Blowdown is common during severe wind and rain storms in California and Oregon *(24,51)*. Wet clinging snow abets windthrow, breaks tops, and splits forks. Striking examples of crown deformation and molding by strong winds are numerous near the coast.

Because of its thin bark, the tree is easily top-killed by fire, but it sprouts rapidly. Dense clumps

Figure *4-Branches of California-laurel are shaded out in dense stands, but new shoots readily develop when the trunk is again exposed to sufficient light.*

are often formed on cutover land, which may prevent the establishment of desired conifers. Very young California-laurel seedlings have less capacity than dwarf chaparral broom **(*Baccharis pilularis*)** or coast live oak **(*Quercus agrifolia*)** to resprout after complete destruction by heat at ground level *(34)*.

California-laurel is relatively tolerant to boron. In comparison tests, it was less tolerant to boron than Digger pine **(*Pinus sabiniana*)** but more tolerant than Pacific madrone **(*Arbutus menziesii*)** or bigleaf maple **(*Acer macrophyllum*)** *(18)*.

More than 40 species of fungi have been observed on California-laurel, and perhaps three **(*Anthostoma oreodaphnes*, *Nectria umbellulariae*,** and **(*Sphaerella umbellulariae*)** are restricted to this species (48). Few fungi cause serious damage to the living tree. In central coastal California, a severe outbreak of laurel leaf blight followed abnormally heavy precipitation in two of three winters. A bacterium, ***Pseudomonas lauracearum*,** and two fungi, ***Kabatiella phoradendri*** f. sp. ***umbellulariae*** and ***Colletotrichum gloeosporioides*,** were isolated from affected leaves (42). No trees were killed and crowns leafed out anew the following year. Dieback of twigs and new shoots was substantial, however, and was followed by scattered dieback of branches up to 2.5 cm (1 in) in diameter associated with a ***Botryosphaeria*** sp., a fungus that has been blamed for much damage to this species (23). Incidence of infection by endophytic fungi, primarily ***Septogloeum*** sp., averaged 25 percent for leaf samples of California-laurel collected from four sites representing an environmental gradient in southwestern Oregon (44). Several sooty molds and other diseases are found on laurel leaves; the stem canker, ***Nectria galligena*,** occurs primarily where snow, ice, or wind cause severe bending and cracks in the bark of stems and branches; and ***Ganoderma applanatum*** fruits readily on scarred trees.

Wood rot is common in California-laurel. Various fungi cause decay associated with wounds, and G. ***applanatum*** may function as a heart rot in live wood (23). Even in young stands, dead knots, stem malformations, and root collars are often decayed. Cull in one northern California study averaged 7 and 10 percent of the gross cubic volume in trees of saw log or cordwood size and quality, respectively ***(31)*.**

California-laurel has no serious insect enemies. A leafblotch miner **(*Lithocolletis umbellulariae*),** a stag beetle **(*Dichelonyx valida*)**, and a thrips **(*Thrips madronii*)** cause some damage to leaves. The cottonycushion scale *(Icerya purchasi)* used to be very damaging but is now under control (48). Several wood borers and beetles attack dead parts of the tree; but only the powderpost beetle **(*Ptilinus basalis*)** that attacks dead and stored wood and oak bark beetles **(*Pseudopityophthorus*** spp.) that infest injured, felled, and recently dead trees cause damage of economic consequence (16).

Except for seed consumption, animal damage to California-laurel appears minor, In some localities and situations, browsing damage to seedlings and new sprout growth may be of consequence. Young laurel seedlings are browsed less than some associated species (34).

Special Uses

Wood of California-laurel compares favorably in machining quality with the best eastern hardwoods (8) and is used for fancy turned woodenware, interior trim, cabinets, furniture, paneling, veneer, and gunstocks. Burls and other growths with unusual grain are especially prized for making gifts, novelties, and wood carvings, all marketed as myrtlewood. The wood of mature trees is moderately heavy, hard, fine grained, rich yellowish brown to light gray, and often beautifully mottled. The wood of younger trees generally has less distinctive grain and markings. By rough estimate, 19 950 to 22 800 m^3 (3.5 to 4 million fbm) are used annually in the myrtlewood industry.

Indians and early settlers used all parts of the tree for food and medicinal purposes *(6,21)*. Leaves are still collected and dried for home use and commercial sale as a food seasoning *(5,37,61)*. **The** leaves, seeds, and wood have strong chemical properties and should be used for food, seasoning, or medicinal purposes with caution *(5,9,36,48,61)*.

California-laurel is used for hedges, windbreaks, and indoor and outdoor ornamental evergreens *(3,29,41,43)*. It also provides food and cover for wildlife (53). Silver gray squirrels, dusky-footed woodrats, California mice, and Steller's jays feed extensively on the seeds *(54,55)*. Hogs eat both seeds and roots. Young sprouts are choice browse for deer and goats in spring and summer *(33,47)* when volatile components of leaves are at lowest concentrations (30).

Genetics

Several racial variations are recognized. ***Umbellularia californica formapendula*** Rehd. is an uncommon, broad-spreading tree distinctive for its pendulous branchlets that contrast strongly with typically ascending branch growth *(24,45)*. ***Umbellularia californica*** var. ***fresnensis*** Eastwood has fine white down on the lower surfaces of leaves and on branches of the panicle *(11)*. Gregarious, rockpile,

dwarf, and prostrate forms (24) may indicate other varietal differences.

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