CALIFORNIA FORESTRY PAMPHLETS

VOL. III

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STATE BOARD OF FORESTRY

G. B. LULL, State Forester

FOREST FIRE REPORT

1909

SACRAMENTO, CAL.
JANUARY 1, 1910

W. W. SHANNON, Superintendent of State Printing

Agr.

Division of Forestry
University of California

FOREST FIRE REPORT—1909

FOREST FIRES CAUSE HEAVY LOSS.

Reports received by the State Forester from the firewardens show that during the past year 638 forest, brush and grass fires occurred within the State. The total area burned was 357,269 acres, divided approximately as follows: Forest, 76,730 acres; brush, 191,510 acres; grass, 88,029 acres. The merchantable timber destroyed amounted to over 40,000,000 feet, worth fully $100,000. Other direct damage was done to grain, grass, fencing and buildings to the amount of half a million dollars. Added to this is the loss from destruction of young growth too small to be merchantable at present, and also the loss from injury to watersheds by the removal of water-conserving brush and timber which together bring the total to a million dollars at least. One fire fighter was caught by the flames and lost his life. Fires to the number of 101 reached a size of 1,000 acres or over before being controlled, and a half dozen covered 20,000 acres or more. These last were principally grass and brush fires, which often spread so rapidly as to cover large areas before they can be suppressed in spite of prompt action on the part of the firewardens. Two hundred and thirty-six fires were extinguished before they covered ten acres. Considering the remote and inaccessible situations in which fires ordinarily occur it is a matter of congratulation that more than one third of the whole number should have been extinguished so promptly.

August Worst Month.

The first fire was reported in February, and from then on the number increased steadily to August, decreasing rapidly during the last three months. The

number of fires reported for each month is as follows: January, 0; February, 1; March, 1; April, 6; May, 31; June, 66; July, 145; August, 174; September, 168; October, 37; November, 8; December, 1.

Wardens Do Good Work.

The great difference between the number of fires which occurred during September and the number which occurred during October is rather remarkable. During previous years October has been a particularly dangerous month for the reason that the light rains which fall ordinarily during late September tempt the people to burn brush and rubbish with little care. During 1909 the rains which fell during the last half of September were rather heavier than usual and this partly explains the circumstance. But a still more important factor is that the people burn brush with more care than they used to. The numerous firewardens distributed over the State have had a most salutary influence. They are for the most part men of experience and discretion, and by knowing what precautions are necessary to insure safety in brush burning, and by insisting that these precautions be taken, they have accomplished the very gratifying reduction in the number of October fires. Only three fires set under permit from firewardens escaped from control.

Causes of Fires.

In this connection it is interesting to note the causes of forest fires. Two hundred and forty-five were of unknown origin. The rest are grouped as follows: Campers, 114; lightning, 74; engines, 53; clearing land, 45; incendiary, 39; hunters, 21; blasting, 9; smoking bees, 7; electric wires, 2. This classification is somewhat arbitrary and requires explanation. Campers include hunters, fishermen, prospectors, travelers in the mountains, and in general, all who start forest fires carelessly. Most of them would call themselves nature lovers, but their love of nature is not strong enough to prompt them to be sure their camp-fires are out, or to be careful of their matches and tobacco. Hunters in the above classification differ from campers in that they deliberately set fires to

drive out game. Of course, most hunters are not included in this category. The old-fashioned stockmen who set fires to "improve the range" are classed here. Incendiary fires are those set intentionally for any one of a number of reasons. The remaining classes require no explanation.

Numerous Convictions.

A large proportion of the fires were of unknown origin. Probably in most cases the firewardens had a shrewd suspicion of the cause but could obtain no legal evidence. Even where it is possible to determine with absolute certainty the cause of a fire there is often too little evidence to warrant legal action. The reasons for this are several. In the first place, fires usually occur in remote districts where inhabitants are few and scattered, and it is easy for any one to set a fire either carelessly or intentionally and avoid being caught at it. Secondly, the firewardens are, very properly, more interested in putting the fire out than in gathering evidence as to how it was caused, and the evidence may be covered up by the time the warden gets around to investigate. Thirdly, there is a strong tendency among many of the voluntary firewardens to consider that they have done all that can reasonably be asked of them when they have extinguished a fire, and, that after the crisis has passed, they should not be expected to spend more time and money in gathering evidence without compensation. This is a reasonable view, revealing one of the faults of a system of fire protection which depends largely on voluntary contributions for its success. It may be noted here that the disproportionately small number of convictions is due largely to these causes. Of 307 fires suspected of having been set in violation of the fire laws, only 18 have resulted in conviction. But considering the difficulties attending successful prosecution for forest fire cases this result is far from discouraging. Fines amounting to $385.00 were imposed on 17 offenders and one was sentenced to 90 days in jail. Other cases are pending.

State and Federal Governments Co-operate.

During the last year there were 609 firewardens under appointment from the State Forester. Two hundred and seventeen of these were paid by the U. S. Forest Service, but requested State appointments also in order to take advantage of the extra powers conferred by the State forest laws. Fifteen counties paid firewardens who received appointments from this office. Both the United States rangers and the county wardens are picked men, and it is due, in large part, to them that so many fires were stopped before they had covered an area of 10 acres. The remainder were volunteers who did excellent work in fighting fires, but who naturally accomplished little in the way of patrol. Thus many fires were allowed to gain such headway as to give serious trouble though they might have been easily extinguished if they had been attacked promptly. But it would be unreasonable to ask a volunteer to spend perhaps a whole day investigating a suspicious smoke in some inaccessible portion of the mountains without compensation. It is greatly to the credit of the volunteers, however, that they actually performed much more in the way of fire protection than could be reasonably expected of them. The firewardens issued burning permits to the number of 1,360 during the year.

Mountaineers Suffer Most.

Along with the $1,000,000 or more that forest fires cost the commonwealth last year should be included an item to cover the expense of fire fighting and patrol. This item is very difficult to reduce to dollars and cents, since it properly includes not only money paid out directly for these purposes, but also services voluntarily furnished by those threatened by fires for which no bills were presented. Commuted to cash the total sum would probably reach $100,000. Part of this was paid from some of the county treasuries; part was paid by the United States Government from the public funds and a very important share of the burden fell upon ranchers, stockmen, timbermen and others having property or interests in the forested region, who not only had to stand the direct loss occasioned

by the fires, but the expense of fighting them as well. It is right that the State should expect a man to protect his own property, to a reasonable extent, without compensation. But the mountaineer who fights a forest fire does much more than protect himself. He protects the valley below. He helps conserve timber for the future and water for irrigation and domestic use. The whole State shares the good that results from his efforts, and the system that requires him to pay so much of the bill is not fair.

Paid Patrolmen Necessary.

Nor is it economical. A small fire may be controlled by one man, whereas a fire twice the size may require four men. The California climate with its long, dry seasons makes it impossible to prevent occasional fires from occurring, but an efficient patrol system will greatly reduce the number that start and will have an even more important effect in limiting the size, and, in consequence, the injurious effects of those that can not be prevented. Of the $100,000 which, it is calculated, the suppression of forest fires cost last year a part went for patrol. A part also went for the fighting of fires which could not have been prevented. These sums are, therefore, well and profitably spent. But a large part, and this includes practically the whole amount contributed by the ranchers and mountaineers, was spent on fires that either could have been entirely prevented, or, at any rate, could have been put out with little trouble or expense under an efficient system of patrol. This last item, which amounts in all probably to one half of the total, or $50,000, may be considered as a tax upon the dwellers in the mountains, and as such it is not only unjustly levied, but uneconomically applied. The same amount obtained by direct taxation would distribute the burden more equitably, and if devoted to the organization of the work of fire prevention, would decimate the destruction by fire. During the next session of the legislature another strong effort will be made to secure an appropriation for this purpose.

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STATE BOARD OF FORESTRY.

CIRCULAR No. 2.

G. B. LULL, State Forester.

IN CO-OPERATION WITH THE FOREST SERVICE, U. S. DEPT. AGRICULTURE.

A HANDBOOK FOR

EUCALYPTUS PLANTERS

(SECOND EDITION.)

SACRAMENTO:

W. W. SHANNON - - - - - - - - - - - Superintendent State Printing.

1908.

STATE BOARD OF FORESTRY.

JAMES N. GILLETT ..... Governor.

CHAS. F. CURRY ..... Secretary of State.

U. S. WEBB ..... Attorney-General.

G. B. LULL ..... State Forester.

PROVISION FOR CO-OPERATIVE WORK.

SECTION 4. The State Forester shall, upon request and whenever he deems it essential to the best interests of the people and the State, co-operate with counties, towns, corporations and individuals in preparing plans for the protection, management and replacement of trees, woodlots and timber tracts, on consideration and under an agreement that the parties obtaining such assistance pay at least the field expenses of the men employed in preparing said plans.—Stat. 1905:235.

CONTENTS.

A HANDBOOK FOR EUCALYPTUS PLANTERS.

INTRODUCTION.

The growing interest in forest planting in California makes it desirable that prospective planters be supplied with concise information regarding the demands and qualities of the genus Eucalyptus, which, owing to its rapid growth and wide adaptation to economic uses, is destined to be planted more extensively than any other tree. Reliable information on this genus is now obtainable in Bulletin No. 35 of the Forest Service, but the information contained is more general in nature than the typical, quick-action planter is willing to digest. More recently a detailed, though as yet unpublished, report on the planting of the commercial eucalypts has been made by S. J. Flintham of the Forest Service after a study conducted in coöperation with the State of California. The essentials for planters have been culled from this report and other sources and embodied in this circular to meet the great demand for specific information on the economies of Eucalyptus planting.

HISTORY OF EUCALYPTUS IN CALIFORNIA.

The eucalypts are exotics in California, having been introduced from Australia in the early fifties by travelers who were impressed with the splendid proportions and rapid development of the genus in its native habitat. They were first planted in the vicinity of San Francisco for ornamental purposes. Later, in the sixties, they were planted near Los Angeles. The rapid growth and complete adaptability of the exotic to its new environments instantly claimed the attention of nurserymen, who recognized its suitability for commercial planting. Between 1870 and 1875 considerable planting was done for fuel, windbreaks and shade along avenues. One of these early groves was established near Irvington in the Santa Clara Valley in 1870, and later, 1872 and 1873, the first plantation in Southern California was made by Hon. Ellwood Cooper on his ranch near Santa Barbara. The well-known Widney and Nadeau groves, set out in 1874 and 1875, were the first extensive plantations made near Los Angeles.

THE TIMBER EUCALYPTS.

Eucalyptus has deservedly claimed more attention than any other exotic genus, and probably more than most of those indigenous to the United States. Great energy and persistence in experimenting with

the genus have been manifested by nurserymen and pioneer planters ever since its introduction. More than 150 species have been identified by botanists who have studied the Australian forests. Fully 100 of these, including practically all the species considered valuable for timber, have been introduced and planted in California.

For general purposes, however, the blue gum has been used more extensively than all other species combined, and even to-day the knowledge of most laymen of the eucalypts is confined to their acquaintance with this species. Several other species, however, possess special qualities which warrant their selection for particular uses and for certain localities. Among these are the sugar, manna, gray, red and lemon gums, which, with the blue gum, owing to their rapid growth and splendid development, rank as the timber eucalypts.

SYLVICAL CHARACTERISTICS.

Age and Size. In Australia the eucalypts reach ages of from 400 to 500 years, and dimensions second only to the California Sequoias. Indeed, in height development, though not in diameter, they surpass them. Many species are said to reach heights from 300 to over 400 feet, and diameters exceeding 12 to 15 feet. These dimensions result from long periods of growth in the virgin forests, however, and no such sizes have yet been attained by eucalypts planted in California.

No eucalypt has grown to greater age than 40 years in this State. At this age the period of rapid development has not been passed, and no disposition to become short-lived is shown, as is frequently the case with species grown outside their habitat. Blue gum trees 175 feet in height and 5 or 6 feet in diameter have been produced here in from twenty-four to thirty years. The single quality, rapidity of growth, entitles the eucalypts to serious consideration, for no other species can attain like dimensions in five times this period.

Form. Naturally the timber eucalypts maintain an erect form, with strong main axes and slender limbs. Young trees shoot up rapidly into slender poles with scantily branched crowns and feathery, drooping foliage. The bole gradually clears of limbs, particularly where the density of the stand causes lateral shading. Open-grown timber has more numerous and larger limbs.

Tolerance. The timber eucalypts are species of moderate shade endurance. During their early growth they will bear more shade than later in life. The seedlings are even shade-demanding, and succeed best under partial shade. When growth has commenced, however, full light should be afforded them.

The intolerance of saplings and poles is well indicated by their rapid height growth, upon which they depend in competition to escape sup-

PLATE 1. Blue gum timber 24 years old, showing characteristic clear, straight growth of this species. Trees over 36 inches in diameter, 175 feet tall, and 100 to 120 feet clear.

pression. It is not uncommon to see saplings too spindling to stand erect, caused by their efforts to overtop a competitor for light.

Root Development. The eucalypts use a great amount of water, hence they prefer a deep soil, through which the roots may penetrate to lower strata in search of greater supplies of moisture. In shallow soils overlying rock or hardpan the roots are forced to spread laterally, and on such situations the growth is generally stunted and slow.

In early years root development is exceedingly rapid, that of young seedlings greatly exceeding the growth of the plant above the surface. During early growth most eucalypts send down a taproot as well as numerous spreading laterals. The taproot of the blue gum, at least, rarely penetrates to a depth greater than 6 feet, further development being concentrated in the strong laterals.

The roots exhibit a strong impulse to seek water, and to reach it sometimes extend over 100 feet, crossing under ditches, pavements and roads. If they gain access to pipes or ditches through cracks or breaks in the masonry, they send out large masses of small feeding roots. Cisterns and water-pipes have been completely clogged in this manner.

Windfirmness. The production of an extensive lateral root system renders the eucalypts very windfirm. Their strong anchorage in the soil, combined with the flexibility of the growing stem, renders them particularly valuable for windbreak purposes, since a break which will yield before the force of the wind tends to deflect the air currents upward, and protects areas far to leeward, whereas an unyielding barrier breaks the wind only on areas in close proximity to it.

Reproduction. The complete adaptability of the eucalypts to California is especially shown by their strong reproduction here by both seed and sprouts.

Sprout Reproduction. All the eucalypts planted in California sprout vigorously from the stump or roots after cutting or in response to any injury to the tree. The small trees in young plantations generally sprout up thriftily after they have been cut back by animals or after saplings have been killed to the ground by frost or fire. After fire injury also, in an attempt at refoliation, the stems generally clothe themselves thickly from the ground to the top with short sprout branches like fire-injured redwoods.

Whenever it is desirable to reproduce a species which possesses coppicing qualities advantage is generally taken of them. With most species, however, the sprouts produced after the third or fourth cutting are less thrifty than those after the first or second. This tendency to weaken seems absent in the eucalypts, or if present, coppicing has not been practiced long enough in California to reveal it. Fuelwood

groves have sprouted up vigorously after the fourth and fifth cutting, and seedling trees over thirty years old sprout after cutting as thriftily as young trees. Indeed, it is almost impossible to kill the stumps of old trees or to prevent the sprouting of old roots left in the ground after the stumps have been grubbed out.

Seed Reproduction. Since natural regeneration is not practiced, the natural seeding of eucalypts is of little commercial importance. Seed is produced abundantly by all the eucalypts introduced into California. The fruit generally remains on the trees, unopened, until the fall of the seed cases to the ground. Wind dissemination plays no part in the extension of Eucalyptus, and as the seeds are not eaten by birds, the seedlings always occur beneath or very near the parent tree.

GENERAL REQUIREMENTS.

Every species makes definite ecological demands upon its habitat. The optimum development of a species is contingent upon the fulfillment of its requirements. It generally happens, however, that the demands of a species are not inflexible, and the species will survive if its requirements are but partially met. For example, a species will survive and grow indifferently, if it receives less food or light than it requires for best development. In the case of temperature much depends upon the age and condition of the tree species at the time its normal temperature range is crossed. If it is thriving and the temperature change comes gradually it will frequently withstand the shock without injury. Under less favorable conditions it will not recover. Except upon temperature the demands of eucalypts are fairly flexible. Their thermal demands, however, must be met. Whenever Eucalyptus planting is undertaken outside the thermal range of the species used some loss must be expected. Where only small plantations are made a risk is generally warranted. But where extensive commercial plantations, involving heavy expense, are made, they should lie within the thermal range of the species used. Since this circular deals with the commercial production of eucalypts, the planting of any species will not be recommended outside its thermal range. It is probable that most of the species treated will grow, indifferently at least, considerably outside of the range where their planting will be advised.

Soil. Practically, all the eucalypts grow best on a deep, fertile, well-drained, loam soil. But, as more valuable crops likewise develop most successfully there, the necessity arises of finding similar or poorer classes of land, which, on account of inaccessibility, or roughness,

is not of first value for agricultural purposes. These abound in the valleys and on the slopes of the lower hills throughout California. The chemical composition of the soil is of little importance, so long as an excess of injurious chemicals does not occur. The physical properties of the soil, such as permeability, retentiveness, etc., are vastly more important.

Temperature. No one factor has so much influence in governing the extension of Eucalyptus as temperature. The fact that its planting range is practically restricted to California is wholly attributable to the frost-tenderness of the genus. During the seedling years the danger from frost is greatest. The susceptibility of the sugar gum seedlings to frost injury is particularly marked.

Thermometer readings of temperature are not always true indices of the influence of frost on a tender plant. Much depends upon the condition of the plant at that particular time. If a period of warm weather is followed by a sudden drop in temperature, the plant suffers more than it would if an equally low temperature had come gradually. The exposure of the plantation is likewise important. If the plantation has an eastern exposure where it is reached by the first rays of the sun, the damage will be greater than if it remains in partial shade while the temperature ascends slowly.

The following order indicates the frost-hardiness of the timber eucalypts very closely: Red, gray, manna, blue, sugar, and lemon gum.

Moisture. A rapid growing plant, like anything else which grows rapidly, requires lots of food. This is taken up by the roots in the form of mineral salts in solution and elaborated in the leaves. Hence, the tree can not get its food unless its roots can obtain water. Therefore, other conditions being equal, the rate of growth depends directly on the amount of water the plant secures. While eucalypts will grow where the soil moisture is deficient, the rate of growth will be much slower than where the tree gets all it needs. For commercial purposes it is unwise to attempt to produce Eucalyptus where the soil moisture is markedly deficient. A fairly retentive, deep soil which receives an annual rainfall of from 25 to 30 inches will produce good trees.

Deficient soil moisture is supplemented by atmospheric moisture in the fog belt, where the fog is condensed by contact with the foliage. During a heavy fog the foliage of gum trees drips as if from a shower, and the ground under the trees becomes soaked overnight. The occurrence of fog accounts largely for the excellent growth of Eucalyptus on sandy soil at the Presidio, on the Piedmont Hills, and elsewhere in situations, otherwise inhospitable, throughout the Bay counties. Fogs, likewise, make the Los Angeles plain one of the favorable regions in

the State for Eucalyptus culture, although less so than the Bay counties, owing to lesser precipitation.

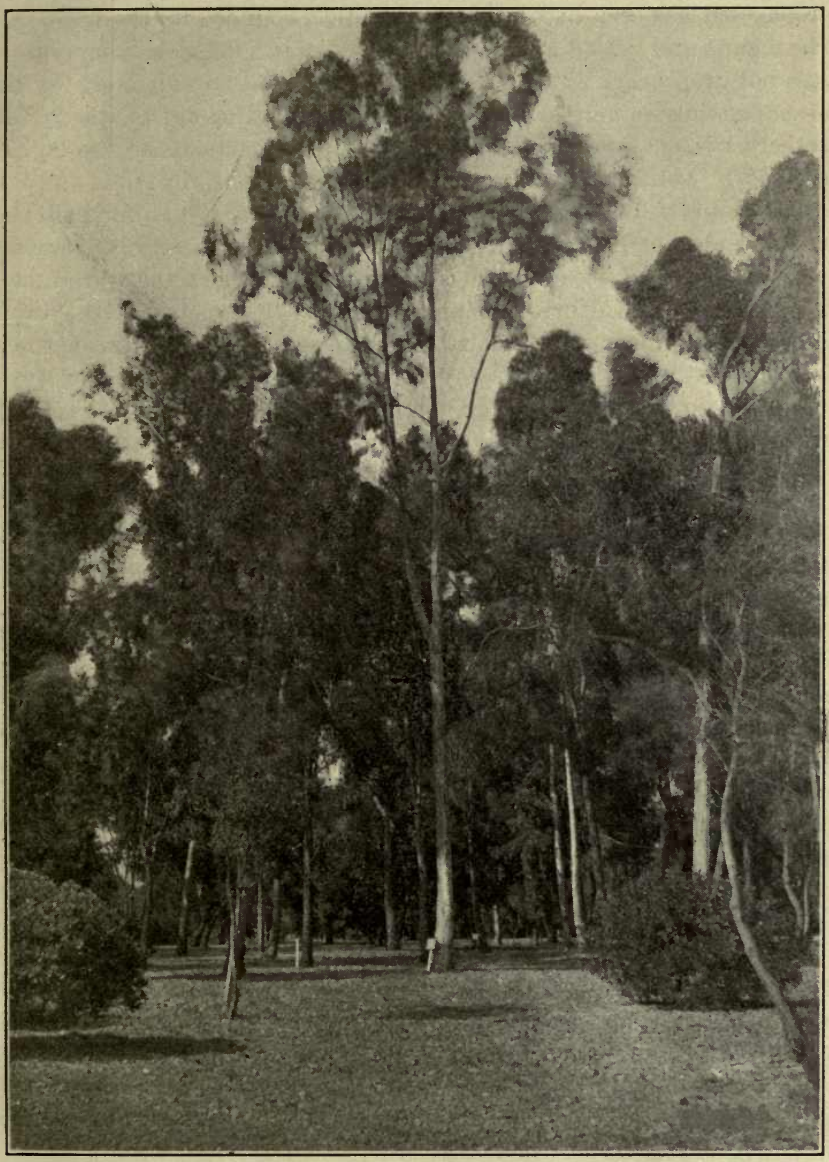

PLATE 2. Gray gum tree about 20 years old in an experimental plantation. Tree grown in an unfavorable situation to a height of over 100 feet and a diameter of 14 inches.

Among the timber eucalypts some are able to thrive on less moisture than others. The following order indicates their relative drought-hardiness: Sugar, red, gray, manna, lemon, and blue gum.

PLANTING REGIONS.

The area within which the timber eucalypts may be successfully propagated has been broadly defined as that bounded by the frost line. The manna and gray gums may be safely planted when the temperature does not drop below 22° F. This area is shown, approximately, by the accompanying isothermal map. Commercial planting outside the 22° F. isotherms is not recommended for any species, nor outside the 26° F. and 28° F. isotherms for blue and sugar gums, respectively.

For successful growth the requirements of eucalypts for soil and moisture are but little more elastic than for temperature. It is unwise to set high-priced seedlings on shallow soil or where the water table is far below the surface. Planters should not forget that the rapid growth and proper development of eucalypts is contingent on their food supply rather than on any inherent quality. Where the water table is accessible at not more than 25 feet below the surface, good growth may be expected.

CHOICE OF SPECIES.

Generally speaking, the blue and sugar gums should be chosen for planting within their thermal ranges. Outside these the red, gray and manna gums must be considered as the leading species.

Whenever the selection of species lies between blue and sugar gum, the kind of product desired and the amount of soil moisture present must determine the choice. If firewood, piles, or dimension stuff is desired, the blue gum should be selected, especially if there is no marked deficiency of soil moisture. If poles, ties or a wood of unusual durability and strength is desired the sugar gum should be chosen, particularly if the situation is rather arid. The sugar gum is the more drought-resisting, but the blue gum is the more rapid-growing.

Outside the planting range of the blue and sugar gums the red gum commends itself, owing to its frost-hardiness and the durability of its timber. In frosty or swampy locations it should receive first preference. The uses of its product are limited, however, by the fact that it is inclined to a crooked, branchy form. It is of rapid growth and furnishes a product which is very durable in contact with the soil.

The gray gum is equally rapid in growth, but is somewhat less frost-hardy than the red. It grows in good form, especially in plantations, and furnishes a very durable timber.

Manna gum grows very rapidly, but it is hardly worthy of consideration, since it is but slightly more frost-hardy than the sugar and blue gums, while its timber is inferior to that of either species.

Lemon gum is probably more valuable for ornamental than for economic planting. Its rate of growth is about equal to that of red


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SISKIYOU
MODOC
TRINITY
SHASTA
LASSEN
MENDOCINO
TEHAMA
PLUMAS
GLENN
BUTTE
SIERRA
LAKE
COLUSA
SUTTER
NEVADA
YUBA
PLACER
EL DORADO
SONOMA
NAPA
SACRAMENTO
AMADOR
ALPINE
CONTRA COSTA
ALAMEDA
SAN JOAQUIN
CALAVERAS
TUOLUMNE
SAN FRANCISCO
SAN MATEO
SANTA CLARA
STANISLAUS
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SANTA CRUZ
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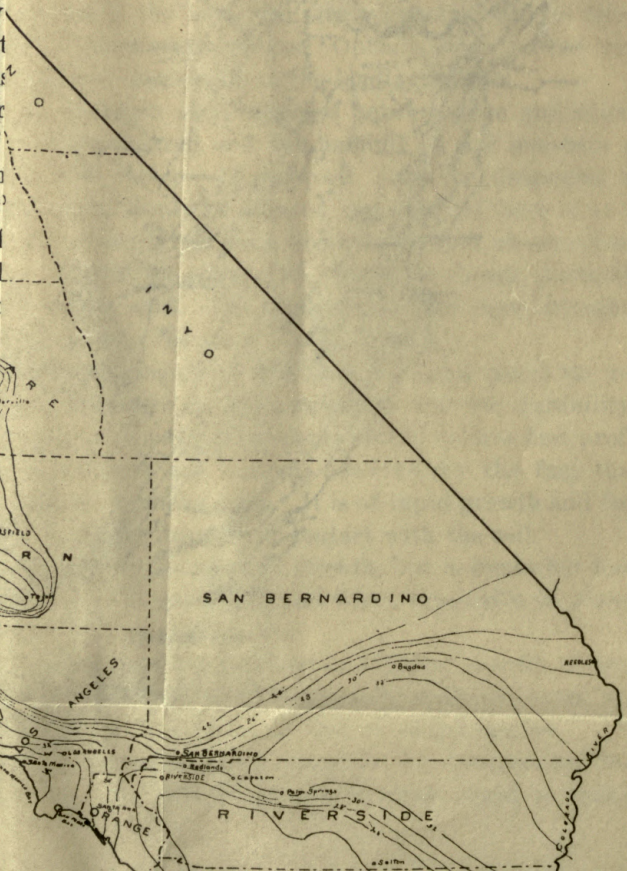

PLATE 3. Exceptional development of manna gum in the San Joaquin Valley. Trees clear, straight, and of very massive proportions. The two trees are 20 to 25 years old, 4 to 5 feet in diameter, 150 to 160 feet tall, and 50 to 60 feet clear.

gum, but it is less frost-hardy and produces a less durable though better formed timber.

HOME-GROWN *vs.* NURSERY SEEDLINGS.

The following list contains the names and addresses of the California firms that are known to deal in Eucalyptus seeds and seedlings. Some of these deal in Eucalyptus stock exclusively.

Dealers in Eucalyptus Seed.

Cox Seed Co.	San Francisco.
Germain Seed and Plant Co.	Los Angeles.
Stengel Exotic Nursery Co.	Los Angeles.
Theo. Payne	Los Angeles.
Johnson & Mussar	Los Angeles.
Fancher Creek Nursery Co.	Fresno.

Nurserymen Propagating Eucalyptus Seedlings.

Cox Seed Co.	San Francisco.
Pacific Nursery Co.	San Francisco.
Western Nurseries	San Francisco.
Seaman	Oakland.
Germain Seed and Plant Co.	Los Angeles.
Stengel Exotic Nursery Co.	Los Angeles.
Theo. Payne	Los Angeles.
Sessions	San Diego.
Warner	Santa Ana.
Young	Santa Ana.
O. Roessner	Pomona.
Griffin	Pomona.
Fancher Creek Nursery Co.	Fresno.
Wilson	Fresno.
Wilson	Dinuba.
Wilson	Visalia.
California Nursery Co.	Niles.
Ritchman	Fullerton.
Timothy Carroll	Anaheim.
J. W. Armstrong	Ontario.
N. Eaton	Ontario.
Stratton	Petaluma.
Leonard Coates Nursery Co.	Morgan Hill.

Whenever planters desire only small quantities of stock it will be advisable to secure it from a dealer. The price demanded for seedlings will be considerably higher than the actual cost of raising the seedlings, but not sufficiently great to warrant small planters attempting to propagate their own seedlings. Generally, the regular price will be reduced by a nurseryman even to a small planter who contracts in advance for a stated number of seedlings.

If large quantities of seedlings are to be used annually for several consecutive years, the saving in the cost of seedlings will warrant the planter in establishing a small nursery and propagating his own stock. The practicability of doing this depends largely on the local prices demanded for seedlings, however, and on the facilities at hand for raising them.

The prices for seedlings exacted by nurserymen in different parts of the State vary from $8 to $30 per thousand, depending largely on the local demand. Hence, if a planter lives in a locality where $30 per thousand is asked, it is expedient, at least, to use home-grown seedlings.

On the other hand, if but $8 per thousand is demanded, generally, it will be more advisable to purchase them outright than to assume the initial expense of preparation and the subsequent work of propagating the plants, although they can be raised for $2.50 to $3.50 per thousand.

Cheapness is not the only quality which commends home-grown seedlings. The certainty of having them when they are wanted is assured, and generally higher-grade stock can be raised than nurserymen supply. The risk entailed in transporting seedlings from the nursery to the planting site is also avoided.

Sugar gum plantation, 1 year old, in Los Angeles Valley. Trees now 7 feet tall.

Blue gum plantation, 1 year old, in Los Angeles Valley. Trees now 14 feet tall.

PLATE 4.

NURSERY PRACTICE.

Lath House. As stated under the heading "Tolerance," Eucalyptus seedlings are naturally shade-demanding and succeed best under partial cover. This condition is created artificially by the construction of a lath house, within which the seedlings are raised to planting size. The amount of light admitted is determined by the width of the spaces between the laths. In practice it has been found that half light and half shade, secured by spacing the laths a distance equal to their width, is about right.

It sometimes happens that the seedlings are attacked by a fungous disease called "damping off," which really amounts to the rotting of the stems just at the surface of the soil. This disease is particularly liable to appear if the seedlings are watered too much, or in the late

afternoon when the soil remains wet overnight, or when they are over-shaded. To check it, it is necessary to admit more light or to sprinkle the surface of the seed boxes with dry sand. In any case the admission of light and the freer circulation of air are desirable, hence the laths should be put on in panels so they can be removed if desired.

Another point to be observed in constructing a lath house, particularly in windy locations, is to lay the lath on the sides of the house diagonally instead of vertically or horizontally. This will give the house greater strength.

The size of the house must be determined by the number of seedlings required per year. As a general guide it is safe to count on forty seedlings for every square foot of floor space enclosed.

Seed Boxes. It is desirable to sow Eucalyptus seeds in boxes instead of in the open soil, in order to facilitate the handling of seedlings and to control the development of their roots. The boxes should be about 18 to 20 inches in surface dimension by 3 or 4 inches deep, and filled almost to the top with fire, mineral soil, free from weed seed. This should be smoothed uniformly, care being taken not to leave any hollows or holes, and not more than 1,000 seeds should be sown in each box. After sowing, the seed should be covered a little deeper than the diameter of the seed with a layer of fine sand.

After the seed is sown, a very light layer of leaf-mold, or sawdust, should be sprinkled on the surface of the soil. This will help to retain the mosisture and thus hasten germination. During warm weather germination may be expected in from four to ten days. When the seedlings appear above the surface the sawdust may be removed. Some contend that redwood sawdust prevents damping off, but the reason for this is not clear.

Watering Seedlings. The regulation of the water supply for Eucalyptus seedlings requires careful attention. Too much and too little water injures them equally. Nearly every difficulty experienced in raising Eucalyptus seedlings can be overcome by gauging the water supply so that the soil is kept moderately moist at all times during the sunny part of the day and somewhat drier at night. If the seedlings begin to wilt, they should be examined immediately and carefully to ascertain whether the wilting is due to drought or "damping off," for in the former case water is needed, while in the latter a drying process, already described, should be instituted. The symptoms are very similar and should not be confused.

As a general rule it is safer to err on the side of too little water rather than on that of too much. It should be given during the day when there is a considerable period of sunlight ahead. During the last two

or three weeks before planting, the seedlings can be hardened and made more woody by curtailing their water supply, though it should not be withdrawn enough to stunt them.

Transplanting. If the 1,000 seeds planted in each box germinate and grow well they will begin to crowd each other when the seedlings are about two inches tall. When this condition obtains it should be relieved by pulling out all but 100, which should be left evenly distributed in each box. Those removed should be transplanted in other boxes.

In removing them from one box to another the roots of the seedlings should not be exposed to the air too long. Eucalyptus seedlings are not so tender as those of conifers, however, and will revive after considerable hardship.

Immediately after being transplanted the seedlings are likely to wilt slightly. If watered freely and shaded well for a few days, however, they will revive, unless the roots have been killed by exposure during the operation. To avoid this it is advisable to transplant on a cloudy or foggy day.

Protection of Nursery. The damage to nursery stock caused by birds and small rodents can be controlled by preventing them from effecting an entrance to the lath house. Ants, however, are likely to invade the lath house and cause considerable trouble if left unmolested. They can be kept from the seedlings by painting the edges of the boxes with corrosive sublimate, which the ants will not cross. An established colony can be killed by pouring carbon bisulphid into the passage holes, which should then be plugged with dirt to confine the gas.

FIELD PLANTING.

In the portions of California suitable for Eucalyptus culture the season is divided between periods of drought and abundant rainfall. In some sections the summer drought is broken by rains in October; in others it may continue till late in November or December, or even later. If late in January or in February sufficient rain has fallen to moisten the soil to a depth of one foot or more, planting should be begun in order that the plantation may become established during the continuance of the rainy season.

No fixed rules to govern planting need be given. Every planter can best decide for himself what arrangement of his men gives best results. On wild, uncultivable land it has frequently been found advantageous to divide the men into three squads. The first, consisting of men equipped with mattocks, precedes the other and prepares holes for the seedlings by removing the sod and digging up the mineral soil. The

second follows, each man having a box of plants and an ordinary trowel, which he uses to scoop out the loosened soil, making a hole to receive the plant, about the roots of which he packs soil closely. The third, consisting of less than half the number of either of the others, keeps the second squad supplied with plants. On tilled land the first squad may be dispensed with.

SPACING.

The proper spacing of seedlings in a plantation is a matter of first importance. Upon it depends the number of seedlings required per acre, the length of time cultivation is necessary, the rate of growth of the trees, and the character of the product. California planters, observing the small spindling trees in the interior of dense plantations and the larger trees along the edges, have inclined to very wide spacing. For different plantations the spacing has varied from 4 by 4 feet to 16 by 16 feet, and the opinion is prevalent that spacing 8 by 8 feet is too close. The very rapid growth of eucalypts soon closes up an open plantation and seems to warrant wider spacing than is advisable with most slower-growing trees. For best results, however, Eucalyptus plantations should not be spaced closer than 6 by 6 feet, nor wider than 10 by 10 feet for any purpose.

The wider spacing is allowable if firewood is the only product sought. For ties, piles, poles, dimension stuff, or any material in which good form is an indispensable quality, the plantations should be spaced not wider than 8 by 8 feet. Sugar and lemon gums, which naturally grow tall and spindling with scanty foliage, should be spaced 6 by 6 feet preferably, and never more than 8 by 8 feet. A similar spacing is recommended to correct the crooked-growing tendency of red gum.

Uniformity of spacing should always be attempted. Sometimes the topography of the planting area will render its attainment impossible, or at least impracticable, in which case it should be approached.

Level, tilled land can be marked to insure uniformity of spacing. On untilled land uniformity may be approximated by keeping the men in the mattock squad in line. Where extensive planting operations are carried on one man may be detailed to set flags at stepped distances apart, to guide the mattock men on the ends of the line. Those between them will soon learn to keep an equal distance apart.

CULTIVATION.

Wherever the condition of the planting area lends itself readily to cultivation, this treatment should be accorded the plantation at least two or three times during each of the first two dry seasons after planting. Once a month is better. Plantations on untilled land will respond sufficiently to hoeing to warrant its practice once, at least.

PLATE 5. Result of a severe ground fire in an old Eucalyptus stand. Trunks charred, many trees killed and fallen, the ground burned clear of litter, and now sprinkled with leaves from fire-injured trees.

Too great stress can not be laid on the benefits derivable from cultivation. Not only is the weed growth, detrimental to plantations, destroyed, but the surface soil is loosened and evaporation is checked. The planter who attends carefully to the cultivation of his grove will be rewarded by the greater number of trees which withstand the drought and by the more rapid growth of his plantation.

COST OF PLANTATIONS.

The total cost of establishing and caring for plantations during the first two years has varied from $15 to over $50 per acre. An expense of $25 per acre is generally considered a fair figure. However, this cost is the result of setting out small groves, for which seedlings have generally been purchased from nurserymen. When stock is grown in a home nursery the cost of planting large areas should not exceed $15 or $20 per acre. Small groves for which plant material is purchased will generally entail a higher expense.

PROTECTION.

Once the plantation is well established its protection from fire and roving stock is the chief feature of management to demand attention. Eucalypts are particularly inflammable, because of the oil contained in their foliage and bark, hence even a slow fire causes serious injury.

Plantations established in open country should have a strip fully a rod wide plowed around them every spring, particularly if they are situated near a railroad or in a locality frequented by hunters. In addition, the owner or caretaker of the plantation should secure an appointment as fire warden from the State Forester, and obtain a supply of fire-warning notices to post conspicuously in the vicinity of the plantation. Although the danger from fire is great in many portions of the State, planters should not be deterred by it, for they have full redress for damages through a civil action, whenever sufficient evidence of the careless or malicious origin of the fire can be collected.

Roving stock of all kinds should be strictly excluded from the plantations. The need for this is particularly great while the trees are small enough to be trampled upon.

Gophers, squirrels, rabbits and other rodents which infest and damage young plantations should be destroyed by firearms or poison.

CUTTING, THINNING AND PRUNING.

All operations which curtail the foliage of the tree should be performed during the late fall or winter, when its functioning processes are suspended or least active. If this is done the surface cut will heal

during the time the tree is dormant and loss of vitality by "bleeding" will be avoided.

In cutting, care should be exercised to slope the stump like the roof of a house, so that the rain falling on it will be conducted off instead of sinking in and permitting fungous growth to start. It is also advisable to cut the stumps very low the first time, for succeeding cuttings will have to be higher to avoid the thickened growth caused by the production of numerous coppice shoots.

The advisability of thinning depends on the age which the grove will be allowed to attain and the use to which the product is to be put. If the grove is to be cut for firewood when six or seven years old, thinning will not be advisable. But if the plantation is expected to produce telephone or telegraph poles, piles or dimension material, which will require longer to mature, a moderate thinning will be advisable during the winter of the fifth or sixth year after the trees have been forced into height by crowding. As soon as the competition for light is relieved by thinning, the rate of height growth will decrease and that of diameter will increase.

The degree of thinning must always be determined by the condition of the plantation and the character of the product desired. Groves should never be opened enough to permit the growth of weeds or to allow the slender trees to be thrown by the winds. Definite rules can not be given in advance. Unless the planter has had experience enough to guide his judgment, it will be advisable to secure an examination of the plantation by a forester, which may be done under the conditions of Section 4 of the State Forest Law.

Pruning will be inadvisable generally. If the plantations are spaced properly the formation of objectionable branches will be prevented by lack of light.

GROWTH.

The measurements upon which the accompanying tables of growth and yield are based were taken in different groves upon sample plots aggregating approximately 10 per cent of the total area of Eucalyptus plantations in California. Since blue gum has been planted commercially to the exclusion of other eucalypts, the collection of data was necessarily restricted to plantations of this species. Although the growth of blue gum is the most rapid of the eucalypts planted in California, the tables may be used to estimate the growth of other commercial species.

The portions of the State for which the tables may be regarded as authoritative are: the Bay counties, the coast region near Santa Barbara, the Los Angeles and Santa Ana valleys, and the coastal valleys near

San Diego. The localities in which the groves measured are situated are mentioned in tables 4 to 10. No plantations are growing in other sections of the State from which data upon growth and yield can be obtained, but the tables will undoubtedly indicate closely the growth of blue gum throughout its planting range.

The majority of the groves measured were situated in Southern California, and the data were collected after the succession of exceptionally dry years in that section from 1898 to 1903. The growth of plantations was considerably retarded during that period of very low rainfall, the sites, occupied by the groves giving the lowest yield, being generally those most unfavorably affected by the drought. The majority of the groves when measured were less than eight years old, hence their growth does not represent the maximum productive capacity of their sites. It is believed the tables are very conservative for the growth of blue gum in California.

Tables 1 to 3 show the volumes of blue gum trees in cubic feet, cords and board feet. For these tables measurements of seedlings and sprout trees were combined, since they differ but little in form and habit of growth. The cubic foot and cordwood tables are based on the computation of the contents of entire trees. The volume and the clear length only, scaled by the Scribner rule, was used for the board foot table. Owing to the scarcity of plantations of older and larger trees, volumes can not be given for trees over 160 feet in height, 24 inches in diameter, and 30 years of age.

In both the volume and yield tables for cordwood, the New England cord of 128 cubic feet is used. The results were obtained by dividing the figures given in the cubic foot tables by 90 cubic feet, which represents very closely the average solid contents of a cord of Eucalyptus wood. However, the New England cord is little used in California, a cord of 96 cubic feet, or about 65 cubic feet solid contents being in general favor. To change from New England to California cords, the amounts should be increased one-fourth.

Tables from 4 to 10 record the growth and yield of individual blue gum plantations. Separate tables have been constructed for seedling and sprout plantations upon different types of soils. Portions of many sprout groves have been cut at different periods, and represent the growth at different ages. Therefore, different portions of the same groves are often separated in the tables to permit arrangement of the sample plots by successive ages, and to show the progress of growth and yield.

In the sprout yield tables the number of trees in the column showing the present stand per acre is often several times as great as would result from the spacing mentioned. This is due to the number of

sprouts allowed to grow up from a stump after cutting the seedling tree. In the seedling table the number of trees in the present stand is frequently lower than the spacing would indicate. This results from the thinning or burning of the stand or the natural reduction in the number of trees. If a stand has been thinned or burned, the fact is noted in the column headed "Remarks."

TABLE 1.—Volume of Blue Gum Seedlings and Sprouts.

Diameter breast-high.	Total height—Feet.													
	30	40	50	60	70	80	90	100	110	120	130	140	150	160
Inches.						*Volume—Cubic Feet.*								
2	0.4	0.7	1.0	1.3										
3	.6	.9	1.3	1.7										
4	1.0	1.4	1.9	2.3	2.8	3.3								
5	1.6	2.1	2.6	3.2	3.9	4.8	5.8							
6		3.0	3.6	4.3	5.2	6.4	7.6	9.0						
7			4.8	5.7	6.8	8.1	9.6	11.0						
8				7.3	8.6	10.1	11.8	13.5	15.4					
9				9.0	10.7	12.4	14.4	16.4	18.6	20.5				
10						15.0	17.2	19.6	22.1	24.7	27.3			
11						17.6	20.4	23.0	26.0	29.1	32.0			
12						20.4	23.7	26.6	30.9	33.5	36.8			
13						23.7	27.2	30.7	34.4	38.0	41.5	45.7		
14									39.2	42.3	46.3	51.3		
15										46.6	51.2	56.8		
16										50.9	56.0	62.5	71.6	84.2
17										55.0	60.8	68.4	78.3	91.0
18											65.8	74.2	84.9	98.0
19											70.7	80.0	91.5	105.0
20												86.0	98.6	112.5
21													105.8	120.0
22													112.8	127.5
23													120.0	135.0

TABLE 2.—Volume of Blue Gum Seedlings and Sprouts.

Diameter breasthigh.	Total height—Feet.													
	30	40	50	60	70	80	90	100	110	120	130	140	150	160
Inches.						*Volume—Cords.*								
2		0.01	0 01	0.01										
3	0.01	.01	.01	.02										
4	.01	.02	.02	.03	0.03	0.04								
5	.02	.02	.03	.04	.04	.05	0.06							
6		.03	.04	.05	.06	.07	.08	0.10						
7			.05	.06	.08	.09	.11	.12						
8				.08	.10	.11	.13	.15	0.17					
9				.10	.12	.14	.16	.18	.21	0.23				
10						.17	.19	.22	.25	.27	0.30			
11						.20	.23	.26	.29	.32	.36			
12						.23	.26	.30	.34	.37	.41			
13						.26	.30	.34	.38	.42	.46	0.51		
14									.44	.47	.51	.57		
15										.52	.57	.63		
16										.57	.62	.69	0.80	0.94
17										.61	.68	.76	.87	1.01
18											.73	.82	.94	1.09
19											.79	.89	1.02	1.17
20												.96	1.10	1.25
21													1.18	1.33
22													1.25	1.42
23													1.33	1.50

TABLE 3.—Volume of Blue Gum Seedlings and Sprouts.

Diameter breasthigh.	Total height—Feet.											
	50	60	70	80	90	100	110	120	130	140	150	160
Inches.					*Volume—Board feet.*							
7	5	5	10	10	15	15	20					
8	10	10	15	20	25	30	35					
9	15	20	25	30	35	45	50	60				
10		30	35	45	50	60	70	80	90			
11			50	60	70	80	90	100	110			
12				75	90	100	110	120	135			
13					110	120	130	145	160			
14							150	165	190	220		
15								190	220	255		
16								220	255	290	330	370
17								250	290	330	370	420
18								280	325	370	415	465
19										415	460	515
20										460	505	565
21											555	620
22											600	675
23											650	725
24												775

TABLE 4.—Growth and Yield of Blue Gum Plantations.

Seedling growth—Loam and sandy-loam soils.

Name of Grove.	Location.		Age.	Area measured.	Original spacing.	Present stand per acre.	Diameter.		Height.		Yield per Acre.				Remarks.
	Town.	County.					Average.	Maximum.	Average.	Maximum.	Total.	Total	Total.	Av. annual.	
			Years.	*Acres.*	*Feet.*	*Trees.*	*Inches.*	*Inches.*	*Feet.*	*Feet.*	*Cu. ft.*	*Cords.*	*Board ft.*	*Cords.*	
Shaw	Long Beach	Los Angeles	3	1.0	8 x 9	554	3.6	5	39	47	602.0	6.7	-------	2.2	
do	do	do	4	1.0	9 x10	463	4.9	10	50	67	1,167.8	13.0	560	3.3	
Nelson	Florence	do	5	.5	8 x 8	382	3.1	5	30	38	263.6	2.9	-------	.6	
do	do	do	7	1.0	8 x 8	565	4.7	8	47	67	1,255 2	13.9	110	2.0	
do	do	do	7	.5	8 x 8	546	5.0	7	50	67	1,362.2	15.1	100	2.2	
do	do	do	7	1.0	8 x 8	488	4.6	8	46	67	1,031.9	11.5	150	1.6	
do	do	do	7	1.0	8 x 8	486	4.9	8	49	67	1,164.8	12.9	140	1.8	
do	do	do	7	1.0	8 x 8	464	5.0	9	50	67	1,220.6	13.6	355	1.9	
Long Beach	Long Beach	do	8	1.0	6 x 6	1,058	4.6	9	63	97	3,498.2	38.9	730	4.9	
do	do	do	8	1.0	6 x 6	1,022	4.4	8	60	97	3,118.9	34.7	380	4.3	
do	do	do	8	1.0	6 x 6	987	4.9	9	69	97	3,707.3	41.2	1,450	5.2	
do	do	do	8	1.0	8 x 8	560	5.4	10	65	87	2,346.0	26.1	1,495	3.3	
do	do	do	8	1.0	8 x 8	525	6.0	10	70	87	2,769.4	30.8	3,040	3.9	
Cuthbert	do	do	9	.3	8 x 8	640	6.6	12	71	77	3,899.3	43.3	1,785	4.8	
Cooper	Ellwood	Santa Barbara	14	1.0	6 x 7	932	4.5	8	52	66	2,143.7	23.8	290	1.7	
do	do	do	14	1.0	6 x 7	928	4.9	9	58	79	2,954.1	32.8	1,080	2.3	
do	do	do	14	1.0	6 x 7	907	4.7	8	53	66	2,230.6	24.8	185	1.8	
do	do	do	14	1.0	6 x 7	903	4.6	8	52	66	2,134.2	23.7	130	1.7	
do	do	do	14	1.0	6 x 8	838	5.1	8	59	79	2,822.0	31.4	840	2.2	
do	do	do	14	1.0	6 x 8	788	4.6	8	52	66	1,885.7	21.0	135	1.5	
do	do	do	14	1.0	6 x 8	639	4.9	8	50	65	1,943.2	21.6	160	1.5	
do	do	do	14	1.0	6 x 8	626	4.9	8	50	65	1,886.8	21.0	205	1.5	
Johnson (1)	Norwalk	do	14	1.0	8 x 8	452	7.7	16	100	145	6,089.0	67.7	16,310	4.8	
do (2)	do	do	14	1.0	8 x 8	438	7.2	15	95	140	5,080.0	56.4	11,950	4.0	
Merritt	Spring Valley	San Diego	15	1.0	9 x 8	79	5.9	34	108	135	3,990.5	44.3	18,585	3.0	Thinned.
Cooper	Ellwood	Santa Barbara	23	1.0	9 x 9	437	9.4	17	98	124	7,159.5	79.6	20,765	3.5	
McDonald	El Cajon	San Diego	27	.6	12 x12	280	9.7	19	80	132	4,094.0	45.5	13,092	1.7	
Nadeau	Florence	Los Angeles	27	.5	8 x 8	268	13.3	23	130	169	10,369.0	115.2	44,190	4.3	Thinned.
Cooper	Ellwood	Santa Barbara	28	1.0	5 x 5	295	7.7	13	85	118	3,166.9	35.2	6,070	1.3	Thinned.
do	do	do	28	.4	5 x 5	275	8.4	14	88	101	3,605.0	40.1	7,950	1.4	Thinned.
do	do	do	28	.6	5 x 6	255	7.7	14	85	118	2,720.3	30.2	5,567	1.1	Thinned.
do	do	do	29	1.0	6 x 8	691	8.1	14	85	102	7,602.7	84.5	17,160	2.9	
do	do	do	29	1.0	6 x 8	595	7.8	13	83	102	6,126.9	68.1	12,800	2.3	
do	do	do	29	.3	8 x 8	467	8.2	15	84	119	5,445.7	60.5	12,700	2.1	
do	do	do	29	1.0	6 x 6	395	7.8	17	80	119	4,502.6	50.0	9,710	1.7	Thinned.
Marsh	Berkeley	do	29	.5	8 x 8	258	10.1	16	90	103	4,625.2	51.4	14,750	1.8	Thinned.

TABLE 5.—Growth and Yield of Blue Gum Plantations.

Seedling growth—Clay-loam soil.

Name of Grove.	Location.		Age.	Area measured.	Original spacing.	Present stand per acre.	Diameter.		Height.		Yield per Acre.				Remarks.
	Town.	County.					Average.	Maximum.	Average.	Maximum.	Total.	Total.	Total.	Av. annual.	
			Years.	*Acres.*	*Feet.*	*Trees.*	*Inches.*	*Inches.*	*Feet.*	*Feet.*	*Cu. ft.*	*Cords.*	*Board ft.*	*Cords.*	
Presidio	San Francisco	San Francisco	13	0.4	5 x 4	1,828	4.9	8	43	58	7,194.5	79.9	6,513	6.1	High yield due to dense planting.
do	do	do	13	.5	Irregular.	758	6.6	11	50	60	3,573.4	39.7	3,760	3.1	
do	do	do	13	1.0	do	715	6.1	11	50	60	2,692.8	29.9	1,780	2.3	
Buvy	Burlingame	San Mateo	18	1.0	6½ x 6½	162	9.6	17	69	90	2,111.4	23.5	5,690	1.3	Thinned.
Brown	Berkeley	Alameda	25	1.0	8 x 8	426	9.7	20	90	141	7,612.6	84.6	25,125	3.4	
Smith (lower)	do	do	27	.8	8 x 8	369	8.9	15	97	114	5,389.9	59.9	15,788	2.2	Burned.
do do	do	do	27	1.0	8 x 8	326	8.5	14	95	114	4,245.5	47.2	11,695	1.7	Burned.
Reservoir	do	do	29	1.0	8 x 8	354	8.7	13	81	118	4,295.3	47.7	10,870	1.6	Burned.
do	do	do	29	1.0	8 x 8	307	9.9	14	84	118	4,999.2	55.5	15,140	1.9	Burned.
do	do	do	29	1.0	8 x 8	299	9.2	15	82	118	4,159.2	46.2	11,780	1.6	Burned.
Smith (upper)	do	do	29	.5	8 x 8	290	10.2	22	93	121	5,560.8	61.8	17,870	2.1	Burned.
Reservoir	do	do	29	.5	8 x 8	280	8.8	18	76	96	3,494.2	38.8	10,360	1.3	Burned.
Institute	do	do	29	1.0	14 x14	269	12.4	23	105	150	8,172.2	90.8	33,590	3.1	
Reservoir	do	do	29	.5	8 x 8	260	10.1	15	85	118	4,504.6	50.1	14,440	1.7	Burned.
do	do	do	29	1.0	8 x 8	258	10.2	16	85	118	4,529.7	50.3	14,450	1.7	Burned.
do	do	do	29	1.0	8 x 8	256	10.2	16	85	118	4,449.9	49.4	14,040	1.7	Burned.
Garber	do	do	29	1.0	8 x 8	241	11.3	21	94	123	5,539.9	61.6	19,835	2.1	Burned.
Reservoir	do	do	29	.5	8 x 8	230	10.1	18	85	118	4,104.2	45.6	13,760	1.6	Burned.
do	do	do	29	1.0	8 x 8	200	10.4	20	86	118	3,765.9	41.8	12,560	1.4	Burned.
do	do	do	29	1.0	8 x 8	186	12.1	21	99	122	5,215.0	57.9	19,105	2.0	Burned.
Smith (upper)	do	do	29	.4	8 x 8	173	11.1	15	96	121	3,913.8	43.5	13,475	1.5	Burned.

TABLE 6.—Growth and Yield of Blue Gum Plantations.

Seedling growth—Adobe soil.

Name of Grove.	Location.		Age.	Area measured.	Original spacing.	Present stand per acre.	Diameter.		Height.		Yield per Acre.				Remarks.
	Town.	County.					Average.	Maximum.	Average.	Maximum.	Total.	Total.	Total.	Av. annual.	
			Years.	*Acres.*	*Feet.*	*Trees.*	*Inches.*	*Inches.*	*Feet*	*Feet.*	*Cu. ft.*	*Cords.*	*Board ft.*	*Cords.*	
Powder	Los Angeles	Los Angeles	7	0.5	10 x 10	382	6.8	12	65	90	2,469.0	27.4	4,430	3.9	
do	do	do	7	.5	10 x 10	338	6.6	11	63	90	2,024.4	22.5	3,430	3.2	
Alamitos	Long Beach	do	16	1.0	10 x 10	384	6.8	12	64	85	2,382.9	26.5	3,965	1.7	
Fair	Irvington	Alameda	29	1.0	6 x 6	491	11.0	12	111	170	13,979.6	155.3	54,480	5.4	Thinned.
do	do	do	29	.5	6 x 12	172	15.2	22	128	159	9,012.4	100.1	41,360	3.5	Thinned.
Winery	do	do	33	.8	8 x 8	455	10.6	19	125	164	12,241.0	136.0	44,675	4.1	

TABLE 7.—Growth and Yield of Blue Gum Plantations.

Seedling growth—Sand soil.

Presidio	San Francisco	San Francisco	10	0.2	4 x 4	2,315	3.9	7	24	31	2,309.9	25.7		2.6	
do	do	do	10	.4	Irregular.	540	5.0	8	46	57	1,319.0	14.7	300	1.5	
do	do	do	13	.5	5 x 5	1,166	5.2	11	47	59	3,103.8	34.5	1,710	2.7	
do	do	do	13	.5	8 x 4	888	5.4	12	52	64	2,658.0	29.5	1,100	2.3	
do	do	do	13	.5	Irregular.	818	4.9	8	37	45	1,665.2	18.5	270	1.4	
do	do	do	13	1.0	do	791	5.4	10	49	68	2,337.9	26.0	1,170	2.0	
do	do	do	13	1.0	do	755	5.4	10	49	68	2,239.5	24.9	1,210	1.9	
do	do	do	13	1.0	do	652	5.8	10	51	68	2,291.7	25.5	2,005	2.0	
do	do	do	13	.5	7 x 8	638	5.7	10	56	86	2,657.6	29.5	2,510	2.3	
do	do	do	13	1.0	Irregular.	634	5.9	11	45	51	2,166.7	24.1	1,325	1.9	
do	do	do	13	.6	do	602	5.5	10	50	65	1,877.3	20.9	792	1.6	
do	do	do	13	1.0	do	568	6.0	12	56	68	2,418.3	26.9	2,030	2.1	
do	do	do	13	1.0	do	565	5.6	11	54	68	2,092.6	23.3	1,565	1.8	
do	do	do	13	.6	8 x 8	565	6.1	10	51	67	2,296.8	25.5	2,363	2.0	
do	do	do	13	1.0	Irregular.	552	5.5	9	50	59	1,737.3	19.3	1,145	1.5	
do	do	do	13	1.0	do	550	5.9	12	56	68	2,234.3	24.8	1,720	1.9	
do	do	do	13	.4	8 x 8	505	5.5	11	44	72	1,592.0	17.7	1,563	1.4	
do	do	do	13	1.0	Irregular.	488	6.1	12	56	68	2,295.1	25.5	1,795	2.0	
do	do	do	13	1.0	do	421	6.5	13	64	78	2,440.6	27.1	4,535	2.1	
do	do	do	13	1.0	do	312	6.7	15	53	71	1,659.6	18.4	2,785	1.4	

TABLE 8.—Growth and Yield of Blue Gum Plantations.

Sprout growth—Loam and sandy-loam soil.

Name of Grove	Location.		Age.	Area measured.	Original spacing.	Present stand per acre.	Diameter.		Height.		Yield per Acre.				Remarks.
	Town.	County.					Average.	Maximum.	Average.	Maximum	Total.	Total.	Total.	Av. annual.	
			Years.	*Acres.*	*Feet.*	*Trees.*	*Inches.*	*Inches.*	*Feet.*	*Feet.*	*Cu. ft.*	*Cords.*	*Board ft.*	*Cords.*	
Kellogg	Loara	Orange	⅔	0.4	8 x 8	2,335	1.3	3	24	30	186.0	2.1		3.2	
do	do	do	1½	.5	8 x 8	1,122	2.3	4	31	39	502.0	5.6		3.7	
Thaxter	Florence	Los Angeles	2	1.0	8 x 8	1,029	2.1	3	27	33	419.8	4.7		2.4	
Nadeau	do	do	2	1.0	8 x 8	948	2.4	5	28	37	449.5	5.0		2.5	
Hoff	do	do	2	1.0	9 x 9	869	2.9	5	40	55	776.4	8.6		4.3	
Becket	Orange	Orange	2½	1.0	10 x10	526	3.1	6	33	45	490.4	5.4		2.2	
Thaxter	Florence	Los Angeles	3	1.0	8 x 8	1,486	2.7	5	36	46	1,017.7	11.3		3.8	
Cuthbert	Long Beach	do	3	.5	8 x 8	1,400	2.7	5	35	46	1,000.2	11.1		3.7	
Hoff	Florence	do	3	1.0	9 x 9	1,196	3.3	7	44	90	1,523.6	16.9		5.6	
Thaxter	do	do	3	1.0	8 x 8	1,190	2.8	8	37	46	899.8	10.0		3.3	
Dominion	Compton	do	3	1.0	9 x 9	983	2.8	6	34	49	721.5	8.0		2.7	
do	do	do	3	1.0	9 x 9	907	2.6	6	33	49	615.4	6.8		2.3	
do	do	do	3	1.0	9 x 9	802	2.5	5	33	49	504.4	5.6		1.9	
Becket	Orange	Orange	3	1.0	10 x10	794	2.9	6	39	61	734.6	8.2		2.7	
Hoff	Florence	Los Angeles	3	1.0	9 x 9	788	3.2	6	43	90	877.1	9.7		3.2	
Becket	Orange	Orange	3	1.0	10 x10	751	3.9	8	47	71	1,240.8	13.8		4.6	
Nadeau	Florence	Los Angeles	4	1.0	10 x10	1,399	3.2	7	39	58	1,525.9	17.0	5	4.3	
do	do	do	4	1.0	8 x 8	1,350	3.1	7	38	58	1,360.5	15.1	15	3.8	
do	do	do	4	1.0	8 x 8	1,172	3.5	7	46	65	1,514.1	16.8	20	4.2	
Dominion	Compton	do	4	.5	9 x 9	1,158	3.0	6	36	49	1,144.0	12.7		3.2	
Nadeau	Florence	do	4	1.0	8 x 8	1,139	3.2	7	44	65	1,279.8	14.2	15	3.6	
do	do	do	4	1.0	8 x 8	1,131	3.0	7	43	65	1,108.8	12.3	5	3.1	
do	do	do	4	1.0	8 x 8	1,006	3.2	7	44	65	1,132.1	12.6	5	3.2	
Hoff	do	do	4	1.0	9 x 9	888	4.2	10	52	90	2,019.3	22.4	455	5.6	
Nadeau	do	do	4	1.0	8 x 8	830	3.7	6	42	58	1,243.0	13.8		3.5	
Hoff	do	do	4	1.0	9 x 9	824	4.1	11	51	90	1,748.2	19.4	700	4.9	
Cuthbert	Long Beach	do	4½	1.0	8 x 8	1,113	3.4	8	44	64	1,491.8	16.6	40	3.7	
Thaxter	Florence	do	5	1.0	8 x 8	1,441	3.6	9	55	91	2,606.0	29.0	555	5.8	
do	do	do	5	1.0	8 x 8	1,378	4.2	11	58	91	3,542.7	39.4	2,380	7.9	
Nadeau	do	do	5	1.0	8 x 8	1,141	3.9	10	49	77	2,158.4	24.0	780	4.8	

do	do	do	5	1.0	8 x 8	1,126	3.1	7	42	77	1,254.1	13.9	30	2.8	
Hoff	do	do	5	1.0	9 x 9	1,017	4.5	9	55	90	2,703.5	30.0	1,225	6.0	
Becket	Orange	Orange	5	1.0	10 x10	838	4.6	9	57	90	2,401.7	26.7	1,075	5.3	
Sexton	Compton	Los Angeles	6	1.0	8 x 8	1,227	5.0	12	70	121	5,343.5	59.4	6,650	9.9	
Thaxter	Florence	do	6	1.0	10 x10	923	4.0	9	49	73	1,810.8	20.1	270	3.4	
do	do	do	6	1.0	8 x 8	889	5.1	12	68	95	3,625.6	40.3	4,560	6.7	
Becket	Orange	Orange	6	1.0	10 x10	830	4.7	10	59	98	2,538.8	28.2	1,985	4.7	
McDonald	Wilmington	Los Angeles	6	1.0	Irregular.	631	3.0	7	32	46	456.1	5.1	10	.9	
Thaxter	Florence	do	6	1.0	10 x10	479	4.6	11	53	73	1,247.7	13.9	495	2.3	
Carson	Wilmington	do	7	1.0	8 x 8	1,655	3.9	9	55	89	3,745.5	41.6	785	5.9	
Nadeau	Florence	do	7	1.0	8 x 8	1,491	4.1	10	54	84	3,258.5	36.2	1,835	5.2	
Carson	Wilmington	do	7	1.0	8 x 8	1,476	4.2	9	60	87	3,765.8	41.8	1,590	6.0	
Thaxter	Florence	do	7	1.0	8 x 8	1,334	4.0	8	62	110	3,529.2	39.2	675	5.6	
Nadeau	do	do	7	1.0	8 x 8	1,233	3.7	9	48	84	1,977.6	22.0	345	3.1	
Thaxter	do	do	7	1.0	8 x 8	1,183	4.5	11	66	110	4.076.2	45.3	2,890	6.5	
do	do	do	7	1.0	8 x 8	990	4.8	11	68	110	3,898.4	43.3	3,935	6.2	
Dorr	Santa Fe Spgs.	do	8	1.0	8 x 8	1,473	4.5	11	65	121	5,110.7	56.8	5,475	7.1	
Holden	Garden Grove	Orange	8	1.0	Irregular.	1,036	4.6	12	60	100	3,389.6	37.7	2,655	4.7	
Adams	Orange	do	8	.3	8 x 8	907	2.9	5	36	50	740.3	8.2		1.0	
do	do	do	8	3	8 x 8	780	3.2	6	40	56	871.3	9.7		1.2	
do	do	do	8	.3	8 x 8	683	3.6	7	43	56	932.3	10.4	17	1.3	
Thaxter	Florence	Los Angeles	9	1.0	10 x10	1,087	4.8	13	62	117	3,924.2	43.6	3,295	4.8	
do	do	do	9	1.0	10 x10	1,076	4.4	11	58	117	3,204.3	35.6	2,585	4.0	
do	do	do	9	1.0	10 x10	713	5.6	12	70	117	3,713.8	41.3	5,745	4.6	
Woodhead	Santa Fe Spgs.	do	16	.3	8 x 8	573	8.5	16	95	162	9,466.7	105 2	29,533	6.6	Thinned.

TABLE 9.—Growth and Yield of Blue Gum Plantations.

Sprout growth—Clay-loam soil.

Name of Grove.	Location.		Age.	Area measured.	Original spacing.	Present stand per acre.	Diameter.		Height.		Yield per Acre.				Remarks.
	Town.	County.					Average.	Maximum.	Average.	Maximum.	Total.	Total.	Total.	Av. annual.	
			Years.	*Acres.*	*Feet.*	*Trees.*	*Inches.*	*Inches.*	*Feet.*	*Feet.*	*Cu ft.*	*Cords.*	*Board ft.*	*Cords.*	
Corcoran	Garden Grove	Orange	2/3	0.5	10 x 10	1,218	1.8	3	26	34	359.2	4.0		6.0	
Nichol	Santa Fe Spgs.	Los Angeles	2	.5	8 x 8	1,764	1.8	3	20	36	145.8	1.6		.8	
Baker	do	do	2	.2	6 x 10	1,595	2.1	3	27	36	703.0	7.8		3.9	
Nichol	do	do	2	1.0	8 x 8	824	2.2	3	30	38	352.2	3.9		2.0	
Baker	do	do	3	.3	10 x 6	1,333	2.7	5	42	60	1,424.7	15.8		5.3	
Alamitos	Long Beach	do	3	1.0	9 x 9	1,128	2.9	6	39	56	1,140.0	12.7		4.1	
do	do	do	4	1.0	8 x 8	1,742	2.8	6	43	73	2,019.0	22.4		5.6	
Baker	Santa Fe Spgs.	do	4	.3	6 x 10	1,437	3.5	7	47	76	2,182.3	24.2	267	6.1	
Alamitos	Long Beach	do	4	1.0	9 x 9	1,268	3.7	7	46	65	1.681.9	20.7	95	5.2	
Dominion	Compton	do	4	1.0	9 x 9	1,145	3.3	7	40	56	1,404.5	15.6	5	3.9	
do	do	do	4	1.0	9 x 9	1,025	3.5	7	44	56	1,357.1	15.1	5	3.8	
Cuthbert	Long Beach	do	4 1/4	.5	8 x 8	1,150	3.3	7	33	64	1,394.0	15.5	10	3.4	
Bank	Los Angeles	do	5	1.5	6 x 10	1,823	2.1	5	30	102	960.8	10.7	217	2.1	
Stewart	Compton	do	5	.5	8 x 8	1,288	4.3	8	59	92	4,062.0	45.1	3,480	9.0	
Woodhead	Santa Fe Spgs.	do	5	.5	8 x 8	1,238	4.4	8	63	94	4,199.6	46.7	3,909	9.3	
Nichol	do	do	5	1.0	8 x 8	1,151	2.8	6	42	72	1,070.6	11.9		2.4	
Baker	do	do	5	.2	10 x 6	1,060	4.2	8	64	85	3,022.5	33.6	1,450	6.7	
Nichol	do	do	5	1.0	8 x 8	1,019	2.7	7	41	72	852,3	9.5	10	1.9	
Corcoran	Garden Grove	Orange	5	.3	10 x 10	857	3.9	8	47	61	1,456.3	16.2	67	3.2	
Gunn	Santa Fe Spgs.	Los Angeles	5 1/3	1.0	12 x 6	1,341	3.6	8	51	84	2,169.3	24.2	230	4.4	
do	do	do	5 1/2	1.0	12 x 6	1,321	3.7	8	52	84	2,273.1	25.3	200	4.6	
Holden	Garden Grove	Orange	6	.5	8 x 8	784	3.9	8	47	74	1,401.4	15.6	140	2.6	
Doty	Compton	Los Angeles	7 1/3	1.0	5 x 10	1,509	3.8	10	57	100	3,638.1	40.4	2,025	5.4	
do	do	do	7 1/2	1.0	5 x 10	1,398	3.9	10	57	100	3,458.9	37.3	1,530	5.1	
Dorr	Santa Fe Spgs.	do	8	1.0	8 x 8	1,389	4.3	12	64	121	4,404.0	48.9	4,010	6.1	
Gunn	do	do	8	1.0	12 x 6	1,284	4.1	10	60	97	3,435.2	38.2	1,465	4.8	
Walton	Compton	do	8 1/3	1.0	8 x 8	895	4.4	8	55	82	2,233.2	24.8	345	3.0	
McDonald	El Cajon	San Diego	9	1.0	10 x 12	534	6.9	24	78	148	4,793.5	53.3	10,565	5.9	

TABLE 10.—Growth and Yield of Blue Gum Plantations.

Sprout growth—Adobe soil.

Name of Grove.	Location.		Age.	Area measured.	Original spacing.	Present stand per acre.	Diameter.		Height.		Yield per Acre.				Remarks.
	Town.	County.					Average.	Maximum.	Average.	Maximum.	Total.	Total.	Total.	Av. annual.	
			Years.	*Acres.*	*Feet.*	*Trees.*	*Inches.*	*Inches.*	*Feet.*	*Feet.*	*Cu. ft.*	*Cords.*	*Board ft.*	*Cords.*	
Hazard	Los Angeles	Los Angeles	1⅜	1.0	8 x 8	775	2.3	5	26	37	356.0	4.0	.....	2.4	
do	do	do	1⅜	1.0	10 x 10	729	2.1	3	22	32	297.0	3.3	.....	2.0	
do	do	do	1⅜	1.0	10 x 10	550	2.1	3	24	32	225.4	2.5	.....	1.4	
do	do	do	1⅜	1.0	10 x 10	488	2.1	3	22	32	202.6	2.3	.....	1.4	
do	do	do	1⅜	1.0	10 x 10	247	2.2	4	25	32	104.8	1.2	.....	.7	Burned.
do	do	do	2	1.0	10 x 10	209	2.0	3	21	28	81.6	.9	.....	.5	Burned.
do	do	do	2¼	1.0	8 x 8	805	2.4	5	28	39	385.0	4.3	.....	1.9	
do	do	do	2¼	1.0	8 x 8	544	2.4	4	28	39	266.2	3.0	.....	1.3	
do	do	do	2½	1.0	8 x 8	761	2.3	4	28	42	345.6	3.8	.....	1.5	
Murphy	Compton	do	3	.8	8 x 8	1,539	2.8	5	36	47	1,135.4	12.6	.....	4.2	
Hazard	Los Angeles	do	3	1.0	10 x 10	1,481	1.6	3	22	34	275.4	3.1	.....	1.0	
Alamitos	Long Beach	do	3	1.0	8 x 10	1,480	2.8	6	38	52	1,242.5	13.8	.....	4.6	
do	do	do	3	1.0	8 x 10	1,180	2 8	6	38	52	978.6	10.9	.....	3.6	
Hazard	Los Angeles	do	3	1.0	10 x 10	889	2.0	3	25	37	359.6	4.0	.....	1.3	
do	do	do	3	1.0	10 x 10	859	2.2	4	26	39	416.1	4.6	.....	1.5	
do	do	do	3	1.0	10 x 10	711	2.4	5	29	43	344.4	3.8	.....	1.3	
do	do	do	3	1.0	10 x 10	696	2.3	5	27	39	351.1	3.9	.....	1.3	
do	do	do	3	1.0	10 x 10	677	2.3	4	28	41	306.8	3.4	.....	1.1	
do	do	do	3	1.0	10 x 10	672	2.2	3	26	34	204.6	3.3	.....	1.1	
do	do	do	3	1.0	10 x 10	559	2.3	4	28	41	249.0	2.8	.....	.9	
do	do	do	3	1.0	10 x 10	518	2.2	4	27	42	228.8	2.5	.....	.8	
do	do	do	3	1.0	10 x 10	404	2.7	5	31	40	233.9	2.6	.....	.9	
Alamitos	Long Beach	do	4	1.0	8 x 10	1,413	3.4	7	49	71	2,226.1	24.7	30	6.2	
Steele	Compton	do	4	1.0	8 x 8	1,409	4.1	8	54	85	3,364.9	37.4	2,150	9.3	
Hazard	Los Angeles	do	4	1.0	10 x 10	557	2.5	5	31	44	286.0	3.2	.....	.8	Burned.
do	do	do	4	1.0	10 x 10	551	2.5	6	31	41	299.2	3.3	.....	.8	Burned.
do	do	do	4	1.0	10 x 10	524	2.6	5	29	46	296.4	3.3	.....	.8	Burned.
do	do	do	4	1.0	10 x 10	494	2.3	4	29	44	232.0	2.6	.....	.7	Burned.
Alamitos	Long Beach	do	4	1.0	10 x 10	368	3.7	5	33	40	247.6	2.8	.....	.7	Burned.
do	do	do	4	1.0	9 x 9	326	4.0	7	36	56	426.1	4.7	10	1.2	Burned.
do	do	do	4	1.0	10 x 10	321	3.6	7	32	46	313.3	3.5	25	.9	Burned.
do	do	do	4	1.0	9 x 9	288	4.3	8	37	56	473.4	5.3	140	1.3	Burned.

TABLE 10.—Growth and Yield of Blue Gum Plantations—*Continued.*

Sprout growth—Adobe soil.

Name of Grove.	Location.		Age.	Area measured.	Original spacing.	Present stand per acre.	Diameter.		Height.		Yield per Acre.				Remarks.
	Town.	County.					Average.	Maximum.	Average.	Maximum.	Total.	Total.	Total.	Av. annual.	
			Years.	*Acres.*	*Feet.*	*Trees.*	*Inches.*	*Inches.*	*Feet.*	*Feet.*	*Cu Ft.*	*Cords.*	*Board ft.*	*Cords*	
Hazard	Los Angeles	Los Angeles	4½	1.0	8 x 8	742	2.4	6	30	57	428.1	4.8	———	1.1	
do	do	do	4½	.5	8 x 8	694	2.7	6	27	45	414.4	4.6	———	1.0	
Alamitos	Long Beach	do	5	1.0	8 x 8	1,659	3.4	8	50	95	2,632.9	29.3	340	5.9	
do	do	do	5	1.0	8 x 8	1,644	3.5	8	50	95	2,848.8	31.7	370	6.3	
Sexton	Compton	do	5	1.0	8 x 8	1,331	4.2	10	60	106	3,668.7	40.8	1,815	8.2	
Hazard	Los Angeles	do	5	1.0	8 x 10	1,288	2.2	7	23	43	436.5	4.9	5	1.0	
Alamitos	Long Beach	do	5	1.0	8 x 8	1,028	4.0	9	50	80	1,895.1	21.1	295	4.2	
do	do	do	5	1.0	8 x 8	978	3.9	8	50	80	1,697.2	18.9	180	3.8	
Hazard	Los Angeles	do	5	1.0	8 x 10	789	2.5	6	28	50	390.2	4.3	———	.9	
Sampson	do	do	5	.1	10 x 10	710	4.2	8	45	79	1,416.0	15.6	400	3.1	
Hazard	do	do	5	1.0	8 x 10	658	2.7	5	29	50	362.5	4.0	———	.8	
do	do	do	5	1.0	8 x 10	583	2.7	6	28	45	356.1	4.0	———	.8	
do	do	do	5	1.0	8 x 10	538	2.6	6	27	45	294.3	3.3	———	.7	
do	do	do	5	1.0	8 x 10	519	2.6	5	27	45	278.6	3.1	———	.6	
Dupuy	do	do	5½	.5	8 x 10	1,018	2.9	5	40	67	937.4	10.4	———	1.9	
do	do	do	5½	1.0	10 x 12	623	3.1	6	41	67	682.1	7.6	———	1.4	
do	do	do	5½	1.0	10 x 12	485	3.4	7	44	67	663.4	7.4	5	1.3	
Montague	Compton	do	6	1.0	8 x 8	1,602	3.3	8	45	81	1,226.1	24.7	65	4.1	
Sampson	Los Angeles	do	6	.2	8 x 8	1,290	4.0	8	52	90	2,745.0	30.5	900	5.1	
Glass	Compton	do	7	.5	8 x 8	2,942	3.8	8	51	85	5,593.2	62.1	870	8.9	
Montague	do	do	7	1.0	8 x 8	1,513	3.6	9	51	100	3,157.6	35.1	660	5.0	
Rosecrans	Gardena	do	7	1.0	10 x 10	1,313	3.8	8	53	80	2,551.0	28.3	220	4.0	
Hazard	Los Angeles	do	7	1.0	10 x 10	562	4.3	10	45	68	1,224.1	13.6	335	1.9	
Doty	Compton	do	7½	1.0	10 x 5	1,624	4.1	11	60	109	4,330.4	48.1	2,075	6.4	
do	do	do	7½	1.0	10 x 5	1,601	4.4	11	62	109	5,161.2	57.3	3,490	7.6	
do	do	do	7½	1.0	10 x 5	1,384	4.4	10	62	109	4,240.6	47.1	1,955	6.3	
do	do	do	7½	1.0	10 x 5	1,367	4.5	11	63	109	4,513.0	50.1	3,180	6.7	
Montague	Compton	do	8	1.0	8 x 8	1,528	4.0	10	57	100	3,889.0	43.2	945	5.4	
Rosecrans	Gardena	do	8	1.0	10 x 10	988	3.5	7	50	80	1,751.2	19.5	20	2.4	
do	do	do	11	1.0	10 x 10	1,022	3.1	9	37	65	1,049.6	11.7	45	1.1	
Montague	Compton	do	12	1.0	5 x 5	736	6.1	13	85	156	5,452.9	60.6	10,650	5.1	Thinned.
Gill	Berkeley	Alameda	13	.3	4 x 4	1,287	4.4	8	53	71	3,104.3	34.5	233	2.7	

The blue gum has gained the reputation of possessing a phenomenal rate of growth, and by an inspection of the figures of average and maximum growth this may be appreciated. Under favorable conditions trees in seedling plantations have reached a maximum development of 5 inches in diameter and 67 feet in height in four years. This represents an average of 17 feet height growth per year, though a growth of 10 to 15 feet in height yearly is the general average. In the height of the first growing season seedlings have frequently been observed to make an average height growth of 6 inches a day. The most rapid seedling growth noted was made by a tree which in nine years reached a height of 125 feet and a diameter of 36 inches. As is usual among vigorously sprouting trees, sprouts upon old root systems surpass seedlings in rate of growth. Ages are occasionally recorded in the sprout tables in fractions of a year, representing the number of months' growth. In eight months a maximum diameter of 3 inches and 34 feet height has been reached while in three years a maximum diameter of 7 inches and 70 feet in height has been attained.

In different groves and even upon different sample plots in the same grove a considerable variation in yield is shown, often ranging from maximum to minimum upon the same soil. This variation is determined to some extent by the character of the planting site, the permeability of the soil and the moisture available, and partly by the density of planting. It is governed mainly, however, by the density of the present stand of trees in consequence of the treatment accorded after planting. The deterioration of a grove because of lack of cultivation or protection, or from neglect after cutting, is sufficient to reduce the yield to a minimum on sites capable of maximum production. Unfortunately, the variation of this factor prevents its use in the construction of tables.

Sufficient data are not available from the measurements of young plantations to construct a complete table, giving the yield of poles and piles at different ages. A tree with a butt diameter of 9 inches is required to produce a pole of the smallest merchantable size, namely, 20 feet long with a top diameter of 7 inches. Sprout stands are usually cut before eight years of age, and in this time the yield of poles is low, since few trees in dense sprout stands attain the butt diameter required. The acre yield of poles having a top diameter of 7 inches from two representative seedling plantations of maximum growth has been estimated as follows:

TABLE 11.—Yield of Poles per Acre.

No.	Age.	20 Feet.	30 Feet.	40 Feet.	50 Feet.	60 Feet.	Total.
1	16	37	35	21	17	13	123
2	16	30	27	16	9	8	90

Each of these acres yielded, in addition, 30 cords of fuelwood.

ECONOMIC PLANTING.

Windbreaks. The protection afforded by windbreaks must be reckoned an important factor in the horticultural development of California. The necessity of windbreak protection in many sections of the State is so great that without it certain crops can not be raised. Many trees are suitable for windbreak planting, yet California farmers are united in the opinion that Monterey cypress is the only competitor of blue gum and other eucalypts for this purpose.

The eucalypts excel other species in their towering height and rapid growth, thus affording a protection most quickly. The trees are slender and open-crowned, but double rows of trees or close planting provide a strong check against the wind. The blue gum surpasses all others for this purpose, and should be used throughout its thermal range. Its tall, limber shafts yield before the wind and act as a cushion to deflect the air currents upward over an orchard, while ordinary windbreak trees form a solid wall on the leeward side of which the wind draws down and forms eddies.

In the open valleys of Southern California Eucalyptus windbreaks have become a prominent feature of the landscape and their presence is recognized as indispensable to successful orcharding. To their protection may be attributed in large measure the fine quality of the California citrus crop, and in this way these trees return vast sums annually to the State. In citrus sections, such as the Santa Paula, San Fernando, San Bernardino, San Gabriel and Santa Ana valleys, windbreaks alone render the production of citrus fruits profitable. In unprotected orchards, nearly the entire crop is frequently blown from the trees, or so scarred and bruised that the grade and market value are much reduced. Orchard trees are even broken or partially defoliated during severe storms. To avert this danger and improve the grade of fruits, windbreak planting is being greatly extended even in old citrus sections.

More extensive shelter-planting is advisable in many sections of the State, notably in the Sacramento and San Joaquin valleys. Hitherto windbreaks have been used chiefly to shelter citrus orchards, but now they are coming into favor to shelter vineyards, deciduous orchards, olives and walnuts. Much more extensive development may be attained by their use in sections where strong or cold winds are felt. Along the coast, shelter from sea winds is found to increase the yield of grain crops.

Eucalyptus windbreaks in some sections have changed the aspect of the country and by moderating the winds have greatly improved the climate. Waste, sandy, stretches have been turned to productive agricultural use. In the region of Oxnard the towering windbreak lines hold the loose sand from drifting before the steady sea winds, and

the region has thus become, largely through their agency, an important center of sugar-beet production.

PLATE 6. Avenue planted with blue gum trees in San Bernardino Valley. Trees serve as windbreaks for citrus orchards. They are 12 to 20 inches in diameter and 125 feet high at 12 to 15 years of age.

Along the coast the planting of shelter belts for the protection of towns has been practiced to some extent, to the greater comfort of the

resident population. This branch of shelter planting should be extended particularly on the windward side of seaport towns, where windbreaks in proper places will protect anchored vessels and facilitate shipping. Windbreak planting should also be practiced in many coast localities to hold the sand from drifting inland and covering up valuable agricultural land, crops and dwellings.

Fully grown Eucalyptus windbreaks running at right angles to the direction of the prevailing winds every quarter mile across level country afford effective protection. Near the foothills the lines should be closer together, since the winds blowing down from the mountains gain greater velocity. Through orchards they are generally located every 100 or 200 feet. Though a heavy wind may be swaying the tops of the trees in a windbreak, usually there is hardly any stir in the air near the ground within a well-protected citrus orchard. The wind is never sufficiently strong to whip the foliage or injure the fruit.

All crops protected in this way suffer less from winds than open-grown crops. They remain uninjured when unprotected crops are blighted, unless the arrangement of the windbreaks results in defective wind-drainage and the formation of a frost hole. After a cold night, during frosty winter months, the shade cast by a windbreak on the eastern side of an orchard will often prevent injury from too rapid thawing.

Citrus trees are unfavorably affected by shade, hence the yield of fruit of rows adjoining a windbreak is often lessened. Windbreaks on the north and east sides of an orchard are less harmful than on the west or south side. Under ordinary conditions the south side of an orchard should be left open for wind-drainage.

The best spacing of gum trees for windbreaks is 4 feet apart each way in double rows. The trees of the second row should be planted opposite the open spaces in the first row. Double, or even triple, rows should be planted where the winds are severe. Triple rows will always be adequate for crop protection, though shelter belts from 10 to 20 rows wide may be advisable to protect from strong sea winds.

Monterey cypress is frequently planted alternately or in double rows with eucalypts to maintain a dense shelter near the ground, since the gum trees clear the lower stem with later growth, giving access to the winds. This combination is an excellent one, since great density is united with towering height. The cypress is well adapted to this use by its tolerance of shade. Cypress and eucalypts should be planted in separate rows and not alternated in the same row, the cypress being located on the windward side of the line, excepting on the north side of a field, where it should be planted on the south side of the line to receive more light.

On irrigated land trees are not compelled to root deeply for moisture, hence they maintain a very shallow root system. If a Eucalyptus windbreak surrounding irrigated land is not irrigated, its roots will extend to adjoining orchards and appropriate moisture from them to supply its own needs. The area drawn upon depends upon the size of the windbreak, but usually it is not greater than 50 feet each way.

To prevent this, wide root extension must be limited and the sheltering trees forced to root into deeper soil layers. This can be accomplished without injury to the shelter belts, by running a parallel trench 6 to 10 feet from them. The trench should be dug 3 or 4 feet deep, cutting off the surface roots of the gum trees, then refilled to prevent the roots from dipping beneath it to seek the orchard. The roots will then spread out in the loosened soil of the trench, which should be reopened about every second year to restrain their extension beyond it. The result is to compel deep rooting, which is attested in numerous orchards by the heavy production of citrus trees in rows adjacent to the windbreak.

Commercial Plantations. With the exception of a few small, scattered groves of black locust, planting for timber production in California has been confined to the eucalypts and chiefly to the blue gum. This species has been grown extensively in Southern California for fuel, and except for small amounts of oak, juniper, mesquite and pine has supplied the section for the past thirty years.

The returns on investments in Eucalyptus plantations have been generous, in many cases exceeding those received from equal areas under cultivation in orchards or agricultural crops. Groves set out in the fertile Los Angeles valley have yielded from 50 to 80 cords per acre at every cutting. Yields of 75 cords per acre every seven or eight years have been frequent.

At the present time there are several thousand acres in California planted to Eucalyptus. The following is a partial list of the larger fuelwood groves:

Owner.	*Location.*	*Acreage.*
Cooper	Ellwood	200
Bennett	Del Mar	200
Nadeau	Florence	115
Meecham	Petaluma	100
Varrick	Orange	90
Hazard	Los Angeles	90
Thaxter	Florence	80
Nichol	Santa Fe Springs	80
Smith	Berkeley	80
Bixby	Long Beach	80
Rosencrans	Gardena	80
Gunn	Santa Fe Springs	50
Hough	Huntington Park	40
Sexton	Compton	40
Kellam	Compton	40

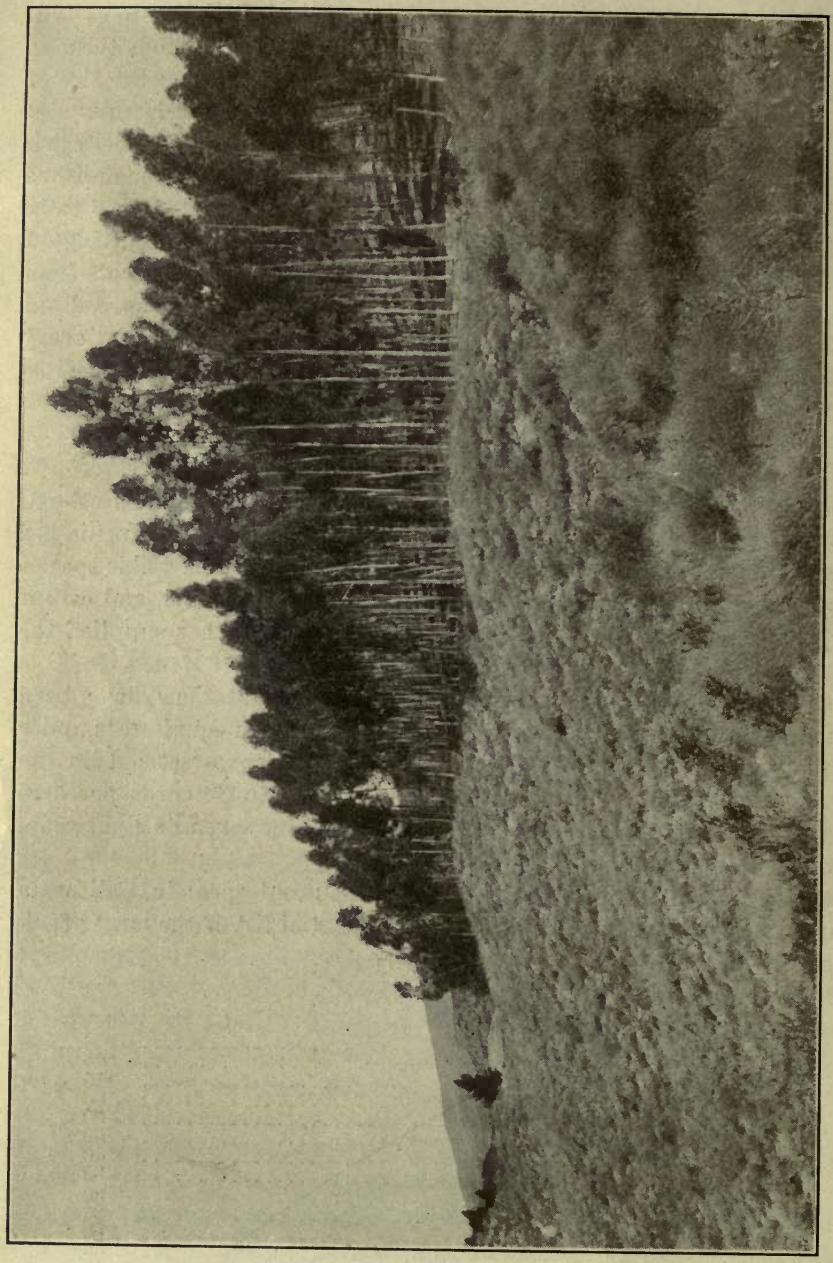

PLATE 7. Stand of sugar gum 14 years old planted on a chaparral slope in the Sierra Madre foothills. Trees 6 to 12 inches in diameter and some over 100 feet tall.

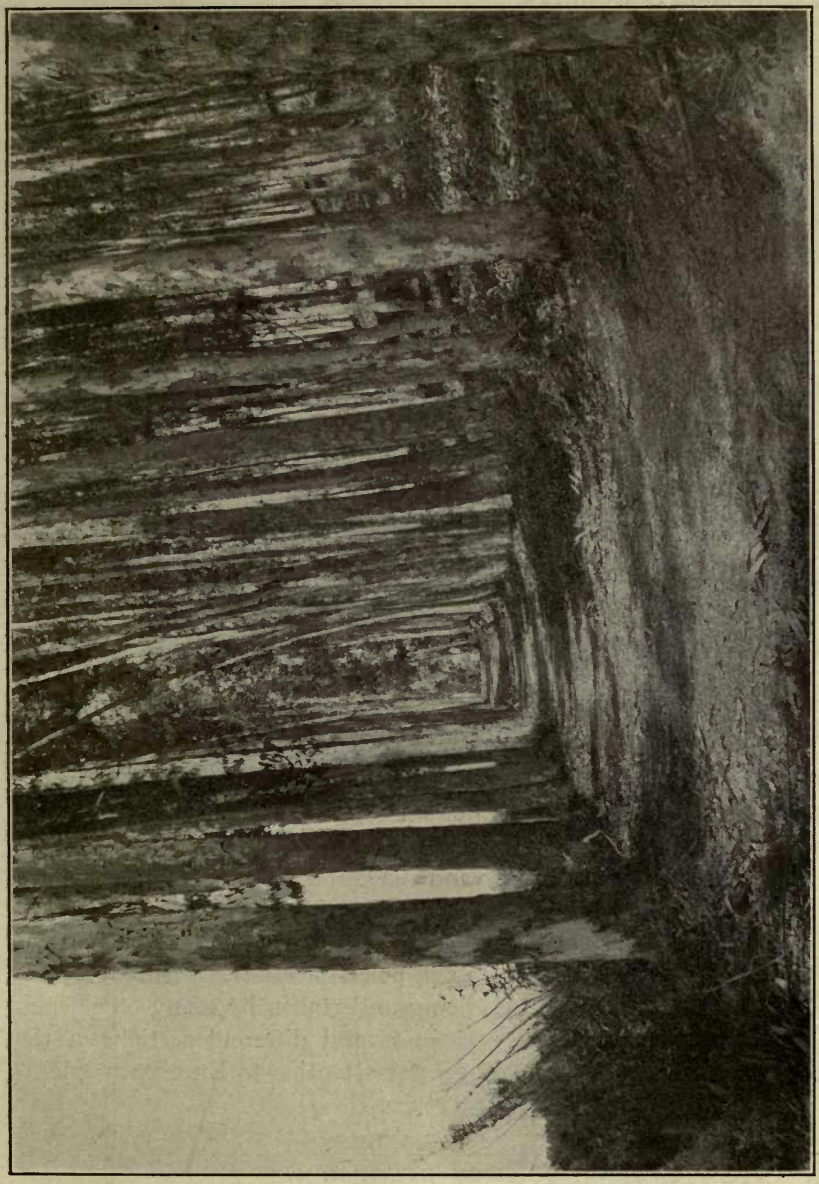

PLATE 8. Interior of a 14-year-old grove of sugar gum planted in the foothills of the Sierra Madre Mountains at an elevation of over 2,000 feet. Good forest conditions established.

In recent years several plantations of large size have been established in anticipation of a market for gum wood of merchantable size or for poles, piles, and railroad ties.

The plantation of Mr. Dwight Whiting at El Toro, Orange County, now covering 1,000 acres, is the most extensive commercial plantation in the State. Its oldest portions are now three years old. Planting will be continued annually until a forest of 4,000 acres is established. The plantation consists almost entirely of gray, red, and sugar gums.

The Bixby Company of Long Beach has begun the planting of an area of about 3,000 acres near Orange, Orange County. Blue, gray, lemon and sugar gums, in varying proportions, will be used.

The Santa Fe Railroad Company has recently acquired a tract of 8,600 acres in San Diego County, which will be devoted to Eucalyptus production to supply the company with poles, piles, ties, and other timber. The gray, lemon, sugar and blue gums will be planted.

The Union Lumber Company, located at Fort Bragg, Mendocino County, is the first lumber organization to become interested in the commercial planting of Eucalyptus. This company has cut over an area of 10,000 to 15,000 acres of redwood during the course of its operations. The logged redwood lands do not naturally restock with merchantable timber, because space between stumps afford too much entrance to lateral light, causing the production of limbs and hence knotty timber. Eucalyptus will be planted between the clumps of coppice shoots to cut off the lateral light and force the redwood second-growth into height development.

The Central Counties Land Company, which has recently acquired extensive holdings on and near Clear Lake, Lake County, has begun the propagation of blue and sugar gum seedlings for planting on its lands both for ornamental and commercial purposes.

The Pacific Electric Company and the Ontario Power Company have recently acquired smaller tracts in Riverside and San Bernardino counties, upon which they have begun planting with several species of Eucalyptus to raise tie timbers and poles for electric wiring. Extensive commercial planting is also being undertaken by many other companies and individual landowners in several different sections of the State. It is apparent that much greater attention to Eucalyptus planting may be expected in the near future.

TIMBER UTILIZATION.

Fuelwood. In Southern California the use of gum fuelwood has been most general. Gum cordwood is a staple fuel and may be found on sale in woodyards in most of the valley sections of the State. In the northern valleys it is much less common than in Southern California, owing to

its greater scarcity and the competition of valley oaks, which have been slaughtered regardless of their value for ornament and shade. Fuel oils have supplanted fuelwood to some extent, yet in Southern California, where fuel oils are available, fuelwoods have never been disposed of at a sacrifice.

Eucalyptus wood has high fuel value. It makes a quick, hot fire, hence it is very suitable for cooking purposes and for use in open fireplaces. It burns with a bright blaze and emits a pleasant, aromatic odor. In heating qualities it is hardly inferior to California oak wood. Most consumers are prejudiced in favor of oak wood, however, hence gum wood commands a lower price in the market than oak or mesquite. In different localities the price of gum fuelwood varies from $5 to $14

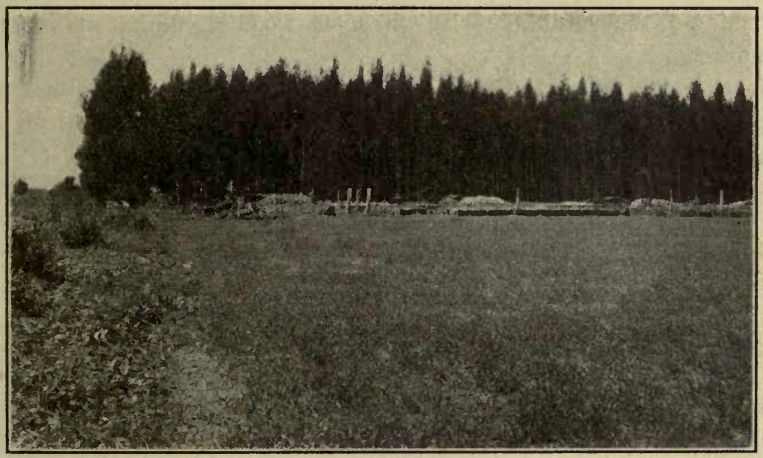

PLATE 9. Cutting a 6-year-old stand of blue gum for fuel. Portable sawing and splitting machine and piled cordwood in foreground. Stand averages 80 feet in height. Five acres cut yielded 350 California cords.

per cord, with tendencies toward the latter. Wood of the slower-growing eucalypts and that of old trees possesses higher value than young wood from quick-growing species. Green gum wood makes poor fuel.

Gum wood is sold by the short cord of 96 instead of 128 cubic feet, two tiers of wood, 10 to 18 inches long, piled 8 feet long and 4 feet high, constituting a cord. Ten-inch wood is generally sold at the same price as 18-inch wood, without protest by the consumer. The wood cut from the rapid-grown gum sprouts is mainly sapwood, which shrinks greatly in drying. A cord will lose 15 per cent or more of its volume in seasoning.

Cordwood for the market is usually cut from tall, slender, sprout-grown trees rarely over 8 inches in diameter. The trees are sawed into fuel lengths without peeling the bark. If left in the round the sticks

do not burn as well as if split. Splitting must not be delayed after cutting, as the wood becomes very hard upon drying. Wood of sugar and red gum is quite straight-grained and splits without difficulty. Blue gum wood, particularly the sap-wood of old, open-grown trees, is very tough and cross-grained. The interlocked fibres must be chopped through in splitting and seasoned blocks defy all attempts to split them with an ax.

A small industry has grown up in Southern California through the cutting of blue gum groves for fuel. Traveling cutting concerns undertake the cutting of groves by contract, employing gangs of choppers and operating portable sawing and splitting machines in working up the product. The cost of cutting varies with the cost of labor from $2 to $3 per cord, and a margin of from $3 to $8 profit is left the owner, according to the advantage with which the wood is sold and its nearness to market.

Green wood should be piled for seasoning away from contact with the ground. The wood decays rapidly in contact with the soil and soon loses its fuel value.

A superior grade of charcoal can be made from gum wood. Where old groves are rooted up after repeated cuttings, the massive stumps are frequently burned for charcoal, and cordwood has likewise been used to some extent for this purpose.

Posts. A supply of strong, durable fence posts is one of the greatest needs of the California rancher. At present, dependence is placed in redwood and to a limited extent in local plantations of black locust. The hardness and strength of Eucalyptus wood would justify its use for posts if it were more durable in contact with the soil. Certain species, notably sugar and red gum, are of average durability.

Round blue gum posts from sapling groves have been used to some extent, but without satisfactory results. Split or sawn posts of more mature timber would doubtless last much longer, but these have not been widely used owing to the difficulty of splitting the wood. It is apparent that Eucalyptus has fallen into disrepute for post purposes without receiving a thorough trial.

Experiments in seasoning and treating Eucalyptus to determine its durability under better treatment have been undertaken recently by the Forest Service in coöperation with the State of California. Thousands of posts, of the size ordinarily used, were cut from young sprout plantations. Some were set green and unpeeled, others peeled and seasoned. Still other posts, green, seasoned, peeled, and unpealed were impregnated with hot creosote for different lengths of time in small portable tanks. They were then given distinguishing marks and set in fence lines in soils of different kinds.

Examinations of the posts will be made from time to time to determine their durability under different methods of treatment. The experiment, when concluded, will demonstrate whether blue gum may be used to advantage for post material.

Red, blue, sugar and red iron bark gums were used. It was found that all yielded to treatment remarkably well. The average cost per post was 6 or 7 cents for preservative alone. To this must be added the minor cost items, labor and wear of apparatus. The greater durability of treated gum posts is still unknown, but judging from the increased life of other inferior woods after treatment, and the known value of creosote as a preservative, it is safe to predict an increased durability all out of proportion to the cost of treatment.

Poles. A large amount of timber is used annually for poles for electric wiring. The increase in value has almost prohibited the use of the much preferred Oregon pine (*Pseudotsuga taxifolia*), and pole timbers of lower grade have come into use. Oregon cedar from which from six to fifteen years' service is obtained, depending on the character of the soil in which the poles are set, is the chief substitute. Experiments are also being conducted looking toward the substitution of yellow pine and yellow cedar. Eucalyptus poles have been tried to a limited extent, and may be expected under treatment to outlast the pole timbers in present use.

Railroad Ties: The development of transcontinental, interurban and urban railways has created a strong demand for timber suitable for ties. Eucalyptus timber has not yet come into general use for ties, although the indications are that it will be used more extensively in the future. The value of the wood for tie use has been tested by the Southern Pacific Company. Some hundreds of ties of California-grown blue gum were laid green and untreated in sandy soil in the roadbed through central Nevada. They exhibited good wearing qualities and the requisite strength, but, through lack of proper seasoning, checked badly, so that in some cases they failed to hold the spikes. At the end of four years the ties showed no signs of decay; after seven years' service some were worthless from decay, but some were sound at the end of eleven years.

The result of the experiment officially reported to the company credited the gum ties with being equal to the best second grade Southern pine, but the experiment was not followed by more extensive use. Gum timber can not compete with the best tie timber in durability, but if the life of gum wood is extended by preservative treatment its wearing qualities will make it a superior tie timber.

With increase in cost of redwood and pine timber, lower grade ties of the more durable eucalypts should find a place in the market. Sea-

soned gray, red and sugar gum timbers are moderately durable and should give longer service than blue gum. Sugar gum is probably the best eucalypt for tie production.

Mine Timbers. Blue and sugar gum have been used with success in timbering mines near Escondido. The gum timber has been found superior to any other obtainable there. Few of the timbers have decayed, although the mines are flooded during a part of each year. Difference in value of the two species has not yet become apparent, but it is probable the sugar gum will prove superior, as it excels blue gum in both strength and durability.

Wharf Piling. The problem of maintaining wharves has become an important one on the Pacific coast. Not only are the best pile timbers very expensive, but they will not resist the attacks of the teredo and limnoria and have to be replaced continually.

Both the teredo and limnoria are troublesome all along the Pacific coast, being carried from port to port by the shipping. The teredo attacks the piling at the ground line, under water, and burrows chambers through the wood. When the piling is unprotected, this source of injury is generally negligible, for the timbers are more speedily eaten off at the water line by the limnoria. The limnoria have no natural enemies in American waters to decimate their numbers, hence they are constantly increasing and becoming more troublesome. Their attacks are particularly severe in the warm waters of the southern ports and in sheltered harbors.

In an attempt to maintain durable wharves, experiments have been made with costly iron and cement piles, but the lower cost and greater ease of setting keeps the wooden pile in favor. Various expensive treating and sheathing experiments have been tried, but preservative processes have failed so far to check the borers. Limnoria will not attack wood which is coated with sand. This fact has been taken advantage of to defeat them by applying a rough cement wash to the exposed surface of the piles. This coating not being elastic, however, fails to prevent the limnoria from entering at season checks and continuing their work under the cement covering. Pile timbers are generally creosoted or oiled, and often wrapped and battened, to increase their period of service, but limnorias attack even creosoted wood. When untreated, piles are generally set unpeeled, as the borers do not work while the bark remains.

Aside from its use for fuel, gum timber has been most extensively used for piling. After extended trial the blue gum pile has been determined the best in use on the Pacific coast. Whenever it can be obtained, contractors and wharf managers discriminate in its favor.

It is attacked and ultimately destroyed by borers, notwithstanding contrary statements. Its superiority seems to lie in its extreme hardness, for when gum and softwood piles are used together in a wharf, the borers concentrate their attack on the softer piles. Experienced

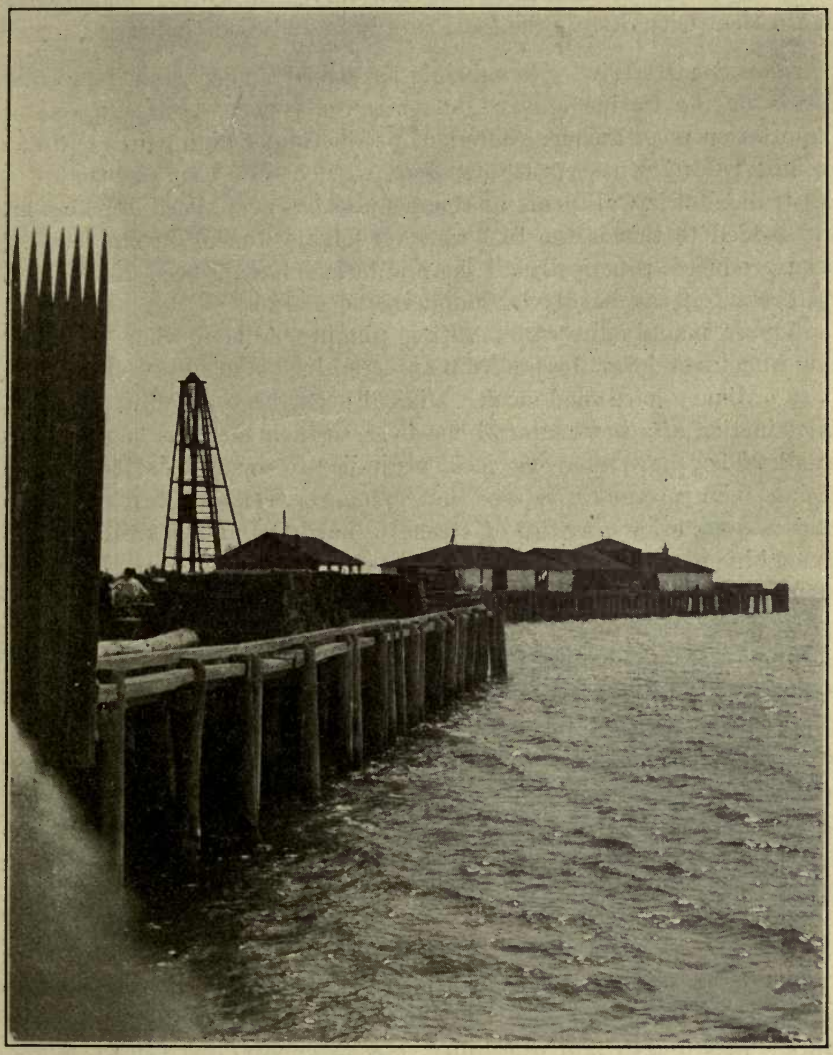

PLATE 10. Blue gum piling in the wharf at Santa Barbara.

users discriminate in favor of piles from old, slow-grown trees cut during the winter and seasoned thoroughly.

Eucalyptus piles in general use are from 30 to 35 feet long and from 12 to 24 inches in diameter. Such piles bring from $5 to $15 apiece on the stump.

Gum piling was first used in the wharf at Santa Barbara. Its use in some other wharves was accidental, but since its successful trial it has been used in the wharves at Crescent City, Oakland, Port Harford, Gaviota, Santa Barbara, Serena, Summerland, Avalon, Oceanside and San Diego. On account of its superior service it is used in the wharf at Crescent City despite the local supply of redwood timber.

Dimension Material. No valuable hardwood timber is native to California or the Pacific coast. Demands for it have been supplied by importation from Eastern centers of production at high prices and high freight rates. Eucalyptus has been widely used for saw-timber in Australia, but in California its commonness has prejudiced users against it. Added to this is the fact that very little dimension material has been produced, practically all the plantations having been cut for fuel. At present it can hardly be found in the market.

Pioneer manufacturers, operating planing mills in San Francisco, Los Angeles and San Jose, have persevered for twenty years in utilizing it as ordinary hardwood stock. Difficulty has been encountered in the introduction of a new material, however, so their business has remained small. They have overcome local prejudice to some extent by guaranteeing their product. Severe and extended trial has proven that it possesses superior qualities of strength, hardness and flexibility. Seasoned blue gum timber has been substituted in San Francisco for orders of maple, hickory, and "ironwood" without the knowledge but to the entire satisfaction of the purchaser.

No fixed stumpage price for Eucalyptus timber prevails. It is bought either by the single tree or at the market price of cordwood. Large trees which contain 4 to 6 cords, or will cut 1,500 to 3,000 feet B. M., are bought for from $12 to $25 per tree. The total cost of stumpage, logging, manufacturing and seasoning is about $20, hence it is apparent that manufacturers can readily undersell Eastern hardwoods. Gum timber has been sold at from $100 to $125 per M, and retails for 12½ cents per foot for finished and 10 cents for rough timber.

QUALITIES OF EUCALYPTUS WOOD.

The timber eucalypts furnish a hardwood possessing qualities similar to those of Eastern hickory and ash. The wood of different species differs in strength and durability, but in general the timber is very strong, heavy and hard, with a close-grain and homogeneous structure.

The specific gravity of the wood of most species is greater than that of water, the dry wood of blue gum averaging over 60 pounds per cubic foot, varying from 50 to 70 pounds, according to the age of the timber. The wood of other species is still heavier. It is very tough, resisting indentation, tension or torsion. This is of advantage, for it

will not crack nor break out under strain at joints or bolt holes. The wood is stiffer and less elastic than Eastern hickory.

The wood of different species ranges in color from white to dark brown. The heart and sapwood of many species is indistinguishable. The heart of blue gum is a little darker than the sapwood, while that of red gum is red or dark brown in color. The grain of blue gum closely resembles that of hickory and ash.

SEASONING.

The difficulties experienced in seasoning Eucalyptus timber have been a great obstacle to its more extensive utilization. It has received an undeserved reputation for warping and checking from many who have used it green or improperly seasoned. It is no more difficult to season than oak, hard maple and many other hardwoods, which are annually cut and seasoned by the million feet in the Eastern States. The success attained by several experienced manufacturers proves that it yields readily to thorough methods.

To insure successful seasoning the trees should be felled between November and March. Sawlogs should be manufactured as soon as possible after cutting, for they check quickly with exposure to sun and winds. When not to be sawn immediately, they should be piled in the shade without peeling. The ends of the logs should be painted to prevent checking.

Ordinarily, sawn lumber should be loose-piled under cover with abundant space for air circulation. The ends of the timbers should be weighted. By this treatment 6 by 8 inch or larger timbers are thoroughly and evenly seasoned without warping or checking, though the wood may shrink considerably during the seasoning process. Inch boards are apt to warp in seasoning, so the lumber is usually sawn into planks. The heartwood is more apt to check than the sapwood.

Air seasoning produces better results than kiln seasoning. Air-dried lumber may be used in a year, but two years' seasoning gives better results and is generally practiced.

USES OF LUMBER.

Vehicle Parts. Blue gum has been extensively used as a substitute for other hardwoods in the manufacture of vehicles. Its strength and elasticity recommend it very highly as a substitute for hickory and ash, which are rapidly becoming scarce. Gum timber is just as durable and nearly as strong as hickory. If kept from contact with the soil, it will not decay under exposure to the weather, and will retain its shape if properly seasoned.

Its usefulness for vehicle parts has been recognized locally for a long time. The ranchers of the Los Angeles and Santa Clara valleys

have used it for poles, shafts, reaches, axles, doubletrees, racks, bolsters, spokes, hubs and felloes and for the wooden parts of plows, harrows and other agricultural implements. Like its first use for piling, Eucalyptus was first employed for vehicle parts by accident.

Recently gum wood was experimentally used for wooden ties on heavy auto trucks. The motors of these vehicles are damaged and bolts are soon cut off by the jar of running on steel rims on city pavements, and expensive sets of rubber tires last but a few months. A wooden tire was devised by bolting seasoned blocks of gum wood, set with the grain vertical, into a patent rim attached to the wheels. The tires have been used successfully for six months without attention or repair, and show few signs of wear. They have been found to break the jar and to take up vibrations as readily as rubber tires.

Insulator Pins. Eucalyptus has practically supplanted black locust wood for insulator pins. This use annually consumes a large part of the manufactured timber product, and in this form alone has California-grown gum timber been exported. Large orders for insulator pins have been filled in Canada and the Eastern States. Gum pins are in use in most of the telephone and power transmission lines in this State, and are used exclusively by leading contractors. Sound pins are still in use after fifteen years' service.

Furniture. Seasoned blue and red gum wood has been used to a limited extent for cabinet work and for the manufacture of furniture. Handsome chairs and tables have been made, which are very strong and do not warp, check or loosen at the joints. The wood takes a splend finish and has been stained to imitate mahogany very closely.

Other Uses. In a few instances unstained panels, showing [illegible] have been used in the interior finishing of houses. The ti[illegible] also been manufactured into flooring and used in place of har[illegible]aple. It has been used for pulley blocks, belt wheels, saw tables, brakeshoes, for levers of house-moving windlasses, and, indeed, most generally where a durable wood of homegeneous structure is required.

BOTANICAL NAMES.

A list of the botanical names of the species mentioned in this report follows:

Common Names.	*Scientific Names.*
Blue Gum	Eucalyptus globulus.
Sugar Gum	Eucalyptus corynocalyx.
Red Gum	Eucalyptus rostrata.
Gray Gum	Eucalyptus tereticornus.
Manna Gum	Eucalyptus viminalis.
Lemon Gum	Eucalyptus citriodora.

CIRCULAR No. 3.

STATE BOARD OF FORESTRY.

G. B. LULL, State Forester.

A BIBLIOGRAPHY OF FORESTRY IN CALIFORNIA

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1908.

STATE BOARD OF FORESTRY.

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CHAS. F. CURRY.....Secretary of State.

U. S. WEBB.....Attorney-General.

G. B. LULL.....State Forester.

A BIBLIOGRAPHY OF FORESTRY IN CALIFORNIA.

INTRODUCTION.

This bibliography of forestry in California attempts to bring together such books, official reports and articles in periodicals as may appear serviceable to the forester or the non-professional student. It does not include the exceedingly large amount of popular writing designed to further the adoption of protective measures, nor descriptive matter of primarily a literary character. Even in its chosen field, it does not pretend to be exhaustive. Important data and discussions, especially in dendrology and forest description, will be found scattered through innumerable botanical, geological, and other scientific books and periodicals. To gather them would involve an amount of labor quite disproportionate to the harvest thus to be collected.

There are a number of periodicals quite indispensable to the student of California forestry, which have not been analyzed because they are provided with such excellent indices, that their California articles may be readily found. Among these are:

Garden and Forest.
The Forestry Quarterly.
Forestry and Irrigation. (This periodical was in its earlier volumes known as The Forester. The publishers have recently announced the contemplated change of name to Conservation.)
Water and Forest.

The trade papers dealing with lumbering and other forest industries will, of course, not be neglected by the student. The most important of these are The American Lumberman (formerly Northwestern Lumberman), and Pacific Coast Wood and Iron.

In the office of the State Forester at Sacramento numerous manuscript notes on California forestry are being collected. In the State Library at Sacramento newspaper clippings on this subject are preserved.

GENERAL PUBLICATIONS.

LAKE BIGLER FORESTRY COMMISSION. Report to Governor George Stoneman.

8°, 15 pp. Sacramento, State Printing Office, 1884.

Recommends, among other things, the appointment of a permanent forestry commission.

STATE BOARD OF FORESTRY, California. First Biennial Report, for the years 1885-86, to Governor George Stoneman.

8°, 238 pp., 6 folding maps. Sacramento, State Printer, 1886.

—— Second Biennial Report, for the years 1885-86, to Governor R. W. Waterman.

8°, 182 pp., 6 folding maps, 24 pl. Sacramento, State Printer, 1888.

—— Third Biennial Report, for the years 1889-90, to Governor R. W. Waterman.

8°, 212 pp., 31 pl. Sacramento, State Printing Office, 1890.

—— Fourth Biennial Report, for the years 1891-92, to Governor H. H. Markham.

8°, 81 pp., 9 pl. Sacramento, State Printer, 1892.

NOTE.—The reports of the first forestry board contain, in addition to the usual administrative data and discussions on forestry propaganda, numerous special articles which are listed below under their appropriate heads. These reports are now out of print and becoming quite scarce. A set is preserved in the State Library.

STATE FORESTER, Report of the, for the period July 12, 1905, to November 30, 1906.

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This is the first report of the new Forestry Board.

DUDLEY, William R. Forestry Notes.

A series of news and comment on matters relating to forestry, in the Sierra Club Bulletin.

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NOTE.—The forestry stations at Santa Monica and Chico were at first under the supervision of the old State Board of Forestry, and reports on their operations are inserted in the four biennial reports of that body. The act abolishing that board (Statutes 1893, p. 229) transferred them to the University of California, and further reports were issued as university publications.

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In: Second Biennial Report California State Board of Forestry, pp. 160-173, 6 maps. 1888.

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In: Second Biennial Report California State Board of Forestry, pp. 144-153. 1888.

DUDLEY, William R. Zonal distribution of trees and shrubs in the Southern Sierra.
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In: Sierra Club Publications, 5: 33-43, January, 1904. 2 pl.
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KINNEY, Abbot. Report on the forests of the Counties of Los Angeles, San Bernardino, and San Diego, California.
In: First Biennial Report California State Board of Forestry, pp. 25-27, 2 maps.

LEIBERG, John B. Forest conditions in the Northern Sierra Nevada, California.
U. S. Geological Survey, professional paper 8, series H, Forestry, 5, p. 194, 12 maps, quarto. Washington, Government Printing Office, 1902.

LEIBERG, John B. San Jacinto Reserve. (Preliminary report.)
In: U. S. Geological Survey, 19th Annual Report, 1897-98. Part V, Forest Reserves, pp. 351-356, 2 pl., large 8°. Washington, Government Printing Office, 1899.

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In: U. S. Geological Survey, 19th Annual Report, 1897-98. Part V, Forest Reserves, pp. 367-370, 2 pl., large 8°. Washington, Government Printing Office, 1899.

LEIBERG, John B. The San Jacinto Forest Reserve.

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PARISH, S. B. Distribution of Southern California trees.

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I. Introduction.
II. The Redwood.
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IV. Causes and results of forest destruction.

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Bull. 38. 8°, 40 pp., frontispiece, 12 pl., 4 text figs., 2 diagr. Washington, Government Printing Office, 1903.

Contains the following articles: *Fisher*, R. T., A study of the redwood; *Shrenk*, H. V., The brown rot disease of redwood; *Hopkins*, A. D., Insect enemies of the redwood.

COOPER, Albert W. Sugar pine and western yellow pine in California.

Forest Service, U. S. Dept. Agric., Bull. 69. "In coöperation with the State of California." 8°, 42 pp., 4 pl. Washington, Government Printing Office, 1906.

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In: Publications of the Sierra Club, 4 : 53-58.

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Silvical leaflet 2. Issued Sept. 5, 1907. 8°, 3 p.

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Silvical leaflet 9. Issued Oct. 7, 1907. 8°, 4 p.

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MUIR, John. Sequoia Forests of California.
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PRICE, W. W. Description of a new grove of Sequoia gigantea.

In: Publications of the Sierra Club, 1: 17-22. (Placer County grove.)

NEEDHAM, James C. Report on the proposal to condemn private holdings.

House Report 461, 58th Congress, 2d session. In Miscellaneous House Reports, vol. 2. (Serial 4578.)

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In: Sierra Club Bull., 3: 182. May, 1900.

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Senate Document, 93, 58th Congress, 2d session. Miscellaneous Senate Documents, vol. 3. (Serial 4588.)

PLUMMER, Fred G. Report on Calaveras groves of Big Trees, California.

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Contains tables showing number and location of Big Trees, timber content, value, and similar information.

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House Report 1426, 60th Congress, 1st session. 1908.

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Sierra Club Bull., 3: 187. May, 1900.

CLARKE, F. L. The Big Basin.

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NOTE.—For description of work done in Redwood Park see Report of State Forester, 1906, p. 34. For attacks made on management on account of cutting, etc., daily papers in spring of 1908, and file of newspaper clippings in State Library.

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Circular 59 (revised), issued October 3, 1907. Forest Planting Leaflet. 8°, 13 pp.

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In: Third Biennial Report State Board of Forestry, pp. 25-31. 1890.

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U. S. Dept. Agriculture. Bureau of Forestry, Bulletin 35, 8°, 106 pp., 91 pl. Washington, Government Printing Office, 1902.

SHINN, Chas. H. Report on Santa Monica Forestry Station.
In: Partial report of work of the agricultural experiment stations of the University of California. 1895-97, pp. 418-426. Also 1897-99, pp. 338, 346, 349.

STATE BOARD OF FORESTRY. A handbook for Eucalyptus planters.
Circular 2. (The pamphlet relating to the Redwood Park counts as circular 1, but is not so numbered.) 8°, 48 pp., 10 pl., mostly set in the text, and one map folded in. Sacramento, State Printing Office, 1907.
Has numerous volume and yield tables.

NOTE.—Numerous silvicultural notes relating to Eucalyptus are found in agricultural and horticultural publications, such as the Reports of the State Agricultural Society, the State Commission of Horticulture, the proceedings of the California Fruit-growers' Association, and others. See also later reports of the Chico and Santa Monica stations, as above.

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NOTE.—For statistics of causes, convictions, etc., see Report of State Forester, 1906, p. 27.

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Bull. 62, 8°, 67 pp. Map of grazing lands and diagram of answers in pocket. Published also as Senate Doc. 189, 58th Cong., 3d session. Washington, Government Printing Office, 1905.

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In: Report of the Regents of the University of California, 1875, pp. 66-68.

MACKIE, W. W. The value of oak leaves for forage.

University of California publications. Agricultural Experiment Station, Bulletin 150, 8°, 21 pp., 11 ill. in text. Berkeley, April, 1908.

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See also below, "National Forests."

NOTE.—The following statistical publications do not refer specifically to California, but contain the most accessible material relating to this State:

Circulars of the U. S. Forest Service relating to forest products of the U. S. (annual), sawmill statistics, mining timber, etc.

Decennial and quinquennial reports of the U. S. Census Bureau on manufactures.

See also files of lumber trade papers, especially Pacific Coast Wood and Iron.

FOREST LAW AND POLICY.

NOTE.—A compilation of California statutes relating to forestry, in force in 1904, may be found in Bull 57, Bureau of Forestry, Forest Laws of the United States. Statutes prior to that time, but no longer in force, must be sought in the official publications of statutes passed at each session of the Legislature, and in the successive editions of the codes.

STATE BOARD OF FORESTRY. Forest laws of California and rules for the prevention of forest fires.

16°, 23 pp. Sacramento, State Printing Office, 1906.

—— Forest laws of California and rules for the prevention of forest fires.

16°, 22 pp. Sacramento, State Printing Office, 1906.

A new edition of preceding publication, made necessary by changes in the law.

BILLS RELATING TO FORESTRY, INTRODUCED IN THE LEGISLATURE OF THE STATE OF CALIFORNIA.

NOTE.—The bills introduced in the Legislature have been preserved for the last ten or twelve sessions in the State Library at Sacramento, and probably in no other place.

The bills introduced in the session of 1903 were as follows:

Senate Bill 20, Ralston: To establish school of forestry in University of California.

Sen. Bill 28, Wolfe: To appoint a commission of waters and forests.

Assembly Bill 74, Johnson: To withdraw from sale tax lands, etc.

Ass. Bill 260, Walsh: To establish school of forestry.

In 1905:

Sen. Bill 33, Wolfe: Providing for investigations in coöperation with United States.

Sen. Bill 342, Ralston: To devote certain claims growing out of civil war to forestry.

Sen. Bill 638, Anderson: To establish a State Board of Forestry.

Sen. Bill 579, Ralston: To establish a school of forestry.

Ass. Bill 80, Estudillo: To provide for investigations jointly with United States.

Ass. Bill 358, Johnstone: To provide for the protection and management of forests.

Ass. Bill 439, McGowan: To devote certain civil war claims to promote forestry.

Ass. Bill 514, Drew: Prescribing treble damages for negligent setting of fires.

Ass. Bill 623, Walsh: Providing for a school of forestry.

Ass. Bill 712, Johnstone: Establishing a state forestry policy.

Ass. Bill 1156, Stanton: Permitting counties to spend money for forestry purposes.

Assembly Joint Resolution 10, Jones (Tuolumne): Relating to grazing of cattle on forest reserves.

In 1907:

Sen. Bill 63, Wolfe: To establish school of forestry.

Sen. Bill 766, Irish: To dispose of moneys received from U. S. Forest Reserves.

BILLS RELATING TO FORESTRY, INTRODUCED IN THE LEGISLATURE OF THE STATE OF CALIFORNIA—*Continued.*

In 1907:

Sen. Bill 900, Willis: Providing for fire lanes, etc., in San Bernardino Forest Reserve.

Ass. Bill 37, Jury: To prevent the destruction of young forest trees.

Ass. Bill 100, Drew: Relating to evidence in actions for firing of woods.

Ass. Bill 101, Drew: Relating to the measure of damages for injuries to timber.

Ass. Bill 102, Drew: Relating to forest fires.

Ass. Bill 103, Drew: Authorizing county boards to appropriate money for forestry purposes.

Ass. Bill 105, Drew: Relating to malicious burning of forests.

Ass. Bill 106, Drew: Relating to the State Board of Forestry.

Ass. Bill 872, McClellan: To dispose of money received from U. S. Forest Reserves.

NOTE.—The name after the number of a bill in the above list refers to the member introducing the measure.

It has not been practicable to list the bills introduced before 1903.

The disposal made of each bill can be found by reference to the Final Calendar of Legislative Business for each session of the Legislature.

ANON. Arbor day bill, to be offered for adoption at the session of the legislature of 1887.

In: First Report California State Board of Forestry, p. 223, 1886.

GAGE, Henry T. Defense of the veto of Senate Bill No. 7.

In: Second Biennial Message of Governor, 1903, p. 9.

KELLY, Allen. Forest reservations.

In: Fourth Biennial Report California State Board of Forestry, pp. 20-22. 1892.

STATE BOARD OF FORESTRY, Memorial of, to Congress of the United States.

In: Third Biennial Report State Board of Forestry, pp. 67-71. 1890.

NATIONAL FORESTS (Forest Reserves).

For legislation relating to National Forests and Forestry by Federal authority in general, see U. S. Statutes at Large, one or two volumes annually. Much of this legislation is to be sought for in the annual appropriation acts for the Agricultural Department.

The boundaries of the National Forests may be learned from the proclamations of the President of United States, establishing or modifying them. These are first issued on quarto sheets, and afterwards printed in the annual volumes of the Statutes at Large. National Parks are created by acts of Congress. See Statutes at Large, and Compiled Statutes of United States. A convenient compilation of recent changes in boundaries will be found in Forestry and Irrigation for August, 1908.

Act regulating entry of agricultural lands within forest reserves, June 11, 1906. Statutes of 59th Congress, session 1, p. 233.

(Excludes Southern California.)

Correspondence and report on extending agricultural entry law to Southern California. 60th Congress, 1st session, Senate Report 533.

Statement of money received by Forest Service from National Forests, during fiscal year 1906-1907. Senate Document 437, 60 Cong. 1, Sess. 1908.

(For California table, see page 2.)

GENERAL LAND OFFICE, U. S. Department of the Interior. Forest Reserve Manual, for the information and use of forest officers.

Approved by the Secretary of the Interior April 12, 1908. 90 pp, 8°. Washington, Government Printing Office, 1902.

This book has been superseded by the "Use Book" of the Forest Service.

—— Regulations governing entries within National Forests.

Dated, Washington, D. C., July 23, 1907. 8°, 7 pp.

FOREST SERVICE, U. S. The Use Book. Regulations and instructions for the use of the National Forests.

248 pp., 12°. Washington, Government Printing Office, 1907. (Issued July 1, 1907.)

This is the 2d revision of this book, superseding all former issues.

NOTE.—Many important data regarding the affairs of the National Forests may be found in the monthly "Field Program," published by the U. S. Forest Service. Debates in Congress regarding the forest policy of the government are fully reported in the Congressional Record.

—— On the destruction of Wolves and Coyotes in California forest reserves.

NOTE.—See data in following publications of Biological Survey, U. S. Department of Agriculture, Circulars 55, March 13, 1907; 58, May 14, 1907; 63, April 20, 1908. Also: Bulletin 72, Forest Service, Wolves in Relation to Stock, Game, and the National Forest Reserves.

WELFARE EFFECTS.

ANON. Tri-counties Reforestation Committee.

(No title page.) Oblong, 12°, 16 pp., 6 pl. from original photographs taken in San Bernardino Forest Reserve, April 17, 1907.

Contains: Toumey, Jas. W. The influence of forests in regulating run-off. Reprint from Yearbook, U. S. Department of Agriculture, 1903.

PRENTICE, Wm. K. Deforestation in Syria and its effects. Reprint from Forestry and Irrigation, May, 1907.

Also: Observations by FRANCIS CUTTLE, chairman of the Tri-counties Reforestation Committee, list of membership, and statement of objects of organization.

LULL, G. B. Natural warfare and human welfare.

Bulletin Cal. Physical Geography Club. 1: No. 3, pp. 8-11, Jan. '08.

Author is State Forester of California. References to California local conditions.

MANSON, M. Comparison of water discharge on timbered and treeless areas along the Yuba River.

In: A reconnaissance on the Yuba River. Water Supply and Irrigation, paper 46, U. S. Geological Survey. (Serial 4137.)

TOUMEY, James W. The relation of forests to stream flow. Reprint from Yearbook of Department of Agriculture for 1903.

8°, pp. 279-288. The data were collected in the San Bernardino National Forest. Their substance is reprinted in report of State Forester, 1906, and with photographic plates in pamphlet of Tri-county Reforestation Committee. qu. v.

VISCHER, Hubert. The influence of redwood forests upon the flow of streams.

In: First Biennial Report California State Board of Forestry, pp. 202-205. 1886.

APPENDIX.

For the convenience of non-professional students, the titles of a few easily accessible popular books on forestry in general, although not referring specially to California, are herewith appended. The first two of these books treat the subject principally from the economic or sociological side, the others from the technical side.

BRUNCKEN, Ernest. North American Forests and Forestry.

FERNOW, B. E. Economics of Forestry.

GIFFORD, John. Practical Forestry.

GREEN, Samuel B. Principles of American Forestry.

PINCHOT, Gifford. A primer of forestry.

—— The use of the National Forests.

ROTH, Filibert. A first book in forestry.

On the influence of forests on soil fertility, climate and the like, the best comprehensive work is still G. P. Marsh, The earth as modified by human action (in the earlier edition known as Man and Nature).

CALIFORNIA
STATE BOARD OF FORESTRY

CIRCULAR No. 4

G. MORRIS HOMANS, State Forester
Reprint from Fourth Biennial Report of State Forester

Native Growth for Planting in California

BY

EVANGELINE PORTER

Outdoor Art League of Santa Clara County

FRIEND WM. RICHARDSON, SUPERINTENDENT OF STATE PRINTING
SACRAMENTO, CALIFORNIA
1913

STATE BOARD OF FORESTRY.

HIRAM W. JOHNSON ---------- Governor

FRANK C. JORDON ---------- Secretary of State

U. S. WEBB ---------- Attorney General

G. MORRIS HOMANS ---------- State Forester

NATIVE GROWTH FOR PLANTING IN CALIFORNIA

By Miss E. Porter,

Out Door Art League of Santa Clara County.

"My position has been that the woody flora of any particular region is, and must ever be, the one criterion in the determination of our choice of material." (Professor Macbride, University of Iowa.)

The trend of the times is toward the preservation of natural beauty. National, state and city parks make it possible to retain much wild, unspoiled nature, of which we stand in such need. Outside these park areas, it is difficult in the march of civilization, with its manifold industries and occupations, the building of railroads and the making of homes, to preserve natural beauty. But there is the widest desire for it everywhere manifest—among landscape architects, real estate men, public officers, railway officials—and we believe that the more closely nature is studied and her counsels heeded, the less difficult the problem will become.

THE HARMONY OF NATURE.

Nature has covered the architectural foundation—the mountains, cañons and plains—with growing things which are not only in perfect harmony with the structure which they adorn, but with each other. It is possible to destroy the beauty of the landscape, not only by the destruction of this native growth itself, but also by the introduction of foreign growth into its midst, a fact not so widely recognized.

FORESTRY EXPERIMENTS.

In this connection, recent experiments in the Forestry Department are interesting and very encouraging. Where eucalyptus trees have been planted on the lower slopes of the mountains, in southern California, they have not made as satisfactory protection to the watershed as the native chaparral. Even the pines removed from mountain heights to these lower levels do not thrive as well. So it has been decided that in the Forest Reserves, at least for the present, that the manzanita, the buckthorn, the sage, and the wild buckwheat are to remain, clothing the unmarred hillsides with their lovely bloom. It is suggested further, by one writer, that the Government be asked to "reforest" the slopes already denuded, with honey-bearing plants, for the benefit of the beemen. If a useful industry can thus be carried on, at the same time protecting the watershed and preserving characteristic natural beauty, it will be one step toward an ideal civilization.

It is encouraging that the Bureau of Forestry believes it will pay to hold cut-over redwood lands for future crops, which will also aid in preserving the original landscape.

UNNECESSARY PLANTING.

In the making of homes in regions of great natural beauty it would seem desirable to alter the surroundings as little as need be, planting only to restore where nature has been disturbed. But even in summer camps one sees much effort expended in artificial gardening, all out of harmony with the delicate blooms and rugged forest trees. Of course where the home is permanent, and architecture more pretentious, and the need of formal gardening is felt, it is possible to separate the artificial from the natural surroundings, and so prevent incongruity.

It is a pleasure to record here that Mr. F. A. Hihn and Mr. Frank L. Brown in Santa Cruz County, Mrs. Lillian Ferguson in Marin County, Mr. Charles K. Field, and others are helping to restore the characteristic beauty of the redwood region by the planting of these young trees about their homes.

CHARACTERISTIC NATURAL BEAUTY.

Each region has an individual charm produced by its native trees, shrubs and flowers. Even under artificial conditions, by using the native growth for planting, this characteristic beauty is in a great measure preserved. The native elms and maples that shade the streets and highways of New England have their appropriate quiet beauty; the royal palms forming the approach to Cuban haciendas have a tropic splendor in keeping with the landscape; and the moss-draped native oaks that lead to the old plantations of the south have a distinctive beauty that no foreign trees could give.

In Italy eminent men are urging not only the restoration of the classic native growth, but also the "removal of the new and inharmonious." The Italian Govern-

PLATE XI. Native sycamores on Penitencia Creek road, Santa Clara Valley.

ment is to restore some of the buildings of ancient Rome and surround them with a magnificent park. Already thousands of young trees have been set out, but only natives of the soil—the laurel and the ilex, the olive and the pine—have been chosen.

Our greatest landscape architects realize the value of characteristic beauty, and the folly of attempting to transform one landscape into another of a totally different kind. Only a few days ago in Denver, William Law Olmsted said (and there is perhaps no higher authority) "we should not try to imitate Eastern landscapes."

The charm of variety is not attained by assembling many kinds of inharmonious trees and shrubs together, but by emphasizing the characteristic growth of each region.

We Californians, a cosmopolitan people, are slowly learning that our architecture and landscape art, as well as mode of dress, must be formed by the natural conditions of the State in which we dwell.

Plants brought from even Arctic regions would in time, no doubt, adapt themselves to new conditions, and grow into harmony with their surroundings, but why should we force nature to repeat her patient processes, when the decoration she has already prepared is so perfect and so beautiful?

TOPOGRAPHY OF CALIFORNIA AND HIGHWAY CONSTRUCTION.

In order to bring the topography of the State clearly before the reader's mind, we quote from the opening chapter of John Muir's "The Mountains of California."

"Go where you may within the bounds of California, mountains are ever in sight, charming and glorifying every landscape. Yet so simple and massive is the topography of the State in general views, that the main central portion displays only one valley, and two chains of mountains which seem almost perfectly regular in trend and height: the Coast Range on the west side and the Sierra Nevada on the east. These two ranges coming together in curves on the north and south inclose a magnificent basin.

"This is the grand central valley of California, the waters of which have only one outlet to the sea through the Golden Gate. But with this general simplicity of features there is great complexity of hidden detail. The Coast Range, rising as a grand green barrier against the ocean, is composed of innumerable forest-crowned spurs, ridges, and rolling hill-waves which inclose a multitude of smaller valleys; some looking out through long, forest-lined vistas to the sea; others, with but few trees, to the central valley; while a thousand others yet smaller are embosomed and concealed in mild, round-browed hills, each with its own climate, soil and productions."

Through this varied and beautiful country the state highway is to pass, and many new county roads are projected or in course of construction. To construct and plant these highways, as well as those already made, so that the beauty of the landscape as a whole shall be preserved, is the difficult problem presented.

PLANTING ON MOUNTAIN ROADS.

When the road must penetrate mountain gorges or find its way among the rolling hills, skillful engineering is required to preserve the contour of the land. But in the way of planting only restoration is needed—covering scarred banks with native vines and shrubs which strengthen while they adorn—reforesting with native trees where blackened stumps show that forest giants once stood.

WATERWAYS.

When the highway at lower levels follows where cool alders fringe the stream, or where sycamores define it with their gleaming trunks, where willows bind the banks and make the low-lying country beautiful as the waterway draws near the sea, art and nature counsel "Plant only to restore."

COAST VALLEY ROADS.

When the road winds among the liveoaks of coast valley floors, there seems no question still of introducing foreign growth. What could be more satisfying than such "nature-planted" roadways? And to scatter these trees "whose rounded outlines are repeated in the soft curves of the foothills" along the intervening roadway, linking grove with grove, would seem the logical treatment, if we are to preserve the distinctive charm of the original landscape.

It is true that oaks are comparatively slow growing, but even when no more than shrubs they are very decorative. With proper care the young trees make a surprising growth, and in thirty years a man may stand under a fair sized liveoak of his own planting. But, after all, are we to plant only for ourselves, and give no thought to future generations? It would seem our duty to at least repair the natural loss among

PLATE XII. Native liveoaks on roadway near Palo Alto. Help to further efforts looking toward the preservation of our roadside trees.

our native trees, thus securing the permanent character of the landscape. Besides the esthetic value, there is the historical association and sentiment which are well worth considering.

EXAMPLES OF WRONG PLANTING.

There is no more striking example of unwise planting than parts of the road leading down the San Francisco Peninsula, the old Camino Real which is to be incorporated in the new State highway, where lines of closely planted eucalyptus trees hide and dwarf the low rolling hills beyond. An avenue of eucalyptus trees taken by itself is most impressive and satisfying, with its vista of great trunks and spreading boughs. Taken in connection with the adjoining landscape, and we believe that at least on country roads this is the main point to consider, the effect of the same avenue may be most disastrous.

An avenue of palms stately and beautiful in itself looks out of place in most parts of California. It is making a feeble imitation of the tropics out of a temperate country, often for a purely commercial reason—that is, to please tourists who are even now becoming dissatisfied with this false ideal.

IRREGULAR PLANTING.

Irregular planting of the highway contributes much toward preserving the natural aspect of the country. It helps to prevent the "checkerboard" effect produced by many conventional avenues intersecting each other on a valley floor, when viewed from an adjoining height. Continuous shade is perhaps not so much of a necessity in these days of rapid transit. There are some practical reasons which make a scattered planting very desirable—such as the quicker drying of the road; more easy avoidance of trolley and telephone poles, when the lines must follow the highway, and less injury from shade to some growing crops.

In support of this method of planting we quote from a pamphlet written by G. H. Allen, B. S., and endorsed by the Munson-Whitaker Company, landscape foresters, of New York and Boston. Mr. Allen says, "Along country roads the trees should be planted in an irregular manner, leaving intervals of open. . . . . Along city streets the trees may be arranged in a more conventional manner, although broken rows are by no means desirable."

A SPECIAL PROBLEM.

The following is one of the problems where the irregular planting of native trees seems the only solution—the planting of a highway which on a valley floor crosses and recrosses a wooded stream, at times following it for a short distance. In such a case, if an attempt is made to plant the highway in a formal manner with exotic trees, the treatment becomes confused and absurd. For either the highway must be broken up into sections by the interruption of the stream, or else the graceful fringe of native trees along the bank is ruined by the regular spacing of foreign trees. By scattering the native oaks, sycamores or willows of the creek bank along the rest of the highway, the harmony of the whole is secured. But, could the highway in the first place have followed the stream, along its entire course, the ideal would have been attained.

NEW RESIDENCE TRACTS.

In laying out residence tracts in wooded regions, curved roads are logical and often employed, even in a level district. The trees are thus more easily avoided, and the beauty of the groves preserved. Little or no planting of the new roads is necessary. Unfortunately examples are to be seen of tracts where straight roads have been driven through the groves of oaks or other native trees, and emphasized by the planting of exotics, all in utter disregard of the original landscape.

CONVENTIONAL AVENUES.

Even when the highway or city street is regularly planted, preference should be given to native trees. The native laurel and big-leaved maple are admirably adapted for conventional avenues. And even the willow or sycamore, though losing in picturesqueness, will with care become more suitable for formal planting.

THE GREAT CENTRAL VALLEY.

In the valleys of the Sacramento and San Joaquin the problem of planting becomes more complex and the ideal more difficult to attain. The treeless stretches of this great valley, with the snow-capped Sierra always in sight as the dominant feature of the landscape, have their own charm. But immediate shade is a necessity in that region of great heat; and there remains only for us to plant in such a way as to mar

as little as possible the original beauty of the landscape. Where native trees exist, except in the vicinity of water courses, it is the graceful "weeping oak" that more than any other tree gives distinction to the valley floor. To emphasize this dominant tree, the roble of the Spaniards, more strongly, placing it in groups about homes or irregularly along the highways; and to greatly widen the fringe of native growth with ash, alder and cottonwood along the streams, might be the ideal general treatment for the great valley. For quick shade the oaks could be interspersed with native maples, cottonwoods, and other fast-growing trees. At least let us not thoughtlessly interpose a huge unchanging barrier of alien trees between us and "that wall of light, ineffably fine, and as beautiful as a rainbow, yet firm as adamant."

The gray-foliaged Sabine pine lends a peculiar charm to the hot, dry foothills of the Sierra and other ranges. It should be cherished for its decorative value in the regions where it grows; and the various species of oaks (its associates) depended on for shade.

THE OCEAN SHORE.

Cool breezes make shade less of a necessity in a driveway near the sea. And there is the sense of freedom and wildness and broad outlook over the water to make us hesitate before doing any planting there. It would be a pity to thrust petty designs or tropical foliage on our rugged headlands to disturb the characteristic beauty of the sand dunes; or to make of any roadway following the seashore an aggressive line of planting, destroying the subtle beauty of the shore line and ruining the contour of headland and mountain and gently sloping hill.

When planting seems a necessity there, and it must form an integral part of the landscape, the native growth and its arrangement should be carefully studied. Where shade is needed, groups of native conifers might form the setting for dwellings or other buildings as the road approaches bold promontories. It is significant that when the Monterey pine and cypress are transplanted to our dry inland valleys their life is very much shortened.

Where deep, wooded cañons end abruptly near the ocean, the growth of redwood or other native trees might be extended in straggling groups, as though they had strayed from the main forest. And where willows, laurels and alders follow the water courses quite to the sea, additional irregular plantings of these same trees might be made nearby upon the shore.

THE SEMI-DESERT COUNTRY.

The desert, too, has its unique beauty which needs no adornment from the hand of man. He is, in a sense, an interloper, and should strive, at least, not to "make nature hideous by his presence."

In the semi-desert regions of southern California yuccas and palms may be legitimately used for planting. There is one native species of the latter—*Washingtonia filifera*. If the native trees do not give enough shade, where heat and light are so intense, there are exotics which might properly be made use of, such as the mimosa, the carob, and the locust. These being of the same general type as the native mesquite, they would in a measure preserve the harmony and character of the landscape.

The piñons and junipers which give such a unique charm to the mesas and low hills, should by all means be made use of for home and highway planting in the regions where they grow.

NOT A GEOGRAPHIC LINE.

It will be seen that there is no thought of drawing a mere geographic line in advocating the choice of native trees for planting. By native is meant the tree or shrub indigenous to a given locality, not to the State as a whole. A redwood tree, for instance, transported from a deep, moist cañon of the northern ranges to the level, semi-desert country of southern California, would be out of harmony with its new environment. A foreign tree might be much more suitable from a landscape point of view. There is the beauty of the three or shrub viewed alone, and the beauty that comes from the harmonious whole. The olive is one of the foreign trees that seems not out of place in certain parts of the California landscape.

DETAILS—PRACTICAL WORKING—GENERAL SCHEME.

To sum up: Preserve the original landscape as far as possible by the planting of native growth.

When, for practical reasons, the native trees and shrubs can not be used for planting, select from exotics those which are of the same type—that resemble the native in form, texture or color.

In presenting this paper we feel how incomplete and inadequate it is to this important subject. But we believe that at least the principles set forth are fundamentally correct. Each section of this great State must, with patience and feeling, solve the planting problem for itself.

It is hoped that the bill (initiated by this organization) creating in each county a forestry commission and forester, will, in its amended form, be signed by the Governor at the coming session of the legislature. We believe that it will prove a practical system for the protection and proper planting of highway trees.

But it would seem that the general supervision of some central body is needed to secure the harmonious treatment of the State as a whole, with its varied, wonderful and characteristic beauty.

TABLE OF CONTENTS.

Division of Forestry
University of California

YIELD FROM EUCALYPTUS PLANTATIONS IN CALIFORNIA.

INTRODUCTION.

The study of yield from eucalyptus plantations in California was made in coöperation between the California State Board of Forestry and the Forest Service of the United States Department of Agriculture. The field work extended over a period of two months (June 24 to August 30, 1910), during which time practically all the important eucalyptus groves of any extent within the State were visited and examined. Sample plots, usually a quarter of an acre in extent, were measured off within the groves showing the best growth. The diameter of every tree within the sample plot was carefully measured with a diameter tape, and the average height of the trees of the different diameter classes was obtained with the Forest Service hypsometer-grademeter. Usually only one such sample plot, selected to show average conditions, was measured in each grove, but in several instances, in the larger groves, two sample plots were taken and the results averaged. The sample plots were located in the interior of each grove, and excluded the larger but shorter trees in the outside rows in order to obtain average conditions of yield in the interior of the plantations. With few exceptions no measurements were taken in groves less than an acre in extent or under three years of age.

The object of this report is to give in tabular form the results of measurements thus obtained. The figures given represent the actual yield now on the ground in the best eucalyptus groves in California.

FACTORS INFLUENCING GROWTH.

Soil. While eucalyptus is greatly influenced by the quality of the soil, and under similar temperature and moisture conditions will make the best and most rapid growth on soil of good quality, care must be taken not to overestimate the effect of the quality of the soil on its rate of growth. One of the best groves in the State (the Linda Vista Grove

near Mission San Jose) is growing on a hard clayey loam with a high per cent of adobe. The chemical composition of the soil is far less important than its physical composition, because the latter determines to a large extent the amount of available soil moisture. A deep, loose, moderately fine grained, sandy loam is the best for most species of eucalyptus. It is also the best for almost all other forest trees. The amount of available soil mositure depends also on the depth of the water table. Eucalyptus, as a rule, prefers a moist soil and responds readily to irrigation on dry situations. Low, swampy land, however, is not favorable to good growth, especially if the roots of the trees are constantly flooded. The red gum (*E. rostrata*) and the swamp mahogany (*E. robusta*) are probably the least exacting in this respect, and will thrive in wet situations. The sugar gum (*E. corynocalyx*), on the other hand, is the most intolerant in this respect. Excessive irrigation in a young plantation is inadvisable, since it tends to develop a surface root system which may die when the artificial watering is stopped. Conditions most favorable for the growth of eucalyptus are a well-drained soil with a water table 8 to 12 feet deep, though trees may make good growth in places where the ground water is 30 feet or more in depth. A soil underlaid by a layer of impermeable hardpan near the surface is unfavorable for eucalyptus, since such a layer cuts off the supply of available soil moisture. A young plantation may make very good growth on such a soil until the roots reach the impenetrable layer, when the trees will remain scrubby and stunted. For this reason it is often unsafe to determine the suitability of a region to the growth of eucalyptus by judging the growth made in young plantations. A stiff clayey soil, or one containing a high per cent of adobe, is unfavorable to the growth of eucalyptus mainly because such a soil does not allow of a thorough drainage.

Temperature. The effect of temperature on the growth of eucalyptus is of prime importance in California, because the range of the tree is determined by its ability to endure cold more than by any other one factor.

Precipitation. The question of precipitation is more regional than local and will not be discussed here at length. The relative humidity of the atmosphere, the distribution of the rain throughout the year, and the occurrence of droughts are more important in determining the growth of the tree than the actual total amount of annual rainfall, and for this reason it is possible to grow eucalyptus near the coast where the trees can get the benefit of the sea fogs, when an interior valley receiving the same amount of annual rainfall may prove too dry.

Methods of planting. The methods employed in planting and caring for a grove have a great influence on the yield. The question of proper

spacing is of especial importance. Wide spacing favors diameter growth and wide branching, while close spacing stimulates height growth and favors the development of clear straight trunks free from branches. If trees are grown too far apart they receive too much light, branch out, and tend to become scrubby and scraggy. On the other hand, if planted too close together proper growth is interfered with, and the trees tend to become tall and spindling. Between these two extremes there is a spacing which will result in the most desirable height and form of a tree, as well as in the best diameter growth. This optimum spacing of eucalyptus varies with the species, the quality of the soil, the amount of available moisture in the ground, and the amount of precipitation. In general it may be stated that spacing on poor soil should be closer than on good soil, since the rate of growth on the former will be slower, and it is necessary to plant more trees to the acre to form a close crown cover and establish forest conditions as soon as possible. However, since there may be insufficient food and moisture for the trees on the poor soil, thinnings should be made early, so as to give the best trees a chance to develop. On the other hand spacing on good soils need not be as close, and thinnings need not be made as early. In the two groves giving the heaviest yield per acre in California, the Newark grove and the Fruitvale grove, the spacing is 6 by 6 feet. This is probably merely a coincidence, since the best growth is usually found in the case of trees growing singly or in narrow belts of from two to ten rows of trees. Much more data will have to be collected before a definite conclusion can be reached on the best spacing of eucalyptus.

Cultivation. There is no doubt that cultivation stimulates growth in the first few years. In a case where the water table is fairly near the surface and the atmosphere is very hot and dry, cultivation may save a plantation by keeping it alive until the roots tap the water table and the trees are able to take care of themselves. To this extent cultivation will increase the growth, and therefore the yield, in the early years of the plantation's life. It will probably affect the final yield to a small extent. The chief advantage lies in the fact that cultivation insures a more flourishing and more rapid growth for the first few years when the trees need it most.

Methods of management. The ultimate yield will no doubt be influenced by the number and severity of the thinnings which might be made from time to time, but as there are practically no old groves of eucalyptus in California which have been systematically thinned no definite statements can be made. This is a matter which must be worked out in practice, and any estimates at present would be mere guesses. It is safe to say, however, that the ultimate yield will be

greater and of better quality in case thinnings are intelligently made. The Webb grove near Hayward was the only managed stand of eucalyptus found in the State. Here the trees were set out in 1873-74 and spaced 8 by 8 feet. When ten years of age the grove was thinned by taking out alternate rows of trees, leaving a present stand spaced 16 by 16 feet. The grove is now thirty-six years old, averages 168 trees per acre, and shows a yield of 5,178.8 cubic feet, or 17,600 board feet per acre. This yield is exceeded by several unmanaged stands. The poor showing made by the Webb grove is probably due to the poor soil and the depth of the water table.

YIELD.

The yield from existing groves was obtained by means of sample plots and volume tables by the following methods:

1. *Diameter of the tree.* The diameters were measured outside the bark at a point 4½ feet above the ground. This is known as the "breast-high diameter," and is the standard used almost universally by foresters. As has already been mentioned, the measurements were made with a diameter tape.

2. *Height of the tree.* This refers to the total height of the tree from the ground to the topmost point in the crown. It was obtained by means of an instrument known as the hypsometer-grademeter.

3. *Number of trees per acre.* All trees 1½ inches or more in diameter were measured. When a tree forks at a point less than 4½ feet above the ground, each fork was measured as a separate tree; when the tree forks at a point higher than 4½ feet above the ground, it was measured as a single individual. Eucalyptus trees, when grown in an open stand, are apt to fork close to the ground. Many trees when injured send out numerous shoots or suckers, some of which develop into merchantable size. It often happens, therefore, that the number of trees per acre when a plantation is five years or more of age is greater than the number originally planted, in spite of the fact that many trees may have been crowded out and killed in the natural struggle for existence.

4. *The volume table.* After the diameter and the height of a tree were ascertained, its volume was obtained by means of tables which show the average volume or contents of trees of various sizes. Two of the same species having the same diameter and the same height give practically the same volume wherever grown and whatever system of management is used, provided they are approximately of the same age.

Table I shows the average volume in cubic feet of different sized blue gum trees.

TABLE I. Volume Table for Blue Gum (Eucalyptus globulus). Seedlings and Sprouts.

Diameter breast-high.	Total height—Feet.											Basis.
	40	50	60	70	80	90	100	110	120	130	140	
Inches.	*Volume of used length with bark—Cubic feet.*											*Trees.*
5	2.3	2.7	3.2	3.7	4.5	5.6						197
6	3.0	3.6	4.4	5.4	6.4	7.6	8.8					200
7	3.8	4.7	5.7	7.2	8.4	9.7	11.3	12.8				201
8	4.8	6.0	7.3	8.9	10.5	12.0	14.0	16.1				171
9	5.8	7.3	8.9	10.8	12.7	14.6	17.0	19.4	21.3			120
10		8.8	10.7	12.8	15.0	17.4	20.2	23.0	25.8			72
11		10.4	12.5	14.9	17.5	20.5	23.7	26.8	30.5	33.7		41
12					20.2	23.7	27.4	30.9	35.2	39.2		27
13					22.9	27.2	31.4	35.4	40.0	44.8	50.5	20
14							35.6	40.0	45.1	50.6	56.6	7
15									50.2	56.8	63.0	4
16									55.5	62.2	69.4	5
17									61.1	68.3	75.9	3
18									66.8	74.2	82.5	2
19									72.5	80.3	89.2	1
20									78.4	86.6	96.3	2
												1,073

To construct the above table several thousand felled trees were measured in 1903 and the diameter taken at intervals of 10 feet along the stem of the tree. Of the trees measured 1,073 of the largest were selected, the volume of each one was computed and the resulting data plotted on cross-section paper. Curves were then drawn and the averages read from the curves. The volume of the stump, which was 6 to 12 inches high, and of the top above a point where the diameter inside the bark was less than 2 inches, were not included. The data were worked over recently for the purposes of this circular, and errors appearing in former tables based on them have been corrected.*

To convert the volume of a tree in cubic feet to its equivalent in standard cords it was assumed that on the average 90 cubic feet of solid wood will equal one standard cord of 128 cubic feet. The California cord contains three fourths of the volume of a standard cord.

*The lefthand vertical column in the above table shows the diameter of the tree at breast height; the upper horizontal line shows the total height of the tree from the ground to the top of the crown. To find the volume of a tree of any diameter and height, for example, 10 inches in diameter and 100 feet high, look in the lefthand column for the diameter (10) and under the height (100) find the volume (20.2 cubic feet).

Table II shows the average volume in board feet of different sized blue gum, as scaled by the Scribner decimal rule.

TABLE II. Volume Table for Blue Gum (Eucalyptus globulus). Seedlings and Sprouts.

Diameter breast-high.	Total height—Feet.										Basis.
	50	60	70	80	90	100	110	120	130	140	
Inches.	*Volume, scaled by Scribner rule-board feet.*										*Trees.*
7	5	5	10	10	10	15	20	------	------	------	198
8	10	10	15	20	25	30	35	------	------	------	171
9	15	20	20	30	35	40	50	60	------	------	119
10	20	25	30	40	45	55	70	80	95	------	72
11	25	30	40	50	60	70	85	100	115	------	41
12	------	------	------	60	75	90	105	120	140	------	27
13	------	------	------	70	85	105	125	145	170	205	20
14	------	------	------	------	------	------	145	170	195	230	7
15	------	------	------	------	------	------	------	195	225	260	4
16	------	------	------	------	------	------	------	220	250	290	5
17	------	------	------	------	------	------	------	245	280	315	3
18	------	------	------	------	------	------	------	270	305	345	2
19	------	------	------	------	------	------	------	290	330	370	1
20	------	------	------	------	------	------	------	315	360	405	2
											672

The above table is based on the measurements of 672 felled trees. The diameter inside the bark was measured every 10 feet along the stem, and the scale was obtained by referring to a Scribner decimal log rule. All logs having a diameter of 5.5 inches or more inside the bark at the small end were scaled. Logs smaller than 5.5 inches in diameter inside the bark were considered too small to scale for lumber.

The Scribner decimal log rule was used because it is the fairest rule in common use for scaling small logs, as may be seen from the following table:

TABLE III. Comparison of Log Rules for Board Measure.

Twelve-foot logs.

Name of rule.	Diameter in inches.							
	6	8	10	12	14	16	18	20
	Board feet.							
Scribner	14	23	38	59	86	119	160	210
Doyle	3	12	27	48	75	108	147	192
Doyle and Scribner	3	12	27	48	75	108	147	192
Spaulding	------	------	38	58	86	121	162	207

While the Spaulding rule is the legal rule in California, it was intended primarily for scaling conifers, and gives no values for logs less than 10 inches in diameter.

The Doyle rule is in common use and is more generally employed than any other rule. It is very unfair to small logs, as may be seen from the above table.

The Doyle and Scribner rule is a combination of the two rules after which it is named, and combines the unfairness of both. For diameters less than 28 inches it is identical with the Doyle rule, and for diameters of 28 inches or over it is the same as the Scribner rule.

The following description of the Scribner rule is taken from page 32 of "The Woodsman's Handbook," Bulletin 36 of the Forest Service:

THE SCRIBNER RULE.—This is the oldest log scale now in general use. . . . . The rule was based on computations derived from diagrams drawn to show the number of inch boards that can be sawed from logs of different sizes after allowing for waste. The contents of these boards were then calculated and the table built up in this way. Sometimes the Scribner rule is converted into what is known as the Scribner decimal rule by dropping the units and rounding the values to the nearest tens.

Table II, showing the volume of trees expressed in board feet, does not include the volume of the tops too small to scale as lumber. This is given in Table IV, which shows the volume of the part of the tree between points where it is 5.5 inches and 2.0 inches in diameter inside the bark.

TABLE IV. Volume of Merchantable Tops. Blue Gum (Eucalyptus globulus). Seedlings and Sprouts.

Diameter breast-high.	Total height—Feet.										Basis.
	50	60	70	80	90	100	110	120	130	140	
Inches.	*Volume—Cubic feet.*										*Trees.*
7	3.8	4.4	4.9	5.5	6.0	6.5	7.1	------	------	------	198
8	3.3	3.9	4.5	5.0	5.6	6.1	6.6	------	------	------	171
9	2.8	3.5	4.0	4.6	5.1	5.6	6.2	6.7	------	------	119
10	2.3	3.0	3.6	4.1	4.7	5.2	5.7	6.3	6.8	------	72
11	1.7	2.5	3.1	3.7	4.3	4.8	5.3	5.8	6.3	------	41
12	------	------	------	3.2	3.9	4.3	4.8	5.3	5.8	------	27
13	------	------	------	2.8	3.4	3.9	4.4	4.8	5.3	5.5	20
14	------	------	------	------	------	------	4.0	4.4	4.8	5.0	7
15	------	------	------	------	------	------	------	3.9	4.3	4.5	4
16	------	------	------	------	------	------	------	3.5	3.8	4.0	5
17	------	------	------	------	------	------	------	3.0	3.3	3.5	3
18	------	------	------	------	------	------	------	2.4	2.8	3.0	2
19	------	------	------	------	------	------	------	1.9	2.3	2.5	1
20	------	------	------	------	------	------	------	1.4	1.7	2.0	2
											672

Detailed descriptions and yield tables of individual groves are given in the following pages:

TABLE V. Summary of Yield from Blue Gum Plantations.

Seedling growth.

Name of grove.	Location.		Age.	Original spacing.	Present number of trees per acre.	Biggest diameter.	Greatest height.	Yield per acre.				Soil, water table, etc.
	Town.	County.						Total.	Total.	Total.	Unmerchantable tops.	
			Years.	*Feet.*	*Trees.*	*Inches.*	*Feet.*	*Cubic ft.*	*Cal. cds.**	*Bd. ft.†*	*Cal. cds.**	
Pratt Bros.	Escondido	San Diego	1⅓	8 x 8	636	3	25					Fine decomposed granite. Water table, 6 to 20 feet.
Wheeler	Callender	San Luis Ob'po	3½	10 x10	328	6	40	196.0				Loose sand. Water table, 100 feet.
Ontario	West Ontario	San Bernar'o	5	8 x 8	616	6	50	572.8				Sedimentary soil. Water table, 130 feet. Irrigated.
Thompson	Garden Grove	Orange	5	9 x 9	616	7	70	1,948.8	28.9	280	27.9	Loose loamy sand. Water table, 20 feet. Irrigated.
Jackson Park	Zaferia	Los Angeles	6	8 x 8	684	8	60	1,695.2	25.1	240	24.1	Light sandy loam. Hardpan. Water table, 17 feet.
Porter	Summerland	Santa Barbara	7	8 x 8	496	7	50	1,035.6	15.3	60	15.2	Sandy loam. Water table, 75 feet.
Sexton	Watts	Los Angeles	7	8 x 8	340	10	70	1,510.4	22.4	1,600	15.1	Hard sandy loam. Water table, 12 to 15 feet.
Diam'd Coal Co.	Watts	Los Angeles	7	8 x 8	560	10	90	2,245.4	33.2	2,370	24.1	Stiff sandy loam. Hardpan. Water table, 15 feet.
Hunter	Bairdstown	Los Angeles	8	6 x 8	844	8	80	2,947.6	43.6	1,280	39.2	Sandy loam. Water table, 12 feet.
Knapp	Garden Grove	Orange	8	6 x 8	888	8	70	2,354.0	34.9	1,160	30.7	Stiff sandy loam. Water table, 10 to 12 feet.
Courreges	Talbert	Los Angeles	8	6½x 6½	728	10	80	3,322.0	49.2	5,160	28.5	Fine silt, mixed with loam. Water table at surface.
Meechan (Fritsch)	Live Oaks	Sonoma	9	12 x12	344	12	110	5,334.4	79.0	13,100	27.7	Fine light sand. Water table, 10 to 15 feet.
Gordon	Strawb'ry Park	Los Angeles	10	10 x10	430	10	80	1,410.8	20.9	1,620	14.5	Sandy loam, mixed with clay. Hardpan. Water table, 80 feet.
Howland	Sunnyside	Los Angeles	10-12	8 x 8	660	7	70	1,044.8	15.2	80	15.5	Hard sandy loam. Hardpan. Water table, 20 feet.

Meechan (Fritsch)	Live Oaks	Sonoma	12	12 x 12	336	12	120	5,939.6	6.2	88.0	16,660	25.7	Fine light sand. Water table, 10 to 15 feet.
Clark	San Mateo	San Mateo	15	6 x 6	632	12	100	5,466.8	4.6	81.0	10,400	38.7	Stiff loamy clay. Water table, 25 feet.
Windermere.	La Mirada	Los Angeles	16	8 x 8	528	12	120	7,065.6	5.5	104.7	17,920	36.3	Light sandy loam. Water table, 10 feet.
Meechan (Long Belt)	Live Oaks	Sonoma	22	10 x10	596	22	120	12,672.0	9.2	187.7	37,800	46.6	Deep, fine grained loamy sand. Water table, 20 to 25 feet.
Fruitvale	Fruitvale	Alameda	25	6 x 6	776	18	150	16,694.8	8.3	247.9	54,200	57.8	Heavy loamy clay with adobe. Water table, 20 to 25 feet.
Meechan (Stony Pt.)	Stony Point	Sonoma	30	8 x 8	724	16	130	10,491.2	4.4	155.4	27,920	53.5	Sedimentary soil. Water table, 10 to 20 feet.
Meechan (Faught)	Stony Point	Sonoma	30	8 x 8	732	15	130	10,671.2	4.4	158.1	25,000	63.9	Fine loamy sand. Water table, 50 feet.
Meechan (Shropshire)	Live Oaks	Sonoma	30	9 x 9	516	12	100	4,974.8	2.1	73.7	9,320	35.5	Fine sand mixed with clay. Water table, 30 to 35 feet.
Meechan (Ellis)	Live Oaks	Sonoma	30	10 x10	684	16	110	8,701.6	3.6	128.9	21,010	44.1	Fine light sand with clay. Water table, 15 to 20 feet.
McDonald	El Cajon	San Diego	30	10 x10	300	15	120	4,056.4	1.7	60.1	10,160	19.9	Fine loose loamy sand. Water table, 12 to 15 feet.
Therefall	Newark	Alameda	32	6 x 6	540	20	170	15,836.4	6.2	234.6	57,820	41.2	Adobe loam. Water table, 14 to 15 feet.
Jewett	Elmira	Solano	35	10 x10	344	22	130	10,377.2	3.7	153.7	36,020	21.9	Fertile clayey loam. Water table, 25 to 30 feet.
Webb	Hayward	Alameda	36	8 x 8	168	19	110	5,178.8	1.8	76.7	17,600	10.9	Hard adobe clay. Water table, 40 feet.
Linda Vista	Mission San Jose	Alameda	40	8 x 8	612	18	150	15,139.6	4.7	224.3	50,620	50.0	Hard clay loam with adobe. Water table, quite deep.

*A California cord is equal to ¾ of a Standard cord.

†The total expressed in board feet is not in addition to the total stated in cubic feet and in cords, but is another way of expressing the same total.

TABLE V. Summary of Yield from Blue Gum Plantations.—*Continued.*

Sprout growth.

Name of grove.	Location.		Age	Original spacing	Present number of trees per acre.	Biggest diameter.	Greatest height.	Yield per acre.				Soil, water table, etc.
	Town.	County.						Total.	Total.	Total.	Unmerchantable. tops.	
			Years.	*Feet.*	*Trees.*	*Inches.*	*Feet.*	*Cubic ft.*	*Cal. cds.**	*Bd. ft.†*	*Cal. cds.**	
Glass	Watts	Los Angeles	8	8 x 8	1,064	11	90	3,888.8	57.6	5,740	34.2	Stiff sandy loam. Water table, 15 to 25 feet.
Montague	Watts	Los Angeles	8-9	8 x 10	928	10	90	3,530.0	52.3	4,080	35.5	Stiff heavy loamy sand. Water table, 12 feet.
Thaxter	Nadeau	Los Angeles	11-13	8 x 8	1,024	10	80	1,642.8	24.3	1,240	19.5	Light loamy sand. Water table, 16 to 30 feet.
Thaxter	Nadeau	Los Angeles	13-20	10 x 10	608	12	130	4,964.8	73.5	10,320	34.7	Light loamy sand. Water table, 30 to 35 feet.

* A California cord is equal to $\frac{3}{4}$ of a Standard cord.

† The total expressed in board feet is not in addition to the total stated in cubic feet and in cords, but is another way of expressing the same total.

WHEELER GROVE.

Located near Callender, San Luis Obispo County.

Species ---------- Blue gum. Seedlings.
Age ---------- 3½ years.
Elevation ---------- 200 to 300 feet.
Soil ---------- A drifting, loose, light sand. Top of hill, with a general southeast slope.
Water table ---------- About 100 feet deep.
Area of grove ---------- 5 acres.
Spacing ---------- 10 by 10 feet.
Sample plot ---------- ¼ acre. In a long strip. Young wild seedlings were used, which were picked from under a windbreak of trees. Beans were grown between the young plants the first year. The plantation was cultivated for the first two years.

Information in regard to age and management of this grove obtained from Mr. T. P. Lukens.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*
2	20	20	----------
3	30	88	----------
4	40	136	----------
5	40	80	184.0
6	40	4	12.0
Totals	----------	328	196.0

SUMMARY.

Age, 3½ years. Seedlings.

Volume per acre, 196.0 cubic feet, which is equal to 2.2 standard cords, or 2.9 California cords.

ONTARIO GROVE.

Located near Dr. Turner's Orange Grove, West Ontario, San Bernardino County.

Species ---------- Blue gum. Seedlings.
Age ---------- 5 years.
Elevation ---------- About 800 feet.
Soil ---------- Light, fine grained, sedimentary soil, mixed with gravel.
Water table ---------- 130 feet deep.
Area of grove ---------- About 5 acres.
Spacing ---------- 8 by 8 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet. This grove was cultivated several times, and partly irrigated the first three years.

Information in regard to age of the grove and cultivation obtained from adjoining neighbor, who has lived there for a number of years.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*
2	30	66	----------
3	40	96	----------
4	40	220	----------
5	40	224	515.2
6	50	16	57.6
Totals	----------	616	572.8

SUMMARY.

Age, 5 years. Seedlings.

Volume per acre, 572.8 cubic feet, which is equal to 6.4 standard cords, or 8.5 California cords.

THOMPSON GROVE.

Located at Garden Grove about 1 mile from Railroad Station, Los Angeles County.

Species ---------- Blue gum. Seedlings.
Age ---------- 5 years.
Elevation ---------- About 100 feet.
Soil ---------- A very light, loose, loamy sand.
Water table ---------- About 20 feet deep.
Spacing ---------- 9 by 9 feet.
The land was irrigated for three years. The soil is very sandy and porous and will not hold water. This grove is part of a 60-acre plantation belonging to several owners.
Sample plot ---------- ¼ acre. 100 by 109 feet.

Information in regard to age of the grove obtained from Mr. Mickle, who helped plant and irrigate this grove.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	30	16			
3	40	64			
4	50	64			
5	60	172	550.4		550.4
6	60	272	1,196.8		1,196.8
7	70	28	201.6	280	137.2
Totals		616	1,948.8	280	1,884.4

SUMMARY.

Age, 5 years. Seedlings.

Volume per acre, 1,948.8 cubic feet, which is equal to 21.7 standard cords, or 28.9 California cords.

Volume per acre, 280 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,884.4 cubic feet, equal to 20.9 standard cords, or 27.9 California cords.

JACKSON PARK GROVE.

Located near Zaferia on the Pacific Electric car line from Los Angeles.

Species ---------- Blue gum. Seedlings.
Age ---------- 6 years.
Elevation ---------- About 100 feet.
Soil ---------- Light sandy loam, with layer of hardpan about 2 or 3 feet below the surface.
Water table ---------- About 17 feet.
Area of grove ---------- About 5 acres.
Spacing ---------- 8 by 8 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet.

Information in regard to the age of the grove obtained from one of the neighbors.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	72			
3	50	80			
4	50	96			
5	60	240	768.0		768.0
6	60	156	686.4		686.4
7	60	32	182.4	160	140.8
8	60	8	58.4	80	31.2
Totals		684	1,695.2	240	1,626.4

SUMMARY.

Age, 6 years. Seedlings.

Volume per acre, 1,695.2 cubic feet, which is equal to 18.8 standard cords, or 25.1 California cords.

Volume per acre, 240 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,626.4 cubic feet, equal to 18.1 standard cords, or 24.1 California cords.

PORTER GROVE.

Located on the hills between Santa Barbara and Summerland, Santa Barbara County.

Species ---------- Blue gum. Seedlings.
Age ---------- 7 years.
Elevation ---------- About 300 feet. The grove is on a gentle southeast slope.
Soil ---------- A deep, fine-grained, sandy loam.
Water table ---------- 75 feet, or more, deep.
Area of grove ---------- 6 acres.
Spacing ---------- 8 by 8 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet. The land was cultivated and watered for the first three or four years.

Information in regard to age and management of this grove obtained from a forest ranger who lives nearby.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	30	24			
3	30	36			
4	40	116			
5	50	144	388.8		388.8
6	50	164	590.4		590.4
7	50	12	56.4	60	45.6
Totals		496	1,035.6	60	1,024.8

SUMMARY.

Age, 7 years. Seedlings.

Volume per acre, 1,035.6 cubic feet, which is equal to 11.5 standard cords, or 15.3 California cords.

Volume per acre, 60 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,024.8 cubic feet, equal to 11.4 standard cords, or 15.2 California cords.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

SEXTON GROVE.

Located on Central avenue, between Watts and Compton, Los Angeles County.

Species ---------- Blue gum. Seedlings.
Age ---------- 7 years.
Elevation ---------- About 100 feet.
Soil ---------- Very hard sandy loam.
Water table ---------- 12 to 15 feet deep.
Spacing ---------- 8 by 8 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet.

Information in regard to age of the grove obtained from Mr. Brinkerhoff, who lives near the plantation.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	28			
3	50	24			
4	50	36			
5	60	60	192.0		192.0
6	60	60	264.0		264.0
7	60	64	364.8	320	281.6
8	70	32	284.8	480	144.0
9	70	28	302.4	560	112.0
10	70	8	102.4	240	28.8
Totals		340	1,510.4	1,600	1,022.4

SUMMARY.

Age, 7 years.

Volume per acre, 1,510.4 cubic feet, which is equal to 16.8 standard cords, or 22.4 California cords.

Volume per acre, 1,600 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,022.4 cubic feet, equal to 11.4 standard cords, or 15.1 California cords.

DIAMOND COAL CO. GROVE.

Located on Central avenue, between Watts and Compton, Los Angeles County.

Species ---------- Blue gum. Seedlings.
Age ---------- 7 years. Planted in the winter of 1902-3. One half of the area is cut and the other half is intact. The sample plot was taken in the uncut portion.
Elevation ---------- About 100 feet.
Soil ---------- Stiff, sandy loam. Probably underlaid with hardpan.
Water table ---------- About 15 feet.
Area of grove ---------- About 30 acres.
Spacing ---------- 8 by 8 feet.
Sample plot ---------- Two areas of one quarter acre each.

Information in regard to age of the grove obtained from Mr. Brinkerhoff and Mr. Breckenridge, who live nearby.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	30	74			
3	40	46			
4	60	78			
5	60	116	371.2		371.2
6	70	102	550.8		550.8
7	70	72	518.4	720	352.8
8	80	54	567.0	1,080	270.0
9	80	16	203.2	480	73.6
10	90	2	34.8	90	9.4
Totals		560	2,245.4	2,370	1,627.8

SUMMARY.

Age, 7 years.

Volume per acre, 2,245.4 cubic feet, which is equal to 24.9 standard cords, or 33.2 California cords.

Volume per acre, 2,370 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,627.8 cubic feet, equal to 18.1 standard cords, or 24.1 California cords.

HUNTER GROVE.

Located at Bairdstown, Los Angeles County.

Species ---------- Blue gum. Seedlings.
Age ---------- 8 years.
Elevation ---------- About 300 feet.
Soil ---------- Sandy loam.
Water table ---------- About 12 feet deep.
Spacing ---------- 6 by 8 feet.
Sample plot ---------- ¼ acre. 135 by 81 feet.

Information in regard to age of the grove obtained from neighbors residing adjoining the grove.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	12			
3	50	32			
4	60	192			
5	70	340	1,258.0		1,258.0
6	70	148	799.2		799.2
7	70	112	806.4	1,120	548.8
8	80	8	84.0	160	40.0
Totals		844	2,947.6	1,280	2,646.0

SUMMARY.

Age, 8 years. Seedlings.

Volume per acre, 2,947.6 cubic feet, which is equal to 32.7 standard cords, or 43.6 California cords.

Volume per acre, 1,280 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,646.0 cubic feet, equal to 29.4 standard cords, or 39.2 California cords.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

KNAPP GROVE.

Located at Garden Grove, about half a mile east of Railroad Station, Los Angeles County.

Species ---------- Blue gum. Seedlings.
Age ---------- 8 years.
Elevation ---------- About 100 feet.
Soil ---------- A rather stiff, sandy loam. The adjoining land is cultivated for garden truck.
Water table ---------- Surface water 10 to 14 feet deep.
Area of grove ---------- About 3 acres.
Spacing ---------- 6 by 8 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet. This grove will probably be cut within a year and the land used for truck farming.

Information in regard to age of grove obtained from Mr. Knapp, the present owner.

YIELD.

Diameter Breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	124			
3	50	164			
4	60	156			
5	70	156	577.2		577.2
6	70	180	972.0		972.0
7	70	92	662.4	920	450.8
8	70	16	142.4	240	72.0
Totals		888	2,354.0	1,160	2,072.0

SUMMARY.

Age, 8 years. Seedlings.

Volume per acre, 2,354.0 cubic feet, which is equal to 26.2 standard cords, or 34.9 California cords.

Volume per acre, 1,160 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,072.0 cubic feet, equal to 23.0 standard cords, or 30.7 California cords.

COURREGES GROVE.

Located near Talbert, R. F. D. No. 1, Huntington Beach, Los Angeles County.

Species ---------- Blue gum. Seedlings.
Age ---------- 8 years.
Elevation ---------- About 100 feet.
Soil ---------- Fine sedimentary silt, mixed with loam.
Water table ---------- Right at the surface. Well layer 75 to 100 feet deep.
Area of grove ---------- A little over 1 acre.
Spacing ---------- 6½ by 6½ feet.
Sample plot ---------- ¼ acre. 109 by 100 feet. This grove was cultivated and weeded the first year. The seedlings were bought in the nursery and were planted when the trees were about 6 inches high.

Information in regard to age of the grove obtained from Mr. Courreges, the owner.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	50	88			
3	50	140			
4	60	72			
5	60	80	256.0		256.0
6	70	84	453.6		453.6
7	70	80	576.0	800	392.0
8	70	96	854.4	1,440	432.0
9	80	60	762.0	1,800	276.0
10	80	28	420.0	1,120	114.8
Totals		728	3,322.0	5,160	1,924.4

SUMMARY.

Age, 8 years. Seedlings.

Volume per acre, 3,322.0 cubic feet, which is equal to 36.9 standard cords, or 49.2 California cords.

Volume per acre, 5,160 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,924.4 cubic feet, equal to 21.4 standard cords, or 28.5 California cords.

MEECHAN GROVE — FRITSCH FIELD.

Located at Live Oaks, Sonoma County.

Species ——— Blue gum. Seedlings.
Age ——— 9 years.
Elevation ——— About 50 feet.
Soil ——— Fine grained, very light sand.
Water table ——— 10 to 15 feet deep.
Area of entire grove ——— About 20 acres.
Spacing ——— 12 by 12 feet. Staggered.
Sample plot ——— ¼ acre. 100 by 109 feet. The grove was cultivated the first year.

Information in regard to age and management of this grove obtained from Mr. F. Meechan.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	30	4			
3	40	4			
4	40	8			
5	70	16	59.2		59.2
6	80	24	153.6		153.6
7	90	40	388.0	400	240.0
8	100	68	952.0	2,040	414.8
9	100	88	1,496.0	3,520	492.8
10	110	56	1,288.0	3,920	319.2
11	110	28	750.4	2,380	148.4
12	110	8	247.2	840	38.4
Totals		344	5,334.4	13,100	1,866.4

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

SUMMARY.

Age, 9 years. Seedlings.

Volume per acre, 5,334.4 cubic feet, which is equal to 59.3 standard cords, or 79.0 California cords.

Volume per acre, 13,100 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,866.4 cubic feet, equal to 20.7 standard cords, or 27.7 California cords.

GORDON GROVE.

Located near Strawberry Park, Los Angeles County.

Species ---------- Blue gum. Seedlings.
Age ---------- 10 years.
Elevation ---------- About 100 feet.
Soil ---------- Light sandy loam with clay in places, and small patches of hardpan.
Water table ---------- Surface water 80 feet deep. Wells over 200 feet deep.
Area of grove ---------- 61 acres.
Spacing ---------- 10 by 10 feet.
Sample plot ---------- Two areas of a quarter acre each.

Information in regard to age of the grove obtained from Mr. Finch, manager of the ranch, who has lived near the grove for fourteen years.

YIELD.

Diameter breast-high	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	60			
3	50	60			
4	50	78			
5	60	58	185.6		185.6
6	60	72	316.8		316.8
7	70	48	345.6	480	235.2
8	70	36	320.4	548	162.0
9	80	12	152.4	360	55.2
10	80	6	90.0	240	24.6
Totals		430	1,410.8	1,620	979.4

SUMMARY.

Age, 10 years.

Volume per acre, 1,410.8 cubic feet, which is equal to 15.7 standard cords, or 20.9 California cords.

Volume per acre, 1,620 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 979.4 cubic feet, equal to 10.9 standard cords, or 14.5 California cords.

HOWLAND GROVE.

Located at Sunnyside, Los Angeles County.

Species ---------- Blue gum. Seedlings.
Age ---------- 10 or 12 years.
Elevation ---------- About 100 feet.
Soil ---------- Heavy, hard sandy loam. Streaked with hard pan.
Water table ---------- Surface water 20 feet. Wells 80 feet deep.
Area of grove ---------- About 20 acres.
Spacing ---------- 8 by 8 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

Information in regard to age of the grove obtained from Mrs. Howland, who does not remember whether the grove is ten or twelve years old.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	124			
3	40	104			
4	60	156			
5	60	160	512.0		512.0
6	60	108	475.2		475.0
7	70	8	57.6	80	39.2
Totals		660	1,044.8	80	1,026.2

SUMMARY.

Age, 10 or 12 years.

Volume per acre, 1,044.8 cubic feet, which is equal to 11.6 standard cords, or 15.5 California cords.

Volume per acre, 80 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,026.2 cubic feet, equal to 11.4 standard cords, or 15.2 California cords.

MEECHAN GROVE — FRITSCH FIELD.

Located at Live Oaks, Sonoma County.

Species ——— Blue gum. Seedlings.
Age ——— 12 years.
Elevation ——— About 50 feet.
Soil ——— Fine grained, very light sand.
Water table ——— 10 to 15 feet.
Area of grove ——— About 20 acres.
Sample plot ——— ¼ acre. 100 by 109 feet. The grove was cultivated the first year.

Information in regard to age and management of this grove obtained from Mr. F. Meechan.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
3	40	16			
4	50	28			
5	80	12	54.0		54.0
6	80	16	102.4		102.4
7	90	36	349.2	360	216.0
8	90	36	432.0	900	201.6
9	110	60	1,164.0	3,000	372.0
10	120	60	1,548.0	4,800	378.0
11	120	52	1,586.0	5,200	301.6
12	120	20	704.0	2,400	106.0
Totals		336	5,939.6	16,660	1,731.6

SUMMARY.

Age, 12 years. Seedlings.

Volume per acre, 5,939.6 cubic feet, which is equal to 66.0 standard cords, or 88.0 California cords.

Volume per acre, 16,660 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,731.6 cubic feet, equal to 19.2 standard cords, or 25.7 California cords.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

CLARK GROVE.

Located about a quarter of a mile south of St. Matthews School, San Mateo Park, San Mateo County.

Species ---------- Blue gum. Seedlings.
Age ---------- About 15 years.
Elevation ---------- About 200 feet.
Soil ---------- A stiff, loamy clay.
Water table ---------- About 25 feet deep.
Area of grove ---------- About 2 acres.
Spacing ---------- 6 by 6 feet.
Sample plot ---------- ¼ acre. 109 by 100 feet.

Information in regard to age of this grove obtained from several old residents in San Mateo.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	30	8			
3	40	60			
4	50	48			
5	60	88	281.6		281.6
6	70	100	540.0		540.0
7	90	88	853.6	880	528.0
8	90	96	1,152.0	2,400	537.6
9	90	76	1,109.6	2,660	387.6
10	100	36	727.2	1,980	187.2
11	100	20	474.0	1,400	96.0
12	100	12	328.8	1,080	51.6
Totals		632	5,466.8	10,400	2,609.6

SUMMARY.

Age, about 15 years. Seedlings.

Volume per acre, 5,466.8 cubic feet, which is equal to 60.7 standard cords, or 81.0 California cords.

Volume per acre, 10,400 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,609.6 cubic feet, equal to 29.0 standard cords, or 38.7 California cords.

MEECHAN GROVE — LONG BELT.

Located at Live Oaks, Sonoma County.

Species ---------- Blue gum. Seedlings.
Age ---------- 22 years.
Elevation ---------- About 100 feet. The sample plot was taken in the sag of a hill with a general, gentle, north slope.
Soil ---------- A deep, very fine grained, loamy sand, with a small amount of clay.
Water table ---------- 20 to 25 feet deep.
Area of grove ---------- A long belt, 7 rows (62 feet) wide, and 1½ miles long.
Spacing ---------- 10 by 10 feet.
Sample plot ---------- ¼ acre. 60 by 180 feet. All trees were taken, those on the outside as well as those on the inside rows. This sample plot represents the best portion of the grove. The grove was cultivated the first year.

Information in regard to age and management of this grove obtained from Mr. F. Meechan.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
3	40	8			
4	50	16			
5	70	56	207.2		207.2
6	90	68	516.8		516.8
7	100	48	542.4	720	312.0
8	100	44	616.0	1,320	268.4
9	100	88	1,496.0	3,520	492.8
10	110	80	1,840.0	5,600	456.0
11	120	40	1,220.0	4,000	232.0
12	120	64	2,252.8	7,680	339.2
13	120	32	1,280.0	4,640	153.6
14	120	12	541.2	2,040	52.8
15	110	12	546.0	1,980	44.4
16	110	12	597.6	2,280	38.4
17					
18	110	12	720.0	2,880	25.2
22	100	4	296.0	1,140	4.8
Totals		596	12,672.0	37,800	3,143.6

SUMMARY.

Age, 22 years. Seedlings.

Volume per acre, 12,672.0 cubic feet, which is equal to 140.8 standard cords, or 187.7 California cords.

Volume per acre, 37,800 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 3,143.6 cubic feet, equal to 34.9 standard cords, or 46.6 California cords.

WINDERMERE GROVE.

Located between Santa Fe Springs and La Mirada, Los Angeles County.

Species ---- Blue gum. Seedlings.
Age ---- 16 years.
Elevation ---- About 100 feet.
Soil ---- Rather light sandy loam.
Water table ---- About 10 feet deep.
Area of grove ---- About 4 acres, but most of it is cut over. Sample plot was taken in the uncut portion.
Spacing ---- 8 by 8 feet.
Sample plot ---- ⅛ acre. 54 by 100 feet.

Information in regard to the age of the grove obtained from Mr. R. C. McGill, manager of the Windermere Ranch.

YIELD.

Diameter Breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	50	16			
3	60	48			
4	80	32			
5	80	56	252.0		252.0
6	80	64	409.6		409.6
7	100	24	271.2	360	156.0
8	100	56	784.0	1,680	341.6
9	100	72	1,224.0	2,880	403.2
10	110	96	2,208.0	6,720	547.2
11	110	40	2,072.0	3,400	212.0
12	120	24	844.8	2,880	127.2
Totals		528	7,065.6	17,920	2,448.8

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

SUMMARY.

Age, 16 years. Seedlings.

Volume per acre, 7,065.6 cubic feet, which is equal to 78.5 standard cords, or 104.7 California cords.

Volume per acre, 17,920 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,448.8 cubic feet, equal to 27.2 standard cords, or 36.3 California cords.

FRUITVALE GROVE.

Located on land belonging to the Coast Manufacturing and Supply Company, in Fruitvale, Alameda County.

Species ---------- Blue gum. Seedlings.
Age ---------- 25 years.
Elevation ---------- About 50 feet.
Soil ---------- A heavy loamy clay with admixture of adobe.
Water table ---------- 20 to 25 feet deep.
Area of grove ---------- About 2 acres; in a long belt, 125 feet wide.
Spacing ---------- 6 by 6 feet.
Sample plot ---------- ¼ acre. 50 by 218 feet. This grove was cultivated the first two years. The trees are unusually straight and symmetrical.

Information in regard to age and management of grove obtained from Mr. Cole, the superintendent of the company.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
3	50	4			
4	60	32			
5	70	72	266.4		266.4
6	70	116	626.4		626.4
7	80	100	840.0	1,000	550.0
8	90	76	912.0	1,900	425.6
9	100	48	816.0	1,920	268.8
10	110	112	2,576.0	7,840	638.4
11	120	40	1,220.0	4,000	232.0
12	130	60	2,352.0	8,400	348.0
13	140	28	1,414.0	5,740	154.0
14	140	40	2,264.0	9,200	200.0
15	140	24	1,512.0	6,240	108.0
16	140	8	555.2	2,320	32.0
17	140	8	607.2	2,520	28.0
18	150	8	733.6	3,120	25.6
Totals		776	16,694.8	54,200	3,903.2

SUMMARY.

Age, 25 years. Seedlings.

Volume per acre, 16,694.8 cubic feet, which is equal to 185.9 standard cords, or 247.9 California cords.

Volume per acre, 54,200 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 3,903.2 cubic feet, equal to 43.4 standard cords, or 57.8 California cords.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

MEECHAN GROVE — STONY POINT.

Located at Stony Point, Sonoma County.

Species ——— Blue gum. Seedlings.
Age ——— 30 years or more.
Elevation ——— About 75 feet.
Soil ——— Very light, fine grained, sedimentary sand or silt covered with a heavy litter and humus.
Water table ——— 10 to 20 feet deep.
Area of grove ——— 8 to 10 acres.
Spacing ——— 8 by 8 feet.
Sample plot ——— ¼ acre. 100 by 109 feet. The grove was cultivated the first year.

Information in regard to age and management of this grove obtained from Mr. F. Meechan.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	24			
3	50	40			
4	60	96			
5	80	96	432.0		432.0
6	100	80	704.0		704.0
7	110	84	1,075.2	1,680	596.4
8	110	68	1,094.8	2,380	448.8
9	120	56	1,192.8	3,360	375.2
10	120	60	1,548.0	4,800	378.0
11	120	56	1,708.0	5,600	324.8
12	130	44	1,724.8	6,160	255.2
13	130	12	537.6	2,040	63.6
14					
15	130	4	225.2	900	17.2
16	130	4	248.8	1,000	15.2
Totals		724	10,491.2	27,920	3,610.4

SUMMARY.

Age, 30 years or more. Seedlings.

Volume per acre, 10,491.2 cubic feet, which is equal to 116.6 standard cords, or 155.4 California cords.

Volume per acre, 27,920 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre 3,610.4 cubic feet, equal to 40.1 standard cords, or 53.5 California cords.

MEECHAN GROVE — FAUGHT FIELD.

Located at Stony Point, Sonoma County.

Species ——— Blue gum. Seedlings.
Age ——— 30 years.
Elevation ——— About 200 feet. Located on a fairly steep east slope.
Soil ——— A fine grained, loamy sand.
Water table ——— 50 feet or more.
Area of grove ——— 4 or 5 acres. In the shape of a long belt, 20 rows (150 feet) wide.
Spacing ——— 8 by 8 feet.
Sample plot ——— ¼ acre. 218 by 50 feet. The grove was cultivated the first year.

Information in regard to age and management of this grove obtained from Mr. F. Meechan.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	8			
3	60	16			
4	80	40			
5	80	112	504.0		504.0
6	100	144	1,267.2		1,267.2
7	100	112	1,265.6	1,680	728.0
8	110	68	1,094.8	2,380	448.8
9	110	80	1,552.0	4,000	496.0
10	120	44	1,135.2	3,520	277.2
11	120	48	1,464.0	4,800	278.4
12	120	36	1,267.2	4,320	190.8
13	130	20	896.0	3,400	106.0
14					
15	130	4	225.2	900	17.2
Totals		732	10,671.2	25,000	4,313.6

SUMMARY.

Age, 30 years. Seedlings.

Volume per acre, 10,671.2 cubic feet, which is equal to 118.6 standard cords, or 158.1 California cords.

Volume per acre, 25,000 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 4,313.6 cubic feet, equal to 47.9 standard cords, or 63.9 California cords.

MEECHAN GROVE — SHROPSHIRE FIELD.

Located at Live Oaks, Sonoma County.

Species ---------- Blue gum. Seedlings.
Age ---------- 30 years.
Elevation ---------- About 350 feet; on top of a round hill.
Soil ---------- A fine sand, mixed with a small amount of clay, and covered with a coarser sand.
Water table ---------- Although the grove is on top of a hill, the water table is not very deep, because of several springs in the vicinity. It is probably not more than 30 or 35 feet deep.
Area of grove ---------- About 4 or 5 acres.
Sample plot ---------- ¼ acre. 100 by 109 feet.

Information in regard to age and management of this grove obtained from Mr. F. Meechan.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	8			
3	40	16			
4	60	56			
5	70	40	148.0		148.0
6	80	92	588.8		588.8
7	90	84	814.8	840	504.0
8	90	72	864.0	1,800	403.2
9	90	92	1,343.2	3,220	469.2
10	100	36	727.2	1,980	187.2
11	100	16	379.2	1,120	76.8
12	100	4	109.6	360	17.2
Totals		516	4,974.8	9,320	2,394.4

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

SUMMARY.

Age, 30 years. Seedlings.

Volume per acre, 4,974.8 cubic feet, which is equal to 55.3 standard cords, or 73.7 California cords.

Volume per acre, 9,320 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,394.4 cubic feet, equal to 26.6 standard cords, or 35.5 California cords.

MEECHAN GROVE — ELLIS FIELD.

Located at Live Oaks, Sonoma County.

Species ---------- Blue gum. Seedlings.
Age ---------- 30 years.
Elevation ---------- About 200 feet. Sample plot was taken on a gentle southwest slope.
Soil ---------- Deep, very fine grained, very light sand, with an admixture of clay.
Water table ---------- Probably 15 to 20 feet.
Area of grove ---------- The grove is a shelter belt, 7 rows (about 60 feet) wide and one third of a mile long.
Spacing ---------- 10 by 10 feet.
Sample plot ---------- ¼ acre. 60 by 180 feet. Outside, as well as inside, trees were measured. The grove was cultivated the first year and ploughed over the second year.

Information in regard to age and management of this grove obtained from Mr. F. Meechan.

YIELD.

Diameter Breast-high.	Average Height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	30	12			
3	40	52			
4	50	44			
5	70	52	192.4		192.4
6	80	48	307.2		307.2
7	80	104	873.6	1,040	572.0
8	90	116	1,392.0	2,900	649.6
9	100	72	1,224.0	2,880	403.2
10	100	84	1,696.8	4,620	436.8
11	110	48	1,286.4	4,080	254.4
12	110	8	247.2	840	38.4
13	100	12	368.4	1,260	46.8
14	90	12	372.0	1,140	31.2
15	90	12	422.4	1,210	28.8
16	90	8	319.2	1,040	18.4
Totals		684	8,701.6	21,010	

SUMMARY.

Age, 30 years. Seedlings.

Volume per acre, 8,701.6 cubic feet, which is equal to 96.7 standard cords, or 128.9 California cords.

Volume per acre, 21,010 board feet,*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,979.2 cubic feet, equal to 33.1 standard cords, or 44.1 California cords.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

McDONALD GROVE.

Located about one mile from Railroad Station, El Cajon, San Diego County.

Species ---------- Blue gum. Seedlings.
Age ---------- 30 years.
Soil ---------- A fine grained, rather loose, loamy sand.
Water table ---------- 12 to 15 feet.
Area of grove ---------- This grove has an area of about 5 acres and is in the form of a shelter belt about 200 feet wide, forming three sides of a rectangle. A part of it has been cut over. The sample plots were taken in the uncut portion.
Spacing ---------- 10 by 10 feet.
Sample plot ---------- Two sample plots. ¼ acre each.

Information in regard to age of the grove obtained from Mr. Dodson of El Cajon.

YIELD.

Diameter Breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
3	30	8			
4	40	12			
5	50	14	37.8		37.8
6	60	18	79.2		79.2
7	70	26	187.2	260	127.4
8	80	28	294.0	560	140.0
9	90	122	1,781.2	4,270	622.2
10	90	34	591.6	1,530	159.8
11	100	22	521.4	1,540	105.6
12	100	4	109.6	360	17.2
13	110	10	354.0	1,250	44.0
14					
15	120	2	100.4	390	7.8
Totals		300	4,056.4	10,160	1,341.0

SUMMARY.

Age, 30 years. Seedlings.

Volume per acre, 4,056.4 cubic feet, which is equal to 45.1 standard cords, or 60.1 California cords.

Volume per acre, 10,160 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,341.0 cubic feet, equal to 14.9 standard cords, or 19.9 California cords.

THEREFALL GROVE.

Located about three miles from Railroad Station, Newark, Alameda County.

Species ---------- Blue gum. Seedlings.
Age ---------- 32 years.
Elevation ---------- About 50 feet.
Soil ---------- Adobe loam.
Water table ---------- 14 to 15 feet deep.
Area of grove ---------- 7 acres.
Spacing ---------- 6 by 6 feet.
Sample plot ---------- ¼ acre. 109 by 100 feet.

Information in regard to age of the grove obtained from the manager of the Pacific Land Investment Co., the present owners.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	30	4			
3	40	16			
4	50	36			
5	70	40	148.0		148.0
6	70	36	194.4		194.4
7	90	56	543.2	560	336.0
8	110	88	1,416.8	3,080	580.8
9	120	40	852.0	2,400	268.0
10	130	44	1,245.2	4,180	299.2
11	130	20	674.0	2,300	126.0
12	140	52	2,267.2	8,580	327.6
13	150	16	913.6	4,000	96.0
14	150	12	757.2	3,300	62.4
15	150	36	2,530.8	10,980	180.0
16	150	8	616.8	2,680	33.6
17	160	16	1,476.8	6,480	64.0
18	160	12	1,221.6	5,220	42.0
19	160	4	441.2	1,860	12.0
20	170	4	537.6	2,200	11.6
Totals		540	15,836.4	57,820	2,781.6

SUMMARY.

Age, 32 years. Seedlings.

Volume per acre, 15,836.4 cubic feet, which is equal to 176.0 standard cords, or 234.6 California cords.

Volume per acre, 57,820 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,781.6 cubic feet, equal to 30.9 standard cords, or 41.2 California cords.

GLASS GROVE.

Located on Central avenue, between Watts and Compton, Los Angeles County.

Species ---- Blue gum. Sprouts.
Age ---- 8 years. Planted originally about 16 years ago.
Elevation ---- About 100 feet.
Soil ---- Stiff, sandy loam.
Water table ---- 15 to 25 feet deep.
Area of grove ---- 4 acres.
Spacing ---- 8 by 8 feet.
Sample plot ---- ¼ acre. 181 by 60 feet.

Information obtained from Mr. Glass, the present owner of the grove.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	156			
3	40	256			
4	60	172			
5	60	140	448.0		448.0
6	80	92	588.8		588.8
7	80	84	705.6	840	462.0
8	80	92	966.0	1,840	460.0
9	90	48	700.8	1,680	244.8
10	90	4	69.6	180	18.8
11	90	20	410.0	1,200	86.0
Totals		1,064	3,888.8	5,740	2,308.4

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

SUMMARY.

Age, 8 years. Sprouts.

Volume per acre, 3,888.8 cubic feet, which is equal to 43.2 standard cords, or 57.6 California cords.

Volume per acre, 5,740 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,308.4 cubic feet, equal to 25.6 standard cords, or 34.2 California cords.

JEWETT GROVE.

Located near Elmira, Solano County.

Species ---------- Blue gum. Seedlings.
Age ---------- About 35 years.
Elevation ---------- About 75 feet.
Soil ---------- Very fertile clayey loam.
Water table ---------- 25 to 30 feet deep.
Area of grove ---------- Originally about 5 acres, but most of it is cut over.
Spacing ---------- 10 by 10 feet.
Sample plot ---------- ¼ acre. 180 by 60 feet. About ten years ago 200 trees were cut in this grove. The sample plot was located so as to exclude the cut area.

Information in regard to age of the grove obtained from Mrs. Jewett, the present owner. When the Jewetts came to this place, twenty-five years ago, the trees were already of good size. Mr. McCrory, an old settler in the vicinity, thinks that the trees were set out about thirty-five years ago.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
4	50	16			
5	50	4	10.8		10.8
6	60	12	52.8		52.8
7	90	40	388.0	400	240.0
8	90	28	336.0	700	156.8
9	100	32	544.0	1,280	179.2
10	100	12	242.4	660	62.4
11	100	32	758.4	2,240	153.6
12	110	16	494.4	1,680	76.8
13	110	40	1,416.0	5,000	176.0
14	110	40	1,600.0	5,800	160.0
15	120	20	1,004.0	3,900	78.0
	120	16	888.0	3,520	56.0
	120	8	488.8	1,960	24.0
	120	12	801.6	3,240	28.8
	120	8	580.0	2,320	15.2
20					
21	130	4	372.4	1,580	5.2
22	130	4	399.6	1,740	5.2
Totals		344	10,377.2	36,020	1,480.8

SUMMARY.

Age, about 35 years. Seedlings.

Volume per acre, 10,377.2 cubic feet, which is equal to 115.3 standard cords, or 153.7 California cords.

Volume per acre, 36,020 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,480.8 cubic feet, equal to 16.5 standard cords, or 21.9 California cords.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

WEBB GROVE.

Located between San Lorenzo and Hayward, Alameda County, R. F. D. No. 8 from Hayward.

Species ---------- Blue gum. Seedlings.
Age ---------- 36 years.
Elevation ---------- About 200 feet.
Soil ---------- Hard adobe clay.
Water table ---------- About 40 feet deep.
Area of grove ---------- About 5 acres.
Spacing ---------- Originally 8 by 8 feet. Thinned out when the grove was about 10 years old, by taking out alternate rows. Present spacing 16 by 16 feet.
Sample plot ---------- ¼ acre. 66 by 165 feet.

Information in regard to age and management of this grove obtained from Mr. E. O. Webb, the owner.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
6	70	8	43.2		43.2
7					
8	70	8	71.2	120	36.0
9	80	12	152.4	360	55.2
10	100	20	404.0	1,100	104.0
11	100	16	379.2	1,120	76.8
12	110	32	988.8	3,360	153.6
13	110	20	708.0	2,500	88.0
14	110	16	640.0	2,320	64.0
15	110	24	1,092.0	3,960	88.8
16					
17	110	8	439.2	1,720	22.4
18					
19	110	4	260.8	1,040	6.0
Totals		168	5,178.8	17,600	738.0

SUMMARY.

Age, 36 years. Seedlings.

Volume per acre, 5,178.8 cubic feet, which is equal to 57.5 standard cords, or 76.7 California cords.

Volume per acre, 17,600 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 738.0 cubic feet, equal to 8.2 standard cords, or 10.9 California cords.

LINDA VISTA GROVE.

Located about a mile and a quarter south of Mission San Jose, Alameda County.

Species ---------- Blue gum. Seedlings.
Age ---------- 40 years.
Elevation ---------- About 500 feet. Located on a gentle, west slope.
Soil ---------- A hard clay loam, with admixture of adobe.
Water table ---------- Quite deep, but there are a number of springs on the area.
Area of grove ---------- About 3 acres.
Spacing ---------- 8 by 8 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet.

Information in regard to age of the grove obtained from the manager of the ranch.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
3	40	16			
4	60	24			
5	70	52	192.4		192.4
6	80	68	435.2		435.2
7	100	68	768.4	1,020	442.0
8	110	84	1,352.4	2,940	554.4
9	120	68	1,448.4	4,080	455.6
10	130	56	1,584.8	5,320	380.8
11	130	28	943.6	3,220	176.4
12	130	40	1,568.0	5,600	232.0
13	140	28	1,414.0	5,740	154.0
14	140	32	1,811.2	7,360	160.0
15	140	20	1,260.0	5,200	90.0
16	150	12	925.2	4,020	50.4
17	150	4	335.6	1,440	15.2
18	150	12	1,100.4	4,680	38.4
Totals		612	15,139.6	50,620	3,376.8

SUMMARY.

Age, 30 years and over. Seedlings.

Volume per acre, 15,139.6 cubic feet, which is equal to 168.2 standard cords, or 224.3 California cords.

Volume per acre, 50,620 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 3,376.8 cubic feet, equal to 37.5 standard cords, or 50.0 California cords.

MONTAGUE GROVE.

Located on Central avenue, between Watts and Compton, Los Angeles County.

Species ---------- Blue gum. Sprouts.
Age ---------- 8 or 9 years.
Elevation ---------- About 100 feet.
Soil ---------- Stiff, heavy, loamy sand.
Water table ---------- 12 feet deep.
Spacing ---------- 8 by 10 feet.
Sample plot ---------- ¼ acre. 218 by 50 feet.

Information in regard to age of the grove obtained from Mr. Brinkerhoff and Mr. Breckenridge, who live within half a mile of the plantation.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	50	144			
3	60	172			
4	70	160			
5	70	84	310.8		310.8
6	80	148	947.2		947.2
7	80	100	840.0	1,000	550.0
8	80	76	798.0	1,520	380.0
9	80	28	355.6	840	128.8
10	90	16	278.4	720	75.2
Totals		928	3,530.0	4,080	2,392.0

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

SUMMARY.

Age, 8 or 9 years. Sprouts.

Volume per acre, 3,530 cubic feet, which is equal to 39.2 standard cords, or 52.3 California cords.

Volume per acre, 4,080 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,392.0 cubic feet, equal to 26.6 standard cords, or 35.5 California cords.

THAXTER GROVE.

Located about a quarter of a mile west of Nadeau, on the Pacific Electric car line from Los Angeles, Los Angeles County.

Species ---------- Blue gum. Sprouts.
Age ---------- 11 to 13 years. Planted originally twenty to twenty-five years ago.
Elevation ---------- About 150 feet.
Soil ---------- Light loamy sand.
Water table ---------- Originally 16 feet deep, but in the last few years about 30 feet deep.
Area of grove ---------- 8 to 10 acres.
Spacing ---------- 8 by 8 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet.

Information in regard to age of the grove and time of cutting obtained from Mrs. Annette Thaxter, the present owner.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic Feet.*
2	50	208			
3	50	272			
4	60	232			
5	60	148	473.6		473.6
6	70	100	540.0		540.0
7	70	32	230.4	320	156.8
8	80	16	168.0	320	80.0
9	80	4	50.8	120	18.4
10	80	12	180.0	480	49.2
Totals		1,024	1,642.8	1,240	1,318.0

SUMMARY.

Age, 11 to 13 years. Sprouts.

Volume per acre, 1,642.8 cubic feet, which is equal to 18.2 standard cords, or 24.3 California cords.

Volume per acre, 1,240 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 1,318.0 cubic feet, equal to 14.6 standard cords, or 19.5 California cords.

THAXTER GROVE.

Located near Nadeau Station, on the Pacific Electric car line from Los Angeles, Los Angeles County.

Species ---------- Blue gum. Sprouts.
Age ---------- 13 to 20 years. Planted originally about thirty years ago. Cutting in this grove extended from 1890 to the winter of 1897.
Elevation ---------- About 150 feet.
Soil ---------- Very light loamy sand.
Water table ---------- 30 to 35 feet deep.
Area of grove ---------- About 5 acres.
Spacing ---------- Originally 10 by 10 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet.

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

Information in regard to age of the grove and time of cutting obtained from Mr. Bell, the former owner, and Mrs. Annette Thaxter, the present owner.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.	Volume per acre.	Volume per acre.	Volume of tops per acre.
Inches.	*Feet.*	*Number.*	*Cubic feet.*	*Board feet.*	*Cubic feet.*
2	40	32			
3	60	84			
4	60	124			
5	90	96	537.6		537.6
6	90	68	516.8		516.8
7	90	64	620.8	640	384.0
8	110	48	772.8	1,680	316.8
9	120	32	681.6	1,920	214.4
10	120	32	825.6	2,560	201.6
11	130	16	539.2	1,840	100.8
12	130	12	470.4	1,680	69.6
Totals		608	4,964.8	10,320	2,341.6

SUMMARY.

Age, 13 to 20 years. Sprouts.

Volume per acre, 4,964.8 cubic feet, which is equal to 55.2 standard cords, or 73.5 California cords.

Volume per acre, 10,320 board feet.*

Volume of merchantable tops, including the trees too small to scale, per acre, 2,341.6 cubic feet, equal to 26.1 standard cords, or 34.7 California cords.

YIELD FROM EUCALYPTUS OTHER THAN BLUE GUM.

Although there are seventy-five or more different species of eucalyptus growing in California, very few of them outside of blue gum are found in grove form, the trees usually occurring either singly, in narrow belts, or in small patches. Old plantations of even an acre in extent are extremely rare. It is, therefore, impossible to give the yield from planted eucalyptus other than blue gum, except to make the general statement that, although inferior to many of the eucalypts in the quality of its wood and its durability in contact with the soil, blue gum is by far the most rapid growing of the eucalypts. This lack of definite data is very unfortunate in view of the extensive planting of the red, gray, and sugar gums that has taken place within the last two or three years. The few eucalyptus groves more than five or six years of age, outside of blue gum, which are now found in the State show without exception slow growth and poor form and development. The trees are either crooked and scrubby, or else spindling and leaning, and few of the trees growing in grove form will make desirable timber. Whether this poor growth and form is a result of the inability of the trees to grow in close stands, or whether it is due to some other factor, it is impossible to state; but it may be of interest

*The volume given in board feet *is not in addition* to the volume stated in cubic feet and in cords, but is simply another way of expressing the same total.

to know that the same poor development of the eucalypts was found in Hawaii, though there the blue gum (*E. globulus*), the red mahogany (*E. resinifera*), and the swamp mahogany (*E. robusta*) make desirable form development when grown in close plantations. Both in California and in Hawaii many other species besides blue gum make excellent growth if planted as single trees or in small patches.

The Dwight Whiting grove at El Toro, in San Diego County, about five years old, composed of a mixture of several species; the Vowkowitch Brothers' grove near Hanford, in Kings County, about six years old, composed mostly of red, gray, and blue gums; the San Mateo grove of ironbark (*E. sideroxylon*); the Clift grove of sugar gum on Point Loma, in San Diego County, all show poor development and slow growth. Following are tables showing the stand in two of the oldest groves of eucalyptus other than blue gum:

CARPENTER GROVE.

Located near Santa del Rosa, San Bernardino County.

Species ---------- Sugar gum (*E. corynocalyx*). Seedlings.
Age ---------- 19 years.
Elevation ---------- About 1,200 feet. Slope moderate, south exposure.
Soil ---------- A coarse grained loamy sand mixed with adobe; mostly of decomposed granite.
Water table ---------- Probably over 100 feet.
Area of grove ---------- 2 acres.
Spacing ---------- 8 by 8 feet.
Sample plot ---------- ¼ acre. 100 by 109 feet.

Information in regard to the age of the grove obtained from the owner of the grove, who consulted an old journal kept when the plantation was started.

YIELD.

Diameter breast-high.	Average height.	Trees per acre.
Inches.	*Feet.*	*Number.*
2	20	44
3	30	148
4	40	172
5	45	88
6	45	44
7	50	16
Total		512

DAVIS GROVE.

Located near Lankershim, Los Angeles County.

Species ---------- Irregular mixture of Blue gum (*E. globulus*) and Red gum (*E. rostrata*).
Age ---------- 8 years. Sprouts. Planted originally in 1894, and the entire area cut over in 1902.
Elevation ---------- About 800 feet.
Soil ---------- Light sandy loam.
Water table ---------- 15 feet.
Area of grove ---------- 15 acres.
Spacing ---------- 16 by 4. Trees 4 feet apart in rows, and rows 16 feet apart.
Sample plot ---------- ¼ acre. 100 by 109 feet.

Information in regard to the age of the grove and time of cutting obtained from Mr. E. B. Mitchell, who helped plant the trees and who also helped in cutting the grove.

YIELD.

E. ROSTRATA.			E. GLOBULUS.		
Diameter breast-high.	Average height.	Trees per acre.	Diameter breast high.	Average height.	Trees per acre.
Inches.	*Feet.*	*Number.*	*Inches.*	*Feet.*	*Number.*
2	20	184	2	30	20
3	40	340	3	50	36
4	40	264	4	60	12
5	40	76	5	60	4
6	50	20	6		
Total		884	Total		72

DAVIS GROVE.

Age 3 years. Sprouts.

The same grove as above. The sample plot taken in an area where the trees were cut off a second time.

YIELD.

E. ROSTRATA.			E. GLOBULUS.		
Diameter breast-high.	Average height.	Trees per acre.	Diameter breast-high.	Average height.	Trees per acre.
Inches.	*Feet.*	*Number.*	*Inches.*	*Feet.*	*Number.*
2	20	804	2	25	64
3	30	264	3	40	52
4	35	4	4	45	4
Total		1,072	Total		120

CALIFORNIA STATE BOARD OF FORESTRY

BULLETIN No. 1

G. M. HOMANS, - - - State Forester

In Co-operation With the

FOREST SERVICE, U. S. DEPT. AGRICULTURE

YIELD FROM EUCALYPTUS PLANTATIONS IN CALIFORNIA

BY

LOUIS MARGOLIN,
Forest Examiner, Forest Service
United States Department of Agriculture

1910

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CALIFORNIA
STATE BOARD OF FORESTRY
BULLETIN No. 2
G. MORRIS HOMANS, State Forester

PHARMACAL PLANTS AND THEIR CULTURE

BY
ALBERT SCHNEIDER, M.D., Ph.D.,
COLLABORATOR

SACRAMENTO
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MEDICINAL AND POISONOUS PLANTS.

CHAPTER I.

GENERAL CONSIDERATIONS.

1. **Introduction.**—The United States pays about eighteen million dollars annually for imported vegetable drugs. Some of these are from tropical countries and can not be grown within the bounds of our native country, but the majority of plants used in medicine, which have been imported heretofore, might readily be cultivated in the United States. Furthermore, there is a steadily increasing shortage of wild-growing, native, medicinal plants. Sooner or later these must be cultivated to prevent extermination or paucity. It is also a fact that the foreign supply of vegetable drugs is extremely uncertain and variable, both as to quality and quantity, conditions which can be corrected by growing drugs of first quality at home.

That medicinal plants may be grown profitably has been proven by the several isolated attempts in widely-separated areas of the United States. The following suggestions are intended to serve as stimulus, as well as a guide, to those interested in the cultivation of medicinal plants, primarily in California, also in other states.

Within recent years the pharmaceutical press has published reports on the scarcity of certain drugs, as belladonna, hyoscyamus, hydrastis, senega, and others. Some anxiety begins to arise concerning the future supply of cascara bark.

The present tendency in medical and pharmaceutical botany is toward greater simplification. The number and variety of plants now used medicinally is very small when compared with the number used in the past, and the process of "weeding out" is still going on, as is shown by the fact that in the eighth decennial revision of the United States Pharmacopœia about forty crude vegetable drugs were excluded, while only three or four new ones were admitted. This process of reducing the number of vegetable drugs does not, however, imply that the importance of studying new and old medicinal plants is correspondingly lessened. Rather the reverse is true. Botanists, chemists, physiologists, and pharmacologists must extend their investigations into fields still unknown or imperfectly understood. There is, for example, much uncertainty as to the identity, origin, and physiological action of many long-used vege-

table drugs, to say nothing of the vegetable drugs of such countries as China, India, Arabia, and Central America, which are awaiting our careful study and investigation in order to determine their possible therapeutic value.

Many of our native medicinal plants require further study, and some of the poisonous plants will no doubt prove very efficacious medicinally. The therapeutic use of drugs, vegetable and others, is based largely upon empiricism, and no one can state definitely what the future scientific progress in medicine may develop. Recent bacteriological research has completely revolutionized certain phases in the treatment of diseases, and it is highly probable that in the future the method of application and the therapeutic use of many drugs will be changed completely. It is an obligative duty to study vegetable drugs as thoroughly as possible, in order that the best results may follow their use in disease.

The study of known and unknown medicinal plants would be greatly advanced through experimental gardens, scientifically conducted. In Europe such gardens have been established for centuries, and effective efforts in this direction are now being made in various parts of the United States. The Department of Agriculture has established experimental gardens at Chico, Whittier, and Davis, in California, in which are to be grown economic plants, including medicinal plants. A garden of medicinal plants was established at Golden Gate Park, San Francisco, in which about five hundred species were under cultivation in 1904-05, but owing to lack of funds the work has recently been discontinued. Many medicinal plants are also grown in the University gardens at Berkeley, California. Many foreign medicinal plants have been introduced into California, and a number of private economic and pleasure gardens are still in existence in various parts of the State. Gardens, more or less pretentious, devoted to medicinal plants, are established at New York (New York Botanical Garden), Philadelphia, and at the Indiana State University. In addition, there are gardens of medicinal plants operated in connection with the following colleges of pharmacy: Scio College, Department of Pharmacy; University of Michigan, School of Pharmacy; Purdue University, School of Pharmacy; Brooklyn College of Pharmacy, and St. Louis College of Pharmacy. These beginnings, when more fully developed on a coöperative basis, will be important factors in perfecting our knowledge of the cultivation, constituents, properties, and uses of the medicinal plants, native and introduced, of the United States.

2. Flora and Climatic Conditions of California.—California is a large, mountainous state, with extensive valleys, and has a wide latitudinal and altitudinal range. Along the entire coast the temperature is kept quite uniformly mild by the Pacific currents, there being only

about 10° difference in the average temperature of the northern and southern limits of the state. Thunderstorms and cyclones are unknown. The coast winds blow in one direction for about eight months of the year. Snow is formed on top of the higher coast-range hills and mountains. There are sharply contrasted wet and dry seasons. In and about San Francisco there are about three months of heavy rains, namely January, February, and March, with a few rains in December and April. From about the first of May to the close of November there is no rainfall worthy of mention. Toward the north from San Francisco the amount of rainfall is increased; toward the south it is decreased. At Los Angeles and south the rainfall is much less, and irrigation is in many instances necessary to insure crops. Remarkable results have, however, been obtained by the Campbell method, or dry farming, without irrigation. The persistent "high fogs" of the coast region during the months of July and August are a peculiar feature. These fogs come in from the Pacific Ocean and cause the temperature to fall considerably, so that it is unpleasantly raw and chilly, demanding the use of a light overcoat for outdoor wear, and a fire in the grate to make the interior comfortable. Along the middle coast region the temperature rarely falls below 30° F., and the difference in mean average temperature between the northern and southern coast limits of the State does not vary more than 10° F.

The climate of the interior of the State is very variable, according to locality, differing from the immediate coast belt of approximately the same latitude and altitude in that the winters are colder and the summers hotter. The rainfall is variable. There may be snow in the winter, and in many localities there are thunderstorms and electrical displays during the summer months.

Local variations in meteorological conditions are remarkable, a distance of from ten to thirty miles showing great differences in temperature, number of foggy, cloudy and chilly days, annual rainfall, daily and nightly variations in temperature, etc. There may be a dense, cold fog in a given limited area, while in a locality a mile distant it may be comparatively warm with the brightest sunshine. This is but natural, because of the altitudinal variations, alternation of hill ranges and valleys, interrupted by higher peaks, river valleys, etc. The new arrival from the Eastern States is forcibly impressed by the browned hillsides during the summer months and the emerald verdure during the winter. Grasses and annuals generally die, excepting those under cultivation, as soon as the dry season sets in.

Even more impressive is the varied flora of the State, as might well be expected from such a peculiar climate. In the middle, and even in the northern, portions of the State, along the coast and in the interior

valleys of middle and southern California, the vegetation presents a tropical aspect, due to the palms, cycads, yuccas, aloes, century plants, magnolias, figs, banana plants, lemons, limes, oranges, carobs, olives, eucalypti, and other plants, which are not found in the open in the central, eastern, and northern United States. Wild oats, wild rye, and other grasses are common and cause the prompt green coloration of hillsides within a few weeks after the first heavy rainfalls in the autumn. Among the native trees are the incomparable giant sequoias, the tall pines, and the enormous gnarled oaks. The multitude of varieties of introduced eucalypti and acacias form the striking feature of the California arboreal flora. Many remarkable foreign plants have become well established, as the gingkos, casuarinas, tree ferns, araucarias, palms, cycads, pepper trees, and others. Plants which in the East are known only as small herbs here assume tree-like proportions, as the hydrangeas, fuchsias, geraniums, the lemon verbenas, and others. Evergreen trees predominate, though such deciduous trees as the cherry, apple, plum, poplar, maple, walnut, hickory, and many others do well and are extensively cultivated. Most of the subtropical plants are from Australia, southern Europe, and Mexico; many are now being introduced from China, Japan, and the Philippines. Some are from South America, the West Indies, Italy, and Spain, with stragglers from other tropical and subtropical countries. Under cultivation, with suitable soil and drainage, the vegetation grows with remarkable rapidity and luxuriance. Some plants will not thrive well because of the prevailing cool nights, as Indian corn, cotton, and sugar cane, although these plants are grown quite successfully and profitably in certain localities. Cotton, for example, does well in the Imperial Valley region.

With a flora so remarkable and varied, it is reasonable to expect the presence of a comparatively large number of plants which have, or may have, medicinal value. This will be borne out by the list of medicinal plants reported from the State. Aromatic, fragrant, and spicy fruits, trees, grasses, and herbs are abundant. The medicinal uses of many have been ascertained through the Indians, early Spanish missionaries and settlers.

3. California Dealers in Vegetable Drugs.—In order to ascertain certain facts with regard to the commerce in California vegetable drugs, a letter was addressed to the leading wholesale drug houses in San Francisco, asking for a list of vegetable drugs which were obtained from the State. Prompt replies were received and with one exception the following are the drugs secured from the State which were offered for sale at regular market value: *Cascara sagrada, Yerba santa, Yerba buena, Berberis aquifolium, Grindelia robusta, Angelica root, Absinthium,*

Marrubium, and *Eucalyptus* leaves. The one exception was the F. A. Weck Company, who gave a much longer list, as follows:

Berberis aquifolium root
Cascara sagrada bark
California laurel leaves
Damiana leaves
Eucalyptus globulus leaves
Eschscholtzia californica
Grindelia robusta
Grindelia squarrosa
Kava kava root
Manzanita leaves
Rhus toxicodendron
Yerba buena
Yerba reuma
Yerba santa
Wild potato root (man in the earth)
Mullein leaves
Mullein flowers
Skunk cabbage root
Skunk cabbage leaves
Wild cucumber root
Angelica root
May weed herb
Scouring rush
Pine buds
Pine needles
Plantain leaves
Plantain root
Wormwood herb
Horehound herb
Linden flowers
Sage
Thyme
Summer savory
Sweet marjoram
Red clover flowers
Peach leaves
Raspberry leaves
Strawberry vine
Garden lettuce
Hops
Orange flowers
Orange peel
Orange pits
Apricot pits
Red rose leaves (petals)
Pale rose leaves (petals)
Pumpkin seeds
Watermelon seeds
Mustard seed
Canary seed
Rape seed
Hemp seed
Flax seed
Low mallow
Wild sage
Spikenard
Burdock root
Buckeye bark
Buckeye leaves
Milk weed
Horseradish
Cherry stems
Poppy heads
Coriander
Fennel
Caraway
And others.

The information gained was somewhat surprising, on the one hand because not more drugs were secured from the State, and secondly because the Weck Company supplied comparatively such a large number from the State. From several interviews with Mr. F. A. Weck it was ascertained that the maintenance of such a list was uncertain for several reasons. The principal one was high American labor *versus* cheap European labor. A crude vegetable drug can, as a rule, be imported at less cost than it can be gathered at home. Mr. Weck is a very keen observer who has made a special study of the vegetable drug resources of the State, and has ascertained what vegetable drugs may be secured and collected with profit. His usual plan was first to find out what crude drug or drugs were wanted and then to find men who would sign a contract to collect, cure, and deliver to him the desired quantity of the drug at a stipulated price. In many instances these contracts were signed with parties living in the region where the drug-yielding plants

were abundant. Thus, carload lots of cascara bark have been supplied through him to Eastern and foreign manufacturing houses.

The general conclusions which are deduced from these conversations with Mr. Weck are as follows:

The wholesale dealers, as well as wholesale manufacturers, give little heed to the commercial source of the drug, manner of collecting, drying, etc. They desire a clean, neat-looking article at the very lowest figure. If an English house can supply digitalis leaves, horehound, and mint more cheaply than a California house, then these articles will be imported, even though they may have been rendered comparatively inert through careless packing, storing, age, etc. A San Francisco house will import horehound from England, though that commodity is a common weed throughout the State. It appears that in order that a drug may be profitably procured in the United States, there must first be a large and reliably constant demand, and the drug must be collected on a large scale with the aid of suitable mechanical appliances and machinery. Collecting on a small scale is not profitable. Drying must be done in the open and the drug shipped in bulk, in boxes, barrels, in sacks or wrapped in burlap. Large shipments of herbs may also be baled like hay and wrapped in burlap. Ounce, pound, and larger retail amounts of herbs and leaves may be pressed in paper packages.

4. **What Drugs May Be Collected Profitably.**—From what has been said it is evident that even though a medicinal plant is very common in the United States, marketing the drug may not be profitable because of the high cost of labor and of other conditions. This is made clear in a bulletin issued by the United States Department of Agriculture on the common medicinal weeds of the United States. (Alice Henkel: Weeds Used in Medicine, Farmers' Bulletin No. 188, U. S. Dept. Agr., 1904). In this report the suggestion is made that the medicinal weeds mentioned might be collected and marketed by the farmer. To this end certain directions are given as to time of collecting, part of plant used, curing, garbling, etc. This plan, it was hoped, would not only rid the farm of the objectionable weeds, but would at the same time be a source of revenue, slight though it might be. It does not seem wise to give these suggestions, for several reasons: The farmer is chiefly interested in his crops and other farm products, knows little or nothing about drugs, can not always take the time to collect the drug at the right time, and can not take the time to collect, garble and cure it properly. The attempt would simply result in a poor quality of drug being placed on the market. Drug-marketing should be done by those who understand it and are ready to make a business of it. On studying the market value of the medicinal weeds mentioned, it will be found that the average price per pound of roots and leaves is from five to seven cents, a sum

entirely too small to make it worth while to collect comparatively small quantities, which would certainly be all that could be found on well-cared-for farms. No farmer would care to permit his farm to go to weeds in order that he might sell these to a druggist. The following is the list of medicinal weeds as given by Miss Henkel: *Achillea millefolium* L., *Agropyron repens* (L.) Beauv., *Arctium lappa* L., *Brassica nigra* (L.) Koch, *Chenopodium ambrosiodes* L., *Chenopodium anthelminticum* L., *Cnicus benedictus* L., *Conium maculatum* L., *Datura stramonium* L., *Digitalis purpurea* L., *Eupatorium perfoliata* L., *Grindelia robusta* Nutt., *Grindelia squarrosa* (Pursh.) Dunal, *Leptilon canadense* (L.) Brit., *Erigeron canadense* L., *Lobelia inflata* L., *Marrubium vulgare* L., *Nepeta cataria* L., *Phytolacca americana* L., *P. decandra, Rumex brittanica* L., *Rumex crispus* L., *Rumex obtusifolius* L., *Tanacetum vulgare* L., *Taraxcum taraxacum* (L.) Karst., *Sinapis alba* L., *Verbascum thapsus* L., all of which are more or less common in California.

A large number of drug-yielding plants can no doubt be grown profitably in the United States, but as indicated, this, in the majority of cases, is possible only when done on a large scale. The climate of California is peculiarly adapted to the cultivation of many different kinds of medicinal plants, as has been proven experimentally, and it is to be hoped that some enterprising individuals may make a beginning in establishing plantations of medicinal plants like those of England, Germany, France, Italy, and other European countries. Experiments have been made with the poppy, and it was found that the opium obtained was of excellent quality, but on account of high-priced labor it was impossible to compete with the Oriental market. It may be possible to find some other method of securing the opium. One method, which has been tried, was to cut the plants at the proper time, express the juice from the entire plant, and evaporate it to the proper consistency. It was, however, found that the alkaloidal yield of the gum opium was very low. The statements made in regard to poppy cultivation apply also in a general way to the cultivation of the camphor tree in California. Certain cultural attempts can be undertaken successfully only by those who have ample funds and are willing to do the necessary preliminary experimenting. In fact, such work should have government (State and Federal) support. At a cost of many millions of dollars, the English Government has successfully introduced cinchona culture into India.

5. General Suggestions on the Cultivation of Medicinal Plants in the State of California.—The plants cited in this report are, with few exceptions, found growing within the boundaries of the State. Many more may readily be introduced. It is not, however, intended to imply that all, even, of this limited number of medicinal plant are of unques-

tioned therapeutic value, or that they may be grown profitably. Some of the difficulties in the way of profitable culture have already been referred to, the chief one being high-priced American labor *versus* the cheaper foreign labor. We can no doubt put into operation ways and means which will in a measure overcome this difference in the cost of labor, as the use of time- and labor-saving machinery, improvement in cultural operations, etc. First of all it will be necessary to create an interest in that kind of plant-culture. Such an interest has been created in other countries, notably in England and Germany, where certain medicinal plants are grown on an enormous scale, suffcient to supply the home market at least. Just as we compete successfully or excel in certain branches of horticulture, agriculture, arboriculture, etc., just so may we compete successfully or excel in the growing of medicinal plants. All that is necessary is for enterprising and intelligent individuals to establish plantations of desirable medicinal plants, in suitable localities, growing them on a sufficiently large scale, and putting into operation the appropriate methods of cultivating, collecting, drying, marketing, etc. Beginnings should be made with those drugs which will find a ready market. It must be borne in mind that it is necessary to compete with the foreign market, and that the enterprise should yield a profit equal to that from other soil-cultural pursuits. There is no plausibly apparent reason why this should not be done. If, as the Department of Agriculture suggests, the farmer of the United States may hope to collect medicinal weeds profitably, he will find it certainly even more profitable to devote his entire time and energy to the intelligent culture of medicinal plants, whether weeds or not. A few medicinal plants are being cultivated on a large scale in the United States, as the mints in Michigan and Wisconsin, and crocus in Pennsylvania. It is affirmed that African senna (*Cassia acutifolia*) has been successfully grown at Corpus Christi, Texas, and at Washington, D. C.

As has been indicated elsewhere, most medicinal plants may be grown in the State. The familiar garden herbs and pot herbs used medicinally and for culinary purposes can certainly be grown successfully, if not profitably. We may also include the mints, pennyroyal, sage, lettuce, yerba santa, thyme, caraway, fennel, coriander, camomile, and many others. There are numerous introduced trees, shrubs, and herbs, in cultivation and escaped from cultivation, which might, no doubt, be grown profitably for medicinal purposes, as the camphor tree, broom, blue gum, and carob. It would, however, seem desirable to begin with a few of the more important, less common, herbaceous drug plants, as aconite, digitalis, rhubarb, belladonna, scopola, hyoscyamus, valerian, veratrum, and others, although there is no plausible reason why such common but nevertheless very desirable drugs, as taraxacum, chicory, mallow, burdock, horehound, milk weed, sambucus, stramonium, absin-

thium, rosemary, and many others, should not be very profitably cultivated on a large scale. Insect flowers (*Pyrethrum*), lavendula, hops, and others are now being grown very successfully in the State.

Inasmuch as the work is very largely in the experimental stage, it is desirable to begin with perhaps five or six different species of medicinal plants. In the course of a few years it will be found which plants are best suited to the particular soil, climatic condition, and temperature, and finally the grower will, in all probability, limit himself to those species giving the best promise as to net earnings or gain, per acre. It will be necessary to develop the most suitable methods of cultivation, fertilization of soil, rotation of crops, collecting, garbling, drying, and marketing. Each species of medicinal plant will require its special care and attention, just as with the different field, orchard, and garden plants. For detailed and specific instructions the available literature should be consulted, and, for the rest, experience must be the guide.

6. **General Suggestions on the Cultural Methods.**—On looking over the existing agricultural, horticultural, and arboricultural resources of the State, one is astonished at the variety of crops grown successfully. With few exceptions the plant-cultural enterprises are conducted on an enormous scale as compared with similar European efforts, or even with those of the Eastern and Southern States. This brief statement should serve as a significant hint to those who have the ambition and courage to begin the cultivation of medicinal plants in California.

Random, unintelligent, illy-considered attempts are to be discouraged, as they lead to mistaken conclusions and to failures. Excepting perhaps in a few instances, it is not advised to grow medicinal plants as a side line or "small crop," nor is it advised that those unfamiliar with field cultural operations, chemistry of soil, the chemistry, constituents, and physiological action of vegetable drugs, should initiate or superintend such cultural efforts.

In order to avoid the unprofitable preliminary experimenting above hinted at, it is very strongly urged that beginnings be made with well-known and highly important medicinal plants, as digitalis, aconite, belladonna, scopola, rheum, golden seal, and others. While it is possible to get valuable information from books, correspondence, and hearsay, with regard to the desirable cultural methods, and, accordingly, to make fairly successful beginnings, it would nevertheless be very desirable to send qualified men to countries where these various plants are being grown successfully, with instructions to remain at least several months, to work in the fields and to collect concise and reliable data with regard to the most successful and most profitable methods employed. On returning, these observers should be placed in charge of the field work, with specific instructions to adopt, to the best of their ability, the foreign methods to American (Californian) conditions and require-

ments. For example, if it is desired to begin the culture of digitalis, a competent man should be sent to the digitalis fields of England, secure employment as a laborer, and carefully record the cultural methods, methods of curing, garbling, packing, shipping, marketing, etc. In the course of a few months, or perhaps one season, he should be in a position to give reliable and exact advice as to how to begin the successful culture of English digitalis in California, and should be in position to take charge of, and superintend, the field work, etc. As to what additional or new may be desirable in the way of methods, machinery, devices, etc., must be determined by experience and inventive genius. Similarly, the culture of camomile, chicory, and bittersweet should be studied in Germany; licorice, saffron, squill, and belladonna culture in Spain; licorice and rheum culture in Turkey and Asia, etc.

Following these suggestions would in the end prove most profitable. Much may, of course, be learned from the several attempts that have already been made in this country, particularly in California. For example, hops, insect flower, chicory, canaigre, English mustard, calendula, lavendula, tak oak, eucalyptus, rose (American Beauty), poppy, cardamom, ginger, have been grown and marketed with more or less success, to say nothing of the staple crops as onions, sugar-beets, oranges, lemons, limes, olives, carob, asparagus, celery, Indian hemp (for fiber), etc., and the native medicinal plants as cascara, yerba santa, yerba buena, yerba mansa, berberis, manzanita, and others. Numerous ginseng gardens have been established within recent years in different parts of the United States.

Most of the medicinal plants, like most other economic plants, require rich, well-tilled soil. Some thrive best in a moist, rich soil, as rhubarb, belladonna, aconite, luffa, and colocynth, while others thrive better in a rich, sandy, comparatively dry soil, as cacti, aloes, digitalis, and mustard. Some require shade, as hydrastis, ginseng, May apple, wild ginger, etc. Some require rich, somewhat marshy, soil, as the mints, wild ginger, calamus, and iris. These are all data which must be carefully considered by those who are about to enter upon drug culture.

It will be found that most of the plants recommended for cultivation are herbs or herbaceous, either annuals, biennials, or perennials. In the case of biennials it is, of course, necessary to wait two seasons for a marketable crop, as with digitalis, whereas some perennials, as rhubarb and ginseng, require a wait of three or four years before a crop can be marketed.

In conclusion, it is desired to call attention to the possibilities in extending the range of successful plant culture, in many instances. We need only recall the extension northward of the orange and lemon culture in California. There is no doubt that many drug-yielding and other plants of the tropics and sub-tropics, which are now considered

as unlikely of successful culture in California, may on careful and more extended trial do well, as ginger, cardamoms, cinchona, pilocarpus, ipecac, and others.

7. Preparing Vegetable Drugs for the Market.—The following remarks are intended as mere suggestions which it is hoped will be found helpful in working out the most suitable methods applicable in California.

The exact chemical constituency of many medical plants is as yet not fully understood and much research work along these lines is still to be done. This applies especially to plants bearing medicinally valuable alkaloids, glucosides, and other active constituents. It is also known that the amount of active constituents varies greatly during the vegetative period and in plants from different localities, and it would be very desirable for the drug growers to make chemical analyses of the plants grown at intervals of about one or several months, in order to determine the exact period when the active constituents are most abundant and what plant parts are most active. Such work should, of course, be supplemented by a reference to the literature on analyses made of plants growing in other localities.

The manner in which the drug is prepared also modifies the active constituents, quantitatively as well as qualitatively, for which reason the following suggestions are offered:

Time of Collecting.—Drugs should be collected at the time when the active principle or constituent is present in maximum quantity. Unfortunately, this period is as yet not accurately determined for many plants. The chemical analyses above referred to should be applied in order to clear up the uncertainties.

Naturally, the time of collecting depends upon the part of the plant to be used. In a general way it may be stated that the drug is collected when the plant organ or part to be used medicinally has reached its full development. Flowers, floral parts, fruits and seeds are collected at the time of maturity; not before or after maturity. There are, however, numerous exceptions. The flowers of pale rose, lavendula, orange, santonica, the fruits of the poppy, elaterium, vanilla, pepper, allspice and cubeb, are collected before maturity. Most leaves and leafy herbs are collected at the time of flowering or shortly before that period. Generally leaves and herbs not having a strong odor, as aconite, belladonna, verbascum, stramonium, digitalis, hyoscyamus and others, are to be gathered shortly before blossoming, while aromatic leaves and herbs, as absinthium, tansy, the mints, pennyroyal and rosemary should be collected at the time of blossoming.

With drugs represented by subterranean organs, as roots, rhizomes, tubers and bulbs, also the bark of trees and shrubs, the time of collecting is quite variable. The most suitable time for collecting such drugs is

just prior to or at the time of the cessation of active seasonal growth, and, as is known to the plant grower, this period varies considerably. There are, however, some very notable exceptions to this general rule. Belladonna roots gathered from the blossoming and fruit-bearing plants (July, in the Eastern States and in Europe) are twice as valuable as those collected in March or in October. The roots of taraxacum, valerian, gentian, angelica, tormentilla and others, should be collected in the spring, although there is some difference of opinion with regard to taraxacum and valerian, some authorities stating that these roots should be collected in the fall. Aconite roots should be collected from the flowering plants. Roots and rhizomes of perennial herbaceous plants, as calamus, asarum, inula, licorice, hydrastis, ginseng should, as a rule, not be collected before the close of the third year or season. Roots of biennial plants should be collected in the fall of the second year. Barks should, as a rule, be collected in the fall, at the time of the cessation of the active seasonal growth.

Leaves are generally collected at maturity, without any special reference to the age of the plant from which they are obtained. However, there are notable exceptions. The best tea is made from the exceedingly young leaves and terminal branches. The best coca leaves are picked from the shrubs three to five years old. The first-year leaves of digitalis and hyoscyamus are not to be used, nor the young (dorsiventral) leaves of eucalyptus.

Collecting the Drug.—It is practically useless to attempt giving suggestions which will be of real value to the large grower of medicinal plants. It is very important that detailed information should be obtained from those who have been engaged for years in enterprises of a similar kind. The following are mere hints which may prove useful: Roots, rhizomes and other subterranean organs may be turned up by means of a plow, like potatoes. Picking and removing dirt must no doubt be done by hand, although various mechanical devices, as rake, hooks, etc., may be found very useful. It would be very desirable to invent a device for picking leaves and flowers. In some instances the entire plant may be cut and dried and the leaves removed by flailing, as is done in the case of *Eriodictyon californicum* (mountain balm). This method could no doubt be employed with other herbaceous and shrubby plants having rather thick leaves which become very brittle on drying. Herbs can, of course, be cut by means of mowing machines. Flowers, fruits, and barks must be collected by hand. Seeds, like mustard, are collected by mowing the plants and threshing, as is done in the mustard fields of the Lompoc Valley, California. This method can also be used with umbelliferous fruits, as anise, conium, caraway, fennel, etc. Some seeds and fruits can be removed from the plants by shaking and afterwards raked together or picked up by hand.

Cleaning and Garbling.—All drugs should be freed from foreign matter which may cling to them. This applies particularly to subterranean organs, which must be freed from soil, sand, foreign roots and rootlets and other foreign particles. Most of the dirt may be removed by brisk shaking, especially if the soil, in which the plants have been growing, is quite dry and sandy. Wet adobe soil clings quite tenaciously and after drying it bakes and clings very firmly. Soil which can not be removed by shaking must be removed by washing in clean water. Leaves, herbs, barks, fruits and seeds should never be washed.

Washing should only be employed when necessary and should not be prolonged more than is required. Prolonged soaking and washing in water removes much of the active principle and reduces the value of the drug accordingly.

Garbling consists in removing by picking, sifting or winnowing all undesirable parts or particles. Careful cleaning and garbling gives the drug a wholesome appearance and adds greatly to its commercial as well as medicinal value. Machinery and various mechanical devices are desirable or necessary in cleaning and garbling.

Sorting into grades is not permissible with drugs. That is, separating the crop yield into grades of different qualities, as is generally done with fruits and grains, for only first grades or qualities are wanted. Wholesale as well as retail dealers always call for the best quality drugs. The grower who would place on the market a sorted, inferior article would be guilty of a gross misdemeanor.

Peeling, Cutting and Slicing.—These processes hasten drying by increasing surface exposure and increasing the rate of evaporation of moisture. The special function of the epidermis and cork tissue is to reduce the evaporation of moisture from the interior of plant organs. Removing these tissues therefore permits the more rapid escape of moisture; as a result the drug dries more quickly, which is not only time saving, but also lessens the decomposition of active principles and reduces the tendency toward the development of microbes, molds, mildews and other animal parasites.

Occasionally peeling is for the purpose of removing the outer inert portions, as with many barks (cinnamon, elm, soap bark, butternut, etc.) and the fruit of colocynth. In some instances peeling is practiced when it is unnecessary or undesirable, as in the case of ginger and calamus.

As a rule drugs which are cut or sliced are not peeled or decorticated for reasons which are perhaps self-evident, though there are exceptions, as for example, rhubarb roots, which are both peeled and cut. The manner of cutting and slicing drugs varies in different countries and with different drug collectors. These operations are performed on fleshy roots, rhizomes, tubers and bulbs. Some are sliced or cut trans-

versely, as bryonia, calumba, colchicum, chicory, bittersweet, and couch grass; some longitudinally, as gentian, calamus, belladonna, and some are generally cut in any direction, as inula, rhubarb, and zedoary.

It should be remembered that peeling, cutting and slicing exposes the tissues containing the active constituents to the climatic influences which hasten their evaporation, dissipation and chemical decomposition, therefore, these operations should be reduced as much as is practicable with a reasonably rapid and uniform method of drying or curing. In other words, the pieces should be left as large as possible.

Peeling is done by hand, likewise rossing (removing the outer bark) of barks, but cutting and slicing may be done by suitable mechanical devices.

Scalding.—Certain drugs, as ginger, sarsaparillas, curcuma, salep and a few others, are placed in boiling water before drying. This kills the cells and prevents sprouting, it destroys parasites which may be present and hastens drying because moisture escapes much more rapidly from dead cells than from living cells.

Liming and Bleaching.—It has become customary to bleach and lime certain drugs, as ginger, calamus, orris root and nutmegs. These processes are not necessary or desirable, excepting perhaps in rare instances, and will be passed over without further comment. Here we may also mention the pernicious custom of coloring certain substances, as tea and coffee.

Drying.—After the drug has been collected, cleaned, garbled and otherwise prepared, it is ready to be cured or dried. This is an exceedingly important process to which careful attention must be given. The object to be attained is the removal of moisture in order to prevent the development of microbes, higher fungi and other organisms which feed upon the cell contents including more or less of the active constituents. It is desirable to dry drugs as quickly as possible. Exposing the drugs to direct sunlight is as a rule not preferable. Drying of leaves and herbs should be done under a shed with open sides and ends to insure free circulation of air. Fortunately, the work of drying becomes easy as well as simple in California, as most drug-yielding plants mature during the dry season, so that provision for protection from rains need not be made. However, the dews and fogs of the nights, in many localities, especially near the coast, demand special consideration. Large sheds as above suggested should be built with tables or hurdles on which the drug may be spread. These sheds should be long and narrow and the roof should be quite high above the hurdles. The drug should be spread evenly and turned several times daily. The tops of the hurdles or tables should be perforated to permit ready circulation of air from below. As soon as the air becomes very damp in the

evening the drug should be heaped and covered with canvas to prevent the reabsorption of moisture from the atmosphere. Fleshy drugs (roots, rhizomes, tubers) may be left uncovered for the first few nights. Some drugs can no doubt be dried in the field on the ground, as most herbs, mustard, fennel, caraway, mountain balm and some others.

Whether artificial heat is necessary or desirable must be ascertained experimentally. Suitable arrangements for artificial drying will generally give the best results. Kilns like those used in the hop-growing areas of California will serve for drying leaves, herbs, flowers, etc. Such drugs as jalap, rheum, curcuma, ginger, salep, sarsaparilla, and a few others are often dried in ovens, in houses over an open flame, and in other artificial ways, but that is done only in countries where the sun and natural dry air is not available.

Packing and Shipping.—As soon as the drug is thoroughly dried, it is ready for packing and shipping. No drug should be packed, either in small or large packages, unless thoroughly dry throughout. Containers, for shipment, whether large or small, should be porous so as to permit the escape of atmospheric moisture and the escape of moisture, slight though it may be, from the drug itself. Gunnysacks, grain sacks, barrels, wooden boxes, paper bags, pasteboard boxes, etc., will be found useful. The problem of size and nature of containers, modes of shipment, will solve itself with experience. The important facts to be kept in mind are that the drug should be thoroughly dry when packed, should be put into dry, clean, porous containers, should be stored in a dry place, and should be kept dry in shipment.

Marketing Drugs.—It may be assumed that no one will attempt the cultivation of any drug unless there is a market for it. Nor is it reasonable to suppose that growers will so glut the market as to reduce the market value very considerably within, say, several years. No doubt the numerous ginseng plantations which have sprung up all over the United States within recent years will sooner or later reduce the market value of this drug, but such effect is not yet appreciable. The grower can easily ascertain by inquiry where he can dispose of his product. Whether he deals with the wholesale houses or with the retail druggist will depend upon his personal inclinations, desires, and ideas of business.

Drug Culture and Manufacture.—In many instances it would be most desirable, or even necessary, for the grower to become manufacturer. The grower of lavendula, for example, should manufacture and market the oil of lavender. The California growers of insect flowers manufacture and also market the insect powder (buhach). The manufacturer of belladonna plasters should cultivate the belladonna required in his business. The grower of mints should also manufacture the oil and menthol. This applies especially to the growers of those drugs which

are used in the fresh or undried state, for example such as yield stearoptens, oils, gums, etc.

The mere suggestion must suffice, as it would be impossible, within the scope of this report, to enter into a discussion or fuller explanation. It is reasonable to suppose that a maximum profit accrues from an enterprise when the resources are developed in all possible directions. If it is profitable, for example, to cultivate mustard, it would no doubt also be profitable to manufacture and market mustard oil.

8. **Summarizing Suggestions.**—The foregoing shows, in a general way, the desirability of growing medicinal plants. The subject is treated suggestively, serving as an introduction, not as a citation, of detailed facts which may be put into operation without further investigation. The suggestions given, it is hoped, will lead to more rational attempts at drug-plant culture. The proposed enterprise should be most carefully considered from every viewpoint. Does it appear practical in its results? If so, then enter into the work with the intention of making it a success. Half-hearted attempts quite generally result in total failure and serve, furthermore, to discourage others. The following are the more important factors which must be carefully considered:

1. Is there an adequate market demand (wholesale and retail) for the drug? Is the market demand quite constant or does it fluctuate greatly?

2. Has it been demonstrated that the particular drug plant in which you are interested will thrive in the locality in which you desire to grow it?

3. Are climate (temperature, air, moisture, fog, rainfall) and soil suitable?

4. Is the necessary labor (skilled and unskilled) available?

5. Are the necessary machinery, tools, etc., available?

6. On how large a scale must the enterprise be undertaken in order to assure a reasonable profit under average conditions?

7. How much capital is required to undertake the venture properly and profitably?

8. Is there, or will there be, strong competition, and what influence will this have upon launching the enterprise and upon the net results?

9. Are you familiar with the market, and do you know how to reach the market? This is of great importance.

10. Will it be necessary or desirable to use artificial heat in drying?

11. Is it advisable, also, to become manufacturer? For example, do you intend to grow mint for dealers and for manufacturers only, or do you intend to grow the plants and to manufacture the oil also?

12. Do you intend to supply the retail market or the wholesale market, or both?

In most instances, a certain amount of garden plat and more extensive field experimenting is necessary to determine the best commercially operative methods of procedure, even after being fully informed as to the experimental and commercial operations which may have been carried out successfully in other states or in foreign countries. It is, indeed, important to know how belladonna is grown in Germany, in England, and in the eastern United States, but the methods as employed in those countries do not apply in detail to Californian conditions.

The purely experimental work should be done in botanical gardens created for that purpose. The experimental work in such gardens should be dominated by an economical, practical method. All of the other features should be made subsidiary. In other words, the botanical garden should have an economically commercial significance. Its chief function should be to develop the economic botanical resources of the country. To this end, the garden should be divided into two distinct parts. In one should be carried on the purely experimental work—that is, experimental work having a practical significance. In the second part should be carried on test plantings on a practically economic commercial basis. Such gardens need not be large nor expensive, and they should be distributed geographically and climatologically, in order that the greatest good might be accomplished with a minimum of expenditure. The idea is in the main carried out by Kew with its substations and by the experimental stations of the United States Department of Agriculture, excepting that the mistake is made of controlling substations from one central point. In fact, as far as the United States are concerned, each State should support, direct, and control its own experimental work, with, of course, a coöperative relationship with the experimental gardens or stations of other states. A very efficient state garden of this kind does not require more than ten acres of ground, a propagating house, a tool shed, an office with store rooms, a competent director, one technical assistant, two or three skilled gardeners, and the necessary additional equipment. The annual cost of maintaining such a garden in high operative efficiency need not exceed $10,000. The financial gain to the State to be derived from such a garden would soon amount to millions of dollars annually. From five to twenty-five practical tests should be carried on at one time, and perhaps two or three tests would be concluded each year. No time and effort should be wasted on useless things, as botanical freaks, botanical curios, purely technical research without practical significance, theoretical research and experiments, etc. Neither should time and effort be wasted on simple experiments which can be done by any agriculturist in any field or garden. Also, such gardens must be in charge of competent directors, men who by technical training and practical experience are qualified to direct such experiments as will bring practical net results in the shortest possible time.

CHAPTER II.

LITERATURE ON DRUG PLANTS AND DRUG PLANT CULTURE.

In lieu of records and data from California experimental gardens devoted to medicinal plants, we hereby submit the more important citations to the literature treating of the occurrence, distribution, use and cultivation of medicinal plants, especially those found in the State of California. While some citations to the chemical investigations of drug plants are given, no attempt has been made toward completeness in that direction. Such citations would be of inestimable value to investigators and it is hoped that some one may have the time and the opportunity to complete such a task.

It was thought desirable to include a few citations, which do not refer to medicinal plant culture directly. There is, for example, an extensive literature on fertility of soil, chemistry of soil, seed testing and selecting, plant physiology, tilling of soil, etc., which is of more or less importance to those who desire to enter upon the more intelligent consideration of drug-plant culture. In some instances the publications are abstracted very briefly: others are not abstracted, as the title is sufficient to indicate the nature of the subject-matter. After consulting the literature here cited, those interested will no doubt be able to obtain additional literature and to secure, through other sources, additional desirable and necessary information. The Department of Agriculture at Washington, the California State Horticultural Society, the College of Agriculture of the University of California, the various California state, county and local promotion and development committees, and the boards of trade of towns and cities are willing and ready to give information in so far as it is possible.

Most of the special information, such as range and distribution, morphology, etc., regarding California medicinal plants, will be found in the special California publications, as PACIFIC PHARMACIST, ZOE, ERYTHRAEA, PITTONIA, the PROCEEDINGS OF THE ACADEMY OF SCIENCES, the GEOLOGICAL AND RAILWAY EXPLORATION REPORTS, the ETHNOLOGICAL REPORTS AND GOVERNMENT EXPEDITION REPORTS. These may be consulted in the various libraries of the State, as at Sacramento, State University of California, Leland Stanford University, and at the California Academy of Sciences. There are also various California floras, written by well-known botanists, as Jepson, Coulter, Behr, Watson and others, which may be consulted by those interested. It will also be found that the literature on the introduced medicinal plants of Cali-

fornia soon merges into that of the neighboring states and territories, Mexico, Australia, Japan, and other countries.

Those desiring further limited information on the morphology, chemistry, physiological action, uses, etc., of many of the plants mentioned, are advised to obtain a copy of some Dispensatory (National or King's) or some standard text-book on pharmacognosy, always specifying the latest edition. The National Dispensatory is allopathic while King's Dispensatory is eclectic. Of the text-books on pharmacognosy, Culbreth's and Sayre's are perhaps the most complete in many ways, and the former is quite up to date on nomenclature.

The subject index to the literature will make it possible to collect quickly a nucleus to the literature on the history, range and distribution, chemistry, properties, cultivation, etc., of the plants mentioned. Two almost indispensable publications treating of medicinal plants are THE PROCEEDINGS OF THE AMERICAN PHARMACEUTICAL ASSOCIATION and the AMERICAN JOURNAL OF PHARMACY. Most of the references are made to these publications. There are complete sets in the library of the California College of Pharmacy, San Francisco, and in other college of pharmacy libraries.

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CHAPTER III.

SOME DRUG PLANTS WHICH MAY BE CULTIVATED PROFITABLY IN CALIFORNIA.

Drug plant culture can be considered from the purely theoretical standpoint as well as from the wholly practical standpoint. The former offers roseate promises and hopes, the latter generally starts in with a long series of disappointments. The two are to each other as day and night, and yet it would appear that they go hand in hand, with the latter as an outgrowth of the former. Theoretical drug culture gradually gives way to the purely field culture. Finally, as success looms up big, after many failures, all theorization is cast to the four winds, and the main reliance is placed upon the hoe and the plow, using the theoretical merely as a bit of background.

The man without some means is not advised to go into drug culture. He should put what little money he has into a bank, or invest it in something better established and more promising than drug plant culture. Furthermore, the enterprise must be undertaken on a fairly large scale, otherwise the net profits will not make it worth while. The all-important advice is, don't dabble; go into the enterprise in a whole-souled way and stick to it. This requires some money, good judgment or brains, and patience.

In any new field of enterprise a certain amount of purely experimental work is absolutely unavoidable. This experimental work is always conducted at a financial loss; however, the loss can be reduced to a minimum through wise and careful forethought. The following suggestions, with those already given, must suffice:

1. *Experimental Phase.*—Having decided upon the preliminaries, as to what drug plant or plants can in all probability be grown successfully and profitably in your territory, the possible market, available finances, etc., set aside an area or plat of good arable land in which to carry on what is commonly called a field experiment. Prepare this plat properly and plant it to the particular plant or plants that you intend to grow on a large scale. The details can not be gone into. Each plant tried requires special conditions. The area set aside may be only a few feet square, or it may comprise from two to ten acres. The experimenting may continue for one, two, or even three seasons. In this time the details of cultural and other operations must be worked out, as depth of plowing the soil, time of seeding, transplanting, cultivating, hoeing, irrigating, harvesting, drying, marketing, etc. It is advised to proceed cautiously. Consult all available literature on the subject, some of which is given in the publications cited. This will

serve as a foundation regarding the particular drug plant you may desire to cultivate.

Don't begin on a large or commercial scale until the preliminary details have been worked out to a satisfactory conclusion. Of course, opportunities for further experimenting will always exist, as the absolutely perfect will never be reached. During this experimental period surprises and disappointments will come thick and fast. The disappointments will appertain very largely to the great alterations required in the theoretical drug plant culture. Where you hoped to realize some $2,000 or more at the end of the first or second year, you will, in all probability, find that you lost that amount instead, but you will have gained wonderfully in experience, and this experience is a personal asset which can not be taken from you by any one.

2. *Commercial Phase.*—Based upon the purely experimental phase, you are now ready to exter upon the commercial phase. That is the work (still of an experimental nature) now carried on on a scale sufficiently large to prevent a financial loss, even if there may be no marked gain. It would be useless to enter upon details, as these will be fully known by the time you have completed the experiments.

Certain cultural enterprises can not be undertaken successfully by individuals, because of the necessary financial outlay which they entail. These should be undertaken by the State or by the Federal Government, or perhaps by wealthy individuals or corporations. The introduction of cinchonas into India by the British Government, and into Java by the Dutch Government, cost these nations large sums of money. There is little doubt that cinchonas could be grown in portions of California, as, for example, in the immediate coast region, from Santa Barbara southward. Irrigation would be necessary. A half-hearted attempt was made by the Department of Agriculture of the University of California in 1887.[1] The matter was again urged by the writer in 1905,[2] but thus far no one has appeared who is willing to invest the money necessary to properly attempt the introduction of cinchonas into California.

Camphor trees thrive exceedingly well in California, having escaped from cultivation in places. To grow a camphor tree forest, suitable for the production of camphor on a profitable commercial scale, would no doubt require an outlay of money far beyond the pocketbook of the average individual.

Pilocarpus apparently thrives in the southern coast regions of the State. Attempts to introduce this plant should be carried out much as for cinchona.

[1]Univ. Calif., Coll. Agr. Reports for 1887.

[2]The cultivation of Cinchonas on the Pacific Coast, Druggists' Circular, 40; pp. 426-430 (December, 1905).

Cascara culture could be carried out very successfully in the northern portions of the State, but only by an owner of large holdings and who was in possession of considerable wealth. To start a forest which would, in time, yield profitable quantities of cascara bark requires a vast amount of money.

Attar roses could no doubt be grown successfully in the southern portions of the State, with sufficient capital and intelligent and experienced energy. The necessary preliminary experience must be obtained in Turkey, Bulgaria, France, and other countries yielding attar of rose.

Laurel and cinnamons thrive in the State, but whether they could be cultivated profitably is doubtful. Ginger, cardamoms, aloes, etc., thrive in southern California.

Some persons appear to be greatly disappointed on being informed that the stories about there being big money in cultivating drug plants are not all reliable. However, what has been done in Austria, Germany, Spain, France, and England can be done in the United States, particularly in California.

We shall now cite a few of those drug plants which can be grown successfully and profitably within the State of California. This assumption is based upon experimental evidence and numerous other data which has been gathered from time to time.

1. **Absinthium.**—This and related plants thrive exceedingly well. It is a rank-growing herbaceous plant, which can be cultivated with comparatively little care. Requires rich, moist soil. Any of the lowlands along the coast or of any of the interior valleys would do. Must be grown on a large scale to secure any profits. The grower should also be manufacturer of the oil. The market for oil and herb should be carefully looked into before beginning culture on a commercial scale.

2. **Aconitum.**—Aconite appears to be scarce, and much that is now on the market is adulterated. Several species are substituted for the true medicinal aconite (*A. napellus*). The herb is quite common in California as an ornamental flowering plant. It is extensively cultivated in England and other European countries, where it has become naturalized.

It will no doubt thrive in any of the valley lands of California, requiring rather light, rich soil, with ample soil moisture. In the southern portions of the State, irrigation would no doubt be necessary. In fact, more or less irrigation is desirable in all parts of California, excepting, perhaps, in the extreme northern sections. Plant in rows three to three and one half feet apart. Cultivate like ordinary field crops. We would strongly advise cultivating the officinal aconite for

medicinal use, as the genuine drug is rather scarce. The market, though limited, is constant.

3. **Anise.**—This rank-growing herb thrives exceedingly well in California. Has escaped from cultivation, and is a troublesome weed in places. The grower should also manufacture the oil.

4. **Belladonna.**—This plant requires rich, moist soil, with ample atmospheric moisture in the form of low fogs. The immediate coast region of California is suitable, particularly from Santa Barbara northward. It has been grown experimentally in Los Angeles (Mr. Geo. Hill), in Golden Gate Park (Garden of Medicinal Plants), Berkeley (University Experimental Gardens, and at the writer's home), at Salinas, Fruitvale (Chas. Bixby), and on a commercial scale at Castro Valley.

The seeds are started in cold frames in October, the seedlings are cared for in the cold frames that winter, and the spring and summer of the season following, and transplanted in the following winter. Two and three crops can be gathered in one season, with or without irrigation. The roots are taken up at the end of the third or fourth season.

The alkaloidal content of the California-grown belladonna is remarkably high, in both stems and leaves (0.35 to 0.82 per cent). The entire herb is marketed. For further details as to culture in California, etc., see PROC. A. PH. A., v. 57, pp. 833–843. 1909.

5. **Calamus.**—A marsh or bog plant which could no doubt be grown profitably in the wet, marshy soils of California, along with mints. Like the mints, it has perennial runners or rhizomes, and, after once being started, takes care of itself. The rhizomes can be secured from the notheastern United States, where it is native.

6. **Cannabis.**—This tall, rank, fiber plant thrives exceedingly well in California. It may be grown as a fiber plant or for medicinal purposes, or for both purposes. It thrives best in rich, moist, sandy loam. It should be culturally tried out in the irrigated desert lands of southeastern California, as the probable ideal country for its culture (near Yuma, Imperial Valley, Chucawalla Valley). The cultural possibilities of the plant are unlimited, because of the value of its fiber. Only the dried flowering tops of the pistillate plants are used medicinally. The prospective grower must decide whether culture is for medicinal purposes, for manufacturing purposes as a fiber plant, or both. (*See* DISPENSATORIES and standard works on MATERIA MEDICA, PROC. A. PH. A., v. 57, pp. 843–845. 1909. STATE AND U. S. GOV'T. REPORTS ON HEMP CULTURE, etc.)

7. **Camomile.**—The several recognized medicinal species thrive exceedingly well. A native camomile (*matricaria discoidea* D. C.) is

much used as a domestic remedy, as a tonic diaphoretic and to check diarrhœa; particularly useful in bowel and stomach complaints of children. It has a very pleasant odor, recalling apple blossoms. There is no reason why this should not displace the German camomile. Easily cultivated, in quite dry, sandy, and loamy soil. No irrigation required.

8. **Crocus.**—This liliaceous plant requires rich, moist soil. The chief difficulty in its profitable culture is the cost of labor. A carefully watched commercial experiment carried on for one or two years would make it possible to determine whether or not the culture of this plant could be carried on profitably. Is successfully grown in Pennsylvania. It could no doubt be cultivated in association with colchicum, and perhaps connallaria, which require similar soil conditions.

9. **Dandelion.**—This plant grows in every country. A common lawn weed. The profit in dandelion culture is doubtful, because of the low price for the drug and because of high-priced American labor. Gathering the roots will prove costly.

10. **Dill and Related Plants.**—Thrive exceedingly well in California. Ordinary soil will serve. Conium, caraway, fennel, and celery are closely related to dill, similar in appearance and may be similarly cultivated. Cultivation is quite simple. Sow broadcast on good soil kept free from weeds.

11. **Eriodictyon.**—This popular native drug plant could no doubt be grown profitably on waste hillside lands. Quite common on the coast hills of middle and northern California. Seed can be obtained from the wild-growing plants. Clear the hillside land and sow the seed broadcast.

12. **Foxglove.**—Very common as an ornamental plant (both the English and the German). It requires fairly rich soil with ample moisture. Plant in rows three feet apart, eight inches apart in the row. Leaves can easily be removed by stripping from the stalks. Has escaped from cultivation and occurs spontaneously along the coast region of California and as far north as Vancouver Island. According to reports (G. H. P. Lichthardt of Sacramento and H. K. Mulford Co. of Philadelphia), the California-grown digitalis is rich in active principles.

13. **Ginseng.**—This plant (*Aralia quinquefolia*) has been grown at Sunnyvale and several other places in California. It requires artificial shading and very rich, moist soil. The successful cultivation of this plant requires special knowledge, a long wait for the first crop (four to six years), special cultural methods and careful collecting and drying.

Most of the wild-growing ginseng in the United States has been exterminated by collectors, though it may still be found from Canada south-

ward to Tennessee, in the eastern half of the United States. The true Chinese ginseng is perhaps a different species. Living roots should be imported for experimental purposes. There are numerous private and government reports on ginseng culture, which should be consulted before actual cultural work is begun. See, also, DISPENSATORIES. We would strongly advise a visit to several ginseng plantations in the United States, for the purpose of studying cultural methods, before beginning operations. On this occasion arrangements can also be made to secure seeds and roots for starting the cultural work. Seeds cost about one cent apiece and require eighteen months to germinate. One year roots sell for 10 cents each.

14. **Hemlock.**—A highly poisonous weed which will thrive anywhere. Grown much like dill, caraway, anise and related plants. Has escaped from cultivation.

The market demand is quite limited. Might be grown in conjunction with other medicinal plants, especially those which are closely related, as anise, fennel, etc. Caution must be observed to avoid mixing of plants in the field.

15. **Henbane.**—A biennial narcotic weed, which can be grown in any fairly good soil. Culturally it could be associated with stramonium, Indian hemp (*Cannabis indica*), tobacco and belladonna.

Considerable experimental work is required in establishing the culture of this plant in California and elsewhere in the United States, in order to determine what effect cultivation will have on the yield of active constituents. In order to make culture profitable, the herb (flowering) must be used.

Two forms of henbane are known, the annual and the biennial. The former is not desirable medicinally. It would appear that the biennial form, which is official in the United States Pharmacopœia, tends to flower even during the first year in California. We would advise experimental cultivation for a period of from three to five years, in order to determine the alkaloidal yield of first-year leaves (of flowering, as well as of non-flowering, plants) and second-year leaves, of upper stems, lower stems, influence of sun, fog, irrigation, etc. It thrives exceedingly well in the coast region of California.

16. **Hydrastis.**—This is grown something like ginseng, though some declare that artificial shading is not necessary.

Hydrastis could be cultivated in conjunction with ginseng. A patch of rich soil, with lath shading, 200 by 200 feet, devoted to ginseng and hydrastis would probably keep one man busy most of the time. So far, no one has attempted the commercial culture of hydrastis in California, although the few experimental attempts have shown that it thrives exceedingly well.

17. **Lavender.**—Thrives well throughout the State. The grower should also manufacture the oil.

No doubt, excellent oil lavender could be grown on the hillsides along the coast region of middle and southern California.

18. **Licorice.**—It would appear that in certain parts of the State the conditions for growing licorice are ideal. It thrives best in fine soil in bottom lands, where there is abundant moisture during the growing season, but where the ground bakes hard during the late summer months, which is favorable to the formation of the sweet constituents. The plants would have to be started from seed, but subsequent propagation is from cuttings (waste) left from the harvesting process. Planted in rows four feet apart, four inches apart in the rows. Growth is slight the first and second year. Harvesting begins in the fall of the third or fourth year, after the first transplanting, and continues every year after that. A trench is dug between the rows, two to three feet deep, and all roots found removed. The dirt from the next trench is thrown into the first, and so on. This drug plant is well worthy of a trial.

The California orange lands would no doubt prove ideal for licorice culture. We would also suggest the irrigated, alluvial, desert lands of southeastern California. Cultivation in a dry, hot atmosphere is said to increase the active constituents. The native species (*Glycyrrhiza lepidota glutinosa* Pursh.) is a troublesome weed in places. It resembles the official species (*G. glabra* L.).

19. **Mints.**—Peppermint is very extensively grown in Michigan, to a lesser extent in northern Indiana, in New York, and more recently also in Louisiana and California. Since the mint requires considerable moisture, we would suggest growing it in the drained marsh lands of the State. It would, no doubt, also do remarkably well in heavily-irrigated, desert, loam lands, where it could be grown much like alfalfa, cutting, perhaps, three or four crops each season. We would advise the prospective grower to visit the mint fields of Michigan, make the necessary observations, and secure the necessary rhizomes for starting the cultural operation in California. The grower must also be manufacturer, as the oil is the marketable product. Data for setting up a still, etc., is obtained by inspecting factories in operation. This can without doubt be made a most profitable enterprise in California. The climatic conditions are ideal.

20. **Marjoram.**—We would suggest that some one grow this plant to supply the American spice market. Most of the marjoram of the market is adulterated. It requires fairly rich, moist soil. Could no doubt be grown more profitably in association with other labiates, as peppermint, spearmint, pennyroyal, marrubium, etc.

21. **Marrubium.**—A very common California weed. Can be grown anywhere. Cultural methods much as for mints. Market limited and price per pound low.

22. **Poppy.**—The opium poppy thrives exceedingly well. Grow directly from the seed, as it can not be transplanted with success. The petals and heads are marketable. The opium can not be obtained, profitably, by the Oriental method, on account of the cost of labor. Some years ago it was suggested that the juice be expressed from the entire plant and then evaporated. Such opium contains from one to four per cent of alkaloids, as determined in the laboratories of the California College of Pharmacy. Others declare that the alkaloidal yield of such opium is practically *nil*. Further experimenting is necessary. There is apparently no reason why opium should not be manufactured in this new way. It would, of course, be necessary to change (lower) the alkaloidal standard.

The poppy must be grown from seed, as the seedlings are transplanted with great difficulty. Sow the seed (drill) in rows about two feet apart, and thin out to suit when seedlings are well established. Cultivation is simple and easy.

23. **Medicinal Rhubarbs.**—Do well in the State. Can be grown much like the culinary rhubarbs, which are very extensively cultivated in the San Francisco Bay region. The start must be made from seed, after which the lateral shoots are used for transplanting. Three- to six-year-old roots are gathered, peeled, cut, dried, and marketed.

The medicinal rhubarb could no doubt be grown very profitably on the shaded or northern moist slopes of the coast hills. Forced cultivation is not desirable, as it deteriorates the drug. (*See* DISPENSATORIES and English cultural reports.)

24. **Rosemary.**—Thrives well and is easily cultivated. The grower should also manufacture the oil. Can be grown with such labiates as marrubium and other herbs which do not require very moist soil.

25. **Sage.**—Easily cultivated, common everywhere. Can be grown with other garden herbs.

26. **Scopola.**—Used as a substitute for belladonna, having closely similar properties and uses. The market demand for the drug is, however, uncertain, belladonna having the decided preference. As far as known, this plant has not yet been grown in this State, but there is no reason why it should not do well in the same localities as belladonna, under the same methods of culture.

27. **Squill.**—Thrives exceedingly well in the immediate coast region, in moist, sandy soil. The bulbs grow to large size. Well known to Californians.

28. **Stramonium.**—Grows anywhere. Common in waste places. Culture can only be made profitable when the entire herb is used, excepting, perhaps, the coarse main stems. May be grown with *Hyoscyamus* (henbane) and belladonna. Cultivated in England and other European countries.

29. **Valerian.**—Thrives exceedingly well in fairly moist, somewhat sandy soil mixed with clay. Can be grown in association with stramonium, veratrums, and henbane. Easily cultivated.

30. **Veratrum.**—The veratrums are marsh plants and could no doubt be introduced in some of the California marsh lands.

CHAPTER IV.

THE NATIVE AND INTRODUCED MEDICINAL AND POISONOUS PLANTS OF CALIFORNIA, WITH INDEX TO COMMON NAMES.

The list of medicinal and poisonous plants of California herein reported includes both native and introduced species and varieties. The list is not complete, as many of the more common introduced fruit trees, shrubs, weeds, garden- and pot-herbs having more or less medicinal use are not cited, for the reason that they are almost universally known.

Details regarding description of species are omitted, as this information can be found in any handbook on California flora. A fuller discussion of the therapeutic use of well-known medicinal plants is also omitted, as that information can be obtained from any standard work on vegetable drugs, such as the United States, National, and other dispensatories, text-books on materia medica, such as Maisch's, Wall's, Sayre's, Culbreth's, and others. An effort has been made to cite the popular medicinal uses of plants by Indians, early settlers, and the laity generally. With many of the plants mentioned, this is the only use known. A further careful study may put some of these to the use of medical practice.

The literature cited with the plants mentioned will serve to readily obtain further information regarding range, properties, and use. Unless otherwise stated, the plant cited is a native of the State. Some of the plants cited are of no practical value, but they are given in order to meet the request for information pertaining to them, which has come in from time to time. It may again be repeated that our knowledge of the properties of most of the native medicinal plants of California is very limited indeed. Some of them enjoy such a wide, popular use that they should be more thoroughly investigated chemically and therapeutically, in order that it may be ascertained upon what these reputed virtues depend.

As will be observed, the plants are cited in alphabetical order, according to botanical names. In most instances, a mere mention of properties and use must suffice. In fact, that is all the information that is necessary to give, as the fuller discussion can be found in the Dispensatories and Text-books on Materia Medica, to which réference is made.

The list of common names will be found convenient for reference.

The numerals given refer to the numbers of the plants cited in alphabetical sequence by scientific names.

It is highly probable that some of the purely poisonous plants cited may finally prove of value medicinally. Within recent years, considerable work has been done with regard to plants poisonous to cattle. Dr. Chesnut, of the Department of Agriculture, has made a careful study of the action of permanganate of potassium in counteracting the effects of the alkaloids of many of the poisonous plants of Montana and Colorado. His conclusions are that this substance, owing to its oxidizing powers, is a very effectual antidote if given before the alkaloid has been absorbed into the system.

An opinion prevails among ranchers that cattle avoid poisonous plants instinctively. This is not exactly in accord with facts. It is true that most poisonous plants emit noxious odors, or are disagreeable to the sense of taste, and are therefore shunned and not relished as food; yet it would appear that cattle, under unusual conditions, will actually develop a taste for certain poisonous plants, and, if the opportunity presents itself, will eat such plants in sufficient quantity to produce fatal results, even in the presence of abundance of good forage or grazing. However, the preponderance of range-cattle poisoning is due to a scarcity of food, thus compelling the half-starved animals to feed upon poisonous plants which may be present. Again, herd conditions are, in many instances, responsible for the poisoning, the weaker members being forced to take the leavings, which often include poisonous plants.

The literature on Indian medicine is fragmentary, and the information thus far attainable touching upon the subject is very inaccurate. Indian medicine, in the broad sense of the term, includes various largely ceremonial exercises and dances, superstitious beliefs, social customs and duties, etc. It is the scope of this paper to treat the subject in a more limited sense, briefly explaining internal medication as it is comprehended by the savage intellect, and citing the use of the more important plants employed by the Indians of California in the treatment of disease.

It is evident that the aborigines of California, in common with savages generally, believed in the demoniacal origin of disease. That is, disease was simple the manifestation, in the body, of some evil or undesirable spirit which had taken possession of the body, driving out the normal or rightful spiritual inhabitant. The methods of exorcising the demon of disease, though differing in certain details, resemble each other quite closely. In spite of the admittedly noxious and evil character of the disease demon, he may be presumably cowed, subdued, and driven out by threats, loud, discordant noises, nauseous odors, disagreeably-tasting substances, and other factors which any well-disposed

individual in the normal state or condition might dislike or abhor, as is clearly indicated by the practices of the Indian doctors. The actions and contortions of the dancing doctor are primarily for the purpose of frightening away the cause of the disease. The so-called sucking doctors are somewhat more scientific, as benefit often results from their practices, but after sucking the affected part with great force, acquired through experience, the doctor vomits, which is said to bring up and out the pain-producing matter, in which notion the patient may have full confidence, but it is likely that the doctor is more than half convinced that he is practicing deception. The medicine makers, both male and female, not only treat actual disease, but make medicines for a great variety of purposes, as for childbirth, for hunting, fishing, to subdue the enemy, to ward off evil, to bless, to find lost articles, etc. Their field of action is well-nigh limitless. It is needless to state that their pretensions are the merest absurdities, and are to be compared with the deeds of our modern faith healers, soothsayers, and other fakirs.

Our most reliable information regarding Indian medicine is traceable to the few intelligent, well-educated observers who have lived among the aborigines for some years; as, for example, missionaries and teachers who have worked among them long enough to learn their language, thus enabling them to ascertain the true inwardness of their habits and customs. Unfortunately, excessive sentimentalism too frequently tints the reports of otherwise keen and accurate observers, resulting in a misinterpretation of ulterior motives.

Army officers, with the exception of a few post physicians with a keen thirst for facts, are too much taken up with routine duties, and hence do not make extensive or reliable records. There are many keen observers who make accurate and reliable observations, but fail to make records which can be preserved for future reference. Prospectors and miners, as a rule, give little attention to Indian practices, excepting such as concern them directly in their dealings with Indians. The information given out by them is, as a rule, very fragmentary and very inaccurate. Explorers, collectors, and travelers are generally excellent and accurate observers, and, as a rule, take notes on the spot, but the information thus gained loses in value because of the brevity of the time of the observation. Opportunity for verification is very often wholly lacking, and too frequently single erroneous observations are recorded as being established facts. The most accurate information of all is no doubt that given out by intelligent, well-educated members of the tribes, but since these are few in number, and as a rule difficult of access, it is not an easy matter to secure the desired information. Furthermore, the language of the educated, civilized savage is superlatively

figurative and highly exaggerated, so that, after all, it is quite difficult to deduce the cold facts.

The Indian tribes of the United States differ in intelligence and amenability to the civilizing influence. In such a comparison the tribes of California[1] do not shine forth favorably. They do not have the dignified mien and fair intelligence of the Choctaws and Chickasaws, for example, nor the savage aggressiveness of the Mohawks, Apaches, and other tribes. As near as can be ascertained, they are very filthy, not warlike, though vindictive, ignorant, and resourceless, though capable of subsisting where no other tribe would care to live. The desert tribes are the very lowest in the scale of savagery; only occasionally do they engage in the hunt and in fishing. Their language is very crude, and their vocabulary very limited. The women of some tribes have acquired much skill in basket-making. Their clothing and dwellings are of the crudest. Tribal conditions and social and family relationships are very indefinite and loose. This is approximately the summing up of the California Indians by the historian H. H. Bancroft in his "Native Races of the Pacific Coast."

The most common diseases and pathologic affections of the California Indians (this applies to American Indians generally) are consumption, rheumatism, aches and pains, scrofulous affections, sore eyes, chronic ulcer, and itch. It is generally asserted that smallpox and syphilis were introduced by the whites. Contagious diseases among Indians are generally laid to the doors of the whites. This is affirmed by no less an authority than Dr. Carlos Montezuma, of the Apache tribe. It is very evident that the attempts to civilize and segregate the Indians is conducive to consumption (pneumonitis). This is fully demonstrated in the case of the tribes of Indian Territory. Several prominent members of the Choctaw and Chickasaw Indian Council informed the writer that it was only a question of time when pneumonia would cause the complete extermination of the Indian Territory tribes. The blame is laid to the removal from the more congenial climate of Florida and Alabama, their former homes, to the colder, malarial climate of Indian Territory.

Naturally, medical practice among the tribes of California aborigines was not, and is not, of a high order. General ailments were treated by the incantations and mummeries of the medicine men, who apparently did not have a very high standing, even in their own tribe. If a medicine man failed to effect a cure, or the patient died under his treatment,

[1]There is apparently a close relationship between the various tribes along the entire Pacific coast. For example, the burial customs and certain social customs of the Hupas, as recorded by P. E. Goddard, are almost identical with those of the Nitinats and Clallams on the west coast of Vancouver Island. These latter tribes were once prosperous and independent, but in consequence of the ravages of warfare, smallpox, and syphilis, they began to dwindle rapidly in number, and a more rapid total extinction was prevented by a union of the two tribes. There now remain, all told, about forty members (men, women, and children) living in a village of frame buildings on a low island in San Juan bayou, Vancouver Island, just opposite Cape Flattery. They are squat in figure, semi-aquatic in habit, and are extremely filthy, being infested with body lice and other parasites. Their present tribal organization is very loose.

he was likely to be put to death by the relatives and friends of the deceased. However, if, on the other hand, luck was with him, and the majority of patients recovered, he was in time looked upon as a powerful man, and ranked in importance with a chief.

Sucking an affected part was a common practice, which owed its undoubted efficacy, in many instances, to its counter-irritating effects. Bleeding was practiced for its congestion-relieving properties. However, by far the most important and most scientific institution of the California Indian is the temescal, or sweat bath or sweat house. This is used by the men of most tribes, though it is affirmed that some tribes, as, for example, the Shoshones, were not familiar with it. The sweat house is generally made of arched willow frames, about four feet high in the center and four or five feet across at the base. A hole is dug near one side, about eighteen inches across and one foot deep. The frame of willow is covered with mats and sacking. When a patient is about to receive treatment, stones are heated to a red heat, placed in the hole of the temescal; the patient enters and sits on a mat. By means of branches of *Juniperus occidentalis* Hook. the patient sprinkes water upon the hot stones, which is immediately converted into steam, which fills the space within the temescal and causes the very active perspiration of the patient. In about half an hour the patient rushes forth and takes an immediate plunge bath in a nearby stream. Mrs. Manning, who has taught for years among the Piute Indians of Surprise Valley, Modoc County, Cal., states that the Piutes omit the plunge bath, apparently substituting therefor a rub-down; nor are the juniper twigs always used.

The sweat house is generally a family or individual affair, though in some instances one house is large enough to be used by all of the sick members of an entire camp, and is generally presided over by a female doctor. It is usually built near a stream, for reasons already given. In many instances the fire for heating the stones is started in the fall and kept alive until the following spring. Some patients sleep in the temescal all winter. The frame is covered over almost airtight, and is opened only long enough to permit the entrance or exit of a patient.

The value of the sweat bath in the treatment of rheumatism, and to promote the action of the skin, was fully appreciated. In some localities the sweat house is not necessary, on account of the accessibility of natural hot springs, the curative powers of which are known even to animals, as bears.

With regard to medicinal herbs, many are used, though only a comparatively small number are credited with having marked curative properties. Reliable information regarding the properties ascribed to them, and the exact manner in which they are used, is very difficult to

obtain. In many instances repeated inquiries elicited the mere statement that it is "a very good medicine," or a suggestive motion of the hands upward indicates that it is used as an emetic, while a motion downward implies that it has laxative properties. In some instances it is difficult to determine whether a plant is used for its food value alone, or whether perhaps it also has some medicinal uses. It may be stated that the medical practice of the Indians is not unlike the home medication among civilized peoples, differing largely in that it is more crude. In both instances the remedies used have essentially the following properties, named approximately in the order of their importance: Diaphoretic and diuretic (drinks in the form of decoctions); laxatives, emetics; astringents (used internally and externally), counter-irritants; antiseptics; sedatives and excitants. Indians have ascertained the fact, though unscientifically deduced, that the majority of aches, pains, and various pathological states are due to insufficient or abnormal action of skin, kidneys, and bowels. Restore the normal functions of these organs, and health returns; hence the widespread use of diaphoretics, diuretics, and laxatives. Cuts, bruises, sores, ulcers, and skin diseases are very common and require attention. Most of the herbs applied for these conditions have apparently counter-irritant and antiseptic properties. The most indefinite ailments of Indians are the various pains and aches. These may be rheumatoid, inflammatory, congestive, or otherwise. Pains in the gastric or abdominal region receive a general treatment, and are usually recognized as being different and requiring different treatments from pains in the head and muscles.

It must also be borne in mind that the medicine of the Indians of to-day has been greatly modified through the influence of whites. Many remedies are now used which were not used formerly, and many of the old-time remedies have been discarded. The post physicians have caused some tribes to become indifferent or lax in their tribal and individual medication, because of the free medical service provided by the United States. Furthermore, the savages soon recognize the superiority of modern medicine and gradually abandon the services of the medicine men, this in spite of the antagonism engendered through the invasion of their territories by the whites.

I

THE NATIVE AND INTRODUCED MEDICINAL AND POISONOUS PLANTS OF CALIFORNIA.

1. **Abies concolor** Lindl. White fir. *Coniferæ.*

This tree is common throughout the State. Yields balsam. A decoction of the terminal branches is much used as a diuretic and in the treatment of malaria. (Calif. Geo. Survey. Bot. **2**: 118.) (U. S. Disp.)

Numerous other species and varieties are common and have similar uses.

2. **Abroma angusta** Lam. Wollut comul. *Sterculiaceæ* (*Byttneriaceæ.*)

A handsome evergreen greenhouse tree from India, East Indies, Asia and Australia. The sticky white secretion from the fleshy root bark is said to be of great value in dysmenorrhœa, having properties similar to those of cotton-root bark. Fiber used for cordage.

A. fatuosa L. is also cultivated. (American Journ. Med. Sci., July, 1873.)

3. **Abronia fragrans** Esch. Fragrant abronia. *Nyctaginaceæ.*

A small herbaceous plant said to range from the Columbia River southward. Found in Southern California, Utah and New Mexico. Flowers very fragrant, and would, no doubt, prove useful in the manufacture of perfumery and sachet powders. (U. S. Geo. Survey. Wheeler's Report. Bot. **6**: 49.)

4. **Abronia latifolia** Esch. Yellow sand verbena. *Nyctaginaceæ.*

Common along the seashore from Vancouver Island to Monterey (Calif.). Flowers fragrant, like those of **A. fragrans.** Roots are eaten by the Indians.

5. **Abrus precatorius** L. Wild licorice. Crab's eye vine. Prayer beads. Jequirity. *Leguminosæ.*

A greenhouse climber, native of India, which has been introduced into Africa, West Indies, South America and other countries. In the West Indies the roots are used like licorice. Seeds are very poisonous; used in Brazil as standards of weight. Used also in the treatment of conjunctivitis and keratitis. Seeds said to be eaten in Egypt; how prepared is not stated. Old-time criminal poisoning agent. Seeds are dangerous playthings for children. (Proc. A. Ph. A. **32**; 182-184, 1884.)

6. **Acacia species.** Acacias. *Leguminosæ.*

Numerous species and varieties have been introduced from Australia and elsewhere. No attempt has thus far been made to classify them accurately. Some assert that perhaps one hundred and more species and varieties are found in the State.

The gum (gum arabic) bearing acacias are thorny or prickly shrubs adapted to dry, sandy soils. The Australian gum or wattle gum is obtained from **A. pycanthe** Benth., **A. decurrens** Willd., **A. homalophylla** Cun., and perhaps other species. The bark, leaves and unripe fruit of some species are very rich in tannin and have been used in tanning. Some yield excellent timber.

It is to be hoped that some one will perform the great task of properly identifying the species and varieties of Acacias found in the State. (U. S. Disp.) (Bailey. Cycl. Am. Hort. 5.)

7. **Acacia catechu** Willd. Gum acacia. Cutch. *Leguminosæ.*

Yields the familiar gum acacia, catechu or cutch of the pharmacists. Cultivated in the southern part of the State; not commercially, however.

8. **Acacia farnesiana.** Acacia. *Leguminosæ.*

A native of India cultivated in the southern part of the State. The very fragrant flowers yield a very delicious perfume on distillation. Extensively cultivated for perfumery purposes in Southern France. Worthy of careful consideration for culture purposes.

9. **Acacia gregii** Gray. Acacia. *Leguminosæ.*

Yields shellac in Arizona. **Larrea mexicana** Moric, also yields shellac. Both species occur in the State.

10. **Acacia pycanthe** Benth. Wattle gum. *Leguminosæ.*

The bark is much used medicinally in Australia. The infusion is given in infantile diarrhœa and catarrhal ophthalmia. The tincture, mixed with glycerine, is useful for sore nipples, discharging ears and chapped lips. A bark wash is useful in sore throat, as a gargle. The gum is given internally to cure piles, and in veterinary practice is applied to raw shoulders. Action, no doubt, due to the tannin present.

Other useful species of Acacia are **A. varek** G. et P. and **A. adansonii,** which yield gum senegal. **A. ferruginea** and **A. leucophaea** Willd. yield an intoxicating liquor. Whether these and some other species occur in the State is not definitely known. They would, no doubt, thrive well.

11. **Acer macrophyllum** Pursh. Large-leaved maple. *Aceraceæ.*

Common ornamental tree in northern part of State. Medicinal properties doubtful and use uncertain.

12. **Acer negunda californicum** T. and G. Box elder. *Aceraceæ.*
A common native. Medicinal use doubtful.

13. **Acer saccharinum** Wang. Sugar maple. *Aceraceæ.*
Yields maple sugar. According to Weschke this tree contains an alkaloid. (Contrib. Dept. Pharm., Univ. Wisconsin, 1886.)

14. **Achillea millefolium** L. Yarrow. Milfoil. *Compositæ.*
A well-known old-time medicinal herb, common everywhere. Yields oil. Has an extensive popular medicinal use among Indians and settlers. Tea is used in consumption, stomach-ache, headache; a lotion is used for sprains, etc. Enjoys an excellent reputation in the treatment of neuralgia, toothache, sore gums, and stomach troubles. (Contrib. U. S. Nat. Herb. **7**: III, 391.)

15. **Achras sapota** L. Nase berry. Sapodilla. *Sapotaceæ.*
Native of West India, cultivated in southern California. Fruit edible. Seeds contain a glucoide (sapotin). Yields "chicle" a base for chewing gum. (Nat. Dist.)

16. **Achyrachaena mollis** Shauer. *Compositæ.*
Indians of California use the seeds for pinole (parched, ground and mixed with water). (Contrib. U. S. Nat. Herb. **7**: III, 392.)

17. **Aconitum species.** Monk's-hood. *Ranunculaceæ.*
The native species are no doubt all poisonous and require further study chemically. (Calif. Geod. Survey. Bot. **1**: 12.)

18. **Aconitum columbianum** Nutt. Aconite. Friar's cap. Blue-weed. Monk's-hood. *Ranunculaceæ.*
A native found in the Sierras and northern coast ranges, and along brooks of Oregon, Washington, California, Montana, Wyoming, Colorado, and South Dakota in moist, open woods. This is the most important of the native species. All parts of the plant are poisonous, seeds and roots most. The poisonous principle of this plant is, no doubt, closely related to that of **A. napellus** L. It requires further careful study. The roots have been mistaken for horseradish and the leaves for those of parsley. Many human beings and many heads of cattle have been poisoned by it. Treatment as for aconite poisoning.

19. **Aconitum fisheri** Reich'b. Aconite. *Ranunculaceæ.*
This European species is by some authorities believed to be identical with **A. columbianum.** This is a controversy of considerable importance. **A. fisheri** is said to be used as an adulterant of the official **A. napellus.**

20. **Aconitum napellus** L. Aconite. Wolf's-bane. Monk's-hood. *Ranunculaceæ.*
A well known, very important medicinal plant of which garden

varieties (English and German aconites) are grown throughout the State. Some have escaped from cultivation. Aconite for medicinal purposes is extensively grown in England and Germany. It could be very profitably grown in California. Good leaves are worth about fifteen to twenty cents per pound wholesale.

21. **Acorus calamus** L. Sweet flag. *Aroideæ.*

The dried rhizomes have been much used as a popular blood purifier and bitter aromatic tonic, and as a sialagogue. Used in flatulency, colic and typhoid conditions. Also used in beer making, in the preparation of hair powders, sachet powders, perfumery and in flavoring gin. Grows in marshy soils.

22. **Actæa eburnea** Rydb. *Ranunculaceæ.*

This plant is said to be poisonous and requires further study. Properties said to be similar to those of **cimicifuga.**

23. **Actæa spicata** L. Cohosh. European baneberry. *Ranunculaceæ.*

The black berries are poisonous; mixed with alum, they yield a black ink. Roots are antispasmodic and expectorant.

24. **Actæa spicata arguta** Torr. Baneberry. *Ranunculaceæ.*

Found in rich, rocky woodland soils. Highly esteemed as a medicine by the Indians. Acts as a purgative and in large doses as an emetic. The varieties **A. spicata alba** and **A. spicata rubra** have similar uses and properties. (F. Stearns, Proc. A. Ph. A., 1858.)

25. **Adenostoma fasciculatum** Torr. Chamisol Chamisso. Greasewood. *Rosaceæ.*

Given to sick cows by the Coahuilla Indians, according to Barrows. Oil extracted, mixed with lard and used in the treatment of skin affections. Tea from leaves and bark given internally for syphilis.

26. **Adenostoma sparsifolium** Torr. Yerba del pasmo. Convulsion herb. Bastard cedar. *Rosaceæ.*

Found in southern California. Used by early Spanish settlers as a remedy for numerous ailments, as colds, cramps, lockjaw, snake bite, and tetanus. The powdered twigs and leaves, fried in oil or grease, are used as an ointment. The twigs, steeped in a drink, are given to produce vomiting and to give bowel relief. (See paper by Barrows.) (Bailey's Cyclo. Am., Hort. 24.)

27. **Adiantum capillus-veneris** L. Venus's hair fern. *Polypodiaceæ* (Ferns).

A well-known fern. A syrup (Sirop de capillaire) of this plant is much used as a cough remedy. (Calif. Geol. Survey. Bot. **2**: 342.)

28. **Adiantum pedatum** L. Maiden hair fern. *Polypodiaceæ.*

Used in chronic catarrh and lung trouble. Stems used by Indians in basket and hat making. **A. nigrum** is similarly used.

29. **Æsculus californica** Nutt. California buckeye. Horse chestnut. *Sapindaceæ.*

A native ornamental tree of coast ranges of middle California. The bark is used to cure toothache and other aches. The fresh, unripe fruit is used by Indians to poison fish. The ripe fruit, raw or cooked, is eaten by Indians, fed to squirrels and given to horses to remove bots. Bark is said to produce abortion in cows. The mistletoe growing on this tree is also said to produce abortion. Requires further careful study as to chemistry of constituents and physiological action. (Contrib. U. S. Nat. Herb. **7** (No. III), 366.) (Calif. Geol. Survey, Bot. **1**: 106.)

30. **Æsculus glabra** L. Ohio buckeye. *Sapindaceæ.*

A well-known tree, which is cultivated in many parts of the United States. Poisonous in over-doses, producing symptoms like those by corn cockle (**Agrostemma githago**). The fruit yields abundant starch. Roots and fruit used as a substitute for soap, due to the saponin present. Said to be useful in portal congestion.

31. **Æsculus hippocastanum** L. Horse chestnut. *Sapindaceæ.*

A well-known ornamental tree which is grown in nearly all parts of the United States. The bark and nuts are used as snuff and in the preparation of a wash for ulcers. In England the fruit is fed to cattle. (Am. Journ. Pharm., **44**: 400.)

32. **Æsculus pavia** L. Red buckeye. *Sapindaceæ.*

A native of the eastern and southern United States, but can be cultivated almost anywhere. The active constituent of this plant is supposed to be nearly identical with that of the corn cockle. It is especially abundant in the young shoots and in the seed. Used to poison fish. It is also reputed to be a useful convulsant. (E. E. Batchelor. Am. Journ. Pharm., **45**: 144.)

33. **Agaricus campestris** L. Toadstool. Mushroom. *Agaricaceæ* (Fungi).

Edible. At first refused by Indians until taught by whites. Reported to be poisonous.

34. **Agathis australis** Salisb. Kauri gum pine. Australian or New Zealand pine. Dammara. *Coniferæ.*

An ornamental tree, native of Australia and New Zealand, recently extensively introduced into California, where it does well. The gum (dammar resin) exudes from the roots in New Zealand and the old

gum is dug out of the ground. This gum is highly prized in the arts. On distillation it yields a terpene oil. A collodion-like preparation (Baumé Collodion) is made by dissolving an equal weight of the gum in 90 per cent alcohol. It is said to be very useful in the treatment of wounds, ulcers, eczema and other skin affections, forming an excellent substitute for collodion. (Proc. A. Ph. A., **31**: 95, 1883.)

35. **Agave species.** Agaves. Century plants. *Amaryllidaceæ.*

Century plants in great variety and abundance are found in nearly all parts of the State of California, especially in the southern part, and nearer the coast. Thrive in sandy, dry soil.

36. **Agave americana** L. American agave. Aloe. *Amaryllidaceæ.*

Leaves are used medicinally. Yields pulque. The fiber is used in cordage making.

37. **Agave deserti** Engelm. Agave. Cactus. *Amaryllidaceæ.*

A small plant, native of southern California. Most highly valued by desert Indians, all parts of the plant being used. Fresh shoots or young plants are roasted and eaten, likewise the flowers. Nets, mats, etc., are woven out of the fiber. It yields pulque and "vino mescal." (D. P. Barrows, Land of Sunshine, **13**: v. 314, 1900.) (Bailey, Cyclo. Am. Hort, 34.)

38. **Agave palmeri** Engelm. Amole. Mescal. *Amaryllidaceæ.*

Used as food, for the fiber, and in preparing mescal, the national drink of the native Mexicans. Rich in mucilage and grape sugar (citro-glucoside). Other species, as **A. parryi** and **A. shawii** are similarly used. (U. S. Geol. Survey, Wheeler's Report, Bot. **6**: 52.)

39. **Agave utahensis** Engelm. Mescal. *Amaryllidaceæ.*

The fruit is baked in pits and eaten. (See Death Valley Report, by Coville.)

40. **Agave virginiana** L. Rattlesnake master. *Amaryllidaceæ.*

The roots, which are very bitter, are used in the treatment of colic, in the form of a tincture. Also as an antidote for snake bite.

41. **Aglaia odorata** Lour. *Meliaceæ.*

A native of Cochin-China, cultivated in southern California. The flowers are very fragrant and employed in the manufacture of perfumery and sachet powders. In China the flowers are used to scent certain teas.

42. **Agrimonia gyrosepala** Wallr. Common agrimony. *Rosaceæ.*

This introduced species is closely related to the well-known medicinal **A. eupatoria** L., of which both the herb and root are used. An oil is distilled from it. A decoction of the flowers is useful as a gargle, and has some value as a vermifuge. It contains tannin.

The California species require further careful study as to medicinal properties.

43. **Agropyron repens** Beauv. Dog-grass. Couch grass. Quitch grass. *Gramineæ.*

This grass has escaped from cultivation and thrives well in all parts of the State. Has become a great agricultural pest in places. It is well known medicinally. The rhizomes and roots are used in irritable bladder, kidney diseases, gout, fevers, as a blood purifier, etc. Freely used in the form of a drink. The drug is cheap and the market uncertain. (U. S. Disp.)

44. **Agrostemma githago** L. Corn cockle. *Alsinaceæ.*

A very noxious European weed, introduced into the grain fields of the United States. Many cases of poisoning of human beings and of numerous heads of cattle have been traced to the flour made from wheat grown in cockle-infested fields and the fodder from such fields.

The physiological action and possible therapeutic value of this plant require further careful investigation. The active constituent is a freely soluble, non-crystallizable substance known as saponin, having a sharp burning taste; when inhaled in the smallest quantity it produces violent sneezing.

45. **Ailanthus glandulosa** Desf. Tree of heaven. *Simarubaceæ.*

A native of China, introduced and cultivated in various countries. Bark has cathartic properties due to an oleo-resin. Used as a vermifuge for dogs. Very disagreeable to take. **A. excelsa** resembles it closely and has similar properties. (Proc. A. Ph. A. **30**: 214, 1882.) (Proc. A. Ph. A. **25**: 181, 1877.)

46. **Alectoria fremontii** Tuck. Hair moss. Lichenes.

Used as food by Indians. Reported to have sedative properties. Used in hair tonics. The long, nearly black tufts resemble ladies' tresses. Has no medicinal value.

47. **Aleurites cordata** Müll. *Euphorbiaceæ.*

A native of southern China, cultivated in southern California. Said to yield the finest lac varnish.

48. **Aleurites moluccana** Willd. Candlenut tree. *Euphorbiaceæ.*

This tree is cultivated in southern California. It is a native of the Molucca Islands. The nuts are eaten and yield a valuable oil (the so-called "Kekune oil").

49. **Alliaria (Sissymbrium) officinalis** L. Hedge garlic. *Cruciferæ.*

An introduced European plant. The herb and seeds are highly valued as a diuretic, diaphoretic and expectorant and for external

application in gangrenous affections and to promote the healing of cuts, bruises and ulcers. (U. S. Disp. 1557.)

50. **Allium bolanderi** Wats. Wild onion. *Liliaceæ.*

Bulbs used as food by Indians. Has diuretic properties. Decoction used for kidney troubles, and as an emmenagogue.

51. **Allium falcifolium** H. & A. Wild onion. *Liliaceæ.*

This species is especially valued as an article of diet by the Indians. Apparently not used medicinally, although it has marked diuretic properties.

52. **Allium unifolium** Kell. Wild onion. *Liliaceæ.*

Believed to be poisonous. The bulbs and leaves are fried and eaten by Indians.

Other species of wild onion found in the State are **A. breweri, A. lacunosum, A. serratum** and **A. attenuifolium.** All have the properties common to onions generally. Some are reported to be poisonous.

53. **Alnus** species. Alders. *Betulaceæ.*

Alders are common. The bark is used for tanning and dyeing, and the charcoal is usually employed in the manufacture of gunpowder. The bark, twigs and buds of **A. oregana** Nutt. (Oregon alder) are used as a tonic in tea, beer and other drinks. A bark ointment is used to cure eruptive skin diseases, cuts, sores, ulcers, etc. (Calif. Geol. Survey, Bot. **2**: 80.) (Kellogg Trans. Calif. Hort. Soc., page 163, 1865.)

54. **Alnus incana** Willd. Tag alder. Speckled or hoary alder. *Betulaceæ.*

Rich in tannin. Useful as a hæmostatic. Used in tanning.

55. **Alnus rhombifolia** Nutt. Mountain alder. *Betulaceæ.*

Bark very astringent and somewhat bitter and contains a peculiar dye-stuff. Indians use a decoction of the fresh or dried bark to induce perspiration, to check diarrhœa, to allay stomach-ache, to facilitate child-birth, to check hemorrhages in consumption, etc. Mixed with Indian tobacco, it is given to induce vomiting. (Contrib. U. S. Nat. Herb., **7**: (No. III) 332.) (Calif. Geol. Survey, Bot. **2**: 80.)

56. **Aloe** species. Aloes. *Liliaceæ.*

Many species and varieties are cultivated as ornamental plants. They resemble the century plants (agaves), and thrive well in dry, sandy soil. Whether they could be grown profitably for the inspissated juice, which is used medicinally, would have to be determined experimentally. The dried juice is worth about 20 cents per pound.

57. **Aloe perryi** Baker. Socotrine aloes. *Liliaceæ.*

The inspissated juice of this plant constitutes the Socotrine aloes, which is a very useful laxative. No attempt has been made to grow it commercially in the State. **Aloe vera (vulgaris)** L. yields the Barbado aloes, which is also a very useful laxative.

58. **Athæa** species. Mallows. Hollyhocks. *Malvaceæ.*

Native and introduced species occur in great profusion, some constituting very troublesome weeds. Much used as demulcents, as poultices, in the manufacture of lozenges, confections, etc., as a cough remedy, etc. **A. officinalis** L. and **A. rosea** L. are the two most important species. The roots of the former species are supposed to contain asparagin. (Proc. A. Ph. A., **30**: 217, 1882.)

59. **Alyssum maritimum** L. Sweet alyssum. *Cruciferæ.*

A fragrant ornamental plant used in sachet powders. Sparingly naturalized, frequently cultivated. A familiar old-time medicinal herb. Once used to cure hydrophobia, hiccough, etc.

60. **Amanita muscaria** Fr. Amanita. Fly Agaric. Toadstool. *Agaricaceæ.* (Fungi.)

The best-known of the poisonous fungi. Abundant in various localities of the United States. In Europe it has been used as a fly poison for hundreds of years. In Asia it has long been used as an intoxicant, producing symptoms not unlike those of Indian hemp.

This fungus contains several toxic compounds, the best known of which is muscarin. Many people are killed each year through the eating of toadstools. Cattle are poisoned accidentally. The symptoms of poisoning do not develop at once, usually twelve to fourteen hours elapse before the initial attack. There is no antidote, and treatment, which is entirely symptomatic, is, as a rule, of little avail. Transfusion of normal salt solution may be tried.

Since the eating of toadstools indicates a perverted taste, rather than otherwise, and since these plants have practically no food value, it is most urgently advised not to eat them under any circumstances; thus many a life may be saved.

61. **Amanita phalloides** Fr. Death cup. Poison amanita. *Agaricaceæ.* (Fungi.)

The most poisonous of all fungi found in California, parts of the Eastern and Middle States, and is said to be especially abundant in the vicinity of Washington, D. C. This is the fungus which caused the death of Count de Vecchi, on November 10, 1897 (at Washington).

The active constituent phallin has been carefully investigated by Kobert. It resembles the white of egg (toxalbumen). Salt water

dissolves it readily. Boiling is said to decompose it, and to render it inert. It has the general toxic properties of muscarin.

62. **Amanita verna** Bul. Vernal amanita. *Agaricaceæ.*

Very poisonous. By some authorities believed to be identical with **A. muscaria.**

63. **Amaranthus species.** Pig weeds. Tumble weeds. *Amarantaceæ.*

These weeds are very abundant in certain localities. They are said to be useful in checking hemorrhages. **A. retroflexus** is cultivated by some Indian tribes for its food value, the seeds being most generally used. (Contrib. U. S. Nat. Herb, **7**: (No. III) 346.) (Calif. Geol. Survey, Bot. **2**: 41.)

64. **Amaranthus leucocarpus.** Wats. Pig weed. *Amarantaceæ.*

Used by Indians, medicinally and for food, as is also **A. powellii.** Wats. They have astringent properties. (Proc. A. Ph. A., **27**: 153, 1879.)

65. **Ambrosia species.** Ragweeds. *Compositæ.*

These have enjoyed a popular medicinal use for ages. Used principally in the form of a wash for its astringent stimulating effects. Ragweeds are common along roadsides in nearly all parts of the United States.

66. **Ambrosia artemisiæfolia** L. Ragweed. Roman wormwood. Hogweed. *Compositæ.*

Has the properties of ragweeds generally. Contains a bitter glucoside (Am. Journ. Pharm., 1890.) It has been introduced into the Materia Medica of the Eclectics (see King's Dispensatory). Used principally in low fevers. It is also said to be a useful remedy in **Rhus** poisoning. (Proc. A. Ph. A., **28**: 102, 1880.)

67. **Ambrosia psilostachys** D. C. Ragweed. *Compositæ.*

This plant has not been well investigated. It is generally believed to be inferior to the above species.

68. **Amelanchier alnifolia** Nutt. Service berry. *Pyraceæ.*

The berries, fresh or dried, are eaten by Indians. Perhaps contain amygdalin. The wood is used for making arrows; also for making the sticks with which Indians play the "rag game," resembling shinny-on-the-ice.

69. **Amomum (Elettaria) cardamomum** L. Cardomom. *Zingiberaceæ.*

A well-known spice and aromatic drug. The plant is said to thrive in southern California. Whether it could be grown profitably is not known.

70. **Ammobroma sonoræ** Torr. *Lennoaceæ.*

The fresh plants are dried in the sun or roasted and eaten by the Indians. Said to taste like sweet potatoes. (Calif. Geol. Survey, Bot. **1**: 464.)

71. **Ampelopsis quinquefolium** Michx. American ivy. Virginia creeper. *Vitaceæ.*

A very common cultivated arbor climber. Bark and twigs are used by the Eclectics as an alterative, tonic and expectorant. Also used in dropsy. Poisonous in large doses. (Proc. A. Ph. A., **25**: 187, 1877.)

72. **Amygdalus** varieties. Almonds. *Rosaceæ.*

Numerous varieties of the bitter and sweet almonds are grown in the State. Almond growing is a staple industry. A variety of uses made of the fruit. Numerous special reports on almond culture.

73. **Anagallis arvensis** L. Pimpernel. Poison chickweed. *Primulaceæ.*

A poisonous weed used by the ancients as a nervine in convulsions. Also used in hydrophobia, dropsy and consumption. Applied locally to sores and ulcers. Used in gout, and was at one time much employed as a plague remedy. It is said to contain a pepsin-like ferment. (U. of C. Agr. Exp. Rep., page 247, 1890.)

74. **Ananas (annanassa) sativa** Schultz. Pineapple. *Bromeliaceæ.*

Cultivated in southern California (Santa Monica). The fruit contains a digestive ferment, acting on albuminoids. Has been used to digest the membrane of diphtheria. There are numerous culture varieties. (See very complete paper on cultivation, etc., by P. H. Rolfs, No. 291.)

75. **Anaphalis margaritacea** B. and H. Everlasting. *Compositæ.*

A popular fragrant border plant. Eclectics use it as an astringent and expectorant. The leaves and flowers chewed and juice swallowed relieve ulceration of the mouth. A warm infusion used as a diaphoretic, in bowel complaints and hemorrhages. Used in fomentations to ulcers and swellings. The fresh juice is said to be aphrodisiac.

76. **Andromeda species.** Heathworts. *Ericaceæ.*

The group requires further study. Apparently a mixed genus. Several species have been used as a wash for ulcers. The shoots of **A. mariana** are said to be poisonous to sheep.

77. **Andropogon citratus.** Lemon grass. *Gramineæ.*

This grass has a very delicate lemon fragrance. Yields oil of lemon, useful in perfumery. Could no doubt be cultivated profitably for the manufacture of perfumery and sachet powders.

78. **Andropogon sorghum halepensis** Haeckel. Johnson grass. Sorghum. *Gramineæ.*

A common weed. A useful forage plant, rich in sugar.

79. **Anemiopsis californica** Hook. Yerba Mansa. *Saururaceæ. Piperaceæ.*

Considered to be a very useful remedy for cuts, bruises, sores and sprains. It is also said to be a useful diuretic, in rheumatism, as a blood purifier, in asthma, malaria, dysentery, gonorrhœa, etc. (U. S. Geog. Surv. Wheeler's Report, Bot. **6**: 49.) (H. H. Rusby, Druggists' Circular, Jan., 1890.) (Schneider, A. Yerba mansa. Druggists' Circular, May, 1897.)

80. **Anemone globosa** Nutt. Red wine flower. *Ranunculaceæ.*

Requires further study. Said to be poisonous.

81. **Anemone quinquefolia** L. Wind flower. *Ranunculaceæ.*

Found in shady mountain woods. Perhaps identical with the European **A. nemerosa** L. Poisonous to cattle. Well known medicinally. (Am. Journ. of Pharm. **34**: 300, 1862, and **45**: 299, 1873.)

Other species of anemone are cultivated in the State.

82. **Angelica hendersoni,** C. and R., **A. tomentosa,** Wats, and the varieties **elata** and **californica.** *Umbelliferæ.*

These require further study. The Indians as well as whites use angelica root as a valued remedy and talisman. Chewed and rubbed on, the root is said to prevent as well as to cure rattlesnake bites. It is given in colic, catarrh and colds, for sore eyes, etc. The fresh sprouts are eaten.

83. **Angelica** sp. (?) *Umbelliferæ.*

An unknown species growing on the Sierra Gorda; has strongly aromatic roots and is said to be very useful medicinally. Young shoots are eaten. (Contrib. U. S. Nat. Herb. **7**: (No. III) 371.)

84. **Anhalonium lewini** Henning. Cactus. Pellote. *Cactaceæ.*

Native of Mexico, said to be a powerful cardiac and respiratory stimulant, used in angina pectoris and asthmatic dyspnœa.

Several other species of **Anhalonium** have been used by Mexicans and Indians. The top of the branch of **A. lewini** constitutes the "mescal button" used by the Kiowa Indians of the Rio Grande to produce intoxication during some of their religious ceremonies. The cerebral manifestations due to this stimulant are extraordinary visual hallucinations, visions of infinite beauty, grandeur and loftiness, alternating with visions of monsters and other gruesome forms. There are also remarkable color hallucinations. The intoxication is not unlike that produced by Indian hemp.

As a remedial agent **Anhalonium** has also been tried in hypochondriasis, nervous headache, neuralgias, gout, hysteria, insomnia and other disorders. Various principles have been isolated, notably the alkaloids anhalonine; pellotine and an oily lophophorine. (Lewin in Archiv. für Exp. Path. und Pharm.) Other alkaloids have been isolated from other species (Pharm. Journ. Trans. 52, 1899.) (Pharm. Journ. Trans. 457. 1898.) (Mescal Button Religion. Pacific Pharmacist. **3**: 41-42, 1909.)

85. **Anona cherimolia** Mill. Cherimoya. Custard Apple. *Anonaceæ.*

A native of Peru. Quite extensively grown in southern California. Fruit is much relished and brings a good price in the open market. **A. macrocarpa,** another native of South America, is also cultivated in southern California. Fruit large and highly relished. **A. reniformis** and other varieties are also cultivated.

86. **Anona muricata** L. Sour sop. Custard Apple. *Anonaceæ.*

This plant is cultivated in portions of southern California. The large fruit is popular in the South. An acid drink is made from the juice. The seeds are said to be poisonous, and are used to poison fish; to exterminate lice and insect pests. The bark is drastic purgative.

87. **Antennaria parvifolio** Nutt. Cudweed.

Reported to be poisonous. Requires study.

88. **Anthemis cotula** L. Dog fennel. Mayweed. *Compositæ.*

A very common introduced weed with highly irritating properties. Used for colds, rheumatism, and in the preparation of an eye-wash. Has irritating properties when applied to the skin. An ointment used for rheumatoid affections is made by frying the flowers in lard. (Contrib. U. S. Nat. Herb. **7**: (No. III) 392.)

89. **Anthoxanthium odoratum** L. Sweet Vernal-grass. *Gramineæ.*

Found in California near Mendocino City, Crescent City and in Marin County. Very fragrant, due to the presence of cumarin. Would prove of value in the manufacture of perfumes (sachet powders). Presence in meadows is said to impart the odor of this grass to other grasses and is supposed to flavor the butter. (Calif. Geol. Surv. Bot. **2**: 266.)

90. **Apium nodiflorum** Reich. Water parsnip. *Umbelliferæ.*

This and other species are usually considered poisonous. Formerly used in skin diseases, scrofula, etc. Now rarely used.

91. **Aplopappus palmeri.** *Compositæ.*

The leaves and twigs are used by Coahuilla Indians to relieve swelling and pain. (Barrows.)

92. **Apocynum androsæmifolium** var. **pumilum** Gray. Dog bane. Indian hemp. *Apocynaceæ.*

Native of California. Properties similar to those of 93.

93. **Apocynum cannabinum** L. Canadian or Indian hemp. *Apocynaceæ.*

A common plant of which the bark fiber is much used by the Indians in weaving all manner of cordage and cloth fabrics. Native in California. More or less poisonous. Well known medicinally. (See Dispensatories.)

94. **Apocynum vestitum** Greene. Indian hemp. *Apocynaceæ.*

This plant is closely allied to **A. cannabinum** and has no doubt similar properties.

95. **Aquilegia vulgaris** L. Columbine. *Ranunculaceæ.*

A cultivated plant from Europe. The seeds contain an alkaloid (Aquilegine). The extract of the plant produces symptoms similar to those by aconite. Though not much used now, it was at one time considered diuretic and diaphoretic.

96. **Aquilegia truncata** F. and M. Columbine. *Ranunculaceæ.*

Quite common. Seeds perhaps contain an alkaloid like that of **A. vulgaris** (aquilegine).

The ripe seeds are taken internally in biliousness. Properties no doubt similar to those of **A. vulgaris** (diuretic and diaphoretic).

97. **Arachis hypogæa** L. Peanuts. *Leguminosæ.*

Extensively cultivated in the State. Yield oil and fat used for culinary and other purposes. Eaten roasted as food and used as a substitute for coffee. (Proc. A. Ph. A. (Abstract) **22**: 151, 1874.)

98. **Aralia californica** Wats. Ginseng. California spikenard. *Araliaceæ.*

A decoction of the dried roots highly valued in diseases of the lungs and stomach, and for colds and fevers. **A. spinosa** as well as other species thrive in the State. (Calif. Geol. Surv. Bot. **1**: 273.) (Contrib. U. S. Nat. Herb. 7: (No. III) 371.) (Am. Journ. Pharm. 489–492. 1898.)

99. **Aralia quinquefolia** Decne. (See **Panax quinquefolium.**) American Ginseng. *Araliaceæ.* (See paper by Geo. V. Nash, No. 253.)

100. **Aralia spinosa** L. *Papilionaceæ.*

Cultivated. Properties no doubt similar to those of **A. californica** Wats.

101. **Aragallus species.** *Papilionaceæ.*

These require further study, both as to active constituents and as to

physiological and toxic properties. Other species are found in the State. (**Aragallus** combined with **Astragalus** by Engler and Prantl in Die Natürlichen Pflanzenfamilien.)

102. **Aragallus** (*Astragalus*) **besseyi.** Ryd. Purple loco weed. *Papilionaceæ.* Poisonous. Fatal to cattle.

103. **Aragallus lagopus** Greene. Purple loco weed. *Papilionaceæ.* Poisonous.

104. **Aragallus lambertii** (Pursh) Greene. Colorado loco vetch. *Papilionaceæ.*

Wider range than that of the wooly loco weed (**Astragalus mollissimus**), but closely similar in all other respects.

105. **Aragallus spicatus** Ryd. White loco weed. *Papilionaceæ.* Poisonous.

106. **Aragallus splendens** Greene. Silvery loco weed. *Papilionaceæ.* Poisonous.

107. **Araucaria species.** Pines. *Coniferæ.*

A number of Araucaria species have been introduced and thrive well. The so-called Norfolk pine or Norfolk island pine (**A. excelsa** R.) is a large, handsome tree. They have the constituents of pine generally. Turpentine is obtained from several species. They are familiar ornamental plants throughout the State.

108. **Arbutus menziesii** Pursh. Madrona. *Ericaceæ.*

Fruit said to be edible, though some claim it is poisonous. Grown at the Chico Station. Charcoal is used in making gunpowder. Bark for tanning. Cows will occasionally eat the leaves. The Indians use a leaf infusion for colds. (Contrib. U. S. Nat. Herb. **7**: (No. III) 374.)

109. **Artium lappa** L. Burdock. *Compositæ.*

Well known medicinally. Seeds twenty-five cents per pound. Roots twenty-five or thirty cents per pound. Culture could no doubt be made profitable. Noxious weed when not checked.

110. **Arctostaphylos glauca** Lind. Manzanita. *Ericaceæ.*

Native. Well known medicinally. Easily cultivated.

111. **Arctostaphylos manzanita** Parry. Manzanita. *Ericaceæ.*

Ripe fruit eaten, forming a very important article of diet among the California Indians. Tea of leaves much used for colds. Indians make "manzanita cider" from the crushed ripe fruit. Juice of plant is applied to sores and ulcers. The plant in its medicinal properties is closely similar to **A. glauca.**

112. **Arctostaphylos tomentosa** Dougl. Manzanita. *Ericaceæ.*

Less common than **A. manzanita,** but closely similar and similarly used.

113. **Arctostaphylos uva ursi** Spring. Bearberry. Mountain box. Rockberry. *Ericaceæ.*

Cultivated. Well known medicinally.

114. **Argemone mexicana** L. Prickly poppy. *Papaveraceæ.*

Common in cultivation. The plant has marked emetic, purgative and narcotic properties. Extensively used medicinally for all sorts of ailments, as a cathartic, etc.

115. **Aristolochia** and **Asarum species.** (See **Asarum.**) *Aristolochiaceæ.*

The species have long been known medicinally. The native species require further study. (Calif. Geol. Surv. Bot. **2**: 101.)

116. **Aristolochia serpentaria** L. and **A. reticulata** Nutt. Snakeroot. Serpentaria. *Aristolochiaceæ.*

Not yet introduced, but would no doubt thrive well in moist, hilly woodlands.

117. **Armeria vulgaris** (*Statice Armeria*). Maiden pink. *Plumbaginaceæ.*

Said to be an active diuretic. Should be more carefully studied.

118. **Arnica species.** Arnica. *Compositæ.*

The California species require further study. The medicinal **A. montana** of Europe is reported from the northwestern United States. Is readily cultivated. Used in catarrh, nervous affections, dysentery, rheumatism, dropsy, gout, etc. The entire plant may be used; the flower heads are, however, preferred.

119. **Arnica fulgens.** Arnica. *Compositæ.*

Poisonous.

120. **Arnica monocephala.** Arnica. *Compositæ.*

Poisonous.

121. **Arnica montana** L. Arnica. *Compositæ.*

Well known. Flowers and roots and rhizomes used. Could be cultivated.

122. **Artabotrys odoratissima** R. *Anonaceæ.*

A native of India, cultivated in southern California. The flowers yield the famed volatile "ylang-ylang" oil of the Chinese.

123. **Artemisia species.** *Compositæ.*

Native and introduced species are common.

124. **Artemisia absinthium** L. Wormwood. *Compositæ.*

Common garden herb. Well known medicinally. Herb used. Fifteen to twenty cents per pound. Oil, $4.50 per pound.

125. **Artemisia californica** Less. Old man. Sagebrush. Hill brush. *Compositæ.*

Leaves and branches have decided insecticide powers (H. H. Behr). Employed by the Mexicans as a popular cholera remedy. The Spanish-Californians regard it as a panacea for all ills. (Bot. Mex. Bound. Survey, Emory's Report, page 17, 1859.)

126. **Artemisia dracunculoides** Pursh. "Indian hair tonic." *Compositæ.*

The Indians use this plant as a hair tonic. It has not been examined as to its active properties. (Hall.)

127. **Artemisia frigida** Willd. Sierra salvia. Colorado mountain sage. *Compositæ.*

Much used in the Rocky Mountain region as a diuretic, diaphoretic and mild cathartic. It perhaps contains a glucoside. (F. A. Weiss, Am. Pharm. Journ. 1890.)

128. **Artemisia heterophylla** Nutt. Mugwort. Wormwood. *Compositæ.*

One of the most popular of native medicinal herbs. A decoction of leaves is said to be a specific in colic and colds. On account of its efficacy in bronchitis it has received the name of "bronchitis plant." Indians use a decoction for stomach-ache, headache, diarrhœa, rheumatism, and fevers. Decoction and poultices highly praised as a remedy for poison oak, also to check hemorrhages and to heal wounds. Externally it is used for sore eyes. The juice is used to counteract poison oak. (Contrib. U. S. Nat. Herb. 7: (No. III) 393.)

Other species as **A. bidentata, A. vulgaris californica** Beso., have similar properties and uses. (Le Maout and Decaisne, p. 505.)

129. **Artemisia tridentata** Nutt. Sagebrush. *Compositæ.*

Said to be poisonous. Used by the Coahilla Indians in bowel complaints. (Barrows.) A decoction of the leaves used as a cough medicine. Very likely has diaphoretic and diuretic properties. (Am. Journ. Phar. 62, 1890.) (U. S. D.)

130. **Arundinaria** and **Bambusa species.** Bamboo. *Gramineæ.*

Extensively cultivated as ornamental plants. (Fairchild.)

131. **Arundo donax** L. Giant reed. *Gramineæ.*

Extensively cultivated as an ornamental plant. Roots are said to be diuretic. (Bailey, Cycl. Am. Hort., p. 102.)

132. **Asagræa officinalis** Lind. Cevadilla.

Cultivated. Poisonous. Used almost wholly to destroy head-lice and other body vermin. (U. S. D.)

133. **Asarum caudatum** Lindl. Wild ginger. *Aristolochiaceæ.*

Highly aromatic and would no doubt prove very useful in the manufacture of perfumeries and sachet powders. Infusion said to be useful in female complaints. Two other species are reported, **A. hartwegi** and **A. lemmoni.** All require further study.

134. **Asclepias species.** Milkweeds.

These have the general properties of the *Asclepiadaceæ* and *Apocynaceæ.* The following species are native: **A. mexicana** Cov., **A. speciosa** Torr., **A. eriocarpa,** Benth., **A. vestita,** H. and A., **A. cordifolia,** Benth., and **A. californica** Greene. The Pacific coast species have caused the poisoning of many heads of cattle. The poisonous principles require further study. The sticky juice of **A. ericarpa** and other species is considered an excellent lotion for cuts and sores; to kill warts, and is used in tattooing. The Yokis eat the young shoots of **A. mexicana.** Other medicinal species are to be found escaped from cultivation or grown in the Berkeley and other economic gardens. Indians make various uses of some of the milkweeds. The fiber is used for cordage. The milky juice is generally believed to be poisonous. **A. mexicana** has received considerable attention. **A. eriocarpa** is also poisonous and requires further study. (Contrib. U. S. Nat. Herb. **7**: (No. III) 380); (Calif. Geol. Surv. Bot. **1**: 474.)

135. **Asclepias californica** Greene. **(Gomphocarpus tomentosus.)** Milkweed. *Asclepiadaceæ.*

Said to be poisonous to cattle. Found in pastures. (U. of C. Agr. Exp. Sta. Rep., p. 248, 1890.)

136. **Asclepias cornuti** Desc. Milkweed. *Asclepiadaceæ.*

Well known medicinally. For commercial value of caoutchouc in **Asclepias cornuti** (see Proc. A. Ph. A. (Abstract) **23**: 157, 1875).

137. **Asclepias eriocarpa** Benth. Milkweed. *Asclepiadaceæ.*

Claimed to be one of the best remedies for inflammatory rheumatism. The juice is also used as a healing application to cuts and wounds.

138. **Asclepias mexicana** Cav. Milkweed. *Asclepiadaceæ.*

Properties like those of **A. cornuti.** It is claimed that an insect resembling the Spanish fly, Cantharis, settles on this plant, and transmits to it vesicant and diuretic properties.

139. **Asclepias speciosa** Torr. Showy milkweed. *Asclepiadaceæ.*

Said to be poisonous. Used medicinally like other species. Cultivated as an ornamental plant.

Asclepias tuberosa L. and other species have been introduced.

140. **Asimina triloba** Dun. Common pawpaw. *Anonaceæ.*

Fruit edible, resembling the banana. Readily cultivated, ornamental. (Proc. A. Ph. A. (Abstract) **35**: 148, 1887.)

141. **Asparagus officinalis** L. Asparagus. *Liliaceæ.*

Escaped from cultivation. Extensively cultivated in low lands. The rhizome is said to be laxative and diuretic and to act as a heart sedative. Very likely of little or no medicinal value.

142. **Aspidium filix mas.** Swartz. Male fern. *Filices.*

Does not do well in cultivation. Root decoction is used for soreness and bruises. Well known medicinally. An old-time reliable vermifuge. (See Text-books and Dispensatories.)

143. **Aspidium (Dryopteris rigidum argutum.** Yerba del Golpo. *Filices.*

A decoction from the roots is used for the treatment of bruises and contusions. Used as tænifuge (same as **Aspidium filix mas).** Poultices made from mashed roots used externally for swellings, etc.

144. **Aster puniceus** L. Aster. *Compositæ.*

The rootlets of this ornamental plant are employed as a stimulating diaphoretic in rheumatic and catarrhal troubles. Numerous native and cultivated species found in the State.

145. **Astragalus species.** Loco weeds. *Papilionaceæ.*

Many, not all, species of Astragalus are poisonous. Aragallus and Astragalus species are much confused. The following are the more important poisonous species from the State: **A. hornii** Gray, **A. lentiginosus fremontii** Wats., **A. leucopsis** Torr., **A. menziesii** Gray, **A. matthewsii** Wats. Coahilla and other California Indians eat the seeds. (Barrows.)

146. **Astragalus blankinshippi** Nels. Purple loco weed. *Papilionaceæ.*

Poisonous. Requires further study.

147. **Astragalus drummondii** Dougl. *Papilionaceæ.*

This and other species are said to be poisonous.

148. **Astragalus lentiginosus.** Loco weed. *Papilionaceæ.*

Poisonous.

Requires further study. **Astragalus lentiginosus** (Douglas) var. **Fremontii.**

149. **Astragalus mollissimus** Torr. Wooly loco weed. *Papilionaceæ.*

Native of the great plain region of the United States. A highly poisonous weed which has done inestimable damage to ranchmen.

Between 1881 and 1885 the State of Colorado paid out nearly $200,000 in bounties to eradicate the weed.

The poisonous principle has been studied, however, with unsatisfactory results. An acid (loco acid) has been isolated, to which the poisonous properties are attributed. Requires further careful study.

150. **Atriplex species.** *Chenopodiaceæ.*

Used as food and medicinally by Indians and Mexicans. They are rich in impure soda. (Palmer Proc. A. Ph. A. **27**: 153, 1879.)

151. **Atriplex hortensis.** *Chenopodiaceæ.*

Very rich in sodium and other salts. Used as food and for medicinal purposes by Indians and settlers.

152. **Atropa belladonna** L. Deadly nightshade. *Solanaceæ.*

This plant thrives well in the United States, where it is grown as an ornamental plant, and experimentally and commercially in several places. The firm of Johnson and Johnson of New Brunswick, N. J., manufacturers of belladonna plasters, have grown belladonna experimentally for a number of years. The experiments are now being continued in California (Castro Valley, near Hayward, and elsewhere). (King's Dispensatory, 18th ed., p. 332.) Leaves and roots are used, which should not be collected from first-year plants. Collect from plants two or four years old, at the time of flowering. Price of roots and leaves per pound, about 12 cents wholesale. English belladonna is much more valuable than German belladonna. All parts of the plant are poisonous; used as a nerve sedative, diuretic, in catarrhs, in ophthalmology, in the manufacture of plasters and ointments.

Said to be a preventive and cure of scarlatina (homeopaths), checks secretions, dilates pupil (mydriatic), used in asthma, phthisis, to relax sphincter muscles, to relieve strangulated hernia, etc. (See, also, The Pharmaceutical Era, June 9, 1904, p. 556, Pacific Druggist, 1905, and Pacific Pharmacist, 1907.) For the comparative value of wild and cultured belladonna, see Proc. A. Ph. A. **30**: 162. 1882.

153. **Aurantium dulcis** L. varieties. Oranges. *Aurantiaceæ.*

Extensively cultivated in the State. Other members of the family are cultivated in the State, to say nothing of the remarkable crosses between oranges and related fruits, as the tanglo, mandarin, pomelo, navel oranges, etc.

154. **Baccharis glutinosa** Pers. *Asteroideæ.*

A decoction of the leaves is used as an eyewash by the Coahilla Indians. (Barrows.)

155. **Balsamorrhiza deltoidea** Nutt. Balsam root. *Compositæ.*

Seeds used as food (roasted and ground) by the Klamath Indians of Oregon; likewise the seeds of **B. digittata.**

The **Balsamorrhiza** species (balsam roots) contain a terebinthine principle in the outer root parenchyma which the Indians remove before eating. This resin or turpentine requires further study.

156. **Balsamorrhiza sagittata** Nutt. Wild sunflower. *Compositæ.*

Roots used medicinally by the Piute Indians. Petioles eaten. Fragrant. No doubt contain volatile oil like **B. terebinthacea.** Reported to be poisonous. (U. S. Disp.) Kelly, Drug. Circular (1897).

157. **Balsamorrhiza terebinthaceæ** Nutt. *Compositæ.*

The root has a strong terebinthine odor and is used as a diuretic.

158. **Bamboo.** (See **Arundinaria,** 130.)

159. **Bananas.** (See **Musa.**)

160. **Berberis species.** Barberry. *Berberidaceæ.*

Three species occur, **B. dictyota, B. pinnata** (California barberry) and **B. nervosa** (Mahonia). These, no doubt, have properties not unlike those of **B. vulgaris.** (See J. M. Maisch. The Berberis species of the Pacific coast. American Journal Pharmacy, **50**:374–371, 1878, and Proc. A. Ph. A. **27**:201–206, 1879.)

161. **Berberis aquifolium** Pursh. Oregon grape. *Berberidaceæ.*

Roots are used in treatment of ulcers and sores. The juice of the fruit fermented, with sugar added, makes an excellent wine. California Indians have long used the root decoction as a tonic. The bark is used medicinally. There is still considerable demand for this drug. (Calif. Geol. Surv., Bot. **1**: 14). (U. S. Surv., Wheeler's Rep. Bot. **6**: 41.)

162. **Berberis nervosa** Pursh. False Oregon grape. *Berberidaceæ.*

Berries are strongly acid, but are eaten and are said to promote the action of the liver. The bark and root are used in jaundice. **B. repens** has similar properties. (Calif. Geol. Surv. Bot. **1**: 15.) (Contrib. U. S. Nat. Herb. **7**: (No. III) 348).

163. **Berberis pinnata** Lag. Barberry. *Berberidaceæ.*

Berries are edible. Stem and root contain a yellow die. Properties like those of **B. nervosa.**

164. **Beta vulgaris** L. Beet. Garden or red beet. Sugar beet. *Chenopodiaceæ.*

Escaped from gardens. Sugar beet culture is conducted on an enormous scale in California. (See paper by Geo. W. Shaw. Numerous state agricultural reports on sugar beet culture, etc.)

165. **Betula alba** L. European white birch. *Cupuliferæ.*

Cultivated. Leaves used in gout, dropsy, rheumatism. Saccharine

juice used in kidney and bladder complaints. Bark yields an oil, having the properties of oil of cade. The resinous exudation of young shoots, mixed with soda, is used as a tonic laxative. Inner bark used in intermittent fever. (Am. Journ. Pharm. 1881.)

166. **Betula lenta** L. Cherry. Sweet or black birch. *Cupuliferæ.* Cultivated. Ornamental. Used like **B. alba.**

167. **Bidens species.** Spanish needles. Beggars' sticks. *Compositæ.*

The California species require further study. The roots and seeds of **B. bipinnata** are popularly used as an emmenagogue and by the eclectics as an expectorant in laryngeal and bronchial diseases.

168. **Bigelovia groveolens** I. Gray. *Compositæ.*

The Coahilla Indians prepare a tea from the twigs given for coughs and pains in the chest. (Barrows.)

169. **Bigelovia veneta** (H. B. K.) Gray. Bushy goldenrod. "Yerba anti-rheumatica." *Compositæ.*

Resembles **B. menziesii.** Said to have aphrodisiac properties. Is used in the treatment of rheumatism. It contains a resinous exudation resembling that of **Grindelia robusta.** (U. S. Geog. Surv., Wheeler's Rep. **6**: 46.) (U. of C. Exp: Sta. Rep. 1895, p. 96; 1896, pp. 64, 67, 70.)

170. **Blepharipappus douglasii,** H. and A. Greene. (**Layia calloglossa** Gray). *Compositæ.*

Decoction prepared with equal parts of milk and water, cooled and used as an application to sore and inflamed eyes.

171. **Blumea balsamifera,** D.C. **Blumea camphor.**

Introduced in southern California. Yields camphor by oxidation with nitric acid.

172. **Boisduvalia densiflora** Wats. *Onagraceæ.*

Seeds are rich in oil and are relished by Indians as a food.

173. **Boletus.** Pore fungi. *Boletaceæ.*

Eaten as food by Calpella Indians. Poisonous. (Contrib. U. S. Nat. Herb. **7**: (No. III) 301.)

174. **Brodiæa lactea** Wats. *Liliaceæ.*

Bulbs used by Indians as food. **B. capitata** used similarly by other Indians (Indian potato).

175. **Brunella vulgaris** L. Self-heal. Heal-all. *Labitæ.*

A cosmopolitan plant of European origin. Said to be useful as a gargle in throat diseases; useful in diarrhea and to check hemorrhages. It was highly prized among the common people of Europe.

176. **Bryonia alba** L. *Cucurbitaceæ.*

Introduced in gardens. Thrives well. Well known medicinally. (See text-books on Materia Medica and dispensatories.)

177. **Butneria occidentalis** Greene. Western spice bush. *Butneriaceæ.*

All parts very aromatic. Requires further study.

178. **Buxus sempervirens** L. Common box tree. *Euphorbiaceæ.*

An extensively cultivated evergreen shrub, native of Europe and western Asia. The wood is said to have diaphoretic properties, and a decoction is used in the treatment of rheumatism and secondary syphilis. The leaves are purgative. The volatile oil is given in epilepsy. (U. S. Disp.)

179. **Cactus species.** *Cactaceæ.*

There are several Mexican cacti which are said to be powerful heart stimulants. **(Anahalonium lewini.)** (See also **Opuntia** and **Cereus.)** (Baily, Cycl. Am. Hort. 203.)

180. **Caffea arabica** L. Coffee. *Rubiaceæ.*

Found in conservatories and thrives in southern portions of the State. Not cultivated commercially. Seeds contain caffeine.

181. **Calandrinia caulescens menziesii** Gray. Wild portulacca. *Portulaccaceæ.*

A fodder plant. Considered an excellent pot-herb, used for salads, etc.

182. **Calendula officinalis** L. Marigold. *Compositæ.*

Other species and varieties common in gardens. Well known medicinal plant. Used as a poultice in cancer, sores and ulcers; given in scrofula, jaundice, colic, etc. (U. S. Disp.)

183. **Callitriche palustris** L. Water fennel. Water starwort. *Callitrichaceæ.*

A decoction is given for dropsy and in urinary affections.

184. **Calochortus macrocarpus** Dougl. Mariposa lily. *Liliaceæ.*

The bulbs are greatly relished by Indians, eaten raw. All relish it, children especially. This is unquestionably the most highly-prized bulb known to Indians. Indians claim that the juice of **Calochortus concolor** Purdy is bad for the eyes (Hall). The bulbs of **Calochortus nutallii** are also used as food by Indians. Resembles the Death Camas somewhat.

185. **Calumba. (See Jateorhiza.)**

186. **Camassia esculenta** Lindl. Wild hyacinth. *Liliaceæ.*

A popular food of the Piute Indians; the bulbs are eaten. (Calif. Geol. Surv. Bot. **2**: 158.)

187. **Camassia (Quamasia) leichtinii** Baker. Camas. *Liliaceæ.*

A very important Indian food plant. The bulbs are eaten raw and baked. The related **Quamasia quamash,** Death Camas, is very poisonous.

188. **Camelina sativa** L. False flax. *Cruciferæ.*

Introduced weed. At one time this plant was grown commercially for the oil in the seeds.

189. **Cananga (Unona, Uvaria, Canang) odorata** H. and T. Ylang-ylang. (See **Artabotrys.**)

190. **Cannabis sativa** L. Indian hemp. *Urticaceæ.*

Escaped from cultivation. The exact medicinal value of the California-grown plants requires further careful study. Extensively grown as a fiber plant in Butte County.

191. **Capsicum baccatum.** Bird pepper. *Solanaceæ.*

Easily grown. Supplies the bulk of the cayenne pepper of the market. The name bird pepper refers to the fact that turkeys are very fond of the fruit. Used as a stimulant tonic in atonic dyspepsia.

192. **Capsicum fastigiatum.** Red pepper. Cayenne or African pepper. *Solanaceæ.*

This is a common California product. Very extensively cultivated.

193. **Carica papaya.** Pawpaw. *Passifloraceæ.*

A common introduced plant. Grown as an ornamental plant, and for the fruit in southern California. The fruit contains a ferment papain, which acts on starch, emulsifies fat and converts albuminoids into peptones. Of great commercial interest.

194. **Carica quercifolia.** Pawpaw. *Passifloraceæ.*

Leaves contain high percentage of papain, which is much used as a substitute for pepsin. For fermentative action of juice, see Proc. A. Ph. A. **27**: 231. 1879.

195. **Carob.** (See **Ceratomia.**)

196. **Carthamus tinctorius** L. American, false or dyer's saffron. *Compositæ.*

Native of India and Africa. Cultivated in various parts of the United States. Used for dyeing purposes and as an adulterant of, or as a substitute for, true or Spanish saffron, as a domestic diaphoretic, and laxative in measles, scarlatina, and in other eruptive diseases.

197. **Carum gairdneri** Gray. Wild caraway. *Umbelliferæ.*

Poisonous. Used by Indians. (Palmer.) (Proc. A. Ph. A. **27**: 193, 1879.)

198. **Carya (Hicoria) species.** Hickory. *Juglandaceæ.*

To this group belongs the pecan and the various hickories. No systematic attempts have as yet been made to introduce these into the State. Bark and leaves astringent, used in dyspepsia and intermittent fever. Leaves of **C. porcina** and of other species used medicinally as a laxative and for external application in skin diseases. The bark used in dyeing brown, yellow and green.

199. **Cascara.** (See **Rhamnus.**)

200. **Casimiroa edulis** L. White zapote. *Rutaceæ.*

Introduced in southern part of State. Used as a hypnotic in Mexican hospitals. The seeds are used.

201. **Cassia acutifolia** Del. African Senna. *Leguminoseæ.*

According to H. H. Fisher (*in lit.*), senna has been grown successfully near Corpus Christi, Texas, for several years. Seeds obtained from Mr. Fisher have been planted in the San Francisco Garden of Medicinal Plants; they germinated promptly, but the seedlings were killed by root rot. Attempts to grow it at Salinas, California, met with partial success only. It apparently grows exceedingly well near Mecca, California (Mr. and Miss Evelyth). Would no doubt thrive in the California cotton belts. Requires hot weather, with ample soil moisture. Further culture attempts should be made.

202. **Cassia marylandica** L. American senna. *Leguminosæ.*

This plant is common in the gardens and parks of California. Used as a cathartic like senna.

203. **Castanea chrysophylla** Dougl. Chestnut. Chinquapin. *Cupuliferæ.*

Varies in size from a shrub to a large tree, 150 feet high. Seeds edible. The fruit is good, but is now largely displaced by the Japanese chestnuts. (Contrib. U. S. Nat. Herb. **7**: (No. III) 333.)

204. **Catalpa catalpa** Karst. Cigar tree. Bean tree. Catalpa. *Bignoniaceæ.*

Introduced as ornamental trees. The seeds, pods, and leaves have been found useful in asthma.

205. **Caucalis microcarpa** Hook et Arn. Hedge parsley. *Umbelliferæ.*

A poultice of this plant is used to counteract rattlesnake bites. (Calif. Geol. Surv. **1**: 272.) (U. of C. Agr. Exp. Sta. Rep., p. 244, 1890.)

206. **Caucalia nodosa** Huds. *Umbelliferæ.*

This is also known as a rattlesnake remedy. The species require

further study as to their reputed properties. Probably identical with **C. microcarpa.**

207. **Ceanothus americanus** L. New Jersey tea. *Rhamnaceæ.*

Cultivated. Roots rich in tannin. Leaves used as a substitute for tea.

208. **Ceanothus cuneatus** Nutt. Lilac. *Rhamnaceæ.*

Native plant, which should be more carefully studied.

209. **Ceanothus divaricatus** Nutt. Soap bush. *Rhamnaceæ.*

The blossoms are used as a substitute for soap. (Calif. Geol. Surv. Bot. **2**: 439.)

210. **Ceanothus integerrimus** H. and A. Lilac. *Rhamnaceæ.*

Seeds eaten by Indians. Bark and roots of this shrub used in malaria, catarrh, and liver troubles. Good forage plant. Fruiting capsule very bitter and should be studied more carefully as to possible medicinal properties.

211. **Ceanothus velutinus** Dougl. Mountain balm. Snow brush. White lilac. Manzanita. *Rhamnaceæ.*

The old Indians boil the leaves, dry them and smoke them like tobacco. Also employed medicinally, but no definite information could be obtained as to how; perhaps it was used as a tonic. The Indians appear to be quite enthusiastic about it, and pronounce it "very good medicine." Very likely used much like **C. americanus,** which owes its properties to the presence of tannic acid and an alkaloid ceanothine. (U. S. D.)

212. **Centaurea solstitialis** L. St. Barnaby's thistle. Yellow star thistle. *Compositæ.*

The mature plant is said to be poisonous to horses and cattle. Becoming a very troublesome weed. Cut green, it is said to make good fodder. Introduced from Europe. Requires further study.

213. **Cephalanthus accidentalis** L. Button willow. *Rubiaceæ.*

A tincture made of the bark has been found useful, as a tonic, as a laxative and as a remedy for fevers and coughs.

214. **Cerasus demissa** Nutt. Choke cherry. (*Amygdalaceæ.*) *Rosaceæ.*

Fruits eaten fresh or dried. Green as well as nearly ripe fruit is very astringent. Inner bark gathered in large quantities for medicinal use. Said to be useful as a tonic, to check diarrhœa and to relieve nervousness. The fresh berries are ground (crushed) up entire in a stone mortar and pestle. The dried fruit pulp is boiled and eaten. A decoction of the young shoots and bark is taken, apparently as a

beverage (coffee). Root is used medicinally. (Contrib. U. S. Nat. Herb. **7**: (No. III) 356.)

215. **Cerasus emarginata** Dougl. (*Amygdalaceæ.*) *Rosaceæ.*

Used much like **C. demissa.** Fruit quite bitter and somewhat astringent. Perhaps used because of the medicinal effects due hydrocyanic acid; perhaps tonic.

216. **Cerasus occidentalis** Torr. Red bud. Judas tree. *Rosaceæ.*

Bark used as a substitute for quinine. Requires further study. (Contrib. U. S. Nat. Herb. **7**: (No. II) 356.)

217. **Ceratonia siliqua** L. St. John's Bread. Carob. *Leguminosæ.*

Quite extensively grown in the southern part of the State.

This tree was known to the ancients and the fruit was eaten, which is rich in sugar and has laxative properties. Seeds are very hard and are rejected. Cultivated in various warmer countries, and the pods are often used as fodder for horses.

The fruit is used in a patented remedy of California sold under the name of "Carob." It is tonic and laxative.

218. **Cercis occidentalis** Torr. Common Red bud. *Leguminosæ.*

Bark was used by old settlers as a substitute for quinine in the treatment of malarial fevers.

219. **Cercocarpus betulæfolius** Hook. *Rosaceæ.*

Shrub, 2/15 feet high. Valued as fuel. Reported to have medicinal properties.

220. **Cereus (Cactus) grandiflorus** L. Night blooming cereus. *Cactaceæ.*

This plant does well in the State when carefully cultivated. A very valuable heart tonic with the properties of digitalis. Poisonous. Culture well worthy a trial. Common as an ornamental plant.

221. **Chamæcyparis (Cupressus) lawsoniana** Parl. Oregon cedar. Ginger pine. *Coniferæ.*

Wood of excellent quality, very fragrant, credited with antiseptic and other properties, said to be especially useful in diseases of the lungs.

222. **Chenopodium species.** Pigweeds. *Chenopodiaceæ.* These weeds very common.

The following species are the most important: **C. ambrosioides** (Mexican tea), **C. anthelminticum** (Wormseed), and **C. californicum** (Soap plant.) Most of them are used medicinally, principally the seeds, as a vermifuge. Seeds are rich in oil. (See Proc. A. Ph. A. (Abstract) **27**: 152, 1879.)

223. **Chenopodium album** L. Pigweed. *Chenopodiaceæ.*

Leaves used as greens. Indians use old leaves to relieve stomach-ache.

224. **Chenopodium botrys** L. Jerusalem Oak. *Chenopodiaceæ.*

Is frequently cultivated for medicinal purposes. Other species are **C. murale, C. rubrum** and **C. vulvaria.** There are no doubt additional unidentified species. The Indians use the leaves as food and the seeds and other plant parts medicinally.

225. **Chenopodium californicum** Wats. Soap plant. *Chenopodiaceæ.*

Roots formerly much used as a substitute for soap. Still so used to some extent.

226. **Chimaphila menziesii** Spreng. Pipsissiwa. Prince's pine. *Ericaceæ.*

The leaves are highly valued as a tonic, astringent, and as a remedy for cataract. Other species are **C. corymbosa** Pursh. and **C. maculata** Pursh. No doubt the leaves of these species have medicinal value.

227. **Chlorogalum angustifolium** Kell. Soaproot. *Liliaceæ.*

Found in the San Joaquin Valley and upper Sacramento. Requires further study.

228. **Chlorogalum pomeridianum** Kunth. Soaproot. Soap plant. *Liliaceæ.*

Very common in California. Has received considerable attention. Used by California Indians and Spaniards for cleansing purposes. Rich in saponin. Poisonous; used by Indians to stupefy fish.

Young shoots eaten by nearly all Indians. Dried juice of bulbs used as a glue for fastening feathers to arrows. Roasted and powdered bulbs are used as an antiseptic application for ulcers and sores. A decoction of bulb is said to be useful as a diuretic and laxative, etc. (Contrib. U. S. Nat. Herb. **7**: (No. III) 319.)

229. "**Chucklusa.**"

An Indian name applied to several species of **Peucedauum,** used medicinally and as food. (Am. Journ. Pharm., 1890.)

230. **Cichorium intybus** L. Chicory. *Compositæ.*

This plant has been cultivated very successfully in California in the San Joaquin Valley. Well known. The dried roasted roots are used as a surrogate for coffee.

231. **Cicuta species.** Water hemlocks. *Umbelliferæ.*

Most of the species are believed to be poisonous, and it is known that many are highly poisonous. It is stated that drinking water in which the poisonous species grow will cause symptoms of poisoning.

For cattle poisoning, melted lard is much used as a popular remedy. For references to chemistry, etc., see U. S. Disp.

232. **Cicuta bolanderi** Wats. Large water hemlock. *Umbelliferæ.* Found only near San Francisco Bay. Requires further study. Poisonous.

233. **Cicuta douglasii.** Purple-stemmed water hemlock. *Umbelliferæ.*

Very poisonous. Western Range, Oregon, Idaho, and Washington.

234. **Cicuta maculata** L. American water hemlock. *Umbelliferæ.* A very poisonous plant, native of the United States, found in swampy lands, having a parsnip-like odor. Possible medicinal uses not investigated. Eastern in range. (Calif. Geol. Surv. Bot. **1**: 260.)

235. **Cicuta occidentalis** Green. Wyoming water hemlock. *Umbelliferæ.*

Poisonous. Used by Indians for suicidal purposes. The root is dug up and eaten. Piutes seem to have suicidal tendencies. Poisonous to cattle. Requires further study.

236. **Cicuta vagans** Greene. Oregon water hemlock. *Umbelliferæ.* A western plant found in northern California, Idaho, and British Columbia. Poisonous properties like those of **Conium.** Requires further study.

237. **Cicuta virosa californica** C. and R. California water hemlock. *Umbelliferæ.*

Near San Francisco Bay. Very poisonous. Requires further study as to identity as well as constituents. Well known in Europe. Eastern range in United States.

The active principle of the cicutas is not well known. It appears to be a compound, which has been named cicutoxin by R. Bœhm. It is a resinous, non-crystallizable body, acid in reaction and very bitter, readily soluble in water. It is not an alkaloid, but a toxin, resembling andromedotoxin.

238. **Cinchona species.** Cinchonas. *Rubiaceæ.*

Cinchonas have been grown in the Berkeley gardens, and the alkaloidal constituency thereof examined. It has been suggested that the climate of the mountainous regions of northern California would be well suited for cinchona cultivation, but it is very doubtful whether they would thrive, on account of the low winter temperature. (See paper by Happersberger.)

The conditions (atmospheric moisture, drainage, temperature, rainfall) in many localities of southern California, particularly near the

coast slopes, would seem suitable for cinchona culture, especially the hardy **C. officinalis.** (U. S. Disp., pp. 388–418.) (Bailey, Cycl. Am. Hort., 316.) (Univ. Calif. Coll. Agr. Rep., pp. 74–75, 1879; pp. 103–105, 1883.)

James MacPherson, who has resided at the plateau of the Nilgiri Mountains in India, states that the list of plants in the Report of the Park Commissioners of Golden Gate Park is closely similar to that of the Nilgiri Plateau.

For reference to literature and abstracts of papers on the history, uses and cultivation of Cinchonas, see volumes of Proceedings of the American Pharmaceutical Association, especially the earlier numbers ranging from the first number up to 1880 and later. Each volume will have several references to the subject.

239. **Cinnamomum camphora** Nees. Camphor tree. *Laurineæ.*

Has escaped from cultivation and thrives well throughout the State. Of slow growth. No practical attempts at cultivation and camphor production on a large scale have thus far been made in the United States. There seems to be no good reason why California, Florida and other warm states should not supply camphor. The California tree is evidently as rich in camphor as that of China and Japan, as is shown from recent tests made at the California College of Pharmacy by E. M. Kimberlin. Whether camphor production could be made profitable in California has not yet been determined. Carefully planned tests and experiments would be very desirable to determine this.

240. **Cinnamomum zeylanicum** Nees. Ceylon cinnamon. *Laurineæ.*

Cultivated in southern part of the State. Other species are also cultivated. No commercial use made of the bark. Handsome trees.

241. **Cirsium (Cnicus) arvensis** Scop. Canada thistle. *Compositæ.*

This plant is said to contain an alkaloid and have emetic, tonic and diaphoretic properties. Root astringent, and has been used medicinally. An introduced plant. (H. J. Pierce. Am. Journ. Pharm. **58**: 1896.)

242. **Cistus species.** Rock rose. Labdanum. *Cistaceæ.* (See, also, **Labdanum.**)

Evergreen shrubs extensively cultivated. Contain a resinous substance (labdanum) which is of considerable commercial value in the Orient. It is an expectorant tonic, formerly much used in catarrh and dysentery. Now used only in plasters. (**C. labdaniferus** L. and other species.) (Am. Journ. Pharm. **47**: 499. 1875.) (Proc. A. Ph. A. **27**: 224. 1879.)

243. **Citrullus colocynthis** Schrad. Colocynth. Bitter apple. *Cucurbitaceæ.*

Has been grown in Mexico and promises to do well in this State. A laxative. Poisonous. Well known medicinally. (U. S. Disp.)

244. **Citrus limonum** L. and varieties. Lemon. *Aurantiaceæ.*

Extensively cultivated in southern portions of the State. Related fruits, as the grape fruit, lime, with their numerous culture varieties and artificial crosses, are cultivated in the State. (See publications by Le Long.) (Bailey, Cycl. Am. Hort. 322.)

245. **Claviceps purpurea** Tul. Ergot. Fungi.

This fungus occurs on rye and other cereals. On the western plains it is found on the following grasses: **Elymus species, Agropyron species, Koeleria cristata** (Prairie June grass), **Phalaris arundinaceæ** (reed canary grass), more commonly on **Elymus condensatus** (wild rye grass) and **Agropyron spicatum** (bluejoint grass). On these hosts it is the cause of poisoning cattle. General medicinal uses known to Indians. A very useful hæmostatic. (Contrib. U. S. Nat. Herb. 7: (No. III) 299.) (U. S. Disp. 511.)

246. **Clematis lasiantha** Nutt. Pipe-stem. Large-flowered clematis. *Ranunculaceæ.*

Quite common. Requires study. Perhaps has properties like those of **C. erecta, C. flammula, C. vitalba** and **C. virginiana,** which have been used medicinally in the treatment of cancer, ulcers, syphilitic eruptions, the itch, etc. Some species are much cultivated as ornamental plants.

247. **Clematis ligustifolia** Nutt. *Ranunculaceæ.*

Stem and leaves are chewed to cure colds. Another common California species known as hill clematis.

248. **Clintonia andrewsiana** Torr. Purple clintonia. *Liliaceæ.*

Considered a valuable diuretic, mild tonic and demulcent. (Kellogg, Trans. State Agr. Soc., p. 148.)

249. **Cnicus (Carduus) benedictus** L. Blessed thistle. *Compositæ.*

Introduced in the University gardens at Berkeley, but threatened to spread as a noxious weed and was promptly exterminated. Leaves worth about twenty-five cents per pound. Seeds and herb used in medicine.

250. **Cocos species.** Coco nuts. *Palmæ.*

The cocoa nut palms thrive in southern California. Many species and varieties are being introduced.

251. **Cocos nucifera** L. Coco nut palm. *Palmæ.*

Cultivated in warmer parts of the State. Promises to be a commercial success.

252. **Colchicum autumnale** L. Colchicum. Meadow saffron. *Convallariaceæ.*

A well-known, poisonous medicinal plant, native of southern Europe, Switzerland, and Turkey. Extensively cultivated in Europe. Requires rich, moist soil, in the open. Easy of cultivation. The corms (tubers) are used, having decided diuretic, laxative and alterative properties; much used in rheumatism and gout. Poisonous. Value, thirty-five cents per pound. Seeds are also used.

The corms are collected the second year, after seeds are ripe, washed, sliced, and dried in the sun. Seeds are collected when fully ripened. The present market is supplied from England and Germany.

253. **Coleosanthus californicus** Kuntze. Brickellia. *Compositæ.*

Leaves used as a substitute for tea. (Contrib. U. S. Nat. Herb. 7: (No. III) 393.)

254. **Collinsia bicolor** Benth. Innocence. Collinsia. *Scrophulariaceæ.*

Poultice of the leaves used for insect bites. A plant common throughout western California.

255. **Collomia gracilis** Dougl. *Polemoniaceæ.*

The seeds soaked in water give a highly mucilaginous, cooling drink, known by the Mexicans as "Chia." (See paper by E. Palmer.)

256. **Colutea arborescens** L. Bladder senna. *Papilionaceæ.*

Cultivated as an ornamental shrub. The leaflets are purgative and used as a substitute for senna.

257. **Compositæ.**

The following members of the family, besides many others having medicinal properties, are common:

Arnica discoidea Benth. Coast Arnica.
Arnica latifolia Bang. Arnica.
Cichorium intybus L. Chicory. Introduced.
Gnaphalium species.
Helianthus annuus L. Common sunflower.
Lactuca scariola L. Prickly lettuce.
Sonchus oleraceus L. Sow thistle.
Senecio vulgaris L. Common groundsel.
Solidago species. Golden rod.
Xanthium canadense Mill. Cocklebur.

258. **"Conchatana."**

A medicine made from the roots of some plant used at Bodega. Requires further investigation.

259. **Conium maculatum** L. Poison hemlock. *Apiaceæ.* (*Umbelliferæ.*)

A well-known poison plant, native of Europe and Asia, but common in United States. Escaped from cultivation. Leaves and seeds used, twenty cents per pound. Easily cultivated. (B. Hutchins, **Conium maculatum,** wild parsnip. Calif. College Pharm. 1902. Thesis.)

260. **Concallaria majalis** L. Lily of the Valley. *Convallariaceæ.*

A well-known plant, cultivated extensively as an ornamental plant. The rhizomes and roots are heart tonic and diuretic. Used medicinally in dropsy, heart disease, weak heart, etc. Properties much like those of digitalis. Poisonous. Cultivation easy, simple, and would no doubt be fairly profitable on a large scale. Price per pound, sixteen to twenty cents. For uses and physiological action see Proc. A. Ph. A. (Abstract) **31**: 101, 102, 1883, and text-books on Materia Medica and dispensatories.

261. **Convolvulus arvensis** L. Common bindweed. European bindweed. *Convolvulaceæ.*

A very common troublesome weed. A tincture is made from the entire plant.

262. **Cornus florida** L. Dogwood. *Cornaceæ.*

Introduced ornamental plant. Cultivated as an ornamental tree throughout the State. Bark well known medicinally. Used in intermittent fevers, as an astringent tonic, etc. (U. S. Disp.)

263. **Cornus pubescens** Nutt. Red willow. *Cornaceæ.*

Eaten raw and dried for winter use. No medicinal uses appear to be made of this plant.

264. **Cotyledon californicum** Trelease. Hen-and-chickens. *Crassulaceæ.*

Indians use the leaves in making a soothing poultice. The young leaves of **C. edulis, C. lanceolata** and **C. pulverulenta** are eaten by the Indians.

265. **Coptis species.** Golden thread. *Ranunculaceæ.*

The native species require further study. The roots are bitter and used as a tonic and as a local application in aphthous ulcerations of the mouth. The Japanese **C. anemonifolia** S. and Z. is highly valued as a medicine.

266. **Crateagus oxyacantha** Gert. European Hawthorn. *Rosaceæ.*

Introduced; very common as an ornamental plant. Leaves, bark, flower and fruit have been used medicinally, principally as a cardiac tonic. (G. M. Beringer. Am. Journ. Pharm. **76**: 283–284, 1904.)

The native **Crateagus rivularis** Nutt. (Thorn tree) is said to be poisonous (thorns of the stem). Fruit sometimes eaten by Indians.

267. **Crocus sativus** L. Saffron. *Iridaceæ.*

I am not aware that this plant is actually grown, but it would certainly thrive well in the State. Stigmas used as a coloring agent by baker and confectioner. Well known medicinally. Cultivated in Pennsylvania and New York.

268. **Crotalaria sagittalis** L. Rattlebox. *Papilionaceæ.*

South, central and eastern United States. Not definitely reported from California. Poisonous plant which requires further study.

269. **Croton californicum** Müll. *Euphorbiaceæ.*

A bitter tea is made from the leaves and used for rheumatism, and as a salve (powdered leaves and tallow). Purgative.

270. **Croton tiglium** L. Croton oil plant. *Euphorbiaceæ.*

This and other foreign species and varieties grow very readily in the southern part of the State and some of them are very common as ornamental plants. Well-known medicinally. Poisonous.

271. **Cruciferæ.** Mustard family.

The mustard family is well represented in the State. Many members occur as very troublesome weeds. Many species are naturalized, and others are native. Their medicinal, popular and household use is familiar to all. The following are the more important species: (Calif. Geol. Surv. Bot. **1**: 25.)

Sisymbrium officinale Scop. Hedge mustard.
Sisymbrium pinnatum Walt. Tansy mustard.
Cakile americana Nutt. Sea rocket.
Brassica campestris L. Common yellow mustard.
Brassica arvensis L. Charlock.
Brassica nigra L. Black mustard.
Brassica alba Boiss. White mustard.
Raphanus sativus L. Wild radish.
Raphanus raphanistrum L. Jointed Charlock.
Arabis virginica Trelease. Cress.
Arabis glabra Beruh. Tower mustard.
Arabis blepharophylla H. and A. Cress.
Arabis breweri Wats. Brewer rock cress.
Barbarea vulgaris R. Br. Winter cress.

Nasturtium officinale R. Br. Water cress.
Nasturtium curvisiliqua Nutt. Western yellow cress.
Nasturtium palustris D.C. Mush yellow cress.
Cardamine oligosperma Nutt. Bitter cress.
Capsella bursa-pastoris Moench. Shepherds purse.
Capsella procumbens Fries.
Camalina sativa Crantz. False flax. Seeds rich in oil.
Alyssum calycinum L. Small alyssum.
Alyssum maritimum L. Sweet alyssum.
Lepidium medium Greene. Tall pepper grass.
Lepidium nitidum Nutt. Common pepper grass.

272. **Cucurbita foetidissima** H. B. K. Chili cojote. Gourd. *Cucurbitaceæ.*

Leaves and the large roots are used for washing, but must be thoroughly rinsed, because they are very irritating to the skin. Leaves are highly valued medicinally. The pulp of the green fruit is mixed with soap, and applied to sores and ulcers. Seeds are ground and eaten.

273. **Cucurbita perennis** Gray. Chili cojote. Mock orange. *Cucurbitaceæ.*

Pulp of green fruit used as a substitute for soap. Macerated root used as a remedy for piles, and the seeds are eaten by the Indians. The roots are crushed by the Coahuila Indians, mixed with sugar and applied to the saddle sores of horses. (Barrows.) (U. S. Geog. Surv., Wheeler's Rep. Bot. **6**: 44.) (Calif. Geol. Surv. Bot. **1**: 239.) Also used by Mexicans in tanning.

274. **Cymopteris acaulis** Rydb. *Umbelliferæ.*

This and several other species are used. Some species are perhaps poisonous. Roots said to be eaten by Indians.

275. **Cymopteris fendleri** Gray. *Umbelliferæ.*

Resembles **C. anisatum** and, like that plant, emits a strong anise-like odor when boiled. The decoction used with whisky is used as a warm stomachic bitters. Also used as a kitchen confection in dressing, etc. It has carminative and tonic properties. Roots of most species eaten by Indians. (U. S. Geog. Surv., Wheeler's Rep. Bot. **6**: 44.)

276. **Cynoglossum grande** Dougl. Coyote. Dog ear. *Boraginaceæ.*

Cooked roots are eaten. Indians use grated roots to apply to scales and burns and to relieve stomachache. (Contrib. U. S. Nat. Herb. **7**: (No. III) 282.)

277. **Cypripedium hirsutum** Mill. Larger yellow lady's slipper. *Orchidaceæ.*

Found in Maine, Minnesota, Alabama, Arkansas, and sparingly in Colorado. Can no doubt be introduced into California.

278. **Cypripedium montanum.** Lady's slipper. *Orchidaceæ.*

Not very plentiful and requires study. Another species, **C. californicum,** is found in Mendocino County.

279. **Cypripedium parviflorum** Salisb. *Orchidaceæ.*

Range much as preceding, but extending father north and west, to the State of Washington. Can no doubt be cultivated in certain areas of California.

280. **Cypripedium reginæ** Walt. Showy lady's slipper. *Orchidaceæ.*

In swamps of Georgia, Missouri, and Minnesota. Can no doubt be introduced into the boggy swamp lands of California.

The poisonous nature of the above orchids was not suspected until about 1875, when Prof. H. H. Babcock called attention to symptoms produced not unlike those caused by poison ivy **(Rhus radicans).** In 1894 Prof. D. T. MacDougal of the Tucson Experimental Station investigated these plants more carefully and reached the conclusion that the active principle (oil) occurred in the glandular trichomes of the leaves and stems. The action and exact chemical nature of this substance requires further study. (D. T. MacDougal. On the poisonous influence of **Cypripedium spectabile** and **C. pubescens.** Minnesota Bot. Studies, Bul. 9, Jan., 1894.)

281. **Cytisus laburnum** L. (**Laburnum vulgare** Presl.) *Papilionaceæ.*

Cultivated in California. Poisonous. Has been used in asthma, whooping-cough, dyspepsia, headache, etc.

282. **Cytisus scoparius** L. Broom. *Papilionaceæ.*

Very common as an ornamental plant throughout the State. A decoction is used as a diuretic and cathartic, in cardiac affections and in dropsy. In large doses it is poisonous and emetic. Said to be useful as a supporter of the heart's action during chloroform and ether anæsthesia.

A very common ornamental shrub throughout the State. Well known medicinally. Numerous other species of cytisus are introduced. (U. S. Disp.)

283. **Dalea species.** *Leguminosæ.*

The California species are limited to the southeastern desert regions. They are used as food and medicinally by the Indians.

284. **Dalea emoryi** G. *Leguminosæ.*

This appears to be the most popular species among the Indians. (Proc. A. Ph. A. **27**: 258, 1879.)

285. **Daphne mezereum** L. Mezereon. Olive spurge. *Thymelaceæ.*

Cultivated as an ornamental plant. Well known medicinally. A decoction of the bark is popularly used as a diuretic.

286. **Datisca glomerata** Hook. Durango root. *Datiscaceæ.*

Used by Indians to stupefy fish. Leaves and roots intensely bitter; used as a bitter tonic. Should be more carefully studied.

287. **Datura meteloides** D. C. Jamestown weed. *Solanaceæ.*

The Coahilla Indians have used this noxious weed as a substitute for tobacco; also mixed with drinks and in the form of a poultice. According to Hall, an intoxicating drink is made from the crushed fruits. General medicinal properties similar to **D. stramonium.** Should be more carefully investigated. (Calif. Geol. Surv., Bot. **1**: 544.) (Barrows, Land of Sunshine, No. 13, p. 322, Nov., 1900.) (Hilgard, U. of C. Agr. Exp. Stat. Reports, p. 284, 1890.) (U. S. Dept. Agr. Off. Exp. Sta. Bul. No. 15, p. 369.) (Proc. A. Ph. A., **27**: 158, 1879.)

288. **Datura stromonium** L. Thorn apple. Jamestown weed. Jimson weed. Stink apple. *Solanaceæ.*

Is becoming gradually introduced from the East. A rank weed in waste places. Well known medicinally. Very easily grown. The leaves and seeds are used medicinally. (U. S. Disp.)

289. **Datura tatula** L. Jimson weed. *Solanaceæ.*

Common in the State. Closely related to **D. stramonium.** Contains atropine and hyoscyamine. The seeds are very poisonous. Should be more fully investigated.

290. **Daucus carota** L. Wild carrot. *Umbelliferæ.*

The seeds act as a mild, stimulating diuretic, used in dropsy and chronic nephritis. Contains pectin, vegetable jelly, etc. (U. S. Disp.)

291. **Daucus pusillus** Michx. Rattlesnake weed. *Umbelliferæ.*

Used by the Spaniards as an antidote for snake bite. (Calif. Geol. Surv. Bot. **2**: 452. Contrib. U. S. Nat. Herb. **7**: No. 3, p. 372.)

292. **Delphinium species.** Larkspur. *Ranunculaceæ.*

Numerous species occur in the State, and all are more or less poisonous. Many are cultivated as ornamental plants. This group of plants causes very serious losses to ranchmen through the poisoning of cattle on the grazing ranges.

The symptoms of poisoning by the larkspurs are similar to those of aconite, and the treatment is the same as for aconite poisoning.

293. **Delphinium bicolor** Nutt. Purple larkspur. *Ranunculaceæ.*
Poisonous. Cultivated. Properties simliar to those of **D. consolida.**

294. **Delphinium californicum** T. and G. Coast larkspur. *Ranunculaceæ.*
Not very common. Poisonous.

295. **Delphinium consolida** L. Larkspur. *Ranunculaceæ.*
A common poison weed of Europe; introduced everywhere. Well known medicinally. Seeds used to destroy lice and other vermin. (U. S. Disp. and texts on materia medica.)

296. **Delphinium decorum** F. and M. Larkspur. *Ranunculaceæ.*
Reported to be poisonous. This species and **D. scopulorum** require further investigation as to poisonous properties.

297. **Delphinium geyeri** Greene. Larkspur. *Ranunculaceæ.*
Common on the ranches of Colorado and Wyoming. Fresh leaves are very poisonous. Requires further study.

298. **Delphinium glaucum.** Tall larkspur. *Ranunculaceæ.*
Poisonous to cattle. Requires further study.

299. **Delphinium hesperium** Gray. Western larkspur. Rattlesnake flower. *Ranunculaceæ.*
Poisonous to cattle. (Contrib. U. S. Nat. Herb. **7**: (No. 3) 347.)

300. **Delphinium menziesii** D.C. Purple larkspur. *Ranunculaceæ.*
Common in California. Many heads of sheep have been poisoned by this plant.

301. **Delphinium nudicaule** T. and G. Red larkspur. Sleep root. *Ranunculaceæ.*
Is reported to have narcotic and soporific properties. Should be more carefully studied. (Contrib. U. S. Nat. Herb. **7**: (No. 3) 347.)

302. **Delphinium recurvatum** Greene. Larkspur. *Ranunculaceæ.*
Very poisonous. Requires further study.

303. **Delphinium staphisagria** L. Stavesacre. *Ranunculaceæ.*
A common poison weed from Europe, well known medicinally. May be grown anywhere. Seeds used externally (infusion) to destroy lice and other vermin. (U. S. Disp.)

304. **Delphinium tricorne** Michx. Dwarf larkspur. *Ranunculaceæ.*
Eastern and southern in range, but is grown in California. The active constituents of this plant require further study. Fresh leaves are very poisonous.

305. **Delphinium trolliifolium** Gray. Larkspur. *Ranunculaceæ.*

Occurs from California northward into Oregon and British Columbia. Requires further study.

306. **Delphinium variegatum** T. and G. Sacramento larkspur. *Ranunculaceæ.*

Poisonous.

307. **Dicentra chrysantha** H. and A. Dutchman's breeches. *Fumariaceæ.*

Grows on high, dry ridges. Requires further study as to active constituents. Perhaps contains an alkaloid like that of **D. canadensis.** (W. T. Wenzell, Am. Journ. Pharm. 205, 1855.)

308. **Dicentra farmosa** D.C. Dutchman's breeches. Bleeding heart. *Fumariaceæ.*

Found in shady woods. Said to be tonic, diuretic and alterative. Extensively used by the eclectics.

309. **Digitalis purpurea** L. Foxglove. Digitalis. *Scrophulariaceæ.*

An European plant, introduced everywhere; has escaped from cultivation and occurs spontaneously in several places along the entire Pacific coast as far north as Vancouver Island. Extensively grown in California. According to chemical analyses, the American article is fully as active as the European (English). Easy of cultivation. Thrives best in rather sandy, fairly rich, loose soil. Should be attempted on a large scale (several acres or more). Plant in rows and cultivate not unlike sugar-beet or potatoes. Full grown, bright green leaves of the second year's growth only are collected, at the time of flowering. Spread leaves thinly and dry quickly, carefully and uniformly. When dry, keep in tightly-closed, dry packages in dry place. Should be marketed promptly, as the drug deteriorates rather quickly (one year and less). A very useful drug, heart tonic, poisonous. Market value per pound, for good material, about forty cents.

310. **Dioscorea species.** Yam root. *Dioscoreaceæ.*

Most species are cultivated. Edible, tuberous roots, very rich in starch. The eclectics use the roots of **D. villosa** in bilious colic and the negroes of the southern states use them in the treatment of rheumatism.

311. **Diospyros virginiana** L. Persimmon. *Styraceæ.*

Cultivated in the southern portions of the State. The unripe fruit is very astringent, rich in tannin, used in diarrhœa, dysentery, uterine hemorrhage. The bark is also very astringent and similarly used.

312. **Diplacus glutinosus** Wendl. Glutinous monkey flower. *Scrophulariaceæ.*

313. **Distichlis spicata** Greene. Salt grass. *Liliaceæ.*

Used in indigestion. Requires careful study as to its reputed properties.

314. **Drosera rotundifolia** L. Sundew. *Droseraceæ.*

Introduced, found in conservatories and other places. This species, as well as **D. longifolia** L. and varieties, are said to be useful in phthisis. Well known medicinally, though no longer officinal. Applied in the form of poultices to corns, bunions and warts. Used in Italy to make a liquor called "rossoli." (Proc. A. Ph. A. **27**: 225–227, 1879.)

315. **Dryopteris felix-mas** (L.) Schott and **D. marginale** (L.) Gray. Male ferns. *Filicineæ.*

These important drug plants, of which the rhizomes and stipes yield the oleoresin (male fern oil) which is the most reliable remedy to expel tapeworm. May readily be grown in moist shady places. Whether they can be grown profitably remains to be determined. The grower should also market and manufacture the oil, which is worth thirty-five cents per ounce retail. The rhizomes are worth about twenty-five cents per pound.

316. **Duboisia species.** *Solanaceæ.*

These plants are readily grown, and some of them should be more carefully investigated as to chemical constituency and medicinal properties. **D. myoporoides** is well known; contains duboisine, an alkaloid identical with hyoscyamine.

317. **Duboisia myoporoides** R. *Solanaceæ.*

Grown in experimental gardens. Properties like those of belladonna and stramonium. Poisonous. (See 316.)

318. **Echinacea angustifolia** D.C. Niggerhead. *Compositæ.*

Said to be an antidote for rattlesnake bite, for blood poisoning, etc. Highly spoken of by such authority as J. U. Lloyd. Used as a cancer remedy and blood purifier. (Am. Journ. Pharm., 15–20, 1904.)

This species is closely related to **E. purpureum**, known as black Sampson. Both species are well worthy of more careful study as regards their several reputed properties. Much used by the eclectics.

319. **Echinocactus cylindrica.** Niggerhead. Hedgehog thistle. *Cactaceæ.*

The young shoots and seeds are eaten. Juicy, rich in water.

320. **Echinocactus polycephalus** E. and B. Devil's pincushion. *Cactaceæ.*

Seeds used as food by the Indians. Spines are used for needles.

321. **Echincystis (Micrampelis, Megarrhiza) fabacea** Naud. Wild cucumber. Big root. *Cucurbitaceæ.*

Common in sandy soil. An oil expressed from the roasted leaves has been used to promote the growth of hair. Roots rich in starch and contain an acrid principle having purgative properties similar to those of jalap.

322. **Echinocystis marah** Cogn. Bitter root. Big root. Man root. Chili cajote. *Cucurbitaceæ.*

Closely related to **E. fabacea.** The enormous, tuberous roots, weighing from thirty to one hundred pounds, contain starch and an acrid poison having drastic purgative properties. The seeds and roots are used as a popular medicine in the treatment of rheumatism and venereal diseases. Used in the manufacture of a California "bitters." The medicinal properties of this plant are well worthy of more careful study. The abundant root starch could no doubt be used commercially. The stems and leaves are said to be inert.

323. **Elastica.** India rubber. From various plants.

Many rubber-yielding plants thrive in California, some of which could no doubt be grown profitably. Attempts are being made to secure seeds and living plants of **Parthenium argentatum,** the Mexican rubber plant, which is very rich in rubber. (Pacific Druggist, March, 1905, p. 14.) Rubber is also obtained from several species of milkweed. Rubber plant culture in the State of California is well worthy of careful consideration.

324. **Elymus species.** Rye grass. *Gramineæ.*

Used by the Indians as a mechanical counter-irritant in the treatment of granulated eyelid. The leaf is broken off and held by both hands, is drawn, apex forward, over the granulated lid. This also acts as a cleansing agent. Action purely mechanical, due to the spicules of silica of the marginal epidermal cells.

325. **Ephedra antisyphilitica** Wats. Mountain rush. *Gnetaceæ.*

This plant is not reported from the State. A decoction of the stems is much used in the treatment of gonorrhea. The plant evidently contains a tannin-like glucosid, ephedrin. It requires careful study. (U. S. Geol. Surv., Wheeler's Rep. Bot. **6**: 50, 611.)

326. **Ephedra californica** Wats. *Gnetaceæ.*

Decoctions (tea) of stems used by Indians and Spaniards as a tonic and blood purifier and in venereal diseases. (Calif. Geol. Surv. Bot. **2**: 108.)

327. **Ephedra nevadensis** Wats. *Gnetaceæ.*

Much used in Arizona as a remedy in the treatment of gonorrhea. The Coahilla Indians prepare a cooling drink from the dried twigs and leaves. The seeds are sometimes roasted and eaten.

328. **Ephedra trifurca** Torr. Canutilla. *Gnetaceæ.*

A native of Arizona, which, according to Dr. W. C. Eidenmüller of San Francisco, is an excellent remedy in the treatment of Bright's disease.

The exact botanical relationship of the above species of **Ephedra** should be very carefully determined, and the reputed properties of these plants should be very carefully investigated. Their extended, and evidently successful use in the treatment of gonorrhea would indicate that there may be present constituents other than tannin.

329. **Epilobium franciscanum** Barbey. Willow herb. *Onagraceæ.*

A decoction of the whole herb highly praised in inflammatory conditions of the alimentary canal.

330. **Equisetum arvense** L. Scouring rush. Field horsetail. *Equisetaceæ.*

Reported to be poisonous. Used medicinally, has astringent and stimulating properties. Used as a diuretic.

331. **Equisetum hyemale** L. Scouring rush. *Equisetaceæ.*

An infusion of the entire plant used as a diuretic in dropsical and renal diseases. (Am. Journ. Pharm., 419, 1886.) (Proc. A. Ph. A. **35**: 104, 1887.)

Equisetum variegatum Schl. is used for scouring purposes by settlers, and to smooth down arrows and other woodwork by Indians. Used by Indians and settlers as a stimulating diuretic in renal and dropsical disorders.

332. **Eremocarpus (Croton) setigerus** Benth. Turkey mullein. *Euphorbiaceæ.*

California Indians use the heavily-scented foliage of this plant to stupefy fish, hence it is sometimes called fish loco weed. Also used as an arrow poison. Turkeys are very fond of the seeds. Indians also used the bruised leaves as a counter-irritant applied to the chest to relieve internal pain. A decoction of the plant or leaves put in warm water is used as a wash in typhoid and other fevers. Much used as a poultice. Taste is very acrid. Poisonous. (Contrib. U. S. Nat. Herb. **7**: (No. 3) 363.) (Proc. A. Ph. A. **30**: 250, 1882.)

333. **Ergot.** (See **Claviceps purpurea.**)

334. **Erigeron species.** Fleabanes. *Compositæ.*

E. canadensis, E. philadelphicus, E. glaucus, E. miser, E. augustatus and other species are common in the State.

335. **Erigeron canadense** L. Fleabane. Horse weed. *Compositæ.*

A very common weed which is, however, quite readily exterminated. Familiarly known as having medicinal properties. Used as a tonic, diuretic and astringent in diarrhœa and dropsical complaints. The oil of fleabane is said to be very useful in uterine, pulmonary and other internal hemorrhages; also in the treatment of gonorrhea. (U. S. Disp.)

336. **Eriodictyon californicum** Greene. Yerba santa. California balm. Mountain balm. *Hydrophyllaceæ.*

A native of California. One of the most popular medicinal plants of the State. Indians and settlers consider the leaves a specific for colds, asthma, and grippe. It is highly valued as a blood purifier, as a cure for consumption, bronchitis, catarrh, and rheumatism. The leaves are smoked and chewed like tobacco and made into a tea. The entire plant is cut, dried, and the leaves removed by flailing. The leaves are worth about thirty cents per pound.

Eridictyon tomentosum Benth. A native of southern California. Has properties and uses similar to those of **E. californicum.** Less popularly known.

337. **Eriogonum fasciculatum** Benth. Wild buckwheat. *Polygonaceæ.*

The Coahilla Indians make a strong, black tea from the leaves, which is given for pain in the stomach and for headache. A tea made from the flowers is used as an eye-wash. Also said to be useful in bronchitis, grippe, and hoarseness.

338. **Eriogonum flavum** Nutt. *Polygonaceæ.*

Said to be poisonous. Occasionally cultivated as an ornamental plant.

339. **Eriogonum heraclioides** Nutt. *Polygonaceæ.*

Said to be poisonous. This and other species require further study.

340. **Eriogonum latifolium** Smith. Sour grass. *Polygonaceæ.*

Decoction of stem, leaves, and roots used for pain in the stomach, for headache and for female complaints. A root decoction is used for sore eyes. (Contrib. U. S. Nat. Herb. **7**: (No. 3) 345.)

341. **Eriogonum nudum** Dougl. Blood root. *Polygonaceæ.*

Said to be useful in lung diseases and as a blood purifier.

Erigonum virgatum Benth (wild buckwheat) is used by making a syrup from the entire plant; given in bronchial coughs.

342. **Erodium cicutarium** L. Red stemmed filaree. *Geraniaceæ.*

A very common weed. Said to be useful in dropsy. (W. A. Smith,

Am. Journ. Med. Sci., 1865.) Other species are **E. macrophyllum**, **E. botrys**, and **E. moschatum.**

343. **Eryngium aquaticum** L. Button snakeroot. *Umbelliferæ.*

The root is bitter, pungently aromatic, used as a sialagogue, diaphoretic, and expectorant. Has been used as a substitute for senega. In large doses, emetic. The native species require further study.

344. **Erythræa douglasii** Gray. Canchalagua. *Gentianaceæ.*

Used in the treatment of malaria and as a blood purifier.

345. **Erythræa muhlenbergii** Griseb. Canchalagua. *Gentianaceæ.*

This and **Erythræa leucantha** Griseb. enjoy an excellent reputation among the Indians and settlers as a febrifuge and anodyne. Old settlers call it "opium plant."

346. **Erythræa trichantha** Griseb. Ague weed. *Gentianaceæ.*

Said to be a valuable remedy in the treatment of malaria.

347. **Erythræa venusta** Gray. Canchalagua. California centaury. *Gentianaceæ.*

Very extensively employed as a fever remedy, as a bitter tonic, anti-malarial, and is said to be antiseptic. General properties like those of gentian.

A species of Erythræa, mentioned by Dr. Kellogg, was reported to be a pleasant, bitter tonic, useful in malaria. Its medicinal properties are said to be entirely lost in the dry plant. (Proc. Calif. Acad. **1**: 63, July, 1855.)

348. **Erythronium giganteum** Lindl. Dogtooth violet. *Liliaceæ.*

The Indians eat the corms and also crush them and apply them to boils and ulcers.

349. **Erythroxylon coca** Lam. Coca. *Erythroxylaceæ.*

Apparently no attempts have been made to introduce this plant into California. It thrives in the Andes at an elevation of two thousand to five thousand feet. Would no doubt survive in the warmer portions of the State. It is worthy of a trial.

350. **Eschscholtzia californica** Cham. California poppy. *Papaveraceæ.*

This is the best known flowering herb of the State, and is found everywhere in great profusion and showing considerable variation in the coloration of the flowers. Has received considerable attention on the part of chemists and therapeutists. It is said to be a soporific and analgesic similar in action to opium, without any of the objectionable features of the latter drug. Flowers put in oil and placed in the sun, used as an application to cleanse the hair and scalp and as a hair tonic.

The species occurs in a great variety of forms, by some systematists given the rank of species.

Eschscholtzia douglasii is probably a form of the species. It is much used by Indians in the treatment of headache, as an emetic, to check the secretion of milk, to relieve stomach-ache, toothache, and as a poultice to ulcers and sores.

351. **Eucalyptus species.** Blue gum. Red gum, etc. *Myrtaceæ.*

Some one hundred or more species, varieties and forms of the genus eucalyptus have been introduced into the State, and all thrive well. **E. globulus** is perhaps the most common. The oil is manufactured and is used in the treatment of congestive headache, given in doses of five minims. Eucalyptol is much used as an antiseptic, in the treatment of malaria, as an ingredient of cough drops and other cough remedies, as a stimulating antiseptic in tooth powders and pastes, in the treatment of malaria, etc.

There is a voluminous literature on the botany, range, distribution, uses and products of the various species and varieties. There are several very important English monographs, and much of the work done by English investigators is recorded in the Pharmaceutical Journal and Translations, which should be consulted.

While the oil is manufactured in California, the industry is as yet not carried on on a large scale. A "boiler compound" is manufactured as a by-product of the oil by one firm.

352. **Eugenia michelii** Lam. Cayenne or Surinam cherry. Allspice. *Myrtaceæ.*

Cultivated in the southern portions of the State. Berries edible, with a spicy, aromatic flavor. Much esteemed for jellies. The bark and leaves of several species are used medicinally. (U. S. Disp.) **E. jambosa, E. pimento** (allspice) and other species are cultivated in the warmer portions of the State.

353. **Eulophus bolanderi** C. and R. *Umbelliferæ.*

Indians collect the roots in large quantities and eat them raw or cooked. A staple article of diet, equal in importance to the bulbs of **Calochartus** (Mariposa lily). Taste not unlike that of the chestnut.

354. **Eupatorium bolanderi** D.C. *Compositæ.*

The Apache Indians are said to use this plant as a substitute for tobacco. It has narcotic properties. Smoking it produces nervous tremors (U. S. Geol. Surv., Wheeler's Rep. Bot., p. 45.)

355. **Eupatorium wrightii** Gray. Boneset. *Compositæ.*

This species requires study. Perhaps similar in properties to **E. perfoliatum, E. purpureum, E. teucrifolium** and **E. fœniculaceum.**

356. **Euphorbia species.** Spurge. *Euphorbiaceæ.*

Introduced and native species are common. Some are poisonous and some of the native species are used as food. They have diaphoretic and emetic properties.

357. **Euphorbia albomarginata** T. and G. *Euphorbiaceæ.*

This species, as well as **E. ocellata and E. serpyllifolia,** are used as rattlesnake-bite remedies.

358. **Euphorbia corallata** L. Large flowering spurge. *Euphorbiaceæ.*

Well known medicinally. Can be grown anywhere in sandy soil. Diaphoretic, expectorant and cathartic. Emetic in large doses.

359. **Euphorbia glytosperma** Engl. Spurge. *Euphorbiaceæ.*

Poisonous. Requires study.

360. **Euphorbia ipecacuanha** L. Ipecac spurge. *Euphorbiaceæ.*

Well known medicinally. May be grown anywhere in the United States. (U. S. Disp.)

361. **Euphorbia lathyris** L. Caper spurge. *Euphorbiaceæ.*

A common plant of California, found in gardens and fields. Milky juice poisonous. Seeds very poisonous. Diaphoretic, purgative, emetic. (Proc. A. Ph. A. **30**: 250, 1882.)

362. **Euphorbia marginata** Pursh. Snow-on-the-mountain. *Euphorbiaceæ.*

Native of the western plains, a common weed. The nectar of the flowers is poisonous and the honey made from the flowers is poisonous, detected by the hot, acrid taste. The milky juice produces skin eruptions not unlike those by Rhus poisoning. Requires further study.

363. **Euphorbia ocellata** D. and H. *Euphorbiaceæ.*

Used as a remedy for snake bite. (University correspondence, Dept. of Botany, Univ. Calif.)

364. **Eurotia lanata** Moq. Winter sage. *Chenopodiaceæ.*

Said to be useful in intermittent fever. (Calif. Geol. Surv. Bot. **2**: 56.)

365. **Evernia vulpina** Ach. Wolf's moss. Yellow moss. Lichenes.

Used by Indians to dry up sores and to relieve rheumatism. Also used for dyeing purposes and as packing material. A typical western lichen. No longer considered of any value medicinally.

366. **Exogonium purga** Benth. (**Ipomœa jalapa** Nutt). Jalap. *Convolvulaceæ.*

Well-known purgative. Can be cultivated in portions of the State.

367. **Fabiana imbricata** R. et P. Pichi. *Solanaceæ.*

A South American shrub cultivated in southern California. It is a terebinthine diuretic; it also has tonic and cholagogue properties; used in the treatment of acute and chronic nasal catarrh, in jaundice, in dyspepsia and to increase the secretion of bile. It has been employed in gonorrhea and gonorrheal prostatitis. (U. S. Disp.) (Bailey, Cycl. Am. Hort., 570.) (Proc. A. Ph. A. **37**: 1889.) (Proc. A. Ph. A. **34**: 394–397, 1886.) (Am. Journ. Pharm., p. 65, 1889.)

368. **Ficus carica** L. Fig. *Urticaceæ.*

Fig culture is a most important industry in California. Numerous culture farms or varieties are grown. **F. elastica** Roxb. and **F. indica** L. are also cultivated.

The fig is a popular fruit, has mildly laxative properties. Dried figs are often chopped up with senna leaves and taken as a laxative. (See reports of State Horticultural Society and of the College of Agriculture, Univ. Calif.) (Cycl. Am. Hort., 582–588.)

369. **Filago californica** Nut. and **Filago gallica** L. *Compositæ.*

Decoction of whole plant used for fever and ague.

370. **Fragaria species.** Strawberry. *Rosaceæ.*

Strawberry culture is conducted on a large scale in certain areas of the State. The native species are **F. californica** C. and S. and **F. chilensis** Duch. The herb and fruit (false fruit) are old-time gout remedies. The fruit has refrigerant properties. Strawberries produce symptoms of poisoning in certain susceptible individuals.

371. **Frankenia grandifolia** C. and S. Salt grass. Yerba reuma. *Frankeniaceæ.*

A native herb rich in salts and tannin, employed in catarrhal troubles, also applied externally and used as a gargle in sore throat. (Am. Journ. Pharm., 23–25, 1899.)

372. **Frasera albicaulis** Dougl. *Gentianaceæ.*

This plant is poisonous. Requires further study as regards its medicinal properties.

Frasera speciosa Dougl. (showy frasera) is said to be poisonous. Other species occur in the State. The medicinal fraseras grow well in the State; easy of cultivation.

373. **Fraxinus americana** L. and **F. ornus** L. Ash. *Oleaceæ.*

Cultivated. The bark of **F. americana** is used in dysmenorrhea. **F. ornus** and other species yield the officinal manna, a concrete saccharine exudation. Manna has mildly laxative properties and is given with other laxatives as an adjuvant and to disguise the taste. There are many false mannas found upon the market, obtained from other plants.

374. **Fraxinus oregana** Nutt. Oregon ash. *Oleaceæ.*

Indians apply the fresh mashed roots to wounds, especially to wounds received in bear hunts. (Contrib. U. S. Nat. Herb. **7**: (No. 3) 378.)

375. **Fremontia californica** Torr. California slippery elm. Mountain leatherwood. *Sterculiaceæ.*

Abundant in the southern Sierra. Bark has demulcent properties; used in poultices, etc. (U. S. Geog. Surv., Wheeler's Report, Bot. **6**: 41.)

376. **Fritillaria lanceolata** Pursh. *Liliaceæ.*

Cultivated as ornamental plants. The bulbs are eaten. Other species occur in the State. They require further study. Apparently of food value only.

377. **Fritillaria pudica** Sprengel. *Liliaceæ.*

Bulbs were formerly eaten by Indians, but now only in time of scarcity of food.

378. **Fucus species.** Bladder wracks. *Algæ.*

Demulcent properties in common with other seaweed. Also used as food by Indians. The dried stipes of several species of Laminaria were formerly much used as uterine tents.

379. **Fumaria officinalis** L. Fumitory. *Fumariaceæ.*

A common European cultivated plant. Extensive popular medicinal use. Laxative and tonic; increases secretion of bile. Leaves used in scorbutic affections and in eruptive diseases. (U. S. Disp.)

380. **Galega officinalis** L. Goat's rue. *Leguminosæ.*

A native of southern Europe, readily cultivated. Was at one time extensively employed in malignant fevers, the plague, for snake bite, worms, etc. Now rarely used.

381. **Galium aparine** L. Bed straw. Goose grass. *Rubiaceæ.*

A cold infusion forms a popular cooling drink in fevers.

382. **Galium triflorum** Michx. Sweet scented bed straw. *Rubiaceæ.*

The plant has the fragrance of the European **Asperula odorata.** A decoction is much used as a spring tonic ("May-drink").

383. **Garcinia mangostana** L. Mangosteen. *Guttiferæ.*

Naturalized in the western portions of Jamaica. Cultivated in southern Florida. This highly valued fruit tree could no doubt be cultivated in the southern portions of the State. Fruit very delicious, about the size and form of the orange. The resinous juice is purgative and yields a pigment.

384. **Gardenia grandiflora.** Cape jasmine. *Rubiaceæ.*
A native of China, cultivated in the State. The fruit yields a yellow dye with which the yellow robes of the mandarins are stained. (Bailey's Cycl. Am. Hort., 626.)

385. **Garrya elliptica** Dougl. Silk tassel tree. *Cornaceæ.*
Valued as a tonic in malarial fevers. (U. of C. Agr. Exp. Sta. Rep., 1895–96, 1896–97.)

386. **Garrya fremontii** Torr. California fever bush. *Cornaceæ.*
Used as a tonic and antiperiodic. Contains a bitter principle not unlike quinine in its action. (D. W. Ross, Am. Journ. Pharm., 1877.)

387. **Gaultheria myrsinites** Hook. Wintergreen. *Ericaceæ.*
Closely related to **G. procumbens** and no doubt has similar medicinal properties. The fruit is delicious, likewise the fruit of **G. shallon** Pursh. (Salal.) (U. S. Disp.) (Calif. Geol. Surv. Bot. 1: 455.)

388. **Gaura coccinea** Pursh. Scarlet gaura. *Onagraceæ.*
Said to be poisonous. Requires study.

389. **Gelsemium sempervirens** L. False jessamine. *Logoniaceæ.*
A native of the eastern and southern United States, cultivated in California. Properties well known. Used in fevers, rheumatism, aches and pains.

390. **Genista tinctoria** L. Dyer's weed. *Leguminosæ.*
Cultivated. The flowering tops are used in preparing a yellow dye. The tops and seeds are used medicinally, having purgative and emetic properties.

391. **Gentiana calycosa** Griesb. Gentian. *Gentianaceæ.*
Properties similar to those of **G. lutea** L. Requires further study.

392. **Geranium species.** Cranesbill. *Geraniaceæ.*
The native species require further study as regards astringent properties. Rich in tannin.

393. **Geranium dissectum** L. Common geranium. *Geraniaceæ.*
This species and **G. carolinianum** L. (Carolina geranium) are easy of cultivation.

394. **Geranium maculatum** L. Wild geranium. *Geraniaceæ.*
A native of the eastern United States, requires rich, moist woodland. Well known medicinally (U. S. Disp. and text-books on materia medica.)

395. **Geranium viscosissimum.** Wild geranium. *Geraniaceæ.*
A forage plant. Requires further study.

396. **Gilia aggregata** Spreng. *Polemoniaceæ.*

An infusion of the entire plant used as a drastic purgative. Also used as a tonic, in fevers, etc. Extensive popular use among Indians and settlers. Well worthy of careful study. May take the place of cascara bark. (See 398.)

397. **Gilia cotuæfolia** Steud. *Polemoniaceæ.*

Odor like that of chamomile. There are numerous California species of Gilia which require careful study as to identity and as regards medicinal (laxative, tonic) properties.

398. **Gilia squarrosa** Hook. Skunkweed. *Polemoniaceæ.*

Has a disagreeable odor from which it derives its name. **G. virgata floccosa** has properties like those of **G. aggregata.** Specimens sent to the writer were identified by Mr. Brandegee. (See 396.)

399. **Gingko biloba** L. Maiden hair tree. *Coniferæ.*

A handsome ornamental tree of Asia, cultivated in California. Easily propagated and free from disease. The seeds are eaten by the Chinese. The ripe fruit has a foul odor.

400. **Ginseng.** (See **Panax.**)

401. **Glecoma hederacea** L. Ground Ivy. *Labiatæ.*

A cosmopolitan introduced plant. Has mildly stimulating tonic, diuretic and aperient properties; useful in chonic pulmonary and vesical catarrh. Well-known popular medicinal plant. Figures extensively in plant lore. (U. S. Disp.)

402. **Glycyrrhiza glabra** L. Licorice. *Leguminosæ.*

Cultivated with more or less success in various parts of the United States. To make the venture a financial success, it must be undertaken on a large scale. (See Chap. III.) (Licorice culture in England, Proc. A. Ph. A., **23**: 212, 1875.)

403. **Glycyrrhiza lepidota glutinosa** Pursh. Wild licorice. *Leguminosæ.*

Native of California. Much like **G. glabra** and can no doubt be substituted for the true licorice. Cultivation is said to increase the active constituents.

404. **Gnaphalium decurrens** Ives. Cudweed. Lady's tobacco. *Compositæ.*

Pillows made of the leaves are used to cure catarrhal affections. Said to have sedative properties. **G. margaritaceum,** Life everlasting, and other species of the State (**G. decurrens californicum** D. C.) are said to have similar properties. A decoction is used in intestinal and pulmonary catarrh. Used externally in fomentations for bruises, etc.

Perhaps have but little actual medicinal virtue. The famed Edelweiss of the Alps belongs to this genus (**G. leontopodium**).

405. **Gnaphalium ramosissimum** Nutt. Cudweed. *Compositæ.*

Used by eclectics as an astringent and expectorant. The floss or down of the flower heads is used to stuff pillows.

406. **Godetia** (many species). *Onagraceæ.*

Leaves mixed with lard, heated and strained, when cool, used as an application for chapped hands, etc.

The seeds of **Godetia albescens** Lindl. are used as food. The leaf decoction highly valued as a wash for sore eyes. (Contrib. U. S. Nat. Herb. **7**: (No. 3) 370.)

407. **Goodyera menziesii** Lindl. Rattlesnake plantain. *Orchidaceæ.*

Found in woodlands of northern California, near the coast. Requires further study as to medicinal properties.

408. **Gratiola ebracteata** Benth. *Scrophulariaceæ.*

Requires further study. Reported to have medicinal properties.

409. **Grindelia cuneifolia** Nutt. Gum plant. *Compositæ.*

Reported to have medicinal properties. (University of California correspondence.) No doubt has properties similar to those of **G. squarrosa.**

Used by Indians and settlers in pulmonary troubles and as a wash for poison oak.

410. **Grindelia glutinosa** Dunal. Gum plant. *Compositæ.*

Properties like those of **G. robusta** and other species. (U. S. Disp.)

411. **Grindelia hirsutula** Hook. Gum plant. *Compositæ.*

An infusion of the herb has been recommended against asthma by the Californians of Spanish descent.

412. **Grindelia robusta** Nutt. Gum plant. Grindelia. *Compositæ.*

A native, well known medicinally. Common. Could no doubt be grown profitably. Popular poison oak remedy. (U. S. Disp.) The old settlers used this plant (much praised in medicine to-day as a remedy for poison oak symptoms) for inflammatory rheumatism, giving large quantities of decoction and applying poultices of the leaves.

413. **Grindelia squarrosa** Dun. Grindelia. Gum plant. *Compositæ.*

Well-known medicinal plant. Tonic expectorant; poison oak remedy. (U. S. Disp.) Properties and use as for **G. robusta.** Could no doubt be grown profitably.

414. **Gramineæ.** Grasses.

The grass family is well represented in California. Some species have been reported as poisonous, but in several instances, at least, the

reports were no doubt erroneous, the poisonous effects noted having been due to a fungus (ergot) found on the grass.

The seeds of **Avena fatua** (wild oats), **Danthonia californica** (California wild oat grass), **Bromus marginatus** (poverty grass), **Elymus triticoides** (squaw grass), **Sitanion elymoides** (squirrel tail), **Hordeum murimum** (squirrel tail), **Hordeum vulgare** (barley), **Lolium temulentum** (poison darnel), and **Lolium perenne** (poison rye grass), are made into a meal (pinole) by the Indians and eaten.

415. **Gymnocladus canadensis** Lam. (**G. dioica**). Kentucky coffee tree. *Leguminosæ.*

Cultivated as an ornamental tree. The seeds are said to be poisonous. They contain a saponifiable fixed oil, a little fat, resin and a glucocide. The seeds were once much used as a substitute for coffee, particularly about the time of the Revolutionary War.

416. **Gymnogramma triangularis** Kaulf. Golden back fern. Filices. *Polypodiaceæ.*

A native of California. Contains a ceroptene. Used medicinally by the Indians and Spaniards. (Contrib. U. S. Nat. Herb. **7**: (No. 3) 303.) (W. C. Blasdale, Erythræa, **1**: 252–258, 1893.)

417. **Hagenia abyssinica** Gmelin. Cusso. *Rosaceæ.*

Cultivated in Europe and would no doubt do well in California. A well-known medicinal plant, but no longer enjoying its former popularity as a vermifuge. (U. S. Disp. and Texts on Materia Medica.)

418. **Hamamelis virginica** L. Witchhazel. *Hamamelidaceæ.*

Well known medicinally. Introduced and cultivated as an ornamental plant. A very popular Indian remedy for bruises, sores, ulcers, cuts and other injuries. The leaf infusion much used to rub on flea bites, as a mild counter-irritant and as a mild antiseptic for poison oak; also taken internally. (U. S. Disp.)

419. **Hedera helix** L. Ivy. *Araliaceæ.*

This familiar ornamental plant, introduced from Europe, has been long known medicinally. The leaves are used in preparing a dressing for itch, tetter, ulcers, cutaneous eruptions, etc. (U. S. Disp.) (Chemistry of **H. helix,** Proc. A. Ph. A. **26**: 244, 1878.)

420. **Heleniastrum puberulum.** Sneezeweed. *Compositæ.*

Used as a snuff in catarrh. It is said to be tonic and antiscorbutic.

421. **Helenium autumnale** L. Sneezeweed. *Compositæ.*

An eastern plant found as far west as Oregon and Washington. The active constituents which occur in the flower require further study.

422. **Helenium montanum** Nutt. Sneezeweed. *Compositæ.*

Said to be poisonous. Requires further study.

423. **Helenium puberulum** D.C. Rosilla. Sneezeweed. *Compositæ.*
A highly valued popular medicinal plant. The flower heads and leaves boiled are said to be a "specific for a certain venereal disease," presumably gonorrhea. Used in the treatment of catarrh, as a tonic and antiscorbutic. The flower heads are very acrid (pungent), but are occasionally eaten. The flowers are powdered and used as snuff for catarrh. Joseph Lauer, of Mountain View, Cal., bottled and sold large quantities of medicine made from the flower; used as a catarrh cure. (U. S. Disp.) (Contrib. U. S. Nat. Herb. **7**: (No. 3) 394.)

424. **Helianthemum scoparium** Nutt. Rock rose. *Cistaceæ.*
Properties presumably like those of **H. canadense**, which is used in the treatment of scrofula, scarlatina, prurigo, etc. (U. S. Disp.)

425. **Helianthus petiolaris** Nutt. and **H. lenticularis.** *Compositæ.*
Used medicinally by the Indians. (Proc. A. Ph. A. **27**: 178, 1879.)

426. **Heliotropium curassavicum** L. Heliotrope. *Boraginaceæ.*
The mucilaginous juice of the leaves is dried, reduced to a powder and applied to wounds and abrasions.

427. **Hemizonia species.** Tar-weeds. *Compositæ.*
Common, viscid, resinous herbs, related to the Madeias, which see. There are numerous native species. **H. luzulæfolia** D.C. is very common throughout the western part of the State. The odor is heavy, recalling somewhat that of myrrh.

428. **Heracleum lanatum** Michx. Masterwort. Cow parsnip. *Umbelliferæ.*
Spaniards use a decoction of the herb and roots as a lotion for rheumatism. The basal part of the plant either dried, roasted or cooked, is eaten by Indians. Said to have carminative and stimulant properties, and has been used in epilepsy. Both roots and leaves act as an irritant when applied to the skin. Said to be poisonous.

429. **Heteromeles arbutifolia** R. Christmas berry. Toyon. California holly. *Pyraceæ.* (*Rosaceæ.*)
Found in coast ranges from San Diego to Humboldt County. The fruit is eaten by the Indians. The bark and leaf decoction is used to relieve aches of various kinds. (Am. Journ. Pharm., April, 1882.)

430. **Heuchera micrantha** Dougl. Alum root. *Saxifragaceæ.*
Astringent properties. Requires further study.

431. **Heuchera pilosisissima** F. and M. Alum root. *Saxifragaceæ.*
Requires further study. (U. S. Disp.)

432. **Hibiscus species.** Mallows. *Malvaceæ.*
Many species are introduced and cultivated as ornamental plants.

Hibiscus flowers are used in preparing shoe polish. Rich in a mucilaginous substance.

433. **Hibiscus californicus** Kell. Rosemallow. *Malvaceæ.*

Has not yet been investigated chemically.

434. **Hierochloa macrophylla** Thurb. Holy grass. Large leaved vanilla grass. *Gramineæ.*

Found in the coast redwood belt of California. Very fragrant, due to the presence of cumarin. Retains its fragrance for thirty years or more. Of possible great value to perfumers in the manufacture of sachet powders. Almost exterminated in Marin County. Attempts should be made to perpetuate it by cultivation.

435. **Humulus lupulus** L. Hop. *Moraceæ.*

Hop culture is one of the most important industries in the State. The plant has escaped from cultivation in different parts of the State. Strobiles much used by the Indians in the form of poultices for swellings and bruises.

436. **Hydrangea arborescens** L. Hydrangea. *Saxifragaceæ.*

Extensively cultivated as an ornamental plant. The root has long been known medicinally. The Cherokee Indians and white settlers use a decoction for calculus troubles. (Am. Journ. Pharm., 122, 1887.)

437. **Hydrastis canadensis** L. Golden seal. *Ranunculaceæ.*

This native of Canada and the eastern United States is becoming very rare, due to the herb gatherers. Whereas the rhizomes sold for about ten cents per pound some years ago, it is now worth over three dollars per pound. Cultural attempts are now being made in various parts of the United States. The efforts in California are thus far purely experimental. H. L. Scherb of Los Angeles has made attempts at its culture. Some plants received from him for the botanic garden in Golden Gate Park grew exceedingly well. Golden seal requires a moist, rich, shady soil. In fact, it is grown much like ginseng. The rhizomes with rootlets attached are dug up and dried. A most valuable medicine for which there will be continued good demand. (See Farmers' Bulletin No. 51, United States Department of Agriculture, for full particulars as to culture, etc.)

438. **Hyoscyamus niger** L. Henbane. *Solanaceæ.*

An introduced plant which has escaped from cultivation. Well known medicinally. (See Chap. III.) (Henbane culture in England. Proc. A. Ph. A. **25**: 136, 1877.) (W. A. Puckner, The Assay of Hyoscyamus. Proc. A. Ph. A. **47**: 297–301, 1899.)

439. **Hypericum species.** St. John's wort. *Hypericaceæ.*

The native species require further study. Perhaps have properties

similar to those of **H. perforatum** L., which is used in hysteria, mania, dysentery, gravel, hemorrhages, worms, lung troubles, jaundice, etc.

The following species occur in the State: **H. multilum** L., **H. anagalloides** C. and S. (false pimpernel), and **H. formosum scouleri** Coulter.

440. **Hypericum concinnum** Benth. St. John's wort. *Hypericaceæ.*

Extensive popular medicinal use. Carried as an amulet to ward off lightning and to reveal hidden or lost property.

441. **Hyssopus officinalis** L. Hyssop. *Labiatæ.*

A familiar European pot herb grown in gardens. The infusion is used in chronic catarrh, especially in the aged.

442. **Iberis species.** *Cruciferæ.*

European plants readily introduced. Used medicinally.

443. **Iberis amara** L. Bitter candy-tuft. *Cruciferæ.*

Introduced plant. Used by the ancients in rheumatism, gout and other diseases; useful in cardiac hypertrophy, asthma and in bronchitis.

444. **Ilex species.** Holly. *Ilicaceæ.*

The hollys are extensively cultivated as ornamental plants. Several species are used medicinally in gout, catarrh, pleurisy, smallpox, etc. (U. S. Disp.)

445. **Ilex paraguayensis** St. Hil. Maté. Paraguay tea. *Ilicaceæ.*

Well known medicinally. Contains theine. (U. S. Disp. and Texts on Materia Medica.) (Proc. A. Ph. A. **26**: 299, 1878.)

446. **Illicium verum** and **I. religiosum** Sieb. Star anise. *Magnoliaceæ.*

Well known medicinally. Used as a spice and condiment. (U. S. Disp.)

447. **Imperatoria osthruthium** L. Master-wort. *Umbelliferæ.*

A European plant readily cultivated. Formerly much used in a variety of ailments, and because of its reputed value was given the name of **divinum remedium.** It has only slight stimulating properties, and is no longer used by physicians.

448. **Inula helenium** L. Elecampane. *Compositæ.*

Well known medicinally. Readily cultivated. Tonic, diaphoretic, expectorant, emmenagogue. (U. S. Disp.)

449. **Ipomœia species.** Bindweeds. *Convolvulaceæ.*

Numerous introduced species and varieties are cultivated in the State as ornamental climbing plants. The roots and leaves of some species are used medicinally, largely for the laxative properties. **I. tuberosa** furnishes scammony. The large tuberous roots of **I. pandu-**

rata constitute the jalap of the market. The leaves of **I. maritima** are used in the form of fomentations applied to the enlarged joints of scrofulous patients.

450. **Ipomœia hederacea** Jacq. *Convolvulaceæ.*

A native of Japan. Cultivated as an ornamental plant in California. Contains a resinous principle, perhaps identical with convolvulin. Has decided laxative properties.

451. **Iris species.** *Iridaceæ.*

Many introduced species are found in the State, including **I. germanica, I. versicolor, I. florentina.** Readily cultivated. Requires rich, moist soil. The dried and peeled roots of **I. florentina** are known in the drug market as orris root; they have a fragrant violet-like odor, much used in tooth powders, sachet powders, perfumes, etc. **I. versicolor** is much used in cattle powders. Has cathartic and diuretic properties. (U. S. Disp.)

The following species are native and should be more carefully studied as to properties and constituents: **I. longipetala, I. douglasiana, I. macrosiphon.**

452. **Iris macrosiphon** Torr. Ground iris, wild damiana. *Iridaceæ.*

Found in the coast ranges from San Mateo to Trinity County.

Held in great esteem by Spanish and Mexicans as an aphrodisiac and emmenagogue.

453. **Isatis tinctoria** L. Dyers weed. *Cruciferæ.*

Thrives in cultivation. Escaped from cultivation. Leaves yield an indigo dye and have been used medicinally in jaundice, scurvy and in other complaints.

To obtain the dye, the leaves are ground, made into a paste, placed in heaps and allowed to ferment. (U. S. Disp.)

454. **Isopyrum occidentale** H. and A. *Ranunculaceæ.*

Rare. Perhaps contains alkaloids like those of **I. thalictroides.** (Am. Journ. Pharm. **44**: 453.)

455. **Jasminum species.** Jasmine. *Oleaceæ.*

Extensively cultivated as ornamental plants. The flowers yield the oil of jasmine, which is used only as a perfume. The oil is obtained by placing the flowers with alternating layers of cotton in the sun. The oil is taken up by the cotton and expressed. Distilling destroys the aroma.

456. **Jateorhiza palmata** Miers. Calumba. Columbo. *Menispermaceæ.*

An introduced plant, native of Africa. Well known medicinally; readily cultivated. (U. S. Disp.)

457. **Juglans species.** Walnuts. *Juglandaceæ.*

Juglans californica Wats. Is found in the interior. Other species and varieties are extensively cultivated. (B. M. Long, California Walnut Industry. State Board of Horticulture, Sacramento, 1896.)

Juglans cinerea L. (butternut) (white walnut) is well known medicinally; introduced; extensively cultivated in the eastern states. Yields oil. Cathartic. Tonic. (U. S. Disp.)

458. **Juglans nigra** L. Black walnut. *Juglandaceæ.*

Extensively cultivated in the eastern states. Leaves used in the treatment of diphtheria. The decoction is used as a spray or as a gargle or both. Green fruit pickled and preserved. (Proc. A. Ph. A. **30**: 246, 1882.)

459. **Juniperus species** and varieties. Junipers. *Coniferæ.*

The junipers require further systematic study. The fruit of some species is used as a diuretic. The balsam is used medicinally and in the manufacture of varnish. The twigs made into tea valued as a remedy in malaria.

460. **Juniperus californica** Carr. and variety **utahensis** Englm. California juniper. *Coniferæ.*

Fruit eaten by Indians, raw or made into a bread.

461. **Juniperus communis** L. Juniper. *Coniferæ.*

Well known medicinally. Stimulant, diuretic, tonic, etc. (U. S. Disp.)

462. **Juniperus occidentalis** Hook. *Coniferæ.*

A decoction of the leaves used internally as a remedy for malaria, kidney trouble, boils, headaches, and coughs. Indians use the pitch to fasten the feathers to arrow shafts and rubbed into the shafts to make them stronger and more elastic. Indians eat the berries. (U. S. Disp.)

463. **Juniperus phœnicea** L. Thus. *Coniferæ.*

Cultivated as an ornamental tree. Yielded the frankincense (olibanum) of the ancients. Olibanum was at one time considered a valuable stimulant, now rarely used internally. Inhaling the fumes of the burning incense is useful in bronchitis and other pulmonary troubles. Used as a substitute for balsam of tolu and in making unofficial plasters.

464. **Kalmia angustifolia** L. Narrow-leaf laurel. *Ericaceæ.*

Properties and uses as for **K. latifolia.**

465. **Kalmia latifolia** L. Broad-leaf laurel. *Ericaceæ.*

An eastern poisonous laurel, cultivated as an ornamental plant. Used by the negroes of North Carolina, in the form of a wash, for

sore eyes. The leaves contain gum, resin, tannic acid, arbutin and andromedotoxin (a highly poisonous crystalline substance). Has been used in diarrhea, syphilitic skin eruptions and in skin diseases. Entire plant highly poisonous. Other species no doubt have similar properties. (G. W. Kennedy, Am. Journ. Pharm. **20**: 264.)

466. **Kelps.** Seaweeds. Marine algæ.

Numerous species of seaweed are found along the entire Pacific coast. Some are used as food by Indians. They contain iodine, which could no doubt be extracted in commercial quantities. However, Hilgard (Univ. Calif.) declares that the California species are low in iodine percentage. According to Setchell (Univ. Calif.), the Japanese and Chinese of California collect species of **Nereocystis, Laminaria** and **Porphyra** for food, and even export them. Dr. Hus and others have likewise studied the economic value of the kelps of the Pacific coast.

The marine algæ of the Pacific and Atlantic coasts are quite distinct. Those of the Pacific coast are noted for their size. (Proc. A. Ph. A. **27**: 132–134, 1879.) (Bul. Rhode Island Agr. Exp. Sta. **21**: 1893.)

467. **Laminaria bulbosa.** Seaweed. *Algæ.*

Used in scrofulous affections and in other glandular enlargements. Used as food. (R. G. Whitlock, Calif. Coll. Pharm. Thesis, 1901.)

468. **Lantana brasiliensis** Link. Yerba sagrada. *Verbenaceæ.*

A Brazilian verbena which contains an alkaloid (lantanine) resembling quinine, which is said to be actively antiperiodic.

469. **Larrea mexicana** Maric. Creosote bush. *Zygophyllaceæ.*

Contains a gum which resembles the East Indian shellac (Sonora gum) used for cementing earthenware, etc. It also contains a coloring substance resembling cochineal. The Mexicans use the leaf infusion as a cure for rheumatism. Said to produce marvelous results when applied to necrosed bones. Also used in the treatment of syphilis; in consumption. Indians (Kokapah) use the tea in smallpox. A leaf poultice is applied to the pitted skin. Also used as a horse remedy. A very highly valued Indian remedy. Well worthy of more careful investigation. (U. S. Geol. Surv., Wheeler's Rep. Bot. **6**: 41.) (Calif. Geol. Surv. Bot. **1**: 92.) (U. of C. Agr. Exp. Sta. Rep., 1895–97.) (Proc. A. Ph. A. **26**: 206, 1879.)

470. **Laurus nobilis** L. Sweet bay laurel. *Lauraceæ.*

A common old-time ornamental tree. The leaf oil is a well-known and important article, used in making bay rum and for other purposes. (U. S. Disp. and texts on Materia Medica.)

471. **Lavatera assurgentifolia** Kell. Tree mallow. *Malvaceæ.*

Common in the State. The leaves are rich in mucilage. Eaten by horses and cattle. Demulcent.

472. **Lavendula angustifolia** Miller. Lavender. *Labiatæ.*

This European plant is extensively cultivated everywhere. The flowers and entire plant yield the oil of lavender, which is worth from one to three dollars per pound. The flowers bring about twenty cents per pound. The oil is much used as a flea eradicator and forms the base of many proprietary flea exterminators.

The plant is easily cultivated in California. The grower should also manufacture the oil, which is obtained from the fresh flowers and entire fresh plants. **Lavendula spica** (spike lavender) is also cultivated for the oil which it yields. Medicinally, the lavender oil and the pharmaceutical preparations made from the flowers are used in flatulence, as a carminative, in nervous headache, etc.

473. **Lavendula vera** D. C. Lavender. *Labiatæ.*

Extensively cultivated. The flowers are very fragrant and are much used in sachet powders, perfumes, etc. Lavender oil is official and forms the chief ingredient of many flea exterminators. Good quality of lavender oil has been produced in California. Could no doubt be grown profitably.

474. **Lawsonia alba** Lam. Henna. *Lythraraiceæ.*

Cultivated in southern portions of the State. Used by the women of Egypt and of other countries to color the finger nails and by the men to dye the beard. The gum (labdanum) is collected by passing leathern rakes over the plants or is combed out of the wool of goats which have been among the plants. The plant is used in jaundice, leprosy, skin diseases, catarrh, dysentery, and in pulmonary affections. (U. S. Disp.) (Proc. A. Ph. H. **35**: 164, 1887.)

475. **Lathyrus sativus** L. White vetch. *Leguminosæ.*

A forage plant. Horses feeding on this plant for a long time become paralyzed in the hind extemities. The laryngeal muscles are also paralyzed. The seeds contain a poisonous alkaline volatile substance, which is destroyed on heating, hence cakes made from the seed and thoroughly baked may be eaten and are said to be very nutritious. This plant requires further careful study as to physiological action and possible therapeutic value.

476. **Lathyrus watsoni.** Vetch. *Leguminosæ.*

An excellent fodder plant and sometimes cooked and eaten by the Indians. The older plants are boiled and applied as a poultice to swellings. (Contrib. U. S. Nat. Herb. **7**: No. 3, 357.)

477. **Ledum glandulosum** Ait. Labrador tea. *Ericaceæ.*

Leaves used for killing vermin on cattle and to drive fleas from country houses. Resembles **L. palustre.**

478. **Ledum latifolium** Ait. Labrador tea. *Ericaceæ.*

North American marsh plant. Leaves aromatic and used as a tonic in lung troubles. Also used as a substitute for tea. (Proc. A. Ph. A. **26**: 221, 1878.)

479. **Ledum palustre** L. Marsh tea. *Ericaceæ.*

Everygreen marsh plant. The leaves are balsamic, aromatic, bitter, used in dysentery, leprosy, and scabies. They are said to be narcotic and diaphoretic. In Germany substituted for hops in beer. (Proc. A. Ph. A. **24**: 140, 1876.)

480. **Citrus limonum** L. Lemon. *Rutaceæ.*

Several varieties extensively cultivated in the State. Well-known popular fruit. (See State Hort. Reports and special reports on lemon culture.)

481. **Leonotis leonurus** L. Common motherwort. *Labiatæ.*

A tropical labiate, extensively cultivated, said to have purgative and emmenagogue properties. (Pharm. Journ. Trans., May, 1885.)

482. **Leucrocrinum montanum** Nutt. Wild hyacinth. *Liliaceæ.*

A poisonous plant which requires further study as to chemical constituents and possible therapeutic value.

483. **Lewisia rediviva** Pursh. Bitter root. *Portulacaceæ.*

Indian food plant. The roots and the white inner bark contain a high percentage of starch. Indians store large quantities for winter use. The odor of the boiled root recalls that of tobacco, hence the appellation "tobacco root." (Calif. Geol. Surv. Bot. **1**: 78.) (Am. Journ. Pharm., 1889.)

484. **Libocedrus decurrens** Torr. Incense cedar. *Coniferæ.*

Found in the California coast ranges. Resin very fragrant. The volatile oil, which is found in all parts of the tree, has the odor of incense. The leafy sprigs are used by the Indians in preparing their acorn meal, serving the purpose of a filter and to impart the incense flavor. A decoction of the leaves used in stomach troubles.

485. **Lichens.** Moss. Tree moss. Lichens.

Lichens are abundant in the State, especially **Usnea barbata** (beard moss), which was at one time much used in hair tonics and as a remedy in brain disease. (See, also, **Usnea, Evernia, Cetraria,** and **Rocella.**) Species of **Sticta** are occasionally used in pulmonary complaints. **Cetraria Islandica** (Iceland moss) was formerly official. Lichens are

now rarely used medicinally excepting as popular remedies in certain countries.

486. **Ligusticum** sp.? *Umbelliferæ.*

Indians use a decoction of the roots of an unknown species of Ligusticum as a cough remedy.

487. **Ligusticum filicinium** Wats. "Osha." Colorado cough root. *Umbelliferæ.*

The large aromatic roots are much used as an expectorant tonic. By some considered a specific in the treatment of coughs and colds. Well worthy of more careful study. (See, also, "Osha.") (Am. Journ. Pharm., 1890 and 1891.)

488. **Ligusticum levisticum** L. Lovage. *Umbelliferæ.*

An extensively cultivated well-known European plant. A stimulant aromatic used as a carminative, diaphoretic and emmenagogue.

489. **Ligustrum vulgare** L. *Oleaceæ.*

This and other species are extensively cultivated as ornamental plants. The leaves are astringent and bitter, used as a decoction in the treatment of sore throat, ulcerations of the mouth, etc. Berries are said to have purgative properties, and are used for dyeing purposes.

490. **Lilium species.** *Liliaceæ.*

Extensively cultivated throughout the State as ornamental plants, including those of medicinal value. An ointment made from **L. candidum** used in the treatment of dropsy.

491. **Limodorum giganteum** K. Swamp orchid. *Orchidaceæ.*

Indians drink a decoction to combat manias and severe cases of illness. (Contrib. U. S. Nat. Herb. **7**: No. 3, 330.)

492. **Linanthus ciliatus** Greene. California gilia. *Polemonaceæ.*

Indians use an infusion of this plant in the treatment of coughs and colds and it is said to be a blood purifier. (Contrib. U. S. Nat. Herb. **7**: No. 3, 381.)

493. **Linum species.** Flax. *Linaceæ.*

Common flax (**L. usitatissimum**) is readily cultivated in the State. The following species are native: **L. lewisii** (blue flax), **L. adenophyllum, L. spergulinum, L. micranthum, L. californicum, L. congestum, L. brewerii.**

494. **Linum catharticum** L. Purging flax. *Linaceæ.*

Much used as a mild cathartic; useful in muscular rheumatism, catarrhal affection, dropsy and diseases of the liver.

495. **Linum usitatissimum** L. Flax. *Linaceæ.*

Extensively cultivated as a fiber plant. Seeds rich in oil, which is used for technical and other purposes. Well-known plant.

496. **Lippia citriodora** Kunth. Lemon verbena. Sweet verbena. *Verbenaceæ.*

This and other species of lemon verbena are extensively cultivated as ornamental plants. The deliciously lemon-scented leaves are used in sachet powders. They contain tannin, a volatile oil and an aromatic substance. The Mexican species (**L. mexicana**) is used as a demulcent and expectorant.

497. **Liquidamber styraciflua** L. Alligator tree. Sweet gum. *Hamamelidaceæ.*

Introduced plant. A gum (storax, styrax, liquidamber) exudes from this plant, which is used as an expectorant, diuretic, stimulant; externally in ointments and cerates. Used largely in the manufacture of gum and as a flavoring agent. (U. S. Disp.) (Proc. A. Ph. A. **23**: 157-162, 1875.)

498. **Liriodendron tulipifera** L. Tulip tree. *Magnoliaceæ.*

A large, handsome ornamental tree. The bark is used as a stimulating tonic. It has diaphoretic qualities and is used in chronic rheumatism and in dyspepsia. (U. S. Disp.)

499. **Litmus.** Lacmus. *Lichenes.*

A dye obtained from several species of lichen, largely from **Rocella tinctoria,** found in lower California.

500. **Lolium species.** Darnels. *Gramineæ.*

The nature of the poison of the loliums is not well understood. The poisonous principle temulin, found in the seed, is supposed to be due to the presence of a hyphal fungus. This same fungus is also found in other poisonous species of lolium, as **L. arvense, L. linicola** and **L. italicum.** (Pharm. Journ. Trans. 251, 1899.)

501 **Lolium temulentum** L. Darnel. *Gramineæ.*

Naturalized from Europe. Common in California. Well-known poisonous plant without reputed medicinal value. The parched seeds are eaten by Indians.

502. **Lonicera caprifolium** L. Honeysuckle. *Caprifoliaceæ.*

Well-known ornamental plant found everywhere. The flowers are used in the manufacture of perfumery and a syrup prepared from them is used in asthma and in lung troubles. The juice is said to relieve bee stings. The fruit of all species of Lonicera is emetic and cathartic.

503. **Lonicera interrupta** Benth. Honeysuckle. *Caprifoliaceæ.*
A tea of the leaves is used as a wash for sore eyes. (Contrib. U. S. Nat. Herb. **7**: No. 3, 388.)

504. **Lophantus urticifolius** Benth. *Labiatæ.*
The Indians use the dried and powdered leaves as a sachet powder. Very fragrant.

505. **Lotus wrangelianus** F. et M. *Leguminosæ.*
Reported to be poisonous. (U. of C. Agr. Exp. Sta. Rep., p. 258, 1897-98.)

506. **Luffa ægyptica.** Vegetable sponge. Rag gourd. Luffa. *Cucurbitaceæ.*
This plant is cultivated by Chinese gardeners in the Sacramento Valley bottom lands. The large cucumber-like fruits are beaten and washed to remove pulp and the fibrous framework is dried and sold as a substitute for bath sponge. Common in California drug stores. (Proc. A. Ph. A. **32**: 180, 1884.) (Proc. A. Ph. A. **25**: 200, 1877.) (Bailey, Cycl. Am. Hort., 948.) (Cornell Exp. Sta. Bul., 67.)
The fruit of **L. echinata** contains an acrid poison similar to that of colocynth. Much used medicinally in the Orient.

507. **Lupinus species.** Lupines. *Leguminosæ.*
The lupines are present in great variety and abundance. They are rather showy plants, as a rule quite free from plant diseases. Some species are poisonous.

508. **Lupinus cyaneus.** *Leguminosæ.*
Reported to be poisonous to cattle.

509. **Lupinus leucophyllus** Dougl. *Leguminosæ.*
Poisonous. The poisonous principle has not yet been isolated.

510. **Lupinus luteolus** Kell. Butter weed. *Leguminosæ.*
Poisonous. (Contrib. U. S. Nat. Herb. **7**: No. 3, 358.)

511. **Lupinus sericeus** Pursh. *Leguminosæ.*
Poisonous. Requires study as to the nature of the poisonous principle.

512. **Lycium species.** *Solanaceæ.*
Some species are cultivated as ornamental plants and have been used medicinally, especially **L. barbarum** L. (U. S. D.)

513. **Lycium andersonii** Gray. *Solanaceæ.*
The berries are eaten by the Indians. Requires further study as to reputed medicinal properties.

514. **Lycoperdon species.** Puffballs. *Lycoperdaceæ.* (Fungi.)

Some unripe species are edible. The ripe spores puffed into the nostrils are said to check nose bleed. Spores are also dusted on sores and ulcers to dry them up. Puffballs figure in Indian lore. Ghosts are said to paint their faces with the dust (spores). (Contrib. U. S. Nat. Herb. **7**: No. 3, 300.)

515. **Lycopodium species.** Club moss. *Lycopodiaceæ.*

Many species are cultivated as ornamental conservatory plants. **L. clavatum** yields the lycopodium powder (spores). The club mosses are reputed to have diuretic properties. Have been used in rheumatism, diseases of the lungs and kidneys. Now rarely used medicinally. The spores are much used as a dusting powder and in the making of pills, etc., to make the flashlight in photography, etc.

516. **Lycopus lucidum americanum** Gray. Water hoarhound. *Labiatæ.*

Supposed to have properties similar to those of **L. virginicus** L. and **L. europæus** L. U. S. D.)

517. **Lygodesmia juncea** Don. *Compositæ.*

A poisonous plant which requires further study.

518. **Lyonia (Pieris) mariana.** Stager bush. *Ericaceæ.*

A poisonous plant. The related plant **Leucothöe catesbæi** Gray. Branch ivy, Ericaceæ, is also poisonous.

519. **Lysichiton chamchatcensis** Shott. Skunk cabbage. *Araceæ.*

In bogs of Northern California. The pungent root is made into a salve for ringworm, swellings and inflammatory rheumatism. The root is said to form the chief ingredient of the patent medicine "Skookim." Bears dig up the roots and eat them.

520. **Maclura aurantiaca** Nutt. Hedge. Osage orange. *Moraceæ.*

Cultivated as a hedge plant in the central states. Very hard wood, which takes a high polish. The large yellow fruits resemble the orange in appearance, though unfit for food. The root bark yields a yellow dye. (Am. Journ. Pharm. **46**: 257.)

521. **Madia species.** Tar weeds. *Compositæ.*

Tar weeds are exceedingly abundant in the State, constituting very annoying farm and roadside weeds. The tar weed odor permeates the country atmosphere in the fall of the year. A cooking oil has been obtained from the seeds of **M. dissitiflora.** The seeds of **M. densiflora** are agreeably aromatic. The old Spanish settlers used **M. elegans** medicinally. The madias are said to be useful in urinary troubles. (Contrib. U. S. Nat. Herb. **7**: No. 3, 395.)

522. **Magnolia species.** *Magnoliaceæ.*

Handsome trees, extensively cultivated, especially **M. grandiflora,** with its large white blossoms. The bark and fruit of all species are reputed to have medicinal properties. The root bark is most generally employed, useful in malaria and rheumatism. A popular medicine is made by macerating the fruit or bark in brandy, said to be very efficacious in chronic rheumatism. (Proc. A. Ph. A. **35**: 147, 1887.)

523. **Malacothrix coulteri** Gray. *Compositæ.*

Said to be poisonous. (University of California Coll. Agr. Exp. Sta. Rep., p. 258, 1897-98.)

524. **Malpighia glabra** L. Barbadoes cherry. Nance bark. *Malpighiaceæ.*

A native of Mexico, which could no doubt be grown in the southern parts of the State. The Mexicans use the bark in tanning; said to contain twenty-six per cent of tannin. (Am. Journ. Pharm. **16**: 239.)

525. **Malus rivularis** Roem. Oregon crabapple. *Rosaceæ.*

The sour fruits used in fevers, in wine making, etc.

526. **Malva species.** Mallows. *Malvaceæ.*

Very abundant in the State. Many introduced species cultivated as ornamental plants, arbor plants, etc. They possess demulcent properties.

527. **Malva parviflora** L. Mallow. *Malvaceæ.*

Has laxative properties; useful in indigestion. Eaten in India. Seeds used as a demulcent in coughs and colds and in urinary troubles.

528. **Malvastrum coccineum** Gray. Red false mallow. *Malvaceæ.*

A forage plant. Reported to be poisonous.

529. **Mandragora officinarum** L. Mandrake. *Solanaceæ.*

A European herb famed in history and folk lore. Was formerly credited with all manner of supernatural powers and marvelous curative properties. Now no longer used medicinally. This plant must not be confused with **Podophyllum pelatum,** May apple, which is also known as mandrake. (Peters' History of Pharmacy and Medicine.)

530. **Mangifera indica** L. Mango. *Aurantiaceæ.*

A tropical fruit tree, cultivated in portions of southern California and in Florida. The fruit is delicious. All parts of the tree have a sweet, resinous fragrance. (U. S. Dept. Agr., Div. Pomol. Bul. 1.) (Bailey Cycl. Am. Hort., 978.) (Proc. A. Ph. A. **25**: 218, 1877.)

531. **Manihot utilissima** Pohl and **M. aipi** *Plan.* Cassavas. *Euphorbiaceæ.*

These well-known starch yielding plants thrive well in the southern

part of the State. The large tuberous roots are rich in starch (cassava starch). (U. S. Dept. Agr. Farmers' Bul. No. 167, 1903.)

532. **Maranta species.** Maranta. Arrowroot. *Scitamineæ.*

Common in conservatories. Also cultivated in the open in southern California. Yields starch (maranta starch.)

533. **Marrubium vulgare** L. Hoarhound. *Labiatæ.*

A very common weed along roadsides and in neglected dry fields. A well-known medicinal plant, which can be grown without any difficulty whatever. Whites as well as Indians use a leaf decoction for coughs and colds and to check diarrhœa. Used in cough drops and confections.

534. **Matricaria chamomilla** L. Chamomile. *Compositæ.*

An old-time popular medicinal pot herb, easy of cultivation, and enjoying wide popular use as a tonic and diaphoretic, in the form of a tea. Especially popular among the Germans.

535. **Matricaria discoidea** D. C. Manzanilla. Chamomile. *Labiatæ.*

A fragrant native herb, common along walks and roadsides. A very popular domestic remedy, used as a tonic diaphoretic and to check diarrhœa; given in colic, especially in stomach and bowel complaints of children. Could be grown profitably and would no doubt displace the foreign species. (Calif. Geol. Surv. Bot. **1**: 401) (Contrib. U. S. Nat. Herb. **7**: No. 3, 395.)

536. **Megarrhiza.** (See **Micrampelis.**)

537. **Melia azedarach** L. Pride of India. *Meliaceæ.*

A handsome tree from Persia and India, extensively cultivated in parks, etc., as an ornamental plant. The seeds are rich in oil. The bark decoction is said to have cathartic, emetic and narcotic properties. The bark is used as an anthelmintic, particularly in the southern states.

538. **Melilotus alba** Lam. White sweet clover. *Papilionaceæ.*

A European plant which has become disseminated throughout the United States with marvelous rapidity. The white flowers are fragrant and are used to scent tobacco, cheese, clothing, etc., in sachet powders, to keep away moths, etc. It is used medicinally.

539. **Melilotus officinalis** L. Yellow sweet clover. *Papilionaceæ.*

Well known medicinally. Contains cumarin. Found everywhere, though less abundant than **M. alba.**

540. **Melissa officinalis** L. Balm. *Labiatæ.*

Well-known medicinal herb found almost everywhere; naturalized in places. Readily cultivated. A popular honey bee plant.

541. **Mentha species.** Mints. *Labiatæ.*

The mints are readily cultivated and are common as garden herbs They yield oil and are well known medicinally. Mint culture is profitable if properly conducted on a large scale. Cultivated in various states, as Wisconsin, Michigan, Pennsylvania, some of the southern states and elsewhere. (Proc. A. Ph. A. **30**: 171, 1882.)

542. **Mentha piperita** L. Peppermint. *Labitæ.*

This and other species and varieties of peppermint can readily be cultivated in the State, especially in the coast regions. (See Chap. III.) Well known medicinally. Yields oil and menthol, which have a good market demand. (Schimmel & Co.'s Report for Oct., 1897.) (U. S. D. and Materia Medicas.)

Mentha pulegium L. (European Pennyroyal.) Can readily be cultivated. The oil (oil of Poley) contains pulegine and is said to be extensively used to produce abortion, although such action is denied by some authorities. No longer used by physicians.

M. spicata L. is the spearmint, which is much used as a condiment, etc. Well known medicinally. (U. S. D. and Materia Medicas.)

543. **Mentzelia affinis** Green. *Loasaceæ.*

Said to be poisonous to sheep, though death of animals is ascribed to the formation of "clover hair balls" in the intestines and not to any poisonous principle that might be present. Requires further study.

544. **Mentzelia lævicaulis** T. and G. Blazing star. Loasa. *Loasaceæ.*

A leaf decoction used in colic and as a wash in skin diseases. (Contrib. U. S. Nat. Herb. **7**: No. 3, 369.)

545. **Menyanthes trifoliata** L. Buckbean. March trefoil. *Gentianaceæ.*

A native of the boggy lands of California, said to have become exterminated in certain areas. Has enjoyed a wide, popular, medicinal use in intermittent fevers, scrofula, scurvy, rheumatism, jaundice, dropsy, etc. Much used as a cathartic. In large doses it causes vomiting. (U. S. D.)

546. **Mesembryanthemum acinaciforme.** *Ficoideæ.*

Used medicinally by Indians. Fruit is eaten.

547. **Mesembryanthemum æcquilaterale** Howarth. Fig marigold. Sea fig. Faculty onion. *Ficoideæ.*

Common along the dunes and cliffs near the sea. Cultivated as an ornamental and lawn plant, in parks, etc. Flowers are fragrant Fruit is eaten by children and others. The taste recalls salted apples. Used medicinally by Indians and Spaniards. Has demulcent and diuretic properties.

548. **Mesembryanthemum crystallinum** L. Ice plant. Fig marigold. Diamond fig. *Ficoideæ.*

A native of southern Europe, much used as a lawn and border plant. The plant is very rich in potassium and sodium salts. The expressed juice is used medicinally; has demulcent and diuretic properties.

549. **Mezereum.** (**Daphne mezereum** L.) Mezereon. *Thymelaceæ.*

Well-known medicinal shrub, of which the bark is used. (U. S. D. and Materia Medicas.) (*See* **Daphne.**)

550. **Micromria chamissonis** Greene. Yerba buena. *Labiatæ.*

A plant well known to Californians. The old name for San Francisco was Yerba Buena, in honor of this small, fragrant herb. Used as a tea to cure colic and to purify the blood.

A mint-like plant having the properties of the mints. In great repute among Indians and the early missionaries, as a beverage in fevers and as a tonic. (Proc. A. Ph. A. **31**, 117, 1883.)

551. **Mimulus guttatus** D.C. *Scrophulariaceæ.*

Indians are said to use this plant as a source of salt. It is also eaten. (Contrib. U. S. Nat. Herb. **7**: (No. 3,) 387.

552. **Mimulus langsdorffii** Donn. Monkey Flower. *Scrophulariaceæ.*

Decoction of roots used for diarrhœa and dysentery.

553. **Mimulus moschatus** Dougl. Musk plant. *Schrophulariaceæ.*

Cultivated on account of the musk-scented foliage. Reputed to be useful in certain nervous disorders.

554. **Mimusops species.** Zapote gum. Gum chicle. *Sapotaceæ.*

Several species are cultivated in the southern part of the State. The seeds of most species yield oil. Some yield gum used in the manufacture of chewing gum. **M. elengi** and **M. hexandra** are used medicinally. The bark has astingent, tonic and sialagogue properties. In England the gum is said to be used as a substitute for gutta percha.

555. **Momordica balsamina** L. Balsam apple. *Cucurbitaceæ.*

A climbing plant cultivated for its fruit, which is eaten by some and which has laxative properties. An infusion of the fruit, deprived of the seed, is used as a liniment for chapped hands, burns, piles, and the mashed fruit is used as a poultice. The extract is used in dropsy. Plant is poisonous.

556. **Monarda punctata** L. Horsemint. *Labiateæ.*

Well-known cultivated herb. It is somewhat bitter and pungent, rich in volatile oil, also yields a camphor. It is stimulant and carminative, used as a popular remedy in flatulent colic and in sick headache. **M. fistulosa** is said to be a very active diaphoretic, useful in fevers.

557. **Monardella lanceolata** Gray. Mountain mint. Pennyroyal. *Labiatæ.*

A common herb. Popular remedy, used by the Spaniards to cure various ailments, to relieve colic, as a diaphoretic, etc.

558. **Monardella sheltoni** Torr. *Labiatæ.*

A fragrant herb used as a tea and to relieve colic and to purify the blood. Other species occur in the State which no doubt have similar properties.

559. **Monolopia major** D. C. *Compositæ.*

Reported to be poisonous. Requires further study. (U. of C. Agr. Exp. Sta. Rep. p. 258, 1897-98.)

560. **Morus species.** Mulberry. *Moraceæ.*

Various species and varieties introduced into the State. **M. rubra** and **M. alba** are the best known. Fruits highly relished, mildly laxative and cooling; useful in fevers.

561. **Mucuna pruriens** D. C. Cowage. Cowhage. *Leguminosæ.*

A climbing plant, sometimes cultivated. The fruit spicules used as a worm remedy (round worms). An effective but disagreeable remedy, which is no longer used by physicians. Plant not reported from the State.

562. **Musa sapientium** L. Banana. *Musaceæ.*

The fruit of this plant is familiarly known. The bananas thrive in the State, but are apparently not grown on a large commercial scale. The fruit pulp is very nutritious, eaten raw or fried in butter. Fruits should be well ripened before eating.

563. **Mushrooms** or **Toadstools.** Fungi.

Well-known plants. Some are "edible" and some are poisonous. A wise precaution is not to eat any of them, thus avoiding the danger of poisoning. They have no food value. So frequent are fatal cases of poisoning that it was made desirable to organize "mycological clubs" throughout the United States as a means of mutual safeguarding against poisoning. All this trouble can be avoided by not eating mushrooms. The mushroom taste in the human animal is to be compared to the taste acquired by some cattle for noxious weeds. There is a voluminous literature on mushroom culture.

564. **Myosurus alopecuroides** Greene. Antioch mouse tail. *Ranunculaceæ.*

Found in low grounds. Requires further study as to medicinal properties.

565. **Myosurus minimus** L. Mouse tail. *Ranunculaceæ.*

Perhaps identical with above species.

566. **Myrica californica** Cham. California wax berry. *Myricaceæ.*

Properties similar to **M. cerifera** L., which is well-known medicinally (U. S. D.) The Japanese species (**M. rubra**) is extensively cultivated in the State. They require further study.

567. **Myrtus communus** L. Myrtle. *Myrtaceæ.*

This European tree is extensively cultivated. The leaves contain myrtol, an active antiseptic; said to act as a nerve sedative and stimulant to mucus membranes. Used in bronchitis, cystitis and pyelitis.

568. **Narcissus pseudo-narcissus** L. Daffodil. *Amaryllidaceæ.*

Common garden plant. The bulb and flowers have been used medicinally. Used as an anti-spasmodic, sialagogue, diaphoretic, and in large doses as an emetic. Wild growing plants more active than the cultivated.

569. **Nardia.** Nard. Spikenard. *Araliaceæ.*

Garden plants. Properties like those of valerian. Not now used medicinally. Botanical origin uncertain. By some relegated to valeriana.

570. **Nasturtium officinale** R. Br. Water cress. *Cruciferæ.*

Growing wild and cultivated for table use. Said to be useful in scorbutic affections and in constipation. Other species are similarly used.

571. **Nepenthes** and **Sarrancenia species.** Pitcher plants. *Sarraceniaceæ.*

The pitcher contains a very active proteolytic enzyme. The roots of same species are used as a diuretic, laxative and tonic. (Pharm. Journ. Trans. p. 483, 1899.)

572. **Nepeta species.** Catnip. *Labiatæ.*

Several species are introduced. **N. cataria** is common. Anti-spasmodic and emmenagogue; tonic, excitant. Contain tannin and volatile oil.

573. **Nerium odorum** L. Oleander. *Apocynaceæ.*

Cultivated ornamental shrub. Used since time immemorial to destroy rats. Cases of poisoning by it have been reported. Two alkaloids have been isolated. Used as a heart tonic in valvular lesion. It also has diuretic and cathartic properties. (U. S. D.)

574. **Nicotiana species.** Tobacco. *Solanaceæ.*

The native species have been used by Indians as a stimulant, smoked and chewed. Some tribes have even cultivated the more desirable species.

575. **Nicotiana attenuata** Tor. Tobacco. *Solanaceæ.*

Formerly used as smoking tobacco by the Indians of Modoc County, California.

576. **Nicotiana bigelovii** Wats. Indian tobacco. *Solanaceæ.*

Used as snuff, also mixed with manzanita leaves and smoked.

577. **Nicotiana glauca** Graham. Tobacco tree. *Solanaceæ.*

Said to have caused the fatal poisoning of cattle that eat it, only however, when other food was scant. The plant is introduced from Mexico and is spreading rapidly in California, along ditches and banks, and in low, moist places. Has been mistakenly eaten for wild cabbage with fatal results (H. M. Hall). Requires further study.

578. **Nicotiana tabacum** L. Tobacco. *Solanaceæ.*

This species with its varieties is cultivated on a large scale. Various other species and varieties are found in experimental gardens and elsewhere. **N. biglovii, N. attenuata** and **N. glauca** occur spontaneously.

579. **Nigella damascena.** *Ranunculaceæ.*

Used medicinally. Has been studied chemically. (Proc. A. Ph. A. **30**: 211-212, 1882.)

580. **Nigella sativa** L. Nutmeg flower. *Ranunculaceæ.*

Cultivated. Seeds have a strong aromatic odor, recalling nutmegs. Used as a stimulant, diaphoretic, emmenagogue, and is said to increase the secretion of milk. Used as a corrigent, as a condiment and as an adjuvant with purgatives and tonics.

581. **Nostoc pruniforme.** *Algæ.*

It is stated that some nostocs have aseptic, if not antiseptic properties. It is recorded that specimens kept in water in a bottle remained in good condition for ten years. This matter requires further investigation.

582. **Nuphar advena** Soland. Yellow pond lily. *Nymphæaceæ.*

Found in ponds and sloughs of California. Contains tannic acid. Requires further study.

583. **Nuphar luteum** Sebth. Water lily. *Nymphæaceæ.*

Readily cultivated. Rich in tannic acid. (Am. Jour. Pharm. **96**; 1883.)

584. **Nuphar polysepalum** Eng. Indian pond lily. *Nymphæaceæ.*

Quite common. The seeds are used as food by the Klamath Indians. Contains tannic acid.

585. **Nymphæa odorata** Woodv. Sweet scented water lily. *Nymphæaceæ.*

Readily cultivated. Rich in tannic and gallic acid. Used medicinally

by the ancients; reported to be aphrodisiac. Roots of **N. alba** were also esteemed as an aphrodisiac by the ancients. Numerous varieties found in cultivation. (Am. Jour. Pharm. **96**: 1883.)

586. **Ocium basilicum** L. Sweet basil. *Labiatæ.*

A native of India and Persia, cultivated in gardens. The entire plant is highly aromatic. Has the general properties of aromatic plants. Seeds used in India in the treatment of gonorrhœa.

587. **Œnanthe californica** Wats. Fool's parsnip. *Umbelliferæ.*

Reported to be poisonous. Requires further study as to poisonous constituents.

588. **Œnothera biennis** L. Evening primrose. *Onagraceæ.*

Cultivated. Common throughout the United States. Before the introduction of the potato the fleshy roots of this plant were eaten. Medicinally used in whooping cough, spasmodic asthma; as an ointment in eruptive skin diseases of children and as an application to ulcers.

589. **Œnothera brevipes** Gray. Evening primrose. *Onagraceæ.*

This and other species of evening primrose are eaten by Indians as a salad or stewed. Also used medicinally.

589. **Olea europæa** L. and varieties. Olive. *Oleaceæ.*

Olives are extensively cultivated in California. There is a voluminous literature on the oil, fruit, cultivation, commerce, use, etc., of the olive.

591. **Opuntia species.** Prickly pears. Indian figs. *Cactaceæ.*

The opuntias form a very important vegetation for the Indians of southern California. The young succulent shoots, the fruit, seeds and buds are eaten, cooked or steamed. The plants contain much stored water, which the thirsty traveler often uses. According to Mr. Vermillion (verbal report), railroad employees, civil engineers, and others employed in the desert regions, use the cut opuntia plants to purify drinking water. A number of pieces are placed in a pail of water, the dirt and clay particles cling to the abundant mucilage that exudes, and are carried to the bottom of the vessel. Other cacti are similarly used. Barrows states that there are over fifty species of cacti in the United States, a majority of which are found in California. Mr. Burbank and others have devoted much time and energy toward developing edible spineless varieties. (Bailey Cycl. Am. Hort. 1143-1152.)

592. **Opuntia basilaris** Englm. *Cactaceæ.*

The fruits are eaten after being specially prepared. This is said to be the most valuable of the opuntias.

593. **Opuntia bernardina** Englm. *Cactaceæ.*

Native of southern California. Properties and uses like other species.

594. **Opuntia engelmanni** Solm. Prickly pear. *Cactaceæ.*

Fruit is sweet. Large quantities are collected, dried and preserved for food by the Indians.

595. **Opuntia tuna** Mill. Prickly pear. *Cactaceæ.*

Said to have the properties of **Cactus grandiflorus.** Cultivated for the rearing of the cochineal insect (Parsons).

596. **Opuntia vulgaris** Mill. *Cactaceæ.*

Has the properties of the above species. (Proc. A. Ph. A. **32**: 179-180, 1884.)

597. **Orchis species.** Salep. *Orchidaceæ.*

The dried tubers of various species of orchis are known as Salep. They are mucilaginous, and highly nutritive. In mediæval times much used as an aphrodisiac, although having no such properties. Well-known medicinally in various countries.

598. **Orobanche (Aphyllon) species.** Beech drops. Cancer roots. *Orobanchaceæ.*

Parasitic plants of which there are many species in California. **O. uniflora L.** and other species are used in intestinal troubles. Formerly much used as an application to ulcers, especially to cancerous growths, hence the name "cancer root." "Martin's Cancer Powder" was made of a mixture of cancer root and white oxide of arsenic.

599. **Orobanche (Aphyllon) californica** C. and S. Cancer root. *Orobanchaceæ.*

Said to be rich in tannic acid. The rootstock of **O. ludovicianum** Gray, though bitter, is eaten by Indians (U. of C. Agr. Exp. Sta. Rep., 1897-1898, page 260.) (Cal. Geol. Surv. Bot. **1**: 585.)

600. **Origanum vulgare** L. Sweet marjoram. *Labiatæ.*

Well known and extensively cultivated pot-herb used as a spice. At one time much used medicinally, as a diaphoretic and emmenagogue, and externally as a poultice. Yields the well-known oil of origanum. Used as a condiment.

601. **Orophaca (Astragalus) cæspitosa** Britt. Low milk vetch. *Leguminosæ.*

This plant is reported to be poisonous to cattle. The poisonous constituents require further study.

602. **Oryzopsis membranacea.** Common sand grass. *Gramineæ.*

The seeds are used as food, as a substitute for rice.

603. **"Osha."**

This name is applied to a root derived from an unknown plant, perhaps a species of peucedanum. An analysis of the root was made by Dr. Hermann Haupt, who discovered an acid closely similar to angelic

acid. According to others "Osha" is the root of a Mexican umbellifer, which is said to contain oshaic acid. Requires further study as to medicinal value. (Am. Journ. Pharm. 1867, 1868, 1873.)

604. **Osmorrhiza brachypoda** Torr. Sweet cicely. *Umbelliferæ.*

The roots are highly aromatic. A root decoction is much used as a cough medicine. Seeds should be examined for oil of anise.

605. **Osmorrhiza longistylis** T. and G. *Umbelliferæ.*

This plant is introduced from Canada. The seeds contain oil of anise. (U. S. D.)

606. **Oxalis species.** Sorrel. *Geraniaceæ.*

Rich in acid potassium oxalate, and may be used as an acid refrigerant, like **O. asetosella.**

607. **Oxalis acetosella** L. Wood sorrel. *Geraniaceæ.*

The inspissated juice used as a cautery to remove cancerous growths of the lips. (Am. Journ. Pharm., page 252, 1882.)

608. **Oxalis corniculata** L. Yellow sorrel. *Geraniaceæ.*

This plant has the property of the sorrels.

609. **Oxalis oregana** Nutt. Redwood sorrel. *Geraniaceæ.*

Requires further study as to the nature of the acid.

610. **Oxytropis (Astragalus) lamberti** Pursh. Loco weed. *Leguminosæ.*

A poisonous plant producing the symptoms of the loco weeds proper. (U. S. Geog. Surv., Wheeler's Rep. Bot. **6**: 43.)

611. **Pæonia brownii** Dougl. Peony. *Ranunculaceæ.*

A rare herb. The Spanish Californians considered the roots, which are eaten raw, an excellent remedy for dyspepsia. The powdered roots are made into a decoction and given for colds, sore throat, etc. A root decoction is also used as a horse medicine. The constituents and therapeutic properties require further study. Perhaps similar to **P. officinalis.** (U. S. D.)

612. **Pæonia californica** Nutt. Peony. *Ranunculaceæ.*

The roots of this plant are said to be a tonic, antispasmodic, useful in nervous disorders. Also used in indigestion. (King's Dispensatory.)

613. **Pæonia officinalis** L. Peony. *Ranunculaceæ.*

A common garden herb, well known medicinally. The roots have a strong, peculiar odor, and a nauseous, bitter taste, said to be useful as an antispasmodic. The seeds are purgative and antispasmodic.

614. **Palmæ.** Palms.

Numerous species of palms thrive well in the State. The palms and yuccas give the California flora a tropical appearance, not in accord

with the prevailing coolness of the atmosphere. The date palm thrives as far north as San Francisco, but bears edible, well-ripened fruit only in the southern part of the State.

615. **Panax (Aralia) quinquefolium** D. and C. Ginseng. American ginseng. *Araliaceæ.*

Native of North America closely related to the Chinese ginseng **(Aralia ginseng).** Medicinally of very little value, but very valuable commercially. Used largely by the Chinese, who look upon it as a universal panacea. The wild growing ginseng is becoming scarce. Very extensively cultivated in different parts of the United States. There is a plantation at Sunnyvale, Santa Clara, and in other parts of California.

The plant requires shade (either natural or artificial) and a moist, rich soil. From time of seeding it takes about four or five years before root gathering is begun. Clean, large, unbroken, forked roots bring a good price. Specimens resembling the human form bring high prices. Market value variable, ranging from seventy-five cents to fourteen dollars per pound. California market good. Culture requires care.

616. **Papaver somniferum** L. Poppy. *Papaveraceæ.*

Cultivated everywhere, largely as an ornamental plant. In England also for the fruits and seeds. Experiments should be made to determine whether or not it is possible to secure the opium in some cheap and simple way. Until this is accomplished it will be impossible to cultivate the poppy profitably for the yield of opium, in the United States or any other civilized country.

The quality of opium from the poppy grown in California, has proven first-class. (J. H. Flint, American Journal of Pharmacy, **46**: 105, 1874.) The same may be said of opium from other States of the Union. (Am. Journ. Pharm., 286, 1894; 435, 1896).

617. **Parthenium argentatum** Gray. Mexican rubber plant. *Compositæ.*

A shrubby plant, native of Mexico, which is not reported from the State, but which would undoubtedly thrive on the dry hills of southern California. This plant contains a resin used medicinally by the Mexicans. The plant has come into prominence through the fact that it contains a high percentage of rubber (thirty to fifty per cent). A syndicate has secured possession of all plants about Torreon, Mexico, where it is most abundant. The rubber obtained from this plant is of fair quality, and is said to be exported very largely. Whether this plant can be cultivated readily is a matter which must be determined experimentally. Efforts to secure seed and living plants have thus far failed.

618. **Parthenium integrifolium** L. Prairie dock. *Compositæ.*

An infusion of this plant is used as a substitute for quinine in the treatment of fever and ague. It is used by the Indians as well as settlers. (Am. Journ. Pharm., pp. 494-495, 1882.)

619. **Paullinia pinnata** L. "Timbo." *Sapindaceæ.*

This plant is used medicinally in certain portions of the United States. It enjoys a considerable reputation and has received much attention on the part of students of materia medica. (Proc. A. Ph. A. **25**: 189, 1877.)

620. **Pectis augustifolia** Torr. *Compositæ.*

A small composite with intensely fragrant flowers, odor of essence of lemon. This and one other species appears to have a special action on the salivary glands. (U. S. Geog. Surv. Wheeler's Rep. Bot. **3**: 608, and **6**: 46.)

621. **Pectis papposa** H. and G. *Compositæ.*

Lemon odor like that of the preceding species. May prove of great value as a source of desirable extract for the use of the confectioner. (U. S. Geog. Surv. Wheeler's Rep. Bot. **6**: 46.)

622. **Pelargonium odoratissimum** Ait. Rose geranium. Nutmeg geranium. *Geraniaceæ.*

Extensively cultivated as a fragrant ornamental plant. The oil obtained from the leaves is much used as an adulterant of attar of rose. and is also used in the manufacture of perfumery. Three species are said to contain the fragrant oil, **P. roseum, P. capitatum** and the above.

623. **Perezia microcaphala** Gray. *Compositæ.*

A root decoction is used in the treatment of asthma, as a throat wash, as a laxative, etc. The plant is found along the coast, from Monterey to San Diego.

624. **Perezia nana** Gray. *Compositæ.*

This and other species enjoy a use similar to the above. (Proc. A. Ph. A. **32**: 149-155, 1884.)

625. **Persea gratissima** Gaertner. Alligator pear. *Lauraceæ.*

A native of tropical America which thrives well in the southern portions of the State. The pulp of this fruit is highly prized as an ingredient of salad dressings. Mexicans used the seed as an anthelmintic, and in the form of a liniment in the treatment of neuralgia.

626. **Persica vulgaris** Miller. Peach. *Rosaceæ.*

A well-known fruit tree extensively cultivated throughout the State. The leaves are laxative and sedative, due to the hydrocyanic acid present. Have been used in the treatment of whooping cough and in bladder irritation. Flowers are laxative and are used as a vermicide.

Poisonous in large doses. Peach oil made from the seeds is used as an adulterant of oil of sweet almonds. The expressed fruit juice yields peach brandy.

627. **Petasites palmata** Gray. Coltsfoot. *Compositæ.*

The Indians use this plant in the treatment of grippe, of consumption, as an application for sores, etc. The ash is rich in salt. (Contrib. U. S. Nat. Herb. **7**: (No. III.) 395.)

628. **Peucephyllum schottii** Gray. *Compositæ.*

Said to be useful in the treatment of kidney and bladder trouble. Reported by H. H. Barton of Bishop, Cal.

629. **Peucedanum species.** *Umbelliferæ.*

The roots of nearly all species are used as food by Indians. Some have medicinal properties. (See "Osha.") They contain peucedamine. (Am. Journ. Pharm., 1890.)

630. **Peucedanum grayii** C. and R. *Umbelliferæ.*

This plant is reported to be poisonous. The poisonous principle requires further investigation.

631. **Peucedanum montanum.** *Umbelliferæ.*

This is reported to be poisonous.

632. **Peucedanum palustre** Moench. Marsh parsley. *Umbelliferæ.*

A European marsh plant, introduced into the State and elsewhere. The dried roots are aromatic and acridly pungent. In Russia this plant is used in the treatment of epilepsy.

633. **Peucedanum platycarpum.** *Umbelliferæ.*

Reported to be poisonous. Requires further study.

634. **Peucedanum scopularum** Gray. Indian cabbage. *Unbelliferæ.*

Indians eat the upper portions of the succulent stems, either raw or cooked. Said to have some medicinal properties.

635. **Peucedanum utriculatum.** Nutt. Fir clover. *Umbelliferæ.*

The Indians eat the young leaves raw. (Contrib. U. S. Nat. Herb. **7**: (No. III), 373.)

636. **Peumus boldus** Molina. Boldo. *Monimiaceæ.*

Grown experimentally in different parts of the State. A native of the Chilean Andes. Well known medicinally; has anæsthetic properties.

637. **Phacelia grandiflora** Gray. *Hydrophyllaceæ.*

Reported to be poisonous for some people. Requires further study.

638. **Phalaris arundinacea** L. Reed canary grass. *Gramineæ.*

By some reported to be poisonous, although this is denied by others. It is declared that the symptoms of poisoning are due to the presence of ergot, which is found upon it.

639. **Phoradendron species.** Mistletoe. *Loranthaceæ.*

The mistletoes occur abundantly on the junipers. The dried plant, powdered and mixed with a little flour, is sprinkled on the saddle sores of horses.

640. **Phoradendron flavescens** Nutt. Mistletoe. *Loranthaceæ.*

Found upon oaks and the buckeye. The Indians state that the plants found upon the buckeye are very useful medicinally. Used in the treatment of toothache, for which purpose the leaves are chewed. (Contrib. U. S. Nat. Herb. **7**: (III), 344.) (Bull. Tor. Bot. Club **31**: 435-443, 1904.)

641. **Physalis alkekengi** L. Alkekengi. Winter cherry. *Solanaceæ.*

A native of Southern Europe, cultivated in the United States. The berries, which are eaten, have laxative and diuretic properties, and are used in the treatment of fever.

642. **Phragmites vulgaris** Lam. *Gramineæ.*

Rich in sugar. The stalks are eaten as a substitute for sugar cane stalks.

643. **Phytolacca decandra** L. Poke root. *Phytolaccaceæ.*

Well known medicinally. Easily cultivated in the State of California. (See text-books on Materia Medica and U. S. D.)

644. **Phytolacca dioica.** Poke root. *Phytolaccaceæ.*

Well-known medicinal plant. **P. acinosa** of Japan is well known for its diuretic and poisonous properties. Other species are found in the State.

645. **Pimpinella anisum** L. Anise. *Umbelliferæ.*

This plant thrives exceedingly well throughout the State. It could undoubtedly be cultivated profitably. The plant is well known and requires no further description.

646. **Pinus species.** Pines. Evergreens. *Coniferæ.*

The pines are well represented in the State of California. There are many native as well as introduced species. The resinous exudate of the partially burned basal parts of **P. lambertiana** Dougl., loses its resinous qualities and becomes sweet, resembling manna for which it is sometimes substituted. This resin is said to have cathartic properties. The seeds from the immense cones are eaten by the Indians. In fact, pine seeds constitute a very important article of diet of the California Indians. Pine pitch is used in making and repairing canoes, tents, and in fastening arrow feathers, arrow heads, etc. The dry powdered resin is used as a dusting powder for sores and ulcers. Settlers mix the resin with corn meal and apply as a poultice to produce

counter-irritation. (Calif. Geog. Surv. Bot. **2**: 123.) (Contrib. Nat Herb. **7**: 306-307.) (Proc. A. Ph. A., **26**: 1878, **27**: 1879.)

647. **Pinus contorta murrayana** Bulf. Murray's pine. *Coniferæ.*

The wood of this tree is much used by the Indians in making tent poles, as fuel, etc.

648. **Pinus lambertiana** Dougl. Lambert's pine. Sugar pine. *Coniferæ.*

The saccharine exudation has already been referred to. This is one of the handsomest and most highly valued of the California pines. The gum of the variety **monticola** is used as chewing gum.

649. **Pinus monophylla** Torr. Nevada nut pine. Piñon pine. *Coniferæ.*

Rich in resin. The roasted seeds are eaten. (Calif. Geog. Surv. Bot. **2**: 124.)

650. **Pinus ponderosa** Dougl. Yellow pine. *Coniferæ.*

The gum exudation is used medicinally and as an adhesive agent in tent and canoe making, etc. The gum is also used for chewing purposes. (Contrib. U. S. Nat. Herb. **7**: (No. III), 307.)

651. **Pinus sabiniana** Dougl. Digger pine. *Coniferæ.*

The nuts of this tree form the principal winter fruit of the Digger Indians. The seeds are rich in fat (51.5%) and proteids (28.05%). The yellow pitch is applied as a protective covering to sores, wounds and burns, and is used as a counter-irritant. The bark infusion is given in consumption. Steamed twigs and leaves are said to be useful in rheumatism and for bruises. (Contrib. U. S. Nat. Herb. **7**: (III), 307.)

652. **Pinus torreyana** Parry. Torrey pine. *Coniferæ.*

A comparatively rare tree of southern California. The fruits are eaten by the Indians.

653. **Pirus species** and **varieties.** Pears, apples, etc. *Rosaceæ.*

The multitudinous variety of apples, pears and quinces are extensively cultivated throughout the State. Some California apples are deficient in flavor.

654. **Pistacia mexicana.** Pistacia nut. *Anacardiaceæ.*

A Mexican plant introduced into California. Contains a resinous juice. Requires further study.

655. **Pictacia vera** L. Pistachio nut. *Anacardiaceæ.*

A native of the Orient and Mediterranean countries, cultivated in California. The green seeds are much used as a coloring agent (green) in confections and ice creams. **P. terebinthus** yields the fragrant tur-

pentine, which was used medicinally in the time of Hippocrates. **P. vera** may be grafted on **P. terebinthus.**

656. **Pittosporum species.** Coffee trees. *Pittosporaceæ.*

Handsome ornamental trees from Australia. The seeds are enclosed in a resinous exudate, which should be studied more carefully.

657. **Pittosporum undulatum** Nutt. *Pittosporaceæ.*

The blossoms of this tree yield a volatile oil, having the odor of jasmine flowers.

658. **Plagiobothrys campestris** Greene. Snowdrop. *Boraginaceæ.*

The tender shoots, flowers and seeds of this plant are eaten. A coloring substance is found in the young leaves resembling that obtained from **Alkanna tinctoria.** This substance is also found in other species, notably in **P. ursinus** of California. (Pammel and Norton, Ninth Annual Report of the Mo. Bot. Gardens, pp. 149-151.) (Contrib. U. S. Nat. Herb. **7**: 382.)

659. **Plagiobothrys (Eritrichium) nothafulvus** Gray. *Boraginaceæ.*

Indians use the roots in preparing a red face paint. May prove of commercial value. (U. S. Geog. Surv. Wheeler's Report Bot. **6**: 47.)

660. **Plantago species.** Plantains. *Plantaginaceæ.*

Introduced, and native species are common. They are reported to have diuretic properties. The Indians eat the seeds of **P. patagonica nuda** Gray. **P. patagonica californica** is said to be poisonous. (Calif. Geol. Surv. Bot. **2**: 478.)

661. **Plantago major** L. Plantain. *Plantaginaceæ.*

Infusion of leaves used as gargle in diphtheria. Poultices made from leaves for reducing swellings from poisonous insect bites.

662. **Podophyllum peltatum** L. May apple. *Berberidaceæ.*

This small woodland plant of the Eastern States and Canada could no doubt be introduced into California. It requires rich, shady soil. Well known medicinally.

663. **Pogogyne parviflora** Benth. *Labiatæ.*

A fragrant herb used much like Yerba Buena. The leaves placed in houses are said to drive away fleas and other pests. Used as a tea, as a counter-irritant in colic, etc.

664. **Polygala species.** *Polygalaceæ.*

Most of the species contain a bitter principle and are used medicinally. The native species are woody perennials. **P. senega** is not found in the State, although it could no doubt be cultivated. (Cal. Geol. Surv. Bot. **1**: 58-59.)

665. **Polygala boykinii** Nutt. *Polygalaceæ.*

This plant is said to have the properties of the Southern senega. (Proc. A. Ph. A. **30**: 1882.)

666. **Polygala senega** L. Senega. The true senega is becoming somewhat rare, and its culture would undoubtedly prove a success financially. It requires fairly rich moist soil.

667. **Polygonatum multiflorum** Ell. Solomon's Seal. *Liliaceæ.*

A European plant found everywhere in and out of cultivation. The berries and flowers are poisonous. Formerly much used in skin diseases and as a cosmetic. (U. S. D.)

668. **Polygonum amphibium** L. *Polygonaceæ.*

Used in tanning in the Western States; said to contain 18 per centum of tannin. Used as a substitute for true sarsaparilla.

669. **Polygonum aviculare** L. Yard grass. Goose grass. *Polygonaceæ.*

A very common weed in fields and yards. A decoction of this plant mixed with oak bark is used as an astringent, by Indians as well as whites. Used in kidney diseases. The fibrous roots are used as a substitute for quinine. The seeds are said to be emetic and cathartic. (Contrib. U. S. Nat. Herb. **7**: 3, 345.)

670. **Polygonum hydropiper** L. Smartweed. Water pepper. *Polygonaceæ.*

A yellow dye is obtained from this plant, which is used commercially in Europe. Used medicinally in the treatment of chronic ulcer and in kidney diseases.

671. **Polygonum multiflorum.** *Polygonaceæ.*

The roots of this plant are eaten raw; said to become bitter on boiling.

672. **Polygonum nodosum** Pers. *Polygonaceæ.*

This plant resembles **P. hydropiper.**

673. **Polygonum punctatum** Ell. Dotted smartweed. *Polygonaceæ.*

Properties and uses like those of **P. hydropiper.** (Proc. A. Ph. A. **27**: 147, 1879.)

674. **Polypodium californicum** Kaulf. Polypody fern. (*Polypodiaceæ.*) Filices.

The juice of this plant is used by Indians in the treatment of rheumatism and to rub on sores. An extract is used in the treatment of sore eyes. (Contrib. U. S. Nat. Herb. **7**: 303.)

675. **Polyporus species.** Bracket or shelf fungi. *Polyporiaceæ.*

Some of these fungi are eaten by Indians as well as by whites. They have but little food value, being entirely too woody. (Contrib. U. S. Nat. Herb. **7**: 300.)

676. **Polytrichum juniperinum.** Hair cap moss. Robin's eye. *Bryoideæ.*

This moss is said to be a powerful diuretic, useful in the treatment of dropsy. Other species of moss have similar properties, but are now but little employed by physicians.

677. **Populus species.** Poplars. *Salicaceæ.*

Cultivated as ornamental shade trees. The buds of **P. balsamifera** L. and of other species are highly balsamic, and have been used in kidney, pectoral and rheumatic complaints. The bark of several species (**P. tremuloides** and others) is used as a tonic remedy. (Am. Journ. Pharm. 226, 1892.) (Am. Journ. Pharm. 240, 1889.) (U. S. D.)

678. **Populus fremontii** Wats. Fremont's cottonwood. *Salicaceæ.*

The Indians use a bark decoction as a wash for bruises and cuts, especially for the sores on horses caused by saddle chafing.

679. **Populus tremuloides** Michx. American aspen. *Salicaceæ.*

Indians use the bark of this tree in intermittent fevers. It is likewise a popular domestic remedy, used as a tonic in fevers and malaria. The bark contains salicin and populin. (U. S. Geog. Surv. Wheeler's Rep. Bot. **6**: 51.)

680. **Porphyra laciniata** Ag. Seaweed. *Bangiaceæ.*

A seaweed of the Pacific Coast used as food by the Indians and Chinese. Rich in salt and mucilage. (Proc. Cal. Acad. of Sc. Bot. **2**: 230, series 3). (U. S. Nat. Herb. **7**: 299.)

681. **Porphyra vulgaris** Ag. Seaweed. *Bangiceæ.*

Properties and uses like the preceding species. (Proc. A. Ph. A. **27**: 134, 1879.)

682. **Portulaca oleracea** L. Common purslane. *Portulacaceæ.*

Common in low lands. Used medicinally by the Indians. Also enjoys an extensive popular medicinal use.

683. **Potentilla species.** Cinquefoil. *Rosaceæ.*

There are many California species, most of which are perhaps of no medicinal value. **P. canadensis** L. and **P. argentea** L. have been used as astringents in dysentery, chronic catarrh, night sweats, etc. The roots of **P. sylvestris** Neck (**P. tormentill, Tormentilla potentilla, P. erecta**) are rich in tannin, and are much used as an astringent remedy, and in tanning. They yield a red dye. These species are, however, not reported from the State.

684. **Potentilla glandulosa nevadensis** Wats. *Rosaceæ.*

A decoction of the stem and leaves is used in the treatment of headache and stomach-ache. Its value is undoubtedly due to its astringent properties. (U. S. D.)

685. **Potentilla reptans** L. Cinquefoil. *Rosaceæ.*

This European plant and the American **P. canadensis** L. have been used as astringents in dysentery, catarrhs, etc.

686. **Prinos (Ilex) verticillata** Gray. Black alder. *Aquifoliaceæ.*

A shrubby tree extensively cultivated. Well known medicinally. The bark, and occasionally the berries, are used as a tonic and astringent in the treatment of dysentery. A decoction is used as an application to ulcers.

687. **Prosopis (Algarobia) juliflora** C. *Leguminosæ.*

Indians mix the gum from this plant with mud and apply it to the head to kill lice and other parasites. A blue stain from the leaves and fruit is used as a face paint. The fruit is eaten.

The gum, which resembles gum arabic, has commercial value. The seeds are rich in grape sugar (30 per cent) and are used as food for cattle. Indians prepare an alcoholic drink from the seeds.

The pods and seeds are made into a meal and eaten by the Indians, and also form an excellent fodder for horses. It is reported that confectioners use large quantities of the gum, and that it promises to be of enormous value commercially. **P. pubescens** is similarly used. (Proc. A. Ph. A. **27**: 253-255, 1879.) (U. S. Geog. Surv. **3**: 607.) (U. S. Geog. Surv. Wheeler's Rep. Bot. 6: 42.) (Wiesner's Rohstoffa 1.)

688. **Prunus species.** *Rosaceæ.*

Useful fruit trees, common everywhere. Seeds, leaves and other parts of these trees contain hydrocyanic acid to which they owe their medicinal properties. Cases of poisoning following the eating of fruits and seeds (kernels) have been reported. The young wilted foliage of some cherry trees has proven poisonous to cattle. (Cal. Geol. Bot. **1**: 166.)

689. **Prunus andersonii** Gray. *Rosaceæ.*

The fruit is eaten by the Coahilla Indians.

690. **Prnuus caroliniana** Ait. Laurel cherry. *Rosaceæ.*

Common in the southern coast States and is cultivated in California. Grown as an ornamental plant and as a hedge. The poisonous principle which it contains requires further study.

691. **Prunus demissa** Walp. Western wild cherry. *Rosaceæ.*

This plant is poisonous. It has tonic and diuretic properties.

692. **Prunus domestica** L. Plums. Prunes. *Rosaceæ.*

Plums in great variety, including the prune plum, are extensively cultivated in California. Prunes have mild laxative properties. Cherries are also cultivated in great variety.

693. **Prunus ilicifolia** Walp. Islay. *Rosaceæ.*

The Indians prepare an alcoholic drink from the fruit. The dry leaves are very poisonous.

694. **Prunus laurocerasus** L. Cherry laurel. *Rosaceæ.*

A European plant common in Mexico and thrives well in different parts of the State. Poisonous.

695. **Prunus serotina** Ehr. Wild black cherry. *Rosaceæ.*

Well known medicinal plant which thrives well in California. Fatal cases of poisoning have been reported, due to the eating of fruits, seeds and leaves. The bark is much used in the preparation of cough remedies.

696. **Prunus subcordata** Benth. *Rosaceæ.*

The Indians eat the fruit fresh and also dry it for winter use.

697. **Prunus virginiana** L. Chokecherry. *Rosaceæ.*

A common tree of the United States, which has been a frequent source of fatal poisoning. The fruits are very poisonous. The names **P. virginiana** and **P. serotina** are generally confused.

698. **Pseudopsuga taxifolia** Britt. Douglas spruce or fir. *Coniferæ.*

A drink is prepared from the leaves, which is used as a substitute for coffee. A strong decoction made from the spring buds is used in the treatment of venereal diseases. The leaves are used by the Indians in the sweat bath to cure rheumatism.

699. **Psoralea carylifolia** Roxb. *Leguminosæ.*

The seeds are used in the treatment of leucoderma (white leprosy).

700. **Psoralea physodes** Dougl. *Leguminosæ.*

A native of California popularly employed as a tonic and emmenagogue. Other species are similarly used.

701. **P. soralea tenuiflora** Pursh. *Leguminosæ.*

This plant is said to be poisonous.

702. **Ptelea trifoliata** L. Wing seed. Water ash. *Rutaceæ.*

The bark is much used by Western physicians in the treatment of dyspepsia, and in ailments requiring a mild non-irritating bitter tonic.

703. **Pteris (pteridium) aquilina** L. Bracken fern. *Polypodiaceæ.*

Used by the Indians in making baskets. The rhizomes are said to be eaten by them. Are given to horses as a diuretic, but its action is

said to be violent and dangerous. Used also to destroy tape worm. (Contrib. U. S. Nat. Herb. **7**: 304.)

704. **Pulsatilla hirsutissima** Brit. *Ranunculaceæ.*

Reported to be poisonous.

705. **Puniaca granatum** L. Pomegranate. *Lythrariaceæ.*

Well known fruit tree, extensively cultivated in southern portions of the State. Well known medicinally. (Proc. A. Ph. A. **28**: 176, 1880.).

706. **Purshia tridentata** D .C. *Rosaceæ.*

Indians use a decoction of the leaves as a cough medicine. The directions are "take lots of leaves, drink about a cup full."

707. **Pyrethrum species** and **varieties.** *Compositæ.*

Many species and varieties are cultivated, including **P. roseum** and **P. cinerariæfolium,** from which insect powders are made. Several brands of insect powders are manufactured in California, including the well-known buhach.

708. **Pyrola picta** Smith. White veined skin leaf. *Ericaceæ.*

Plasters and poultices made from the leaves are applied to bruises and sores.

709. **Pyrola rotundifolia bracteata** Gray. Indian lettuce. Canker lettuce. *Ericaceæ.*

A tincture of the fresh plant is used in the treatment of ulcers, sores and cancer.

710. **Pyrus cydonia** L. Quince. *Rosaceæ.*

This well-known fruit tree is common throughout the State of California.

711. **Quercus species.** Oaks. *Cupuliferæ.*

Some of the California oaks (**Q. lobata, Q. agrifolia**) are remarkable for size and grandeur. Nine species occur within the State. The bark of **Q. densiflora** (California tan bark oak) is very rich in tannin, used medicinally, and also in tanning. The seeds of the several species are roasted and eaten by Indians, and constitute a very important article of diet. Small galls of the size of a pea are common on the California live oak. Large galls, several inches in diameter, occur on another species of oak (**Q. lobata,** California oak galls) which are reported to be rich in tannin.

The fresh galls are used in the treatment of sore eyes. The bark of **Q. lobata** is used in the treatment of dysentery. The bark of **Q. californica** and **Q. douglassii** is mixed for tanning purposes. (P. H. Lane: Cal. Tan Bark Oak, Cal. College of Pharm., Thesis, 1902.) (Contrib. U. S. Nat. Herb. Vol. **7**: No. 3), (Contrib. U. S. Nat. Herb. **7**: 343), (Proc. A. Ph. A. **27**: 275, 1879.)

712. **Ramalina reticulata.** Beard moss. Old man's beard. *Lichenes.*

Common on California live oak, hanging in long tufts from the branches. Also found on pines and other trees. Used for bedding and as a packing material. At one time used as a hair tonic. Has no medicinal value.

713. **Ramona (Audebertia) species.** Sage. Greasewood. Humming bird sage. *Labiatæ.*

Noted honey yielding plants of Southern California. The honey from the flowers is of extra quality. The following are the more common species: **A. stachyoides** Benth., **A. nivea** Benth., **A. grandiflora** Benth. and **A. polystachia** Benth.

714. **Ranunculus species.** Crowfoot. *Ranunculaceæ.*

Most of the species have acrid properties and are poisonous. **R. flammula** L., **R. scelaratus** L. and other species found in the State contain alkaloids (ranunculine) which are highly irritating and poisonous. The fresh leaves of several species are applied externally for blistering purposes. There are many native species.

715. **Ranunculus eisenii** Kellogg. Buttercup. *Ranunculaceæ.*

This species contain an acrid, more or less poisonous principle, characteristic of the group. The parched seeds are eaten by Indians. The seeds of **R. californicus** are also eaten. (Cal. Geog. Surv. Bot. **1**: 4.)

716. **Razoumofskya (Arceuthobium) occidentalis** K. Pine mistletoe. *Loranthaceæ.*

A mistletoe parasitic on the digger pine. A decoction of the plant is used by Indians to relieve pain in the stomach. (Contrib. U. S. Nat. Herb. **7**: 3, 345.)

717. **Reseda alba** L. White Mignonette. *Resedaceæ.*

Escaped from gardens native of Europe. Perhaps useful as a diaphoretic and diuretic.

718. **Reseda luteola** L. Dyer's weed. *Resedaceæ.*

Contains a yellow dye which has been used commercially. (Cal. Geog. Surv. Bot. **1**: 53.)

719. **Reseda odorata** L. Common mignonette. *Resedaceæ.*

A common European garden plant, which has escaped from cultivation. Similar in action to **R. luteola.**

720. **Rhamnus species.** Buckthorns. *Rhamnaceæ.*

These constitute the most important medicinal trees of California. Their medicinal value is widely and favorably known. There is some confusion on the part of collectors and dealers with regard to species and varieties. Physicians and pharmacologists are not clear as to their

exact comparative medicinal value. The Indians have long made medicinal use of these plants and the whites ascertained their therapeutic value from the Indians. (See Dispensatories and Materia Medicas.)

721. **Rhamnus californica** Eschw. Cascara sagrada (sacred bark). Coffee berry. *Rhamnaceæ.*

Very common in California, varying in size from a small shrub to a tree of fair proportions. Readily cultivated. Common along the coast region.

722. **Rhamnus californica tomentella** Br. and Wats. California coffee tree. Sacred bark. *Rhamnaceæ.*

This tree is found in the interior of California, and is closely similar to the species both as to appearance and as to properties. A decoction is used as a poison oak remedy. The seeds are said to be used as a substitute for coffee.

723. **Rhamnus crocea ilicifolia** Greene. *Rhamnaceæ.*

The Piute Indians have used this plant as a cathartic and diuretic. The berries are eaten as food, and it is said that they tinge the veins red, due to a deposit of coloring matter.

724. **Rhamnus ilicifolia** K. Buckthorn. *Rhamnaceæ.*

Used medicinally by Indians. Has an orange-colored inner bark. Requires more careful study. (Contrib. U. S. Nat. Herb. **7**: 369.)

725. **Rhamnus purshiana** D. C. Cascara sagrada. *Rhamnaceæ.*

This species is exceedingly abundant in Oregon and Washington, somewhat less abundant in northern California. This is supposed to be the true medicinal sacred bark.

726. **Rheum species** and **varieties.** Rhubarbs. *Polygonaceæ.*

The rhubarbs, culinary as well as medicinal, thrive well in the State, particularly in the Coast region. The plants are propagated from seeds and from the lateral shoots, which are set out about six to eight feet apart, and left to grow from four to seven years, when the roots are dug up during dry weather, peeled and cut into pieces, varying in size. The initial drying is done in the open and completed by artificial heat, not to exceed 80° F. (See Chap. III.) (Proc. A. Ph. A. **25**: 132, 1877), (Proc. A. Ph. A. **26**: 196-201, 1878), (Proc. A. Ph. A. **23**: 145, 1875.)

727. **Rhododendron californicum** Hook. California rose bay. *Ericaceæ.*

It is stated that the honey made from the flowers of this plant is poisonous. The same is reported of the honey from **R. occidentale** Gray. The leaves and roots of the latter plant are said to contain a powerful narcotic poison.

728. **Rhododendron maximum** L. Great laurel. *Ericaceæ.*
Eastern in range; cultivated throughout the State. Poisonous. Requires further study.

729. **Rhododendron occidentale** Gray. Azelea. *Ericaceæ.*
Cultivated as an ornamental plant. Related to the Siberian **R. chrysanthemum.** (Proc. A. Ph. A. **30**: 190, 1882.) (Proc. A. Ph. A. **29**: 225-231, 1881.)

730. **Rhus diversiloba** T. and G. Poison oak. *Anacardiaceæ.*
Perhaps the greatest pest in California. The most annoying of all poisonous weeds. Said to be used by the Indians to counteract rattlesnake poisoning and to remove warts.

731. **Rhus integrifolia** B. and H. Sumac. Lemonade berry. *Anacardiaceæ.*
Rich in tannin. The seeds are used by Indians to prepare a cooling drink. May prove of commercial value. The fruits of **R. laurina** Nutt, and **R. ovata** Wats., are similarly used. The Indians use a tea made from the leaves of the latter species in the treatment of coughs and colds, and for pains in the chest. **R. succedanea, R. vermicifera** and **R. sylvestris,** yield illuminating wax. (Proc. A. Ph. A. **26**: 295, 1878.)

732. **Rhus toxicodendron** L. Poison ivy. *Anacardiaceæ.*
Common throughout the United States, having properties similar to those of poison oak. Rare in California.

733. **Rhus trilobata** Nutt. Red fruited sumac. *Anacardiaceæ.*
Indians powder the berries, making a lotion used in the treatment of smallpox. The fruit is pleasantly acid, and is eaten by the Indians. A stem decoction is said to be excellent for coughs and lung trouble.

734. **Rhus vernix** L., (**R. venenata** D. C.) Poison sumac. *Anacardiaceæ.*
An Eastern poisonous plant which is spreading westward rapidly.

735. **Ribes species.** Gooseberries and currants. *Rosaceæ.*
The fruits have agreeable acid qualities and are eaten raw, cooked and preserved. Numerous varieties and forms are cultivated in the State There are several native species. Among them **Ribes cereum** Dougl.. of which the fruit is eaten by the Indians.

736. **Ricinus communis** L. Castor oil plant. *Euphorbiaceæ.*
A very common ornamental plant, which could be grown commercially. Well known medicinally. There are several varieties.

737. **Robinia pseudacacia** L. Locust tree. *Leguminosæ.*
A handsome ornamental tree with very fragrant flowers. The root bark is much used by the eclectics; said to have tonic, purgative and

emetic properties. Several active principles have been isolated. Poisonous. (U. S. D.)

738. **Roccela tinctoria** A. Orchil. Cudbear. Litmus. *Lichenes.*
This lichen is rare in California; abundant in Lower California. It was at one time a most important article in the dyeing industry.

739. **Romenya coulteri** H. California tree poppy. Matillija poppy. *Papaveraceæ.*
Well known native ornamental plants of southern California, with large showy flowers; very extensively cultivated in the State. There are several varieties or species. (**R. coulteri** Harv., and **R. trichocolyx** Eastwood.) The Indians of Lower California prized the curative powers of these plants very highly.

740. **Rosa species and varieties.** Roses. *Rosaceæ.*
Every one who has resided in California knows in what profusion roses grow throughout the State. The **Attar of rose** (oil of rose) yielding species and varieties would thrive fully as well as others. Attempts should be made to introduce the best attar varieties from Turkey, Bulgaria, France and other countries. No doubt the fragrance of some of the more suitable varieties could be increased by crossing, artificial selection and by special culture methods. The cultivation of the attar yielding roses and manufacture of the oil should be studied at Kizanlik, Bulgaria, and in other attar producing countries, as a preparation to begin similar enterprises in California. The late Dr. A. P. Whittell experimented with roses near Los Gatos some years since, producing a fine quality of attar. It is stated that a good quality of attar of rose has been obtained in California from the "American Beauty" rose, which is very fragrant. The Kizanlik oil of rose is worth six dollars per ounce. It is frequently adulterated.
The petals of **Rosa gallica** and varieties and the undeveloped buds of **R. centifolia** have market value.

741. **Rosa californica.** *Rosaceæ.*
A large plant attaining a height of ten feet or more. The tender shoots are made into a tea. The old straight wood is used for arrow shafts by the Indians. The leaves and petals are rich in tannin and possess astringent properties.

742. **Rosmarinus officinalis** L. Rosemary. *Labiatæ.*
A well-known plant cultivated every where. Used as a stimulating tonic. Yields rosemary oil. Well known medicinally.
The statements made under lavender also apply here. The flowers are worth about ninety-five cents per pound and the oil about $1.50 per pound. The oil is used principally in perfumery, ointments, liniments and lotions. (See **Mentha** and **Lavendula.**)

743. **Rubia tinctorum** L. Madder. *Rubiaceæ.*

The plant has some medicinal use, but is cultivated principally for the dye (madder) which it yields and which is a highly valued pigment used by artists. It thrives well in the State under cultivation. The grower should also manufacture and market the dye. Full directions and suggestions for culture and manufacture must be sought elsewhere. (U. S. D. 1.) (U. of C. Exp. Sta. Rep. p. 244, 1890.)

744. **Rubus species.** Raspberries and blackberries. *Rosaceæ.*

Numerous native and introduced species and varieties occur in the State. The fruits are highly relished. The bark leaves and the fruits are used medicinally. The noted Loganberry is an acidulous fruit for convalescents. Highly prized for jellies and preserves. It is a cross between the raspberry and blackberry. (Dispensatories and Materia Medica.)

745. **Rubus idæus** L. Raspberry. *Rosaceæ.*

The red and black varieties are extensively cultivated in the State.

746. **Rubus vitifolius** C. and S. Blackberry. *Rosaceæ.*

This native plant is rich in tannin and could no doubt be substituted for the official species.

747. **Rumex species.** Dock. *Polygonaceæ.*

Many species occur within the State. They have medicinal properties. Several species have been grown commercially. Some are very troublesome weeds.

748. **Rumex crispus** L. Yellow dock. *Polygonaceæ.*

Used in cutaneous diseases, scrofula, syphilis, etc. The leaves are eaten as greens, and the seeds are made into a mush. Decoction given for inflammation of bladder, fevers and colds.

749. **Rumex hymenasepalus** Torr. Canaigre. Wild pie plant. *Polygonaceæ.*

This plant is very rich in tannin and has been grown on a commercial scale in California. Used in tanning. Used medicinally by Indians and Mexicans; also used as an article of diet.

750. **Ruta graveolens** L. Rue. *Rutaceæ.*

A well-known pot herb extensively cultivated everywhere. Used as a condiment and in the treatment of hysteria, colic, etc.

751. **Sabal serrulata** Nutt. Saw palmetto. *Palmaceæ.*

A natice of the Southern states, which grows in the southern portions of California. The fruit with the pericarp (putamen) removed is used medicinally as a diuretic, nerve sedative, tonic and expectorant, and is official in the United States Pharmacopœia.

752. **Sabatia species.** Centaury. *Gentianaceæ.*

Much used in popular medicine; valued as a tonic and antiperiodic. Used as a substitute for quinine in the Southwest.

753. **Saccharum officinarum** L. Sugar cane. *Gramineæ.*

This is the sugar cane of the South, and may be grown in portions of southern California. It yields sugar and syrup, used in medicine chiefly as a vehicle.

754. **Sagittaria latifolia** Willd. Common arrowhead. *Alismaceæ.*

Common in California on river islands and along the river shores of the interior. The tubers are highly relished by the Chinese and Indians.

755. **Salicornia ambigua** Michx. Pickleweed. *Chenipodiaceæ.*

This and other species yield impure soda on combustion. Pickled and eaten in England. Relished by cattle. Used as a pot herb. (U. of C. Agr. Exp. Sta. Rep., 1895-97.)

756. **Salix species.** Willows. *Salicaceæ.*

There are eight native species. Other species and varieties are being introduced. The bark is rich in tannin; used in basket making, etc.

757. **Salix lasiolepis** Benth. Arroyo willow. *Salicaceæ.*

A strong bark decoction is used as a wash for the itch. Given internally to cure chills and fever and to cause sweating. The roots and leaves are also used medicinally, particularly in fever and ague. (Proc. A. Ph. A. **27**: 274, 1897.) (U. S. Nat. Herb. **7**: 331.)

758. **Salvia species.** Sage. *Labiatæ.*

Numerous species and varieties, native and introduced, are found in the State. Some are cultivated as ornamental plants, and others as garden herbs. The seeds of several native species are eaten. Sage is a popular spice and medicinally is much used as a diaphoretic. It has astringent properties. (Cycl. Am. Hort.) (U. S. D.) (Proc. A. Ph. A. **30**: 172–174, 1882.)

759. **Salvia columbariæ** Benth. Sage. Chia. *Labiatæ.*

Seeds used by the Indians, in soups, etc. They are rich in mucilage. The ancient Mexicans cultivated this plant for the seed, which constituted an important article of diet. (Cal. Geol. Surv. Bot. **1**: 599.) The seed meal mixed with water forms an excellent emulsion drink in gastro-intestinal disorders. The mucilaginous seeds are placed under the eyelid to remove foreign particles. (Contrib. U. S. Nat. Herb. **7**: 384.) (U. S. Geog. Surv. Wheeler's Rep. Bot. **6**: 49.) (U. of C. Agr. Exp. Sta. Rep., page 358, 1897-98.)

760. **Sambucus canadensis** L. Elder. *Caprifoliaceæ.*

A well-known cosmopolitan medicinal plant. Thrives everywhere.

761. **Sambucus glauca** Nutt. California pale elder. *Caprifoliaceæ.*

A popular household remedy. The Indians made many medicinal uses of the leaves and bark. The flowers are considered a very valuable diuretic and diaphoretic remedy. A decoction is much used for sores, sprains, ulcers, itch, skin diseases in general, to check hemorrhage, etc.

The berries of this species are used much like those of **Sambucus canadensis.** The abundant stem pith is used as a tinder with flint and steel. (Contrib. U. S. Nat. Herb. **7**: 388.)

762. **Sapium sebiferum** Roxb. Tallow tree. *Euphorbiaceæ.*

Cultivated in California; a native of Asia. The Chinese use the fat obtained from the seed for lighting purposes. (Pharm. Journ. Trans., 401, 1883; 901, 1887.)

763. **Saponaria officinalis** L. Bouncing Bet. Soapwort. *Caryophyllaceæ.*

Said to be poisonous; contains saponin; used as a substitute for soap. Has been used as a substitute for sarsaparilla in the treatment of scrofulous diseases.

764. **Sarcodes sanguinea** Torr. Snow plant. *Ericaceæ.*

Found in the Sierras. Reported to be poisonous. The Indians of Montana and southern California use it to relieve toothache. The dried and powdered herb is made into a wash for the cure of ulcers, sore mouth, etc. Requires further study.

765. **Sarrecenia flava** L. Pitcher plant. *Carreceniaceæ.*

Used as a tonic, laxative and diuretic. Other species have similar properties and uses. Some grow in the open, others require glass covers.

766. **Sarsaparilla.** (See **Smilax.**)

767. **Sassafras sassafras** Salisb. Sassafras. *Lauraceæ.*

A well-known medicinal plant which may be cultivated.

768. **Saxifraga species.** *Saxifragaceæ.*

There are native species and several introduced species are cultivated as ornamental plants. Some species contain berganin, which is said to be intermediate in action between salicylic acid and quinine. (Phar. Jour. Trans. Aug., 1888.)

769. **Saxifraga peltata** Torr. Indian rhubarb. *Saxifragaceæ.*

The Hupa Indians eat the stems. This, as well as other species, are quite rich in tannic and gallic acid.

770. **Schinus molle.** Pepper tree. *Anacardiaceæ.*

A native of South America. Extensively grown as an ornamental tree. All parts of the plant are pungent and spicy; the odor recalling that of pepper. The fruit is about the size of the pepper and like the

pepper assumes a reddish color on ripening, but otherwise there is no similarity. All parts of the plant are rich in a gum, which is used medicinally by the Peruvians. It is said to be used in diseases of the eye and to harden the gums. (H. A. Wessel, The Pepper Tree of California, Cal. Coll. of Pharm. Thesis, 1904.)

S. terebinthifolius, also a native of South America, is far less common, but is otherwise similar.

771. **Scopola carniolica** Jaq. Scopola. *Solanaceæ.*

The plant does not occur in the State. A valuable newer remedy, having properties nearly identical with those of belladonna. The drug is official. The rhizomes and leaves are used. Poisonous. Resembles belladonna in appearance and may be cultivated like that plant. For a time it was believed that it would be used as the equal to belladonna, but thus far it does not seem to meet with favor among physicians nor among pharmaceutical manufactures. (Proc. A. Ph. A. **47**: 285–297, 1899.) (U. S. D.)

772. **Scorzonella** (**Microseris**) **maxima** Biot. Compass plant. *Compositæ.*

The bitter roots are eaten by the Indians. The gum from the milky juice is used as chewing gum. (Contrib. U. S. Nat. Herb. **7**: 391.)

773. **Scrophularia nodosa** L. Figwort. Scrofula plant. *Scrophulariaceæ.*

A European plant naturalized in the United States. The leaves are used in scrofula, as a tonic, diuretic, diaphoretic and as a local application in hemorrhoids. The native species require further study as to chemical constituents and as to medicinal properties.

774. **Scutellaria californica** Gray. Skullcap. *Labiatæ.*

The leaves are very bitter, and the Indians are said to have used them as a substitute for quinine. Two other species are quite common in the coast ranges and Sierras (**S. tuberosa** Benth. and **S. augustifolia** Pursh.) Require further study.

775. **Sechium edule.** Choco. Vegetable pear. *Cucurbitaceæ.*

A Central American plant which thrives well in California. The large starchy roots are eaten; likewise the rather large fruits, which may be prepared like summer squash. The plant is very prolific, a hundred or more fruits ripening on one plant in one season.

776. **Sedum species.** Stone crop. *Grassulaceæ.*

The European species are much used in popular medicines; valued in the treatment of ulcers, wounds, warts, dysentery, lung troubles, etc. The native species require further study.

777. **Sempervivum tectorum** L. Houseleek. Hen-and-chickens. *Grassulaceæ.*

A common European ornamental border plant. The bruised leaves are used as a cooling application to burns and other external inflammations. The juice is said to remove warts and corns. Pieces of the leaves are used to remove corns.

778. **Senecio species.** Groundsel. *Compositæ.*

There are numerous native and introduced species, which are said to have medicinal properties. **S. aureus** L. (Ragwort) is used by the Indians as a counter-irritant. The European **S. vulgaris** L. enjoys an extensive popular use, particularly valued in amenorrhea. The bruised leaves are applied to sores, ulcers and swellings. The eclectics find it very useful medicinally. Several active principles have been isolated. The group is well worthy of further careful study.

779. **Senna.** (See **Cassia.**)

780. **Serenæa (Sabal) serrulata** Hook. Saw palmetto. *Palmæ.*

The fruit is rich in oil, which is obtained by crushing and expression. No alkaloid has been found. (Pharm. Archives, pages 101–116, 1899.) (See **Sabal serrulata.**)

781. **Shepherdia (Lepargyræa) argentea** Green. Buffalo berry. *Elæagnaceæ.*

A native ornamental plant, well suited to a dry soil and climate. The fruit is quite rich in acid, and is made into jelly. (Am. Journ. Pharm. Dec. 1888.)

782. **Sida hederacea** Torr. *Malvaceæ.*

Said to be demulcent and laxative. Requires further study. Abundant about Sacramento and elsewhere in the State.

783. **Sida rhombifolia** L. Jelly leaf. Queensland hemp. *Malvaceæ.*

A native of Australia. Rich in mucilage, having demulcent properties. **S. paniculata** L. of Peru is rich in mucilage and is said to be a very active vermifuge. The plants are rich in fiber, which is used as a substitute for hemp.

784. **Silene species.** Catch fly. Campion. *Caryophyllaceæ.*

Five species occur in the State, which require further study as to active constituents and properties.

785. **Silene laciniata** Cav. Yerba del India. *Caryophyllaceæ.*

Spaniards make this into a tea. Considered very useful in the treatment of sores, aches, ulcers and sprains. The Eastern species (**S. virginica**) is said to be poisonous, and a useful anthelmintic.

786. **Silybum marianum** Gaert. Mariana. *Compositæ.*
Seeds used as an antispasmodic. Requires further study.

787. **Simmondsia californica** Nutt. *Garryaceæ.*
A large shrub with a curious fruit. The nuts (seeds) taste something like filberts but leave a bitter after taste. The Indians use the seed as food. The Coahilla Indians prepare a drink from the ground seeds. The oil of the seeds is much used as a hair tonic.

788. **Sinapis alba** L. and **S. nigra** Kock. Mustard. *Cruciferæ.*
English mustard has been grown on an enormous scale in the Lompoc Valley in California. "Mustards" of all kinds are very profuse throughout the State, growing very rank and constitute a very troublesome pest to the farmer.

789. **Sisyrinchium bellum** Wats. Star grass. Azulea. Villela. *Iridaceæ.*
A common California plant. A tea made from it is used in the treatment of fevers. A popular notion prevails that it is possible to subsist for many days on this tea alone.

790. **Sissymbrium pinnatum** Greene. Tansy mustard. Palmita. *Cruciferæ.*
The seeds, cooked and seasoned with salt, with milk and sugar added, are eaten. Used largely by the old squaws.

791. **Sium cicutæfolium** Gmel. Water parsnip. *Umbelliferæ.*
A poisonous plant. Children and others occasionally eat the roots, mistaking them for parsnips. (Proc. A. Ph. A. **25**: 168, 1877.)

792. **Smilacina amplexicaulis** Nutt. False Solomon's seal. *Liliaceæ.*
Common in woodlands along the coast. (U. S. D.)

793. **Smilax species.** Sarsaparilla. *Smilaceæ.*
The medicinal sarsaparilla is not cultivated commercially within the State. No doubt certain portions of southern California would be well suited to this plant.

794. **Solanum dulcamara** L. Bittersweet. *Solanaceæ.*
A well-known foreign medicinal plant which could be cultivated very readily.

795. **Solanum nigrum** L. Black nightshade. *Solanaceæ.*
Specially common in the eastern United States, but rapidly spreading westward, and very abundant in certain localities in the State. Commonly known as deadly nightshade, and also as belladonna, and by some has been mistaken for the true belladonna. The unripe fruits are poisonous, but the ripe fruits are said to be eaten. The active constituent is solanine, whose physiological action requires further study.

796. **Solanum triflorum** Nutt. Spreading nightshade. *Solanaceæ.*
A native of the great plains. Poisonous. Requires further study.

797. **Solanum umbelliferum** Esch. *Solanaceæ.*
Fruit is mashed, oil expressed and used as an application to pimples. Decoction of roots for stomach-ache and bowel complaints.

798. **Solidago californica** Nutt. Golden rod. *Compositæ.*
All Solidago species are credited with diuretic properties. Decoction of entire plant, also powder, used to clean old sores.
The golden rods are peculiar to the United States, and the golden rod is the national flower. **S. odora** Ait. was formerly official in the U. S. Pharmacopœia. This and other species have diuretic and diaphoretic properties. (Proc. A. Ph. A. **28**: 146, 1880.)

799. **Sonchus oleraceus** L. Sow thistle. Milk thistle. *Compositæ.*
A common introduced weed. The brown inspissated juice is said to be a powerful hydrogogue cathartic. Combined with belladonna and aromatics, it is given in the treatment of dropsy. Used as an anti-opium remedy by the Chinese of Oakland and San Francisco. Supposed to contain a narcotic. (Proc. A. Ph. A. **24**: 141, 1876.) (Pac. Pharm. **2**: 113, 1908.)

800. **Sorbus ancuparia** L. Mountain ash. *Rosaceæ.*
A small tree of Europe, much cultivated as an ornamental plant. The fruit contains a saccharine substance, sorbin, which readily undergoes alcoholic fermentation. All parts of the tree are highly astringent, and may be employed in tanning. Used in the treatment of scurvy, ulcers, sores, hemorrhoids, etc. (Proc. A. Ph. A. **30**: 237, 1882.)

801. **Sophora japonica** L. Japanese pagoda tree. *Leguminosæ.*
This, and other species, are cultivated as ornamental trees. Said to contain a poisonous volatile alkaloid (sophorine) similar to cytisine.

802. **Spilanthes oleracea** L. Paracress. *Compositæ.*
A native of India, which may be cultivated in the southern portions of the State. Used in India as a toothache remedy.

803. **Spiræa species.** Hardhacks. *Rosaceæ.*
Familiar shrubs cultivated everywhere. Most of the species contain a colorless volatile oil, resembling the oil of gaultheria. The roots contain tannic acid, and are used for their astringent properties. The flowers possess, in a feeble degree, the properties of salicylic acid. (Cycl. Am. Hort. 1699.)

804. **Stachys bullata** Benth. Hedge nettle. *Labiatæ.*
Used as cough medicine.

805. **Sterculia species.** *Sterculiaceæ.*

Several species are cultivated in the State. The fruit contains caffeine particularly that of **S. acuminata.** Sterculia gum is obtained from various Indian, African and Australian species. (Pharm. Journ. Trans. Nov. 1889.)

806. **Stipa viridula** Trin. *Gramineæ.*

It is reported that this grass has a powerful action on the brain and spinal cord. Further study is necessary. Some consider this a valuable forage plant.

807. **Suæda californica** Wats. Seablite. *Chenopodiaceæ.*

This and other species are very rich in soda salts. In Spain, plants of this kind are cultivated for purposes of yielding soda by combustion.

808. **Symphytum officinale** L. Comfrey. *Convolvulaceæ.*

A well-known medicinal plant, widely cultivated, and in places escaped from cultivation.

809. **Syringa vulgaris** L. Lilac. *Oleaceæ.*

This and other species and varieties are extensively cultivated as ornamental plants. The leaves and fruit of the above species are said to have tonic and antiperiodic properties. Contains lilicin.

810. **Tamarindus indica** L. Tamarind. *Leguminosæ.*

A well-known fruit tree cultivated in the southern portion of the State. The fruits are mildly laxative, pleasantly refrigerant, made in cooling drinks for fevers. The fruit is also made into a confection with senna. The leaves furnish a yellow dye; the flowers and fruits are used as a mordant in dyeing. The powdered seeds mixed with glue form a very lasting wood cement. A decoction of the bark is given in asthma. The plant enjoys a wide popular use in India and other tropical countries.

811. **Tanacetum vulgare** L. Tansy. *Compositæ.*

A well-known introduced medicinal plant, used as an anthelmintic, tonic, in dropsy, etc., as a local application to ulcers, and criminally to produce abortion.

812. **Taraxacum taraxacum** Karst. Dandelion. *Compositæ.*

A cosmopolitan plant common in lawns every where where it is often a great pest which is exterminated with difficulty. Root used. Not poisonous. Leaves eaten as salad and greens. Well-known medicinally. (Proc. A. Ph. A. **47**: 305-307, 1899.)

813. **Taxus baccata** L. Yew. *Coniferæ.*

This and many other species are cultivated. The fruit is very poisonous. This poisonous principle occurs in the seed rather than in the fleshy pericarp.

Taxus brevifolia Nutt. (Pacific yew) has bright red berries which are edible, but the seeds are considered poisonous. The wood is very tough. (Contrib. U. S. Nat. Herb. **7**: 305.)

814. **Thalictrum species.** Meadow rue. *Ranunculaceæ.*

Many species seem to have medicinal or poisonous properties. Several have been examined and found to contain alkaloids (thalictrine), which is said to be a very powerful cardiac poison. The group requires further study.

815. **Thalictrum polycarpum** Wats. Meadow rue. *Ranunculaceæ.*

Perhaps contains thalictrine. The juice is applied externally to relieve headache. Decoction of roots used for colic and stomach-ache. Said to have the action and properties of strychnine. (Am. Journ. Pharm., page 336, 1881.)

816. **Thea (Camellia) japonica.** Japanese tea. *Ternstræmiaceæ.*

The leaves of this plant are much used as an adulterant of true tea. It does not contain any theine. (Proc. A. Ph. A. **27**: 209, 1879.)

817. **Thea (Camellia) sinensis** Link. Tea. *Ternstræmiaceæ.*

A shrub extensively cultivated in China, Japan and other countries. Has been introduced into the Southern States, with varying success. Can be grown in California (southern part).

818. **Therofon (Borkinia) elatum** Greene. Boykinia. *Saxifragaceæ.*

A delicately aromatic plant growing on wet, mossy banks. The Yuki Indians use it medicinally. (Contrib. U. S. Nat. Herb. **7**: 353.)

819. **Thuja occidentalis** L. Arbor vitæ. *Coniferæ.*

This and other specimens are cultivated in the State. A decoction is much used in the treatment of intermittent fevers, coughs, scurvy, rheumatism, as an emmenagogue, etc.

820. **Thymus vulgaris** L. Thyme. *Labiatæ.*

Thrives well in California, where it is a very common pot and garden herb. (See statements under lavender.) The oil, which is made from the leaves, is worth $1.50 per pound, the leaves are worth about thirty cents per pound.

821. **Thysanocarpus elegans** F. and M. Lace pod. *Cruciferæ.*

A leaf decoction is given in colic and stomach-ache. The seeds are eaten. (Contrib. U. S. Nat. Herb. **7**: 352.)

822. **Tilia americana** L. Linden. *Tiliaceæ.*

The saccharine exudation of the leaves resembles manna. The leaves of **T. argentia** (**T. tomentosa**) are used as a substitute for tea in Greece. (Proc. A. Ph. A. **31**: 145, 1883.)

823. **Torreya californica** Greene. California nutmeg. *Coniferæ.*

The seeds of this handsome tree resembles the nutmegs in form, size and markings. They are pungent and astringent, and have been used to adulterate true nutmeg. The green leaves have an odor resembling that of the tomato vine. The white fresh portion of the seeds has a bland taste, recalling that of the meat of the cocoanut. The roasted seeds are aromatic and taste something like peanuts. Eaten by Indians. (Contrib. U. S. Nat. Herb. **7**: 305.) (Journ. Am. Chem. Soc. **17**: 935–941, 1895.)

824. **Torula (Saccharomyces) cerevisæ** Turpin. Yeast.

This and related species and varieties constitute the omnipresent yeast organisms which convert sugar into alcohol and carbolic acid gas and several minor side products. These minute organisms are active in all alcoholic fermentations and are employed in making beer, root beer, bread, etc. The yeast cake of the grocer consists of a pure culture of the organisms, dried and pressed. Yeast fomentations and poultices are much used in swellings, boils, skin diseases, etc. There is an extended literature on the uses of the yeast organisms in commerce, in arts, in the household and in manufacture. (Proc. A. Ph. A. **9**: 91, 1860.)

825. **Trichostema lanatum** Benth. Romero. Woolly blue-curls. *Labiatæ.*

Found in southern California. Used as a cosmetic and as an application to old sores and to inflamed tissues. The Spaniards of California look upon this plant as a panacea for many ills.

826. **Trichostema lanceolatum** Gray. Vinegar weed. Tar weed. *Labiatæ.*

Occurs in western California. Very rank odor; poisonous; much used as a fish poison. A leaf infusion is used as an application to cure headaches. Also used as a wash in typhoid fever. (Contrib. U. S. Nat. Herb. **7**: 385.)

827. **Trifolium species.** Clovers. *Leguminosæ.*

There are many native and introduced species and varieties. The Indians use the flowers, seeds and leaves of several species as food. Medicinally these plants are reputed to have blood-purifying properties. The flower heads of red clover are used in the preparation of a quack cancer remedy. A more careful investigation of constituent and physiological action would be desirable. (Proc. A. Ph. A. **29**: 222, 1881.)

828. **Trigonella fœnumgræcum** L. Fenugreek. *Leguminosæ.*

A well-known medicinal plant which thrives well in the State of California. Never given internally; used in emollient applications, plasters, poultices, etc. Much used in veterinary practice.

829. **Triosteum perfoliatum** L. Horse gentian. Bastard ipecac. *Caprifoliaceæ.*

A native of the United States, which spreads very rapidly and is very easily cultivated. It has cathartic and diuretic properties, and in large doses is emetic.

830. **Trillium species.** Bethroot. *Liliaceæ.*

The roots are very persistently pungent and have decided emetic properties. Used medicinally by Indians.

831. **Trillium sessile giganteum.** *Liliaceæ.*

The tuberous roots are used medicinally by Indians. A decoction is said to have soporific properties. The crushed roots and leaves are used as a poultice for boils, etc. (Contrib. U. S. Nat. Herb. **7**: 329.)

832. **Turnera diffusa** Willd. Damiana. *Turneraceæ.*

This plant is found in the West Indies, Mexico and California. It yields the damiana of the drug market, but its action is considered unreliable. (Proc. A. Ph. A. **24**: 185, 1876.) (U. S. D.)

833. **Tussilago farfara** L. Coltsfoot. *Compositæ.*

An introduced plant which spreads very rapidly. The leaves and entire plant are used medicinally in lung troubles, coughs and colds. Used in scrofula. (Am. Journ. Pharm. 340, 1887.)

834. **Typha latifolia** L. Flag tule. Cat tail. *Typhaceæ.*

Indians use roots and base of the stems as food. The down is used for bedding. Medicinal uses uncertain.

835. **Ulex europæus** L. Furze. Gorze. *Leguminosæ.*

A popular European plant, cultivated as an ornamental plant in California. The seeds contain an alkaloid (ulexine) which is similar to cytisine; used in cardiac dropsy. (U. S. D.)

836. **Ulmus species.** Elm. *Ulmaceæ.*

Several native and introduced species occur in the State. They are handsome ornamental shade plants. The bark is very rich in mucilage, and forms a very popular demulcent medicine.

837. **Umbelliferous plants.**

Members of this group occur in great variety, wild growing as well as under cultivation. Among them may be mentioned fennel, caraway, cumin, dill, parsley, angelica, conium and others.

838. **Umbellularia californica** Nutt. California laurel. Mountain laurel. *Lauraceæ.*

A tree common throughout the State. Very variable in size. All parts of the plant are highly aromatic. The leaves, which contain a volatile oil, are used as a condiment in soups. The seeds also contain oil.

The oil is said to have anæsthetic properties and is reported to be useful in nervous disorders, in intestinal colic and in atonic dyspepsia. It has antiseptic properties. Also used as a flea exterminator. (U. of C. Agr. Exp. Sta. Rep., 173, 1897–1898.) (J. M. Stillman and E. O. O'Neil, Am. Chem. Journ. **4**: 206–211, 1882 and 1883.) (Proc. A. Ph. A. **31**: 109, 1883.)

839. **Urginea maritima** (L.) Baker. Squill. *Liliaceæ.*

A native perennial of Southern Europe which thrives remarkably well in California, the bulbs which are used medicinally developing to large size. Grows best on loose, sandy, quite rich hillsides. In order to make culture profitable it must be done on a large scale.

840. **Urtica urens** L. Small nettle. *Urticaceæ.*

An introduced weed, having the irritating properties of the nettle group. Other species are **U. lyalli californica** and **U. holosericea** Nutt. (Cal. Geog. Surv. Bot. **2**: 65.)

841. **Usnea lacunosa** Tuck. Beard moss. Lichenes.

A common lichen on oaks and other trees, used as bedding material. No longer used medicinally.

842. **Ustilago avenæ** Jen. Oat smut. Fungi.

Found on wild oats, cultivated oats and on other members of the grass family. Has the properties of corn smut. (U. S. D.)

843. **Vaccaria vulgaris** Hast. Medic. Cow herb. *Caryophyllaceæ.*

An introduced weed which is reported to have poisonous properties, although it appears to be used as a fodder plant. Requires further study.

844. **Vaccinium ovatum** Pursh. Huckleberry. *Ericaceæ.*

Found in the coast ranges of California. The berries are eaten. The leaves are astringent and have diuretic properties and are used as a substitute for **Uva ursi.**

845. **Valeriana officinalis** L. Valerian. Garden heliotrope. *Valerianaceæ.*

A well-known medicinal plant, readily cultivated every where. Flowers are very fragrant. The rhizomes and roots constitute the drug valerian, which is highly valued as a nerve sedative. Useful in hemicrania, hysteria, low fevers, etc.

A native species (**V. Sylvatica** Banks) found in the wet grounds of the Sierras has the strong scented roots of the official species. Indians are said to use the roots for food.

846. **Vanilla planifolia** Andrews. Vanilla. *Orchidaceæ.*

A native of Mexico and cultivated in the tropics. Has been successfully and profitably cultivated in temperate countries in hothouses.

Readily propagated from cuttings; requires very rich, moist soil and much care in order to develop a good quality of vanilla. Could not be grown in the open, even in the hottest parts of the state.

847. **Veratrum viride** Ait. American hellebore. *Melanthaceæ.*

A native of the United States which is very readily cultivated; requires rich, wet, shady ground. The rhizomes and roots are used in nervous excitement, typhoid fever, convulsions, chorea, mania, etc. The rhizomes are worth about twenty-five cents per pound. This plant is closely similar to if not identical with the European hellebore. **(V. album).**

Among the native species are **V. speciosum** Rydb. (False hellebore) **V. fimbriatum** Gray. These require further study as to constituents and physiological action.

848. **Verbascum thapsus** L. Mullein. Indian tobacco. *Scrophulariaceæ.*

A large weed, introduced from Europe. Used as an adulterant of and a substitute for tobacco. The ancient Greeks and Romans used the leaves as tallow wicks in funeral torches. An old-time remedy which is but little used at the present time. Given in colds, catarrhs, etc.

849. **Veronica officinalis** L. Speedwell. *Scrophulariaceæ.*

A cultivated European plant. It is considered diaphoretic, diuretic, expectorant and tonic. Used in pectoral and nephritic complaints, diseases of the skin, and as an application to wounds. Other species are similarly used.

850. **Viburnum species.** Haw. *Caprifoliaceæ.*

V. opulus (cramp bark) and **V. prunifolium** (black haw) are well-known medicinal trees, which occur under cultivation as ornamental plants.

851. **Viola species.** Violets. Pansies. *Violaceæ.*

V. tricolor and other species are common. Has emollient and laxative properties; used in pectoral, kidney and cutaneous diseases. Medicinal value doubtful.

852. **Vitis species** and varieties. Grapes. *Vitaceæ.*

Numerous varieties extensively cultivated in the State. There is an extensive literature on grape culture and wine manufacture.

853. **Wistaria chinensis** D. C. Wistaria. *Leguminosæ.*

This handsome ornamental climbing plant is very common throughout the State. It contains a crystalline poisonous glucocide (Wistarin). (Pharm. Journ. Trans. Oct. 1886.)

854. **Wyethia species.** *Compositæ.*

The species of California have been quite generally employed medicinally. The Indians use the seeds of several species. They require further study.

855. **Wyethia helenioides** Nutt. *Compositæ.*

Used as a domestic remedy in the treatment of colds, coughs, asthma, throat diseases, influenza, etc. Found in some drug stores, and is said to be prescribed by many California physicians, especially in the country towns. The roots are bitter and aromatic.

856. **Wyethia longicaulis** Gray. Sunflower. *Compositæ.*

The Indians look upon this as a very valuable medicinal plant. A decoction is used as an eye wash, to relieve headache and as an emetic. The dried and powdered roots are applied to ulcers and sores. Also used in rheumatic diseases (in the form of a poultice).

857. **Wyethia mollis** Gray. Indian wheat. *Compositæ.*

Abundant in the Sierras, in open woods. The Modoc Indians powder the seeds and make it into a mush. The mashed roots are used as a poultice for swellings by the Klamath Indians. Seeds and roots form an important food for the Indians.

858. **Xanthium species.** Cockle burs. *Compositæ.*

X. strumarium and **X. spinosum** are found within the State. They are noxious field and yard weeds. Used medicinally and in hair tonics. (Proc. A. Ph. A. **25**: 158–162, 1877.)

859. **Xanthoxylum fraxineum** L. Prickly ash. *Rutaceæ.*

A well-known medicinal tree, extensively cultivated as an ornamental plant. It has diaphoretic and anodyne properties, used in earache, toothache, and in rheumatic affections. Other species are cultivated and have enjoyed various medicinal uses. **X. piperitum** is regarded by the Chinese and Japanese as a valuable poison antitode.

860. **Yucca species.** Yucca. *Liliaceæ.*

Yuccas are cultivated in great variety and abundance. The tender flowering stems of some species are eaten. The Indians use the fiber for textile fabrics.

861. **Yucca mohavensis** Sarg. Amole. Wild date. Soap weed. Spanish bayonet. *Liliaceæ.*

Common in southern California. The stiff, dagger-like leaves are rich in fiber. The roots are used as a substitute for soap; said to be excellent for cleansing woolen goods and hair, to which it imparts a peculiar gloss. The fruit is said to resemble the banana, and is highly relished by the Indians. (U. S. Geog. Surv. Wheeler's Rep. **6**: 608.)

The Coahilla Indians eat the green fruits after roasting in a live coal fire. The raw, ripe fruits are somewhat astringent.

862. **Yucca whipplei** Torr. Spanish bayonet. *Liliaceæ.*

Flowering heads and stalks are roasted and eaten by the Coahilla Indians.

863. **Zamia integrifolia.** Cooutie root. *Cycadaceæ.*

The tuberous roots are rich in starch and constitute a valued article of diet.

864. **Zauschneria californica** Prest. *Onagraceæ.*

Used as a wash for cuts, sores, etc., especially for horses. The dried and powdered leaves are dusted over wounds and sores.

865. **Zea mays** L. Indian corn. *Gramineæ.*

Various field varieties of Indian corn are extensively cultivated in certain portions of the State, particularly sweet corn and popcorn. The only part used medicinally is the corn silk (greatly elongated styles and the stigmas) which has diuretic properties. Corn smut is a fungus which attacks the grain and which has properties similar to those of ergot.

866. **Zingiber officinalis** Rose. Ginger. *Scitamineaæ.*

This well-known spice plant may be grown commercially in the southern portions of the State. So far no one has made the attempt.

867. **Zygadenus species.** *Liliaceæ.*

Most members of this group are poisonous. They are widely distributed throughout the State, and annually cause considerable loss to cattlemen. The poisonous constituents require further study.

868. **Zygadenus elegans** Pursh. Alkali grass. *Liliaceæ.*

Very poisonous. The children of Indians frequently eat of the roots with fatal results.

869. **Zygadenus venenosus** Wats. Hogs potato. Death camas. *Liliaceæ.*

Found in the coast ranges from Monterey to British Columbia. All parts of the plant are poisonous, the bulbs in particular, but hogs have been observed to eat bulbs greedily and without apparent ill effects. Many heads of cattle are poisoned annually due to this plant. It acts as a powerful cerebral excitant. A poultice is applied externally to cure boils and rheumatism, and to alleviate the pain of bruises and sprains.

LIST OF COMMON NAMES IN ALPHABETICAL ORDER.

(Numbers refer to number sequence of the plants mentioned in I, Chapter IV.)

CALIFORNIA
STATE BOARD OF FORESTRY

BULLETIN No. 3

G. MORRIS HOMANS, State Forester

In coöperation with the Forest Service U. S. Department of Agriculture
HENRY S. GRAVES, Forester

WOOD-USING INDUSTRIES OF CALIFORNIA

BY
ANDREW K. ARMSTRONG
Engineer in Timber Tests

SACRAMENTO
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1912

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ACKNOWLEDGMENT.

The State of California and the Forest Service, United States Department of Agriculture, desire to thank the manufacturers who supplied the information embodied in this report, for their interest and coöperation. To the many who have promptly answered requests for information by mail, special acknowledgment is gratefully extended.

ILLUSTRATIONS.

CONTENTS.

THE WOOD-USING INDUSTRIES OF CALIFORNIA.*

INTRODUCTION.

This study of the wood-using industries of California was undertaken with two main objects in view:

1. The determination of the kinds and amounts of wood demanded by the industries manufacturing finished products, with particular reference to the amount produced in the State. This is intended to be an aid toward the adoption of a rational state forest policy, inasmuch as it shows what kinds of woods ought to be produced for home consumption.

2. The dissemination of information to the buyers and sellers of wood in the State.

Accordingly, this publication covers only the woods worked up into finished products within the borders of California, disregarding cross ties, lath, mining timbers, shingles, telegraph and telephone poles, rough lumber used in building operations and other structural work, and dressed lumber, manufactured elsewhere, which is used in the State without further preparation.

PRODUCTION OF LUMBER IN CALIFORNIA.

The last available returns of the United States Census, taken in 1910, show that in the production of lumber California ranked fourteenth in the list of forty-five states. Her 252 mills, in that year, produced 1,254,826,000 feet, board measure, or 3.1 per cent of the total cut of the United States. The composition of this total was as follows:

Species.	Number of mills.	Feet, board measure.	Value.
Redwood	67	543,493,000	$8,435,011
Western yellow pine	166	399,067,000	6,001,968
Douglas fir	85	103,169,000	1,419,605
Sugar pine	81	101,561,000	1,901,221
White fir	66	65,120,000	780,789
Incense cedar	59	20,846,000	266,829
Spruce	34	14,105,000	208,049
Oak	13	4,376,000	187,424
Hemlock	1	2,723,000	26,958
Ash	4	206,000	10,300
All others		160,000	

*The study upon which this report is based was undertaken by the State of California in coöperation with the Forest Service, the work being done under the direction of C. Stowell Smith, Assistant District Forester, Forest Service, United States Department of Agriculture. The statistics were compiled from data collected during a period of about one year, beginning August 1, 1910. By the terms of the coöperative agreement, the State is authorized to publish the findings of the investigation.

Further statistics may be fouud in the publication "Lumber, Lath and Shingles, 1910," compiled by the Department of Commerce and Labor, Bureau of the Census, in coöperation with the Forest Service, which is referred to both here and elsewhere in this publication.

KINDS OF WOODS USED.

California manufacturers report the use of 63 species of wood; and, in 1910, they consumed 662 million feet, or 35 per cent of the total cut of the State, in producing their commodities. Twelve species were logged wholly within the State, five partly within, and the remaining 46 wholly without. Of the latter, 24 were grown in foreign countries, including the Philippine and Hawaiian islands.

A list of these woods with their common and botanical names and other information, is given in Table I; while a short discussion upon the California grown species is given below.

REDWOOD.

Although redwood grows also in southwestern Oregon, the lumber is exclusively produced within the borders of California by 67 mills, whose average cut each for 1910 was about 8,112,000 feet board measure. In the latter year redwood ranked twelfth in the amount of lumber produced within the United States.

The redwood belt extends in a strip 500 miles long, from southern Oregon to central California. The strip is narrow, ranging in width from 10 to 30 miles. The commercial range has been estimated to cover 3,000 square miles, but the dense logging woods cover a much smaller area than that. The heaviest stand is near the center of the redwood region, in Humboldt County, though very dense forests exist both north and south of that point.

Redwood is one of the few soft woods that reproduce bountifully from sprouts. Few trees surpass it in that particular, and the vigor of the sprout growth is remarkable. A large portion of the forest is renewed in that way and the largest trees retain their ability to send up shoots from the stump.

The height that the tree attains commonly varies between 180 and 280 feet, and the diameter between 6 and 12 feet.

The wood is light, soft, brittle, and moderately strong; the grain usually fine, even and straight, though sometimes curly; the color light to dark red, with thin, almost white, sapwood. It splits and works easily, and polishes well; and is very durable in contact with the soil.

Its good qualities are well known abroad and in the east, as in 1907, over 47 million feet of it were shipped to Australia and other oriental ports, South and Central America, Mexico, the United States, Atlantic ports, Europe, Africa, and the Hawaiian Islands. This amount includes water shipments only, as other parts of the United States are supplied by rail from San Francisco and Los Angeles.

PLATE I. Interior of box factory, showing finished sides, tops and bottoms of boxes and crates.

A great deal of interesting information on redwood, the cedars, and cypress of the United States, may be found in Forest Service Bulletin No. 95, from which some of the information in this publication has been drawn.

WESTERN YELLOW PINE.

Western yellow pine grows in many of the western states, but in the production of lumber from this species California ranks first, with 25.5 per cent of the total cut of 1910. In the latter year this pine ranked sixth in the amount of lumber produced within the United States, being exceeded only by southern yellow pine, Douglas fir, oak, white pine, and hemlock.

The total stand of this species in the United Staes, in 1909, has been estimated at 275 billion feet board measure: of which over 30 billion feet of live saw timber grew on the National Forests within the State, and over 13 billion on private holdings. The species is gaining ground within its range.

It occurs in the northern part of California, extending southward in the coast ranges and Sierra to the southern cross ranges. In the northern Sierra it is found at its best development from 2,000 to 5,000 feet above sea level, and in the southern Sierra mainly at elevations of from 4,500 to 8,000 feet.

The height that the tree attains commonly varies between 100 and 200 feet, and the diameter between 3 and 7 feet.

The wood of the yellow pine varies greatly; in one locality alone four kinds of trees are distinguished. The wood is rather heavy as compared with that of sugar pine; is hard, fairly strong, sometimes brittle, and, usually, very resinous. The heartwood is reddish brown in color, and the sapwood (often very thick) yellowish white. The sapwood from certain trees is very light and non-resinous. When finished it has a satiny luster, and is equal to sugar pine for finishing purposes.

It is extensively used for building materials, such as scantling, beams, etc., railroad ties, and for the purposes mentioned later in this report. Small trees 6, 8, and 10 inches in diameter, are used for mine props, although the wood is not durable in an untreated condition.

Those desiring more detailed information upon this species and other pines grown in the United States, should secure Forest Service Bulletin No. 99.

DOUGLAS FIR.

Douglas fir, in 1910, ranked second in the amount of lumber produced in the United States. Although California ranks third in the production of Douglas fir lumber, only 2 per cent of the total amount produced is cut within the State.

This species (called also red fir, Douglas spruce, and Oregon pine) is the only one of the Sierra species that occurs also in the redwood

belt. It is found in the northern mountains of the State, and southward to the San Joaquin River; occurring in the coast ranges to the Santa Lucia Mountains. About 40 per cent of the Douglas fir cut in California comes from the redwood belt. Of the 24 billion feet of live saw timber of this species, growing in the National Forests within the State, 19 billion occur in the Coast ranges and the remainder in the Sierra.

The height that the tree attains commonly varies between 150 and 180 feet, and the diameter between 3 and 6 feet.

The wood is strong and hard, not very heavy, and fairly durable. The grain is straight, but varies from very fine to very coarse. Its great strength gives it a value for bridge timbers and heavy construction work, and its durability renders it useful for railroad ties, mine props, etc. Very little Douglas fir lumber is shipped, as most of it is consumed locally.

The Sierra Douglas fir is generally sound, but low in its content of clear lumber. The bole is comparatively short and tapering, and this, combined with an ill-pruned trunk, results in a high proportion of knotty lumber.

A full discussion of Douglas fir, covering its properties and uses, is to be found in Forest Service Bulletin No. 88.

SUGAR PINE.

Sugar pine, in 1910, ranked twenty-fifth in the amount of lumber produced in the United States. It is cut only in two states, Oregon and California; and in 1910 the latter produced 98.4 per cent of the total cut.

The range of the species in California extends from the northern to the southern border in the Sierra, and on the Coast ranges south to Lake County. The total stand of live saw timber on the National Forests within this region is about 14 billion feet, with about 7 billion additional in private holdings.

The height that the tree attains commonly varies between 160 and 180 feet, and the diameter between 4 and 7 feet.

The wood is very light, soft and not strong; the grain coarse and straight. It is generally very resinous, with large and conspicuous resin ducts. The heartwood is light brown in color, while the sapwood is yellowish white. When finished the wood has a satiny luster, that renders it excellent for interior finishing.

Sugar pine, in contact with the soil, shows moderately durable qualities, although this might prove less apparent in a climate not so dry as that of California. In brief, sugar pine closely resembles the eastern white pine in its physical characteristics. It is, however, generally considered more brittle than the latter; and its large, conspicuous resin ducts are somewhat of a detraction.

The wood is still used for making shakes (a split shingle 36 by 6 inches), as its straight grain, and the ease with which it splits, make it preferable for this purpose. Logs, too knotty to cut into uppers, but otherwise sound and straight grained, are sometimes turned into bolts for match work.

WHITE FIR.

White fir, in 1910, ranked twenty-third in the amount of lumber produced in the United States. It is cut in several states, but, in 1910, California ranked first in the production of lumber from this species, with 49.2 per cent of the total cut.

The species ranges from the northern boundary of the State southward, on the Sierra and on the higher peaks of the coast ranges, to the southern boundary, and eastward to Arizona and Nevada. It is lacking on the coast ranges from Lake County south to the San Rafael Mountains. Over 13 billion feet of it, in the form of live saw timber, are to be found in the National Forests within the State.

Its commercial distribution is entirely within the yellow pine-sugar pine belt. It is not attractive to the lumberman at high levels, except where it occurs mixed with timber trees of the better class. Although it is the most recent of the Sierra species to become merchantable, its standing on the market is insecure. The reason for this lies in the fact that its wood is similar to that of the pines, but far inferior, in most respects. However, it makes excellent paper pulp and is now used most extensively for this purpose. Hitherto, it has had no field outside of that covered by sugar and yellow pine, in which it could not compete.

The height that the tree attains commonly varies between 140 and 180 feet, and the diameter between 3 and 5 feet.

The wood is light, rather coarse grained, brittle, soft, easily worked, warps considerably, splits easily, holds nails fairly well, decays rapidly in contact with the soil; and is often wind shaken. It is odorless and tasteless, and therefore useful for boxes, woodenware, etc.; it has also had some use as door stock, in which it proves fairly serviceable.

Its principal future use, however, may be in the manufacture of paper. It is soft, white, and has a long, strong fiber, three qualities required of a good paper wood. It is now being utilized for this purpose, as, in 1910, 30,845 cords were converted into pulp by means of the mechanical and sulphite processes. This amount, 0.8 per cent of the total pulp wood consumed in the United States, was prepared in Oregon and California.

INCENSE CEDAR.

California is the only state in which incense cedar is cut. The species occurs in the Sierra and coast ranges. Its total stand of live saw timber in the National Forests within the State is about three and three quarter billion feet, forming 1 to 2 per cent of the yellow pine forest in the

Trinity Mountains, 2 to 7 per cent of that in the northern Sierra, and as much as 10 to 20 per cent of that in the southern portion of its range.

The height that the tree attains commonly varies between 75 and 110 feet, and the diameter between 3 and 5 feet.

The wood is very light, soft, brittle, and not strong; the grain fine, straight and even; and the sapwood nearly white. It is easily worked on account of its softness and even texture; and the heartwood is very durable in contact with the soil. It is chiefly used for fencing and poles, and somewhat for sills, etc. Formerly it was not shipped to any extent, but, recently, a heavy demand has arisen for it, in the shape of pencil slats, in the east.

This species is not highly considered by Sierra lumbermen. It has a rapid taper; and the large trees are almost invariably unsound, as cavities filled with brittle, brownish material occur throughout the heartwood. The wood between the cavities is usually sound; and except in so far as the unsoundness affects the strength or appearance of the lumber, it is not objectionable, as this rot ceases after the tree is cut.

The chief future use of the wood will probably be found in the manufacture of the cheaper grades of lead pencils. Here its softness, straight grain, and whittling and staining qualities make it a valuable substitute for the rapidly disappearing southern red cedar. The sound wood between the rotten cavities can be converted into pencil slats with little waste.

BLACK COTTONWOOD.

This species is abundant along streams in the Sierra and southern cross ranges, but much less frequent in the coast mountains. It is generally found between 3,000 and 6,000 feet above sea level.

Under the best conditions for its growth it attains a height between 80 and 125 feet, and a diameter between 3 and 4 feet; but over much of its range it is under 50 feet in height, and the diameter is from 12 to 18 inches.

The wood is soft and straight grained; in dense stands it is fine grained. The color is a dull, grayish brown. Large logs, obtainable from the best grown trees, give clear, wide lumber.

RED FIR.

This species occurs in the northern part of the State, extending southward in the coast ranges to Lake County. It is found throughout the Sierra, but chiefly on the west side, forming 9 billion feet of the total stand of live saw timber in the National Forests within the State.

The tree, in the region of its best development, forms a clear, cylindrical bole, clear from 40 to 60 feet, and reaching a maximum diameter of 5 feet. It commonly attains a height between 125 and 175 feet, and a diameter between 2½ and 4 feet.

The wood is one of the heavy fir woods, soft but firm, rather brittle, straight and usually fine grained. It is considerably more durable, in

an unprotected state, than the wood of any of the other native firs. The color is yellowish brown, with a reddish tinge. It has good working qualities, which should render it useful for a number of purposes to which the pine is put.

LAWSON CYPRESS.

Oregon and California produce all the Lawson cypress lumber that is utilized; but, in 1910, Oregon produced 27½ million feet, board measure, whereas the amount cut in California was too small to report.

This species (known also as white cedar and Port Orford cedar) ranges from the northern border of the State southward within the fog belt, to Mad River, Humboldt County, extending from within a few miles of the sea to points from 10 to 40 miles inland; ascending the seaward slopes of the Coast Range to 5,000 feet elevation. It is not abundant in California, and but 515 million feet of live saw timber are found in the National Forests within the State.

The height that the tree attains commonly varies between 135 and 175 feet, and the diameter between 3 and 6 feet.

The wood is light and moderately strong; the grain fine, even and compact; and the color light yellow or almost white, though occasionally reddish, the thin sapwood being hardly distinguishable. It is abundant in odoriferous oil, distasteful to insects and vermin; and is susceptible of a beautiful polish, as well as easily worked and durable.

YUCCA.

This species ranges from the southern base of the San Bernardino Mountains to the coast, and northward to Monterey, sometimes ascending mountain slopes to 4,000 feet elevation.

The trees are usually under 10 or 12 feet in height, and seldom over 10 inches in diameter.

The wood, pale yellowish white in color, is rather soft and light when dry, but tough because of its strong fibers. The manufacturers of Yucca products will accept no tree under ten inches in diameter; and, after turning off the veneer, they leave a core five inches thick.

BLUE GUM.

This species was introduced from Australia in 1856. It reaches its greatest development along the coast, and in river bottoms, where foggy days are common and the annual rainfall at least 15 inches. When grown under favorable conditions it ranks among the fastest growing trees in the world.

The wood is yellowish white and easily polished. The fibers are much interlaced, making it tough and difficult to split. The grain is often irregular, which makes the wood liable to chip under the planer, but gives it a very pleasing effect when smoothly finished.

So far it has been used successfully only where specially selected trees are sawed, and the lumber carefully air-seasoned for long periods.

It is impossible, at present, to take the run of a eucalyptus grove and turn it into merchantable lumber without making prohibitive the cost of the material obtained. This is chiefly due to the excessive checking and warping, and the great and uneven shrinkage when drying. Under these conditions it can compete with the Australian blue gum neither in price nor quality, should any great demand for eucalyptus lumber arise. Blue gum is not durable in contact with the soil, and is a very poor substitute for Douglas fir piling in waters where the marine wood-borers are active. A full discussion of the California eucalyptus is given in Forest Service Circular No. 179.

SYCAMORE.

This species ranges from the lower Sacramento River, through the interior valleys and coast ranges, to Lower California. The height that the tree attains commonly varies between 40 and 60 feet, and the diameter between 18 and 30 inches. The trunks are often short, giving off several trunk-like branches. The wood is pale brown, tinged with red, cross grained and very difficult to split, but it is attractive and suitable for interior finish and cabinet work.

PEPPERWOOD OR LAUREL.

This species occurs in the coast regions of the State; and also in the Sierra from the head of the Sacramento Valley to the southern border; but its commercial range is limited to the northern coast ranges. The largest single merchantable stand contains about five million feet, board measure.

The height that the tree attains commonly varies between 60 and 80 feet, and the diameter between 2½ and 3½ feet. In the dense forest it has a clean, straight trunk from 30 to 40 feet long. The wood is moderately heavy when dry, hard, very firm, and fine grained. It is a rich yellowish brown, often mottled, and the sapwood is very thick. It is a valuable cabinet and finishing wood, as it has a beautiful grain when polished.

MOUNTAIN MAHOGANY.

This species is found in the Sierra Nevada Mountains and south to the San Jacinto Mountains. The tree is usually shrubby, and under 10 feet in height, though occasionally 15 to 25 feet high, and 4 to 8 inches in diameter. The wood is very dense, fine grained, and exceedingly heavy. It checks and warps badly in drying, after which it is very hard. Freshly cut wood has a distinct mahogany red color, which browns upon exposure.

TANBARK OAK.

The tanbark oak ranges from the northern border of the State through the coast ranges to Santa Barbara, and from the Humboldt region eastward, by the way of the Shasta Mountains, to the Sierra Nevada, following the latter range as far south as El Dorado County.

It attains its commercial development in Mendocino and Humboldt counties; but never forms a pure stand, occurring in association with redwood, Douglas fir, madrona, Garry or Oregon oak, California black oak, and western chinquapin.

The tree generally grows from 50 to 75 feet high, and from 1 to 2 feet in diameter. Trees from 80 to 85 feet, or somewhat taller, and from 3 to 4 feet in diameter, sometimes occur. It grows as a shrub on the high mountains. The wood is dense and fine grained, very hard, and somewhat brittle, the color light brown, faintly tinged with red.

From 1901 to 1907, 185,000 cords of tanbark, at 2,400 pounds to the cord, were produced in California.

Some few attempts have been made to utilize the wood. Flooring was manufactured for a time, and a few thousand feet were converted into furniture, cabinet work, and showcases. The principal difficulty encountered with tanbark oak is the fact that it checks excessively and is liable to decay before it can be manufactured into lumber. This is due largely to the custom of felling the trees in the spring and early summer, at which time the bark can be removed without difficulty. It is well known that the proper time to cut hardwoods for successful handling is in the fall and winter.

It has proved too porous for tight cooperage stock, resembling red oak in this respect; but from experiments that have been made upon it, it appears to be a good wood for wagon rims and auto-top bows. Outside the few uses to which it has been put, some of it is sold for fuel; but the greater portion is allowed to rot in the woods after the bark has been peeled.

Forest Service Bulletin No. 75 gives a full and complete account of the properties and uses of tanbark oak.

THE CALIFORNIA OAKS.

There is at present scarcely any use except as fuel for the various species of California oaks. The old timber is generally too brittle and weak for purposes where strength is required; and the large percentage of rotten trunks in an old stand makes the wood practically useless for lumber purposes. It seems probable, however, that the young growth under 12 inches in diameter possesses sufficient strength and toughness to render it valuable for tool handles and vehicle and implement stock. In fact, the young growth of some of the species is used for these purposes, but only locally. However, one of these oaks, the Garry or Oregon oak, is utilized extensively in Oregon, where it enters into the boat-building, cooperage, fixture, furniture, handle, planing-mill, saddle, and vehicle industries, about two million feet being used. Lumber of this species is shipped into California, although a great deal grows in the northern portion of this State.

MADRONA.

This species grows in the northern cross ranges of the State, in the coast ranges southward to the San Gabriel Mountains, and southward in the Sierra to the head of the Tuolumne River, ranging from sea level to 3,000 feet elevation. Very often the tree grows from 60 to 80 feet high, with a straight, clean trunk 2 to 3 feet in diameter. Frequently, however, it is low and shrubby, or from 25 to 40 feet high, with a crooked or leaning trunk 8 to 15 inches through.

The wood is pale reddish brown, with a thin whitish sapwood; rather heavy, dense, fine grained; very hard when dry, but cuts like softwood while green; and it is usually quite brittle. It makes a handsome flooring, for which small quantities of it are now being used.

THE FOREIGN WOODS.

Mahogany, Japanese oak, and Spanish cedar were the principal foreign woods used in California in 1910.

The name mahogany covers a number of different species, only one of which is the true mahogany. In this publication the name American mahogany designates tropical woods, grown in North and South America, which are called mahogany by the trade. That a large proportion of the lumber thus designated is not the true mahogany, may be gauged from the fact that while the cut of the latter is about eighteen million feet, many times that amount of lumber is sold under that name in the markets of the world. In 1908 the imports of mahogany into the United States amounted to 41,678,000 feet, of which 65.5 per cent came from North America, 18.1 per cent from Europe, 13.8 per cent from Africa, 2.2 per cent from South America, and .4 per cent from Asia. Most of that imported from North America was grown in Mexico, some in British Honduras, some in Cuba, and a small amount in Nicaragua and Honduras. The greater portion of that from South America was the so-called Colombian mahogany, which is not a true mahogany; a little came from Peru, where some of the true mahogany is found. Although no mahogany is produced in Europe, much of it is shipped via European ports (principally those of Great Britain). It is a fact worth noting that the finer qualities of logs come through the English markets, although it is probable that none of the lumber from Great Britain reaches the Pacific coast. An interesting discussion relative to the so-called Colombian mahogany may be found in Forest Service Circular No. 185.

Japanese oak is a comparatively recent arrival in California. It seems to take the place of eastern white oak in places where great strength is not required. Some of it, however, is now being used for railroad ties in this country.

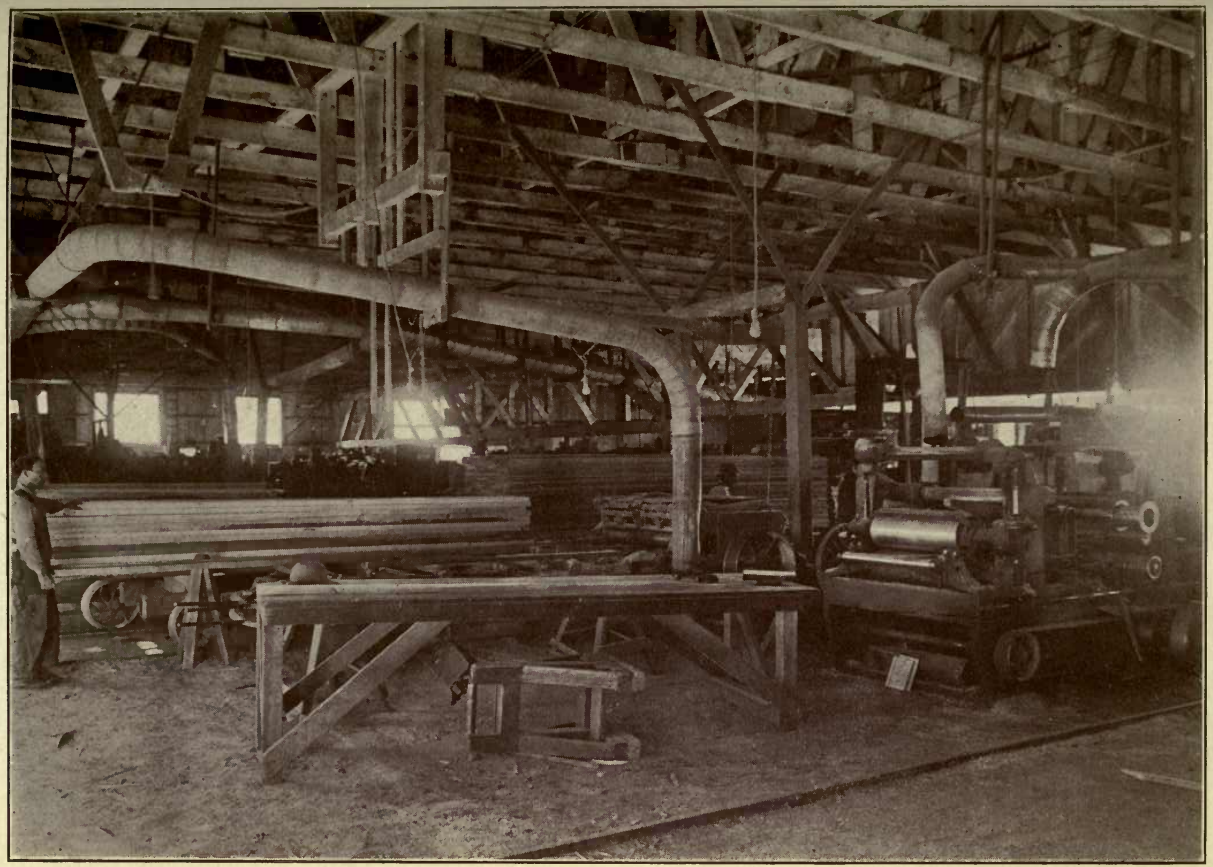

PLATE II. Interior of factory, showing machines used in finishing lumber for boxes and crates.

INDUSTRIES.

Six hundred separate operators manufacture finished products, although all of them do not consider wood as their principal raw material.

Sixty-six per cent of the timber that they use is grown in California; 28 per cent in Oregon and Washington; 5 per cent in the remainder of the United States; and 1 per cent in foreign countries, including the Philippine and Hawaiian islands. Sixty-four per cent of the western yellow pine lumber produced in the State is used in the wood-using industries, together with 20 per cent of the redwood, 18 per cent of the Douglas fir, 32 per cent of the sugar pine, 21 per cent of the white fir, and 13 per cent of the incense cedar lumber. Western yellow pine ranks first in amount and value; redwood second in amount and third in value, while Douglas fir stands third in amount and ranks second in value.

Among the industries specified, Douglas fir ranks first in ten; redwood in nine; plain white oak, eastern maple, and Sitka spruce in two; and western yellow pine, black cottonwood, Lawson cypress, Spanish cedar, hickory, red gum, yucca, Oregon maple and cherry, each first in one. Thirty-four industries in all are tabulated.

The following table gives a comparison between the wood-using industries of the three Pacific coast states, California, Washington and Oregon:

State.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in State, per cent.	Grown out of the State, per cent.
	Feet, board measure.	Per cent.	F. o. b. factory.			
California	661,806,478	51.0	$23 74	$15,712,494	66.0	34.0
Washington	337,555,125	26.1	19 48	6,576,413	99.0	1.0
Oregon	296,791,900	22.9	15 87	4,708,731	99.2	0.8
Total	1,296,153,503	100.0	----------	$26,997,638		

In the tables embodied in this report, a particular manufacture is not considered an industry unless three or more factories are engaged in it, but the data go into the miscellaneous table. This is done to preserve the confidential nature in which the information was submitted.

Where veneer enters into the industry, it has been reduced to the basis of inch boards, and totaled with the lumber. In most cases, under the industry, the actual number of square feet of veneering used is given. It should be mentioned, however, that in 1910 California consumed 183,000 feet (log scale) of wood in the manufacture of veneers.

Where the percentage of manufactured lumber of any species used in an industry is not given, it means that the amount is less than 0.1 per cent of the total.

TABLE 1. SUMMARY OF CONSUMPTION BY SPECIES.

Kinds of wood.		Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, per cent.	Grown out of California, per cent.
Common name.	Botanical name.	Feet, board measure.	Per cent.	F. o. b. factory.			
Western yellow pine	Pinus ponderosa	266,209,631	40.2	$16 44	$4,376,008	96.2	3.8
Redwood	Sequoia sempervirens	109,228,291	16.5	24 58	2,685,267	100.0	0.0
Douglas fir	Pseudotsuga taxifolia	108,720,363	16.4	27 73	3,015,290	17.1	82.9
Sitka spruce	Picea sitchensis	67,131,375	10.1	17 42	1,169,288	0.0	100.0
Sugar pine	Pinus lambertiana	34,946,956	5.3	21 52	752,002	94.2	5.8
White oak (plain)	Quercus alba	24,115,864	3.8	76 15	1,836,377	0.0	100.0
White fir	Abies concolor	13,725,830	2.0	11 49	157,676	100.0	0.0
Western hemlock	Tsuga heterophylla	9,625,330	1.4	15 35	147,718	0.0	100.0
Black cottonwood	Populus trichocarpa	5,011,175	0.8	23 51	117,833	12.9	87.1
Red fir	Abies magnifica	4,604,830	0.7	11 01	50,729	100.0	0.0
Lawson cypress	Chamæcyparis lawsoniana	3,082,447	0.5	51 30	158,150	3.2	96.8
Incense cedar	Libocedrus decurrens	2,757,500	0.4	18 11	50,042	100.0	0.0
Oregon oak	Quercus garryana	2,005,000	0.3	48 13	96,500	0.0	100.0
White oak (quarter-sawed)	Quercus alba	1,508,227	0.2	89 21	134,546	0.0	100.0
Birch	Betula sp.	1,493,873	0.2	79 85	119,279	0.0	100.0
American mahogany	Swietenia mahagoni and Cariniana pyriformis	1,136,537	0.2	178 53	202,908	0.0	100.0
Japanese oak (plain)	Quercus dentata	1,041,950	0.2	91 09	94,917	0.0	100.0
Eastern maple	Acer sp.	1,017,622	0.2	80 67	82,088	0.0	100.0
Eastern ash	Fraxinus sp.	701,698	0.1	93 47	65,587	0.0	100.0
Hickory	Hicoria	619,401	0.0	101 23	66,352	0.0	100.0
Yellow poplar	Liriodendron tulipifera	565,158	0.0	98 39	55,610	0.0	100.0
Japanese oak (quarter-sawed)	Quercus dentata	344,665	0.0	111 46	38,415	0.0	100.0
Genisaro		250,010	0.0	124 98	31,246	0.0	100.0
Red gum	Liquidambar styraciflua	237,258	0.0	79 53	18,869	0.0	100.0
Yucca	Yucca mohavensis	168,800	0.0	62 56	10,560	100.0	0.0
Spanish cedar	Cedrela odorata	162,073	0.0	154 53	25,045	0.0	100.0
Elm	Ulmus sp.	160,040	0.0	50 85	8,138	0.0	100.0
Beech	Fagus atropunicea	160,000	0.0	100 00	16,000	0.0	100.0
Australian ironbark	Eucalyptus leucoxylon	152,000	0.0	110 98	16,869	0.0	100.0
Black walnut	Juglans nigra	112,916	0.0	157 69	17,806	0.0	100.0
Red oak	Quercus rubra	93,500	0.0	58 85	5,503	0.0	100.0
Juana costa	Entevolobium cyclocarpum	90,500	0.0	114 36	10,350	0.0	100.0
Teak	Tectona grandis	89,795	0.0	164 62	14,782	0.0	100.0
California blue gum	Eucalyptus globulus	55,350	0.0	88 06	4,874	100.0	0.0
Cottonwood (eastern)	Populus deltoides	49,225	0.0	96 48	4,749	0.0	100.0
Locust	Robinia pseudacacia	45,000	0.0	40 00	1,800	0.0	100.0
Prima vera	Tubebuia donnellsmithii	36,808	0.0	147 55	5,431	0.0	100.0

Philippine mahogany	Pterocarpus indicus	33,792	0.0	151 51	5,120	0.0	100.0
African mahogany	Khaya senegalensis	33,620	0.0	273 75	9,190	0.0	100.0
Basswood	Tilia americana	27,995	0.0	63 44	1,776	0.0	100.0
Oregon maple	Acer macrophyllum	20,500	0.0	58 83	1,206	0.0	100.0
Siberian ash	Fraxinus excelsa	18,000	0.0	82 78	1,490	0.0	100.0
Sycamore	Platanus racemosa	17,000	0.0	12 47	212	100.0	0.0
Oregon ash	Fraxinus oregona	14,600	0.0	44 93	656	0.0	100.0
Australian blue gum	Eucalyptus globulus	13,000	0.0	105 85	1,376	0.0	100.0
Red bean	Dysoxylon muellerci	10,000	0.0	120 00	1,200	0.0	100.0
Orange	Citrus sp.	8,450	0.0	90 06	761	100.0	0.0
Circassian walnut	Juglans caucasica	8,000	0.0	185 00	1,480	0.0	100.0
Cherry	Prunus serotina	7,575	0.0	149 04	1,129	0.0	100.0
Australian hickory		6,500	0.0	105 08	683	0.0	100.0
Koa	Acacia Koa	6,125	0.0	159 18	975	0.0	100.0
English willow	Salix alba	5,470	0.0	375 00	2,051	0.0	100.0
Pepperwood	Umbellularia californica	5,200	0.0	75 00	390	100.0	0.0
Manzanita	Arctostaphylos glauca	2,000	0.0	27 50	55	100.0	0.0
Mountain mahogany	Cercocarpus parvifolius	1,000	0.0	15 00	15	100.0	0.0
Mountain lilac	Ceanothus thyrsiflorus	1,000	0.0	15 00	15	100.0	0.0
Chestnut	Castanea dentata	1,000	0.0	45 00	45	0.0	100.0
Australian mahogany	Eucalyptus resinifera	1,000	0.0	135 00	135	0.0	100.0
Camphorwood	Dryobalanops aromatica	1,000	0.0	225 00	225	0.0	100.0
Osage orange	Toxylon pomiferum	50	0.0	100 00	5	0.0	100.0
Boxwood sawdust	Buxus sempervirens	175,000	pounds	6 57	1,150	0.0	100.0
Rosewood	Pterocarpa erinoceus	20,050	pounds		501	0.0	100.0
Japanese willow		12,000	pounds		1,140	0.0	100.0
Rattan	Calamus ciliaris	10,000	pounds		800	0.0	100.0
Reed	Arundo sp.	9,000	pounds		1,980	0.0	100.0
Lignum vitæ	Lignum vitæ	1,000	pounds		40	0.0	100.0
Ebony	Diospyros ebenum	500	pounds		250	0.0	100.0
Broom corn		113	tons		11,840	73.4	26.6
Total		661,699,875			$15,712,494		

TABLE 2. SUMMARY OF CONSUMPTION BY INDUSTRIES.

Industries.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, per cent.	Grown out of California, per cent.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Boxes and crates	309,406,285	46.8	$15 63	$4,835,280	78.1	21.9
Sash, doors, etc.	131,519,498	19.9	22 78	2,995,841	73.6	26.4
Planing mill products	98,488,422	14.9	31 20	3,073,410	59.8	40.2
Cooperage	36,247,825	5.5	49 12	1,780,485	17.2	82.8
Miscellaneous	19,109,927	2.9	11 20	213,984	59.2	40.8
Ships and boats	18,281,570	2.8	39 84	728,436	12.0	88.0
Tanks	17,209,311	2.6	38 08	655,150	74.8	25.2
Furniture	7,345,435	1.1	34 75	255,254	25.5	74.5
Woodenware and novelties	6,540,890	1.0	30 02	196,333	25.6	74.4
Fixtures	5,078,627	0.8	66 11	335,751	26.4	73.6
Vehicles	3,133,495	0.5	85 74	268,667	4.6	95.4
Caskets and coffins	2,598,000	0.4	22 00	57,152	66.3	33.7
Trunks and valises	2,017,885	0.3	27 08	54,645	18.0	82.0
Agricultural implements	1,075,900	0.2	36 86	39,656	30.7	69.3
Patterns	690,290	0.1	51 97	35,873	86.2	13.8
Car construction	547,000	----	39 66	21,693	31.1	68.9
Frames and moulding	480,294	----	90 39	43,412	10.5	89.5
Elevators	434,000	----	35 06	15,215	14.0	86.0
Refrigerators, etc.	271,200	----	30 49	8,268	2.2	97.8
Instruments, musical	252,750	----	59 35	15,001	63.7	36.3
Machine parts	250,991	----	43 77	10,986	27.3	72.7
Boxes, tobacco	213,500	----	123 40	26,345	7.5	92.5
Signs	155,000	----	30 09	4,664	86.5	13.5
Dairymen's supplies, etc.	130,000	----	24 81	3,225	47.0	53.0
Sporting goods	65,800	----	76 89	5,060	0.0	100.0
Pumps	49,980	----	22 39	1,119	0.0	100.0
Artificial limbs	45,270	----	103 63	4,691	87.9	12.1
Machinery, electrical	39,050	----	78 00	3,046	0.0	100.0
Instruments, scientific	32,407	----	73 04	2,367	17.6	82.4
Bungs and faucets	27,622	----	53 19	1,469	11.6	88.4
Wood carvings	21,500	----	59 77	1,285	72.1	27.9
Chairs	18,750	----	128 93	2,418	0.0	100.0
Brushes	12,885	----	83 15	1,071	26.7	73.3
Laundry appliances	8,544	----	55 83	477	0.0	100.0
Printing material	6,575	----	153 88	1,012	0.0	100.0
Miscellaneous, given in lbs.	----	----	----	13,753	----	----
Total	661,806,478	100.0	$23 74	$15,712,494	----	----

Total grown in California	438,796,073
Total grown out of California	223,010,405

AGRICULTURAL IMPLEMENTS.

Douglas fir (red fir, Washington fir, Oregon pine). California; Washington; Oregon.

Of total amount of fir manufactured 0.7 per cent used in this industry.

Agricultural implements; frames of fruit-handling machinery; windmill frames.

Strong; cheap; durable against wear.

Rough, all grades, clear predominating, 1 to 8 inches thick.

By-products: strap handles.

Western yellow pine (white pine, mountain pine). California.

Of total amount of yellow pine manufactured less than 0.1 per cent used in this industry.

Harvester construction; raisin mills; siding for agricultural implements and fruit-handling machinery; truck tops.

Soft; light; easily worked.

Rough, clear, 1 to 2 inches thick.

By-products: rollers, runs, screen-frames, strap handles.

Eastern maple (hard maple, rock maple). New England; Lake States; Middle West; South.

Of total amount of maple manufactured 5.9 per cent used in this industry.

Fruit rolls; harvesters; main boxes of hay presses; rollers and runs on agricultural implements.

Strong; tough; bores well; resists splitting; wears smoothly.

Rough, first and second grades, 1 to 4 inches thick.

By-products: rollers, runs, screen frames, strap handles.

White oak, plain (eastern oak). Middle West; South.

Of total amount of oak manufactured 0.1 per cent used in this industry.

Agricultural implements; frames for plows; harrows; harvesters; sills for hay presses.

Strong, durable against decay.

Frames for plows; rough, clear, $\frac{3}{4}$ inch.

Harrow: rough, clear, 2 to 3 inches.

Harvesters: rough, clear, 1 to 2 inches.

Sills: rough, clear, 6 by 8, or 8 by 8.

Hickory. South; Middle West.

Of total amount of hickory manufactured 4.0 per cent used in this industry.

Almond hullers; eveners on hay derricks; harvesters; hitches on agricultural implements; pitmans and springs on fruit-handling machinery.

Hard, strong, tough.

Rough, clear, $1\frac{1}{2}$ to 4 inches thick.

By-products: rollers, runs, screen frames.

White ash. Middle West; South.

Of total amount of ash manufactured 2.8 per cent used in this industry.

Harvesters; screen frames.

Strong, wears well.

Rough, first and second grade, 1 to 4 inches thick.

By-products: rollers, runs, screen frames.

Sitka spruce (spruce). Oregon; Washington.

Of total amount of spruce manufactured less than 0.1 per cent used in this industry.

Fruit racks; seeder construction.

Tough, easily worked.

Fruit racks: rough, clear, 6 inches thick.

Seeders: rough, common to clear, 1 inch thick.

Redwood. California.

Of total amount of redwood manufactured less than 0.1 per cent used in this industry.

Bottoms and sides of fruit-handling machinery; windmills.

Light, easily worked, durable against decay.

Fruit-handling machinery: rough, clear, 1 inch thick.

Windmills: rough, common, 2 inches thick.

TABLE 3. AGRICULTURAL IMPLEMENTS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Douglas fir	717,250	66.7	$28 80	$20,657	115,000	602,250
Western yellow pine	215,000	20.0	39 42	8,475	215,000	
Eastern maple	60,150	5.6	62 54	3,762		60,150
White oak (plain)	29,000	2.7	96 05	2,785		29,000
Hickory	25,000	2.2	50 00	1,250		25,000
White ash	19,500	1.8	116 03	2,263		19,500
Sitka spruce	9,500	0.9	46 84	445		9,500
Redwood	500	0.1	38 00	19	500	
Total	1,075,900	100.0	$36 86	$39,656	330,500	745,400

ARTIFICIAL LIMBS AND SUPPORTS.

Yucca. California.

Of total amount of yucca manufactured 23.6 per cent used in this industry.

Corsets, jackets, surgeon's splints.

Clear, light, fibrous, tough, white, pliable when wet, easily molded to form.

Logs, or veneer, 1-16, 1-12, $\frac{1}{8}$, $\frac{1}{6}$, and $\frac{1}{4}$ inch thick.

English willow. Illinois.

Of total amount English willow manufactured 100 per cent used in this industry.

Artificial limbs.

Lightness, coupled with strength, easily worked.

Rough, specially prepared, seasoned five years, ends painted, 5 by 5, 6 by 6, 8 by 8, up to 10 inches thick.

Checked sticks not accepted.

TABLE 4. ARTIFICIAL LIMBS AND SUPPORTS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Yucca	39,800	87.9	$66 33	$2,640	39,800	
English willow	5,470	12.1	375 00	2,051		5,470
Total	45,270	100.0	$103 63	$4,691	39,800	5,470

BOXES AND CRATES, PACKING.

Western yellow pine (white pine, mountain pine). California; Nevada; Arizona.

Of total yellow pine manufactured 84.6 per cent used in this industry.

Beer cases; box shooks; fruit and shipping boxes.

Light, soft, easily worked, nails well in thin pieces, makes clean, neat appearing box, does not shrink.

Some logs, mostly rough lumber, box grades, 1 to 2 inches thick.

By-products: balusters, brackets, ceiling cores, corner blocks, cresting, piling sticks, stakes; edgings converted into core stock for veneered doors; thin strips into moldings; sawdust used for refrigeration and sweeping purposes.

NOTE.—One manufacturer estimates that a carload of orange-box shooks contains 12,000 pieces $\frac{5}{8}$ by $\frac{7}{8}$ by $11\frac{1}{2}$ inches.

Sitka spruce. Oregon; Washington.

Of total spruce manufactured 69.5 per cent used in this industry.

Berry chests; butter, cheese, cracker, egg and fruit boxes; cannery and packing cases.

Light, white, strong, tough, odorless, tasteless, holds nails well.

Bolts, lumber, veneer. Rough, box, common and merchantable lumber, $\frac{3}{8}$ to $1\frac{1}{2}$ inches thick. Veneer, 2,100,000 feet of 1-24 and 1-20 inch thick used.

By-products: cleats for box covers, crate material, tent stakes, washboard frames; sawdust converted into floor polish and butcher and meat shop floor covering.

Sugar pine. California; Oregon.

Of total amount of sugar pine manufactured 58.8 per cent used in this industry.

Boxes: box shooks.

Light, soft, cheap, holds nails without splitting; good appearance.

Logs: rough, box, 1 to 2 inches thick.

By-products: small boxes.

Western hemlock. Oregon; Washington.

Of total amount of hemlock manufactured 59.2 per cent used in this industry.

Box shooks; butter, cracker, fruit boxes, etc., crates.

Good grain; strong, tough.

Rough, common or box, 1 to $1\frac{1}{2}$ inches thick.

White fir. California.

Of total amount of white fir manufactured 22.1 per cent used in this industry.

Boxes, box shooks.

Durable, cheap, easily available in some localities; nails well.

Rough, box, 1 to $1\frac{1}{2}$ inches thick.

NOTE.—In some cases the knots are cut out and the holes plugged.

Redwood. California.

Of total amount of redwood manufactured 2.2 per cent used in this industry.

Fruit, shelf and shipping boxes; fruit crates.

Soft, easily worked, does not split when nailed.

Fruit boxes and crates; bolts, shelf boxes; surfaced on two sides; clear, $\frac{1}{4}$ and $\frac{3}{8}$ inches thick; covered with cloth or paper, and, in some cases, the lids and bottoms are made of pasteboard.

Heavy shipping boxes: rough, common, 1, $1\frac{1}{4}$ and $1\frac{1}{2}$ inches thick.

Light shipping boxes: for shipping stage effects and decorations; surfaced, common $\frac{1}{4}$ and $\frac{3}{8}$ inches thick.

By-products: balusters, brackets, ceiling cores, corner blocks, stakes.

Douglas fir (Oregon pine). California; Oregon; Washington.

Of total amount of Douglas fir manufactured 2.2 per cent used in this industry.

Boxes.

Cheap, easily worked.

Rough, common, $\frac{1}{4}$ to 1 inch thick.

NOTE.—In some cases the knots are cut out and the holes plugged.

Black cottonwood. Oregon; Washington.

Of total amount of black cottonwood manufactured 44.2 per cent used in this industry.

Boxes.

Strong, tough.

Rough, common, 1 to $1\frac{1}{2}$ inches thick.

Red fir. California.

Of total amount of red fir manufactured 28.8 per cent used in this industry.

Boxes.

Free from pitch.

Rough, box, $1\frac{1}{4}$ inches thick.

Incense cedar. California.

Of total amount of incense cedar manufactured 3.4 per cent used in this industry.

Boxes.

Durability; availability in certain localities.

Logs only.

Red gum. Middle West; South.

Of total amount of red gum manufactured 2.2 per cent used in this industry.

Special boxes.

Clear, smooth, strong, tough, does not warp.

Three-ply veneer, $\frac{3}{8}$ to $\frac{1}{2}$ inch thick.

PLATE III. Paraffining small kegs in cooperage factory. Olive kits above; water pails behind the machine.

Elm (soft elm). Lake States; Middle West; South.

Of total amount of elm manufactured 2.2 per cent used in this industry.

Splint baskets.

Bends well, nails without splitting.

Roller peeled veneer, 1-10, 1-12, and $\frac{1}{4}$ inch thick.

White oak, plain (eastern oak). South; Middle West.

Of total amount of plain white oak manufactured less than 0.1 per cent used in this industry.

Special boxes.

Durable, strong.

Surfaced, $1\frac{1}{4}$ by $\frac{1}{4}$ or 5-16 inches, 5 feet 6 inches long.

Basswood. Middle West.

Of total amount of basswood manufactured 1.0 per cent used in this industry.

Fancy boxes.

Light, tough.

One-ply veneer, $\frac{1}{4}$ inch thick.

TABLE 5. BOXES AND CRATES, PACKING.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Western yellow pine	225,029,000	72.7	$15 43	$3,472,497	215,029,000	10,000,000
Sitka spruce	46,621,590	15.1	16 47	767,875		46,621,590
Sugar pine	20,536,000	6.6	14 46	296,950	18,536,000	2,000,000
Western hemlock	5,700,000	1.8	14 54	82,850		5,700,000
White fir	3,032,080	1.0	15 36	46,573	3,032,080	
Redwood	2,436,000	0.8	15 97	38,903	2,436,000	
Douglas fir	2,395,340	0.8	14 45	34,613	1,170,000	1,225,340
Black cottonwood	2,217,040	0.7	31 60	70,052		2,217,040
Red fir	1,328,330	0.4	15 55	20,653	1,328,330	
Incense cedar	93,750		25 00	2,344	93,750	
Red gum (Missouri)	10,000		130 00	1,300		10,000
Elm	3,630		115 70	420		3,630
White oak (plain)	2,860		70 00	200		2,860
Basswood	665		75 19	50		665
Total	309,406,285	100.0	$15 63	$4,835,280	241,625,160	67,781,125

BOXES, TOBACCO.

Spanish cedar. Mexico.

Of total amount of Spanish cedar manufactured 94.0 per cent used in this industry.

Cigar boxes.

Light, strong, easily worked, nails well.

Surfaced, clear, 3-16 inch thick.

Red gum. Middle West; South.

Of total amount of red gum manufactured 60.2 per cent used in this industry.

Cigar boxes.

Smooth, strong, does not warp.

Stained, surfaced, first grade, 3-16 inch thick.

Basswood. Middle West.

Of total amount of basswood manufactured 88.6 per cent used in this industry.

Cigar boxes.

Stains to imitate cedar.

One-ply veneer, ¼ inch thick.

Redwood. California.

Of total amount of redwood manufactured, less than 0.1 per cent used in this industry.

Cigar boxes.

Light, soft, good color, nails well.

No. 1 shakes, or rough, medium lumber, ¼ inch thick.

NOTE.—All pieces over ¼ by 2 by 4 inches are utilized.

Incense cedar. California.

This material has been tried out for cigar box purposes, but the oils which it contains are absorbed by the cigars, rendering the latter nauseating to the smoker.

TABLE 6. BOXES, TOBACCO.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Spanish cedar	122,500	57.4	$159 34	$19,520		122,500
Red gum (Missouri)	55,000	25.7	80 00	4,400		55,000
Basswood	20,000	9.4	68 75	1,375		20,000
Redwood	16,000	7.5	65 62	1,050	16,000	
Total	213,500	100.0	$123 40	$26,345	16,000	197,500

BRUSHES.

Oregon maple. Oregon; Washington.

Of total amount of Oregon maple manufactured 17.0 per cent used in this industry.

Brush bodies.

Strong.

Rough, clear, 1 to 3 inches thick.

Sugar pine. California.

Of total amount of sugar pine manufactured less than 0.1 per cent used in this industry.

Brush blocks for street brushes.

Rough, good, 2 inches thick; surfaced, clear, 3 by ½ or 1½ by 18 inches.

By-products: small brush blocks.

Eastern maple. Lake States; Middle West; South.

Of total amount of eastern maple manufactured 0.3 per cent used in this industry.

Brush blocks.

Strong, does not split when bored.

Rough, or surfaced, clear, 1 to 1½ inches thick.

General dimensions of blocks 1½ by 3 by 18 and 24 inches.

NOTE.—Blocks, in some cases, roughed out in Pennsylvania. Freight charge then equal to one third manufacturer's charge. One manufacturer plans to experiment with sawdust chemical combinations that may be molded.

Oregon ash. Washington; Oregon.

Of total amount of Oregon ash manufactured 10.3 per cent used in this industry.

Brush bodies.

Tough, workable, does not warp or split.

Rough, clear, 1 to 3 inches thick.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Easily worked, durable.

Rough, third grade, 1 to 3 inches thick.

American mahogany (mahogany). South and Central America.

Brush covers.

Appearance.

Clear veneer 1-16 inch thick.

Yellow poplar (whitewood). Middle West; South.

Brush covers.

Appearance.

Clear veneer, ⅛ inch thick.

TABLE 7. BRUSHES.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Oregon maple	3,500	27.2	$60 00	$210		3,500
Sugar pine	3,440	26.7	100 00	344	3,440	
Eastern maple	3,180	24.7	110 00	349		3,180
Oregon ash	1,500	11.6	60 00	90		1,500
Lawson cypress	1,000	7.8	29 00	29		1,000
American mahogany	200	1.5	210 00	42		200
Yellow poplar	65	0.5	100 00	7		65
Total	12,885	100.0	$83 15	$1,071	3,440	9,445

BUNGS AND FAUCETS.

Sitka spruce. Oregon; Washington.

Plugs.

Tough, tasteless.

Rough, common, 3 by 3 inches.

Hickory. South; Middle West.

Of total amount of hickory manufactured 0.8 per cent used in this industry.

Bung starters.

Strong, tough.

Rough, common, 1½ inches thick.

Redwood. California.

Plugs.

Durable against decay.

Rough, lumber, 1 to 1½ inches thick.

Western yellow pine (white pine). California.

Plugs for oil well pumps to keep them clean in transportation.

Cheap.

Rough, common, 4 by 4 inches.

Rosewood (cocobola). South America.

Faucets, faucet handles.

Non-porous.

Logs, 10 to 12 inches in diameter.

Rough, No. 1 lumber.

TABLE 8. BUNGS AND FAUCETS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Sitka spruce	10,000	54.9	$20 00	$200 00	----------	10,000
Hickory	5,000	27.5	140 00	700 00	----------	5,000
Redwood	2,000	11.0	25 00	50 00	2,000	----------
Western yellow pine	1,200	6.6	15 00	18 00	1,200	----------
Total	18,200	100.0	$53 19	$968 00	3,200	15,000
Rosewood	20,050	lbs., 2½	c per lb.	501 25		
				$1,469 25	----------	(lbs.) 20,050

CAR CONSTRUCTION.

Douglas fir (Oregon pine, Washington fir). California; Oregon; Washington.

Of total amount of Douglas fir manufactured 0.4 per cent used in this industry.

Flooring in logging and freight cars.

Strong, wears well.

Rough, clear, 1 to 6 inches thick.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Of total amount of Lawson cypress manufactured 1.1 per cent used in this industry.

Passenger cars.

Rough, clear and select, 1 to 3 inches thick.

American mahogany (east and west coast mahogany). Central America.

Of total amount of American mahogany manufactured 2.6 per cent used in this industry.

Finish in passenger cars.

Beauty of appearance.

Rough, first and second grade, 1, 2 and 3 inches thick.

Eastern ash (white ash). New England; Middle West; South.

Of total amount of eastern ash manufactured 3.6 per cent used in this industry.

Passenger cars, carlins, corner posts.

Strong, tough.

Rough, clear and select, ½ to 4 inches thick.

Redwood. California.

Siding on box cars.

Durable against decay.

Rough, clear, 1 inch thick.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 1.8 per cent used in this industry.

Roofing and moldings in passenger cars.

Rough, clear, ½ to 2 inches thick.

Siberian ash. Siberia.

Of total amount of Siberian ash manufactured 55.6 per cent used in this industry.

Substitute for eastern ash. See above.

White oak, plain (eastern oak). Middle West; South.

Construction of passenger and freight cars.

Strong.

Rough, clear and select, 1 to 8 inches thick.

Siberian oak, plain (Japanese oak). Siberia; Japan.

Of total amount of Siberian oak manufactured 0.5 per cent used in this industry.

Same as white oak. See above.

Sitka spruce. Oregon; Washington.

Car construction.

Rough, clear and select, 1 to 4 inches thick.

Eastern maple. New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 0.3 per cent used in this industry.

Finish in passenger cars.

Surfaced on four sides, clear, 2 to 4 inches thick.

TABLE 9. CAR CONSTRUCTION.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Douglas fir	402,000	73.5	$24 03	$9,658	150,000	252,000
Lawson cypress	33,000	6.0	42 73	1,410		33,000
American mahogany	30,000	5.5	140 00	4,200		30,000
Eastern ash	25,000	4.6	126 00	3,150		25,000
Redwood	20,000	3.7	25 00	500	20,000	
Yellow poplar	10,000	1.8	62 50	625		10,000
Siberian ash	10,000	1.8	105 00	1,050		10,000
White oak (plain)	5,000	0.9	80 00	400		5,000
Siberian oak (plain)	5,000	0.9	80 00	400		5,000
Sitka spruce	4,000	0.7	15 88	64		4,000
Eastern maple	3,000	0.6	78 64	235		3,000
Total	547,000	100.0	$39 66	$21,692	170,000	377,000

CASKETS AND COFFINS.

Redwood. California.

Of total amount of redwood manufactured 1.6 per cent used in this industry.

Caskets; coffins; shipping boxes for same.

Free from pitch, cheap, good finish, nails well, durable against decay.

Caskets and coffins: rough, clear and merchantable, 1 inch thick for bottoms and sides; 1½ to 2 inches thick for tops.

NOTE.—One firm uses all material over 2 inches long.

Sitka spruce. Oregon; Washington.

Of total amount of spruce manufactured 1.3 per cent used in this industry.

Coffins.

Cheap, durable.

Rough, merchantable, 1 to 2 inches thick.

TABLE 10. CASKETS AND COFFINS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Redwood	1,723,000	66.3	$24 03	$41,401	1,723,000	
Sitka spruce	875,000	33.7	18 00	15,751		875,000
Total	2,598,000	100.0	$22 00	$57,152	1,723,000	875,000

CHAIRS.

White oak, plain (eastern oak). Middle West; South.

Chair frames and legs.

Strong, tough, durable.

Frames: surfaced, clear ⅞ inch thick.

Legs: rough, clear and select, 2 to 3 inches thick.

American mahogany (Lima mahogany). Peru; Central America.

Of total amount of American mahogany manufactured 0.4 per cent used in this industry.

Chairs.

Beauty of appearance.

Rough or surfaced, first grade, 1 to 3 inches thick.

By-products: children's chairs, hassocks, stools.

Philippine mahogany (Narra). Philippine Islands.

Of total amount of Philippine mahogany manufactured 8.9 per cent used in this industry.

Chairs.

Surfaced, clear, 1¼ to 2 inches thick.

By-products: sawdust used in manufacture of chemical combinations for bathroom floors, trays, drainboards, etc.

Red birch. Lake States; Middle West.

Chairs.

Beauty of appearance.

Surfaced, clear, 3 by 6 inches.

By-products: children's chairs, footstools, hassocks.

TABLE 11. CHAIRS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
White oak (plain)	9,500	50.7	$118 42	$1,125		9,500
American mahogany	5,000	26.7	147 50	738		5,000
Philippine mahogany	3,000	16.0	135 00	405		3,000
Red birch	1,250	6.6	120 00	150		1,250
Total	18,750	100.0	$128 93	$2,418		18,750

COOPERAGE.

White oak, plain (eastern oak). South; Middle West.

Of total amount of plain white oak manufactured 86.6 per cent used in this industry.

Staves and heading on tight stock; beer and wine barrels and casks.

Strong, not porous, contains a tannin beneficial to wine.

Staves: rough, clear, 1⅜ inch thick for barrels, 1⅝ for ½ barrels, 1½ for ⅓ barrels, 1¼ for ¼ and ⅛ barrels: beer stock. Heads for barrels, ½ and ⅓ barrels: rough, 2 inches thick. Wine barrels: staves ¾ inch thick: heading, clear, planed and jointed, ⅝ to ⅞ inch thick.

By-products: broken staves and heads converted into small keg heads.

NOTE.—It is estimated that 400,000 wine barrels are used annually in California, besides ⅛ barrels, kegs, etc.

Douglas fir (Oregon pine, yellow fir, Washington fir). California; Oregon; Washington.

Of total amount of Douglas fir manufactured 4.8 per cent used in this industry.

Staves and heading for tight stock: sugar barrels, cracker barrels, etc.

Strong, flexible; contains pitch which renders it unfit for wine barrels, as no suitable filler has been found.

Stave-bolts: rough, lumber, mixed grades, $\frac{3}{8}$ to $\frac{3}{4}$ inch thick.

Western hemlock. Oregon; Washington.

Of total amount of hemlock manufactured 40.8 per cent used in this industry.

Staves and heading for slack stock.

Strong, tough, flexible.

Stave bolts: lumber, surfaced on one side, 7-16 to $\frac{3}{4}$ inch thick.

By-products: broken staves and heads converted into heads for small kegs.

Sitka spruce. Oregon; Washington.

Of total amount of spruce manufactured 5.4 per cent used in this industry.

Tight stock.

Tasteless; seems to be a likely substitute for oak.

Stave bolts.

White fir. California.

Of total amount of white fir manufactured 13.5 per cent used in this industry.

Slack stock.

Light, strong.

Rough, planed and jointed, $\frac{3}{8}$ to $\frac{3}{4}$ inch thick.

By-products: broken staves and heads converted into heads for small kegs.

White oak, quarter-sawed (eastern oak). Middle West; South.

Of total amount of quartered white oak manufactured 31.5 per cent used in this industry.

Barrels and small cooperage.

Strong, tough.

Rough, first grade, 1, $1\frac{1}{8}$ and $1\frac{3}{4}$ inches thick.

Elm. New England; Lake States; Middle West.

Of total amount of elm manufactured 75 per cent used in this industry.

Hoops for beer, cracker, salt and sugar barrels.

Strong, tough, bends well.

Finished, first grade, 6 hoops to the barrel.

PLATE IV. Bar and store fixtures and interior finish, in finishing room of factory. Counter in foreground with Genisaro top and elm front.

Redwood. California.

Slack stock.

Easily worked.

Stave bolts.

Western yellow pine (white pine). California.

Staves for cracker and salt barrels.

Light, strong, substantial.

Clear staves, $\frac{3}{8}$ inch thick, 21 staves to the barrel.

TABLE 12. COOPERAGE.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
White oak (plain)	20,900,510	57.7	$71 69	$1,498,358	----------	20,900,510
Douglas fir	5,183,600	14.3	16 72	86,670	4,240,600	943,000
Western hemlock	3,925,330	10.8	16 50	64,568	----------	3,925,330
Sitka spruce	3,640,525	10.0	16 50	60,069	----------	3,640,525
White fir	1,850,000	5.1	16 50	30,525	1,850,000	----------
White oak (quarter-sawed)	475,000	1.3	70 00	33,250	----------	475,000
Elm	120,000	0.3	32 50	3,900	----------	120,000
Redwood	102,860	0.3	16 00	1,645	102,860	----------
Western yellow pine	50,000	0.2	30 00	1,500	50,000	----------
Total	36,247,825	100.0	$49 12	$1,780,485	6,243,460	30,004,365

DAIRYMEN'S, POULTERERS' AND APIARISTS' SUPPLIES.

Redwood. California.

Incubators, and brooders.

Light, cheap.

Rough, or surfaced on two sides, first and second grade 13-16 or 1 inch thick.

Sitka spruce. Oregon; Washington.

Incubators; brooders; butter molds.

Incubators, brooders: strong, nails well; surfaced on two sides, clear, 13-16 inch thick. Butter molds: soft, tough, light color and weight, tasteless; rough merchantable, 1 to $1\frac{1}{2}$ inches thick.

By-products: dowels, handles.

Eastern maple (hard maple). New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 0.5 per cent used in this industry.

Butter molds.

Close grained, hard, smooth, tasteless.

Rough, clear, 1 to 4 inches thick.

By-products: dowels, handles.

Douglas fir (Oregon pine). Oregon; Washington.

Butter mold frames; poultry houses.

Stiff, straight.

Rough, common, 1 to 4 inches thick.

By-products: dowels, handles.

Eastern cottonwood. Middle West.

Of total amount of eastern cottonwood manufactured 4.1 per cent used in this industry.

Beehive materials.

Rough, first and second grade, 1 inch thick.

TABLE 13. DAIRYMEN'S, POULTERERS', AND APIARISTS' SUPPLIES.

Kinds of wood.	Quantity used annually.		1,000 feet. Average cost per	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Redwood	61,000	47.0	$17 95	$1,095	61,000	
Sitka spruce	60,000	46.2	24 17	1,450		60,000
Eastern maple	5,000	3.8	110 00	550		5,000
Douglas fir	2,000	1.5	20 00	40		2,000
Eastern cottonwood	2,000	1.5	45 00	90		2,000
Total	130,000	100.0	$24 81	$3,225	61,000	69,000

DOWELS.

Western yellow pine. California.

Dowels.

Light, easily worked.

Rough, No. 2, 1 by 10 or 1½ by 1½ inches.

Elm. Michigan; Middle West.

Framing for rattan furniture and baby carriages.

Suitable for bending into frames.

Finished, round, ⅞ to 1 inch in diameter.

Eastern ash (white ash). Middle West; South.

Framing for rattan furniture and baby carriages.

Finished, all round, first quality, ⅜ to 1 inch in diameter.

Eastern maple (white maple). Michigan.

Baby carriage frames.

Light color, fine finish.

Finished, beaded.

Red birch. New England; Lake States; South; Middle West.

Framing for rattan furniture and baby carriages.

Finished, all round, ⅜, ½, ⅝, ¾, ⅞ and 1 inch in diameter.

ELEVATORS.

Douglas fir (Oregon pine, Washington fir). Oregon; Washington.

Of total amount of Douglas fir manufactured 0.3 per cent used in this industry.

Elevator flooring, frames, gates, guides, platforms and posts.

Strong, tough, easily worked.

Frames: surfaced, clear, 2 to 6 inches thick.

Guides: rough, select and clear, 1 to 8 inches thick.

Flooring, gates, posts: rough, clear, 1 to 1½ inches thick.

Eastern maple. Lake States; Middle West; South.

Of total amount of Eastern maple manufactured 3.6 per cent used in this industry.

Flooring, guide strips, platforms.

Hard, durable.

Surfaced, clear, 1 to 4 inches thick.

By-products: cams, car switchbacks, governor frames, shims, etc.

Redwood. California.

Platforms.

Durable against decay.

Rough, common, select and clear, 1 to 4 inches thick.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 2.3 per cent used in this industry.

Cages.

Strong, tough.

Surfaced on four sides, common to clear, 2½ to 6 inches thick.

White oak, plain. Middle West; South.

Frames, platforms, etc.

Strong, tough.

Surfaced, clear, 1 to 4 inches thick.

By-products: cams, governor frames, switch-car backs, shims.

Sugar pine. California.

Platforms.

Durable against decay.

Rough, common, select and clear, 1 to 4 inches thick.

Western yellow pine. California.

Construction.

Surfaced, clear, 4 by 4 inches thick.

Sitka spruce. Oregon; Washington.

Platforms.

Easily worked, good finish.

Rough, clear, 1 inch thick.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 0.2 per cent used in this industry.

Finish.

Surfaced, clear, $\frac{3}{8}$ inch thick.

TABLE 14. ELEVATORS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Douglas fir	294,500	67.8	$25 19	$7,419		294,500
Eastern maple	36,500	8.4	81 79	2,985		36,500
Redwood	36,000	8.3	17 00	612	36,000	
Eastern ash	16,000	3.7	106 00	1,696		16,000
White oak (plain)	16,000	3.7	90 50	1,448		16,000
Sugar pine	15,000	3.5	17 00	255	15,000	
Western yellow pine	10,000	2.3	30 00	300	10,000	
Sitka spruce	9,000	2.1	45 56	410		9,000
Yellow poplar	1,000	0.2	90 00	90		1,000
Total	434,000	100.0	$35 06	$15,215	61,000	373,000

FIXTURES.

Douglas fir (Oregon pine, Washington fir, red fir). California; Oregon; Washington.

Of total amount of Douglas fir manufactured 1.1 per cent used in this industry.

Bases and hidden work on showcases; backing for fixtures; cheap fixtures; counters; finish; framing of showcases and fixtures; pantry fixtures; shelves.

Strong, cheap, takes good stain and polish, beautiful effects in slash grain and mission finish.

Bases, hidden work, backing: rough or surfaced, clear, 1 to 3 inches thick. Cheap fixtures: rough, clear, and select, 1 to 4 inches thick. Counters, shelves: rough or surfaced, mill run, 13-16 and 1 inch thick. Framing: rough, common, 1 to 4 inches thick. Pantry fixtures: rough, common to clear, 1 to 2 inches thick.

By-products: short ends converted into cores for veneer work, rails, small display novelties; sawdust into patented chemical combination used as drainboards, sinks and bathroom floors, etc.

Redwood. California.

Of total amount of redwood manufactured 0.7 per cent used in this industry.

Backing for show and wall cases; counters; drawer bottoms; shelves; showcase linings; store bins, veneer cores.

Shelving, lining: color, figure, ease of working, durability: rough, clear, 1 to 4 inches thick or surfaced $\frac{1}{2}$ to 1 inch thick. Counters: light,

easily worked, good finish, imitates mahogany: rough or surfaced on two sides, clear, 1 inch thick. Store bins: does not stain or warp; rough, common, 1 inch thick. Veneer cores: soft, easily worked: rough, clear, 1 to 4 inches thick.

By-products: cores, drawer fronts for desks, rails, small display novelties.

Sitka spruce. Oregon; Washington.

Of total amount of spruce manufactured 0.8 per cent used in this industry.

Drawer bottoms; flour bins; pantry fixtures; shelving principally.

Flour bins: odorless, tasteless. Shelving: light, soft, strong, tough; rough, clear and select, 1 inch thick.

By-products: cores, dresser brackets, rails, small turnings, etc.

White oak, plain (eastern oak). South; Middle West.

Of total amount of plain white oak manufactured 1.9 per cent used in this industry.

Bar, office and store fixtures; filing cabinets; frames and bases on showcases; showcases; showcase moldings; veneered panels.

Strong, beautiful grain, polishes well.

Fixture work: rough, clear, 1 to 4 inches thick.

Filing cabinets: rough, clear, $\frac{5}{8}$ inch thick.

Showcases: rough, clear, $\frac{7}{8}$ and 1 inch thick.

Showcase moldings: surfaced on two sides, clear, $\frac{3}{4}$ to 3 inches thick.

Veneered panels: 69,500 square feet of rough veneer, 1-20, 1-16, $\frac{1}{8}$ and 3-16 inch thick, used.

By-products: apiarists' supplies, moldings; sawdust used in manufacture of chemically prepared bathroom floors, washboards, sinkboards, etc.; for stable bedding, and for packing ice; shavings for stable bedding.

American mahogany (tobasco mahogany, East and West Coast mahogany, Peruvian, Mexican and Honduras mahogany). South and Central America.

Of total amount of American mahogany manufactured 39.3 per cent used in this industry.

Bar rails and tops; bottoms and panels of showcases; counter tops; fixtures; frames and doors of showcases; wall cases.

Dark color, good figure, finish, rich effects.

Rough, or surfaced, first and second grade, 1 to 4 inches thick; 82,670 square feet of veneer, 1 to 5 ply, 1-20, 1-16, $\frac{1}{8}$, 3-16, $\frac{3}{8}$ and $\frac{1}{2}$ inch thick, used.

By-products: sawdust for packing ice, stable bedding and manufacture of chemically prepared floors, sinks, drainboards, etc.; shavings for stable bedding; strips converted into moldings.

Western yellow pine (white pine, mountain pine). California; Arizona.

Of total amount of yellow pine manufactured 0.2 per cent used in this industry.

Bottoms of showcases; enameled fixtures; pantry and store fixtures; shelving; veneer cores.

Enameled fixtures: color; rough, clear, 1 to 1½ inches thick.

Shelving: soft, easily worked, suitable to the climate: rough, clear and select, 1 inch thick.

Veneer cores: rough, shop, 3-16 to 1 inch thick.

By-products: sawdust used in manufacture of chemically prepared bathroom floors, sinkboards, drainboards, etc.

Red birch. New England; Lake States; Middle West.

Of total amount of red birch manufactured 23 per cent used in this industry.

Bank, bar, office, soda and store fixtures; bases, bottoms, doors, frames and panels of showcases; drawer sides; painted work; showcase moldings.

Hard, strong, finishes to imitate more costly woods, especially mahogany.

Rough, first and second grades, 1 to 2 inches thick; some curly birch; 75,900 feet of 3 to 5 ply veneer, 1-16, ⅛, ¼ and ½ inch thick, used.

By-products: desk door fronts and pulls; 1 inch strips converted into moldings; sawdust used in manufacture of chemically prepared floors, sinks and drainboards.

White oak, quarter-sawed (eastern oak). South; Middle West.

Of total amount of quartered white oak manufactured 13.1 per cent used in this industry.

Bank, bar, office and store fixtures; counter fronts; showcases; veneered panels; wall cases.

Strength, beauty of finish.

Rough, or surfaced, first and second grade, 1 to 2 inches thick.

Veneer: counter fronts, panels, etc.: 27,500 square feet of 1 to 5 ply, 1-20, 1-16, ⅛, ¼ and ½ inch thick, used.

By-products: strips converted into moldings.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Of total amount of cypress manufactured 5.3 per cent used in this industry.

Fixtures; shelving principally; showcase doors.

Light, close grained, easily worked, takes enamel finish, imitates mahogany and birch, odor of wood protects containers against insects.

Rough, clear and select, 1 to 2 inches thick.

By-products: beehive supplies, cores, rails: sawdust used for refrigeration, and in the manufacture of chemically prepared floors, sinks, drainboards, etc.

Sugar pine. California.

Of total amount of sugar pine manufactured 0.4 per cent used in this industry.

Altars; beading for showcases; counters; shelving; veneer cores.

Counters: soft, straight grain: rough, clear, 1 to 2 inches thick.

Shelving: soft, strong, odorless, easily worked, does not shrink: rough, clear and select, 1¼ and 1½ inches thick.

Veneer cores: rough, common and shop, 1 to 2 inches thick.

By-products: desk drawer fronts and pulls; scraps glued together for cores in veneered doors; short ends converted into rails, etc.

Genisaro (jenizaro). Mexico.

Of total amount of genisaro manufactured 49.7 per cent used in this industry.

Bar tops, exposed portions of store fixtures; office, saloon and store fixtures; showcases.

Hard, beautiful grain and appearance.

Rough, clear, 1 to 2 inches thick: 25,500 square feet of 1-20 and 3-16 inch veneer used.

Eastern maple (white maple). Lake States.

Of total amount of eastern maple manufactured 4.9 per cent used in this industry.

Counters; counter tops; fixtures; panels, doors and bottoms of showcases; store fixtures.

Strong, good finish.

Rough, clear, 1 to 4 inches thick: some bird's-eye: 7,175 square feet of 3-ply veneer, 1-16, ⅛ and ¼ inch thick, used.

Siberian oak, plain (Japanese oak). Japan; Siberia.

Of total amount of plain Siberian oak manufactured, 4.3 per cent used in this industry.

Bank, bar, and office fixtures; counter frames; showcases and showcase frames.

Cheap, easily worked, good figure, imitates eastern white oak.

Rough, first and second grade, 1 to 2 inches thick.

By-products: sawdust used in the manufacture of chemically prepared bathroom floors, drainboards, etc.

Black cottonwood. Oregon; Washington.

Of total amount of black cottonwood manufactured 0.7 per cent used in this industry.

Drawer bottoms.

Veneer, 9-32 inch thick.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 4.5 per cent used in this industry.

Backing on veneered work; bottoms and shelves of showcases; cross veneering; drawer sides; enameled fixtures; fixtures; painted work; panels; panel cores.

Soft, strong, easily worked, good color.

Surfaced, clear, ½ to ⅝ inch thick; 72,000 feet of veneer, 3 to 5 ply for panel cores, 1 to 3 ply for cross veneering, painted work, panels, etc., 1-20, 1-16, ⅛ and 3-16 inch thick, used.

By-products: short ends converted into cores, rails, etc.; strips into moldings.

African mahogany. Africa.

Of total amount of African mahogany manufactured 46.5 per cent used in this industry.

Fixtures; panels; showcase frames.

Rough, clear, ½ to 4 inches thick: 2,000 square feet of veneer 1-20 inch thick, used.

By-products: strips converted into moldings.

Japanese oak, quarter-sawed (Siberian oak). Japan; Siberia.

Of total amount of Japanese oak manufactured 4.3 per cent used in this industry.

Bar and store fixtures; general fixture work; panels, showcases.

Hard, durable.

Rough or surfaced, first and second grade, ⅞ and 1 inch thick: panels ⅜ to ¾ inch thick.

By-products: sawdust used in the manufacture of chemically prepared floors, sinks, drainboards, etc.

Red oak, plain and quarter-sawed. South; Middle West.

Of total amount of red oak manufactured 15.5 per cent used in this industry.

Fixtures.

Rough, first and second grade, 1 to 2 inches thick.

Black walnut. South; Middle West.

Of total amount of black walnut manufactured 10 per cent used in this industry.

General fixture work; office, saloon and store fixtures; showcases.

Beauty of finish.

Rough, clear, 1 to 1½ inches thick: 1,000 square feet of veneer, 1-12, ⅛ and ⅜ inch thick, used.

By-products: moldings.

Prima vera (white mahogany). Mexico.

Of total amount of prima vera manufactured 14.3 per cent used in this industry.

Fixtures; showcases.

Rough, clear, 1 to 4 inches thick.

By-products: strips converted into moldings.

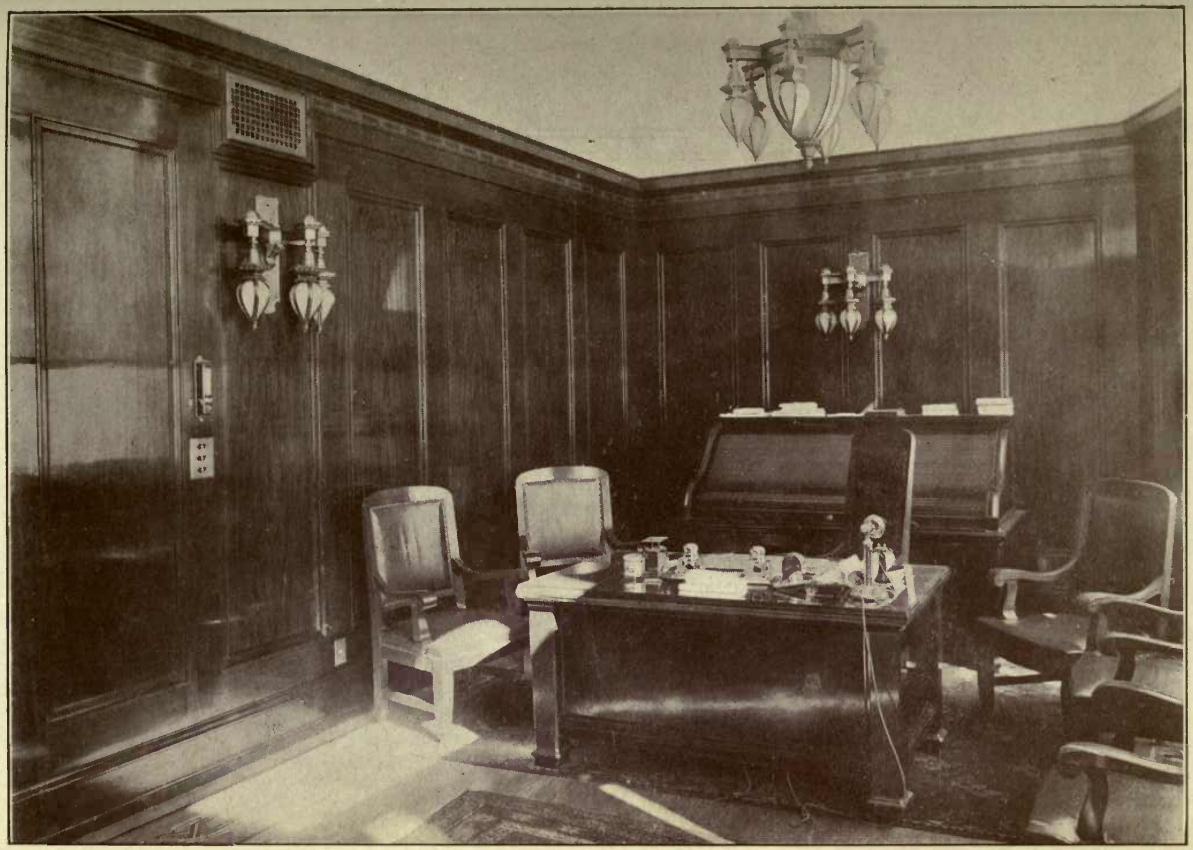

PLATE V. Interior of office. Floor; oak, walnut, and maple. Mahogany interior finish and furniture. Inlaid work above panels, ebony and maple.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 0.6 per cent used in this industry.

Bank, office and store fixtures; showcases.

Strong, good finish.

Rough, clear, $\frac{5}{8}$ to 1 inch thick.

Red gum. Middle West; South.

Of total amount of red gum manufactured 0.7 per cent used in this industry.

Finished surfaces; store fittings.

Light finish to go with Circassian walnut panels.

Rough, clear and select, 1 to $1\frac{1}{2}$ inches thick.

By-products: strips converted into moldings.

Eastern cottonwood. Middle West.

Of total amount of eastern cottonwood manufactured 6.1 per cent used in this industry.

Cores for panels.

Veneer, rotary cut: 20,000 square feet, 3-16 inch thick, used.

Elm. Lake States; Middle West; South.

Of total amount of elm manufactured 0.3 per cent used in this industry.

Bottoms and panels of showcases.

Veneer, 3-ply, $\frac{1}{4}$ inch thick.

TABLE 15. FIXTURES.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Douglas fir	1,252,310	24.7	$31 48	$39,421	17,500	1,234,810
Redwood	742,210	14.6	34 19	25,376	742,210	----------
Sitka spruce	545,150	10.7	33 98	18,524	----------	545,150
White oak (plain)	453,500	8.9	106 93	48,493	----------	453,500
American mahogany	446,485	8.8	180 45	80,571	----------	446,485
Western yellow pine	443,720	8.5	39 01	16,920	431,720	2,000
Red birch	343,142	6.8	84 92	29,141	----------	343,142
White oak (quarter-sawed)	198,320	3.9	107 66	21,351	----------	198,320
Lawson cypress	164,270	3.2	55 71	9,152	----------	164,270
Sugar pine	150,150	2.9	48 39	7,267	150,150	----------
Genisaro	124,325	2.4	122 58	15,240	----------	124,325
Eastern maple	49,815	1.0	95 51	4,758	----------	49,815
Siberian oak (plain)	44,500	0.9	88 09	3,920	----------	44,500
Black cottonwood	33,335	0.7	45 00	1,500	----------	33,335
Yellow poplar	25,160	0.5	113 42	2,854	----------	25,160
African mahogany	15,620	0.3	293 47	4,584	----------	15,620
Japanese oak (quarter-sawed)	14,800	0.3	113 85	1,685	----------	14,800
Red oak	14,500	0.3	87 79	1,273	----------	14,500
Black walnut	11,325	0.2	168 46	1,908	----------	11,325
Prima vera	5,270	0.1	131 38	692	----------	5,270
Eastern ash	4,000	0.1	108 57	434	----------	4,000
Red gum (Missouri)	3,270	0.1	90 41	295	----------	3,270
Eastern cottonwood	3,000	0.1	113 33	340	----------	3,000
Elm	450	-------	115 70	52	----------	450
Total	5,078,627	100.0	$66 11	$335,751	1,341,580	3,737,047

FRAMES AND MOLDING.

Red gum. Middle West; South.

Of total amount of red gum manufactured 33.3 per cent used in this industry.

Picture moldings.

Good grain, fine finish.

First grade, 1 inch thick, in 12 feet lengths.

White oak, plain (eastern oak). Middle West; South.

Of total amount of plain white oak manufactured 0.6 per cent used in this industry.

Picture frames and moldings.

Hard, good grain and finish, joins easily, does not split.

Frames: rough, clear, 1 to 4 inches thick.

Moldings: rough, clear, 1 inch thick, in 12 feet lengths.

NOTE.—A large amount of finished molding is shipped into California from the middle west.

Red birch. New England; Lake States; Middle West.

Of total amount of red birch manufactured 6.9 per cent used in this industry.

Picture moldings.

Straight, good grain.

Rough, first and second grade, 12 feet length.

Redwood. California.

Picture frames.

Straight grained.

Surfaced on one side, clear, 1 inch thick.

Black walnut. South; Middle West.

Of total amount of black walnut manufactured 22.1 per cent used in this industry.

Picture moldings.

Beauty.

Surfaced, clear, 1 inch thick, in 12 feet lengths.

Douglas fir (Oregon pine). Oregon; Washington.

Picture moldings.

Straight grained.

Rough, clear, 1 inch thick.

Sugar pine. California.

Same as Douglas fir.

White oak, quarter-sawed (eastern oak). Middle West; South.

Of total amount of quartered white oak manufactured 0.2 per cent used in this industry.

Picture frames.

Hard, straight grain.

Rough, first and second grade, 1 inch thick.

TABLE 16. FRAMES AND MOLDING.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Red gum (Missouri)	152,000	31.6	$75 00	$11,400	----------	152,000
White oak (plain)	141,432	29.4	104 71	14,809	----------	141,432
Red birch	103,000	21.4	100 00	10,300	----------	103,000
Redwood	47,632	9.9	23 52	1,120	47,632	----------
Black walnut	25,000	5.2	200 00	5,000	----------	25,000
Douglas fir	6,000	1.3	38 00	228	----------	6,000
Sugar pine	2,730	0.6	75 00	205	2,730	----------
White oak (quarter-sawed)	2,500	0.6	140 00	350	----------	2,500
Total	480,294	100.0	$90 39	43,412	50,362	429,932

FURNITURE.

Douglas fir (*Oregon pine, red fir, Washington fir*). Oregon; Washington.

Of total amount of Douglas fir manufactured 3.5 per cent used in this industry.

Bookcases; boxes of couches and wall beds; china closets; cores for veneered furniture; couches; dressers; framing of woven wire mattresses; spring supports of couches and beds; tea tables; turned legs on tables.

Light, strong, gives beautiful effects in slash grain, imitates more costly woods.

Boxes of couches, etc.: rough, clear, 1 to 1½ inches thick.

Dressers, etc.: rough, all grades, 1 to 2 inches thick.

Frames, spring supports, etc.: rough, merchantable, 2 inches thick.

Turned legs: rough, various grades, 2 to 4 inches thick.

Western yellow pine (*yellow pine, white pine*). Arizona; California; Nevada.

Of total amount of yellow pine manufactured 0.5 per cent used in this industry.

Backing; bed rails; bed slat frames; bookcases; boxspring couches; built-in dressers and sideboards; couch legs; drawer bottoms; spring beds; spring mattresses; table tops; wall beds.

Bookcases: clear, 1¼ inches thick.

Box springs, bed springs, mattresses: light, easily worked, nails well; rough or surfaced on one side, merchantable, 1 to 4 inches thick.

Built-in dressers, etc.: all grades and thicknesses.

Couch legs: rough, second grade, 3 by 3 inches.

Table tops: easily worked; rough or surfaced, shop grades, 1 to 1½ inches thick.

Wall beds: rough, clear, 1 inch thick.

By-products: bolster frames; camp chairs and stools; cleats, dowels, and elevator blocks for spring beds; children's chairs; footstools; hassocks.

Sitka spruce. Oregon; Washington.

Of total amount of spruce manufactured 0.8 per cent used in this industry.

Cores in veneered furniture; couch heads; tops on kitchen tables chiefly.

Couch heads: soft, tough, nails well; surfaced, select, 1 inch thick.

Table tops: easily worked, contains no pitch pockets, odorless, tasteless; rough or surfaced, clear and select, $\frac{7}{8}$ and 1 inch thick.

By-products: elevator blocks for wire mattresses.

Sugar pine. California.

Of total amount of sugar pine manufactured 1.0 per cent used in this industry.

Backing; built-in dressers and sideboards; carved work; core stock; table frames and tops.

Light, soft, easily worked.

Backing, cores: rough or surfaced on two sides, shop grades, $\frac{3}{4}$ and 1 inch thick.

Dressers, sideboards: rough, all grades, 1 inch thick.

Carved work: surfaced on two sides, clear, $1\frac{1}{4}$ inches thick.

Table stock: rough, clear and select, 1 inch thick.

Redwood. California.

Of total amount of redwood manufactured 0.3 per cent used in this industry.

Backing and shelves in dressers; bottoms of upholstered furniture; cores for veneered work in legs of heavy mission tables.

Backing, shelves: soft, easily worked; rough, medium, 1 inch thick.

Bottoms: surfaced, select, 1 inch thick.

Cores: cheap, holds glue well, dries quickly; rough, common, 1 to 4 inches thick.

By-products: strips on chairs and tabourets.

White oak, plain (eastern oak). South; Middle West.

Of total amount of plain white oak manufactured 1.1 per cent used in this industry.

Bookcases; couch frames; davenports; desks; furniture; mattresses; sideboards; table legs and tops.

Durable, strong, polish, fuming qualities; finishes well in golden fumed and weathered.

Rough, common for posts and interior work, clear for other uses, 1 to 4 inches thick.

By-products: children's chairs, elevator blocks in wire mattresses, footstools, hassocks, small moldings; sawdust used for bedding in stables and litter in butcher shops.

Japanese oak, plain (Siberian oak). Japan; Siberia.

Of total amount of plain Japanese oak manufactured 16.3 per cent used in this industry.

Flat-top desks; furniture; interior work; panels; posts; table legs.

Strong, beautiful grain, cheaper than the same grades of white oak, takes fume, colors evenly, easily worked.

Rough, common to clear, 1 to 2 inches thick.

By-products: short cuttings and strips used in chairs and tabourets.

Japanese oak, quarter-sawed (Siberian oak). Japan; Siberia.

Of total amount of quartered Japanese oak manufactured 34.9 per cent used in this industry.

Furniture; library table legs; table tops.

Properties same as those of plain Japanese oak.

Rough, first and second grades, 1 to 2 inches thick.

Library table legs: 5,000 square feet of veneer, $\frac{1}{8}$ inch thick, used.

Lawson cypress (white cedar, Port Orford cedar). Oregon; Washington.

Of total amount of cypress manufactured 2.9 per cent used in this industry.

Chests; closet fittings; drawer sides and bottoms; enameled furniture; linen closets.

Soft, aromatic, strong odor repellent to insects, clean appearing, takes good finish, especially for enameling.

Rough, clear and select, 1 to $1\frac{1}{2}$ inches thick.

By-products: garden and surveyors' stakes, spindles; short cuttings and strips used in tabourets.

White oak, quarter-sawed (eastern oak). South; Middle West.

Of total amount of quartered oak manufactured 4.8 per cent used in this industry.

Bookcases; couch frames; furniture, table tops.

Strong; takes good finish, especially when fumed or weathered.

Rough, clear, 1 to 2 inches thick.

Library table legs: 5,000 square feet of veneer, 1-20 to $\frac{1}{8}$ inch thick, used.

By-products: elevator blocks for wire mattresses.

American mahogany (Lima, Peru, Mexico mahogany). South and Central America; Mexico.

Of total amount of American mahogany manufactured 5.8 per cent used in this industry.

Davenports; dresser and table tops; furniture; tables.

Dark, good figure, excellent finish.

Rough, clear, 1 to 4 inches thick: 8,125 square feet of 1 to 3 ply veneer, 1-30, 1-20, $\frac{1}{8}$ and 3-16 inch thick, used.

By-products: children's chairs, footstools, hassocks.

Red birch. New England; Lake States; Middle West.

Of total amount of red birch manufactured 3.4 per cent used in this industry.

Couch legs; drawer bottoms; frames and bases of desks and tables; furniture.

Hard, smooth, strong: finishes to imitate more costly woods, especially mahogany.

Rough or surfaced, first and second grade, 1 to 3 inches thick.

Veneer: some rotary cut: 17,500 square feet, 1 to 3 ply, $\frac{1}{8}$, 1-16 and $\frac{1}{4}$ inch thick, used.

By-products: children's chairs, desk door front and pulls, footstools, hassocks.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 5.1 per cent used in this industry.

Cores for veneering; drawer sides; furniture.

Cores: rough, No. 1, 2 inches thick.

Drawer sides: rough, No. 1, $\frac{1}{2}$ inch thick.

General furniture: 22,500 square feet of veneer, $\frac{1}{8}$ to $\frac{1}{4}$ inch thick, used.

Eastern maple. New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 1.3 per cent used in this industry.

Feet; legs; furniture; tables; table legs.

Good figure, easily worked, fine finish.

Rough, first and second grades, 1 to 4 inches thick; some bird's-eye.

By-products: strips converted into moldings.

Oregon maple. Oregon.

Of total amount of Oregon maple manufactured 58.6 per cent used in this industry.

Couch frames; overstuffed furniture entirely covered by goods.

Hard.

Rough, first and second grades, $1\frac{1}{4}$ and $1\frac{1}{2}$ inches thick.

Black walnut. South; Middle West.

Of total amount of black walnut manufactured 9.6 per cent used in this industry.

General furniture work.

Beauty of finish.

Rough, No. 1 and 2, 1 to 3 inches thick: 500 square feet of veneer, 1-16 and $\frac{1}{8}$ inch thick, used.

African mahogany. Africa.

Of total amount of African mahogany manufactured 28.2 per cent used in this industry.

General furniture work.
Beauty of finish.
Surfaced on two sides, No. 1, one inch thick and above.

Siberian ash. Siberia.
Of total amount of Siberian ash manufactured 44.4 per cent used in this industry.
Drawer sides.
Rough, clear, 1 inch thick.

Eastern ash (white ash). Middle West; South.
Of total amount of eastern ash manufactured 0.9 per cent used in this industry.
Table tops.
Fuming qualities.
Rough, 1 to 2 inches thick, or surfaced on two sides, $\frac{7}{8}$ inch thick; all first grade.

Black cottonwood. Oregon; Washington.
Of total amount of black cottonwood manufactured 0.1 per cent used in this industry.
Drawer bottoms in tables, chiffoniers, cupboards, dressers, etc.; flat top desks.
Veneer, 9-32 inch thick.

Genisaro (jenizaro). Mexico.
Of total amount of genisaro manufactured 1.8 per cent used in this industry.
General furniture work.
Hard, finishes well.
Rough, clear, 1 to 3 inches thick.

Prima vera (white mahogany). Mexico.
Of total amount of prima vera manufactured 8.2 per cent used in this industry.
General furniture work.
Rough, clear, 1 to 4 inches thick.

Philippine mahogany (Narra). Philippine Islands.
Of total amount of Philippine mahogany manufactured 8.9 per cent used in this industry.
Chiffoniers; dressers; tables, etc.; furniture.
Beauty of finish.
Rough, No. 1, 1 to 3 inches thick.

Red fir. California.
Table legs.
Strong.
Rough, clear, 3 inches thick.

Red oak. South; Middle West.

Of total amount of red oak manufactured 1.9 per cent used in this industry.

Furniture.

Beauty of finish.

Rough, No. 1, 1 to 4 inches thick.

Pepperwood (California laurel). California.

Of total amount of pepperwood manufactured 30.8 per cent used in this industry.

Hard, fine finish.

Rough, clear and select, 1 to 6 inches thick.

Teak. Burmah.

Of total amount of teak manufactured 1.7 per cent used in this industry.

Rough, clear, 1 inch thick.

Red gum. Middle West; South.

Of total amount of red gum manufactured 0.2 per cent used in this industry.

Rough, No. 1, 1 to 2 inches thick.

Hickory. Middle West; South.

Of total amount of hickory manufactured 0.2 per cent used in this industry.

Special furniture.

Strong, tough.

Rough, clear, 1 to 2 inches thick.

By-products: sawdust used for floor covering in butcher shops.

Camphorwood. China.

Of total amount of camphorwood manufactured 100 per cent used in this industry.

Chest and closet lining.

Odor repulsive to insects and vermin.

Rough, not graded, 1 inch thick and over.

Circassian walnut. Turkey.

Of total amount of Circassian walnut manufactured 9.4 per cent used in this industry.

Dressers; table tops.

Beauty of finish.

Veneer, $\frac{1}{8}$ inch thick.

Basswood. Middle West.

Of total amount of basswood manufactured 0.7 per cent used in this industry.

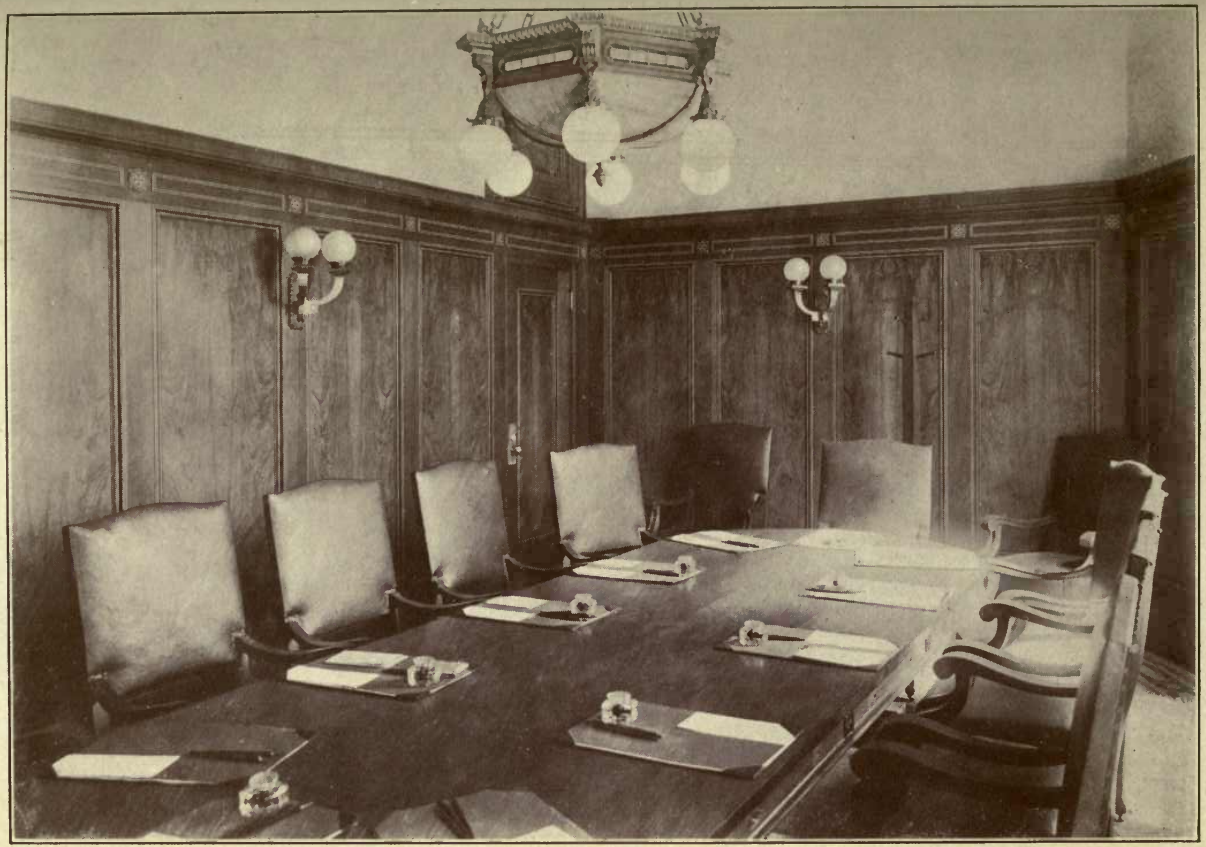

PLATE VI. Interior of Bank Directors' room. Table and panels of Circassian walnut. Inlaid work of walnut, hard maple, and ebony.

Box bottoms on couches; table tops.

Box bottoms: 1 ply veneer, ¼ inch thick.

Table tops: surfaced, first grade, ⅞ inch thick.

Cherry. Middle Atlantic States.

Of total amount of cherry manufactured 6.6 per cent used in this industry.

Tough, easily worked, fine finish.

Rough, clear, 1 inch thick.

Eastern cottonwood. Middle West.

Of total amount of eastern cottonwood manufactured 1.0 per cent used in this industry.

Table tops.

Surfaced, clear, ⅞ inch thick.

Koa. Hawaiian Islands.

Of total amount of koa manufactured 8.2 per cent used in this industry.

Rough, No. 1, 1 to 2 inches thick.

California blue gum. California.

Of total amount blue gum manufactured 0.7 per cent used in this industry.

Repairs.

Strong, good finish.

Rough, clear, 2 inches thick.

NOTE.—One firm reports having manufactured 1,000 feet of blue gum into furniture. It was found that it was too heavy; the gum destroyed the glue joints; it was difficult to nail, and warped after finishing. This firm plans to experiment again.

Japanese willow. Japan.

Of total amount of Japanese willow manufactured 100 per cent used in this industry.

Finished, first grade.

Reed. India.

Of total amount of reed manufactured 100 per cent used in this industry.

Reed furniture.

Comes to California via New York.

TABLE 17. FURNITURE.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Douglas fir	3,831,890	52.8	$23 10	$88,516 66		3,831,890
Western yellow pine	1,228,300	16.9	21 08	25,892 56	1,153,300	75,000
Sitka spruce	524,000	7.2	22 89	11,994 36		524,000
Sugar pine	364,410	5.0	45 63	16,628 03	364,410	
Redwood	353,250	4.9	32 34	11,424 10	353,250	
White oak (plain)	264,625	3.6	105 19	27,834 53		264,625
Japanese oak (plain)	170,000	2.3	85 28	14,497 60		170,000
Japanese oak (quarter-sawed)	120,000	1.7	98 29	11,795 00		120,000
Lawson cypress	90,000	1.2	50 58	4,552 20		90,000
White oak (quarter-sawed)	72,510	1.0	100 12	7,259 82		72,510
American mahogany	66,405	0.9	202 46	13,444 25		66,405
Red birch	50,670	0.7	90 68	4,594 91		50,670
Yellow poplar	28,624	0.4	86 29	2,470 00		28,624
Eastern maple	13,306	0.2	103 95	1,383 16		13,306
Oregon maple	12,000	0.2	60 00	720 00		12,000
Black walnut	10,805	0.1	178 90	1,933 02		10,805
African mahogany	9,500	0.1	307 14	2,917 83		9,500
Siberian ash	8,000	0.1	55 00	440 00		8,000
Eastern ash	6,000	0.1	111 25	667 50		6,000
Black cottonwood	6,000	0.1	45 00	270 00		6,000
Genisaro	4,500		125 55	565 00		4,500
Prima vera	3,000		150 00	450 00		3,000
Philippine mahogany	3,000		125 00	375 00		3,000
Red fir	2,500		22 00	55 00	2,500	
Red oak	1,750		122 82	215 00		1,750
Pepperwood	1,600		71 88	115 00	1,600	
Teak	1,500		163 90	245 85		1,500
Red gum (Missouri)	1,000		110 00	110 00		1,000
Hickory	1,000		140 00	140 00		1,000
Camphorwood	1,000		225 00	225 00		1,000
Circassian walnut	750		200 00	150 00		750
Basswood	500		50 00	25 00		500
Cherry	500		85 00	42 50		500
Eastern cottonwood	500		50 00	25 00		500
Koa	500		200 00	100 00		500
California blue gum	400		150 00	60 00	400	
Total	7,254,295	100.0	$34 75	$252,134 00	1,875,460	5,378,835
	Pounds.		Per M.			Pounds.
Japanese willow	12,000		$95 00	1,140 00		12,000
Reed	9,000		220 00	1,980 00		9,000
				$255,254 00		

GATES AND FENCING.

Douglas fir (Oregon pine). Oregon; Washington.

Fencing.

Strong.

Rough, common to clear, 1 to 4 inches thick.

Redwood. California.

Fencing.

Light, cheap, easily worked, durable when exposed to weather.

Rough, medium grades, 1 to 6 inches thick.

Sugar pine. California.

Fencing.

Light, cheap, easily worked, durable when exposed to weather.

Rough, common, select and clear, 1 to 4 inches thick.

HANDLES.

Hickory. South; Middle West.

Tool handles.

Strong, tough.

Rough, clear.

By-products: wedges, plugs.

Eastern maple (sugar maple). New England; Lake States; Middle West; South.

Broom handles.

Elastic, tough, smooth surface for hands, remains straight.

Finished handles, 42 inches long, $1\frac{1}{8}$ and $1\frac{1}{4}$ inches in diameter.

Douglas fir (Oregon pine). Oregon.

Broom handles.

Finished, clear.

NOTE.—Oregon maple and red alder broom handles, in finished form, are shipped in from Oregon. Alder turns well, is hard, and takes a fine polish. Oregon oak is used locally in parts of California, for ax, pick, and tool handles. Young growth up to ten inches in diameter, is tough and resilient. It should be a good substitute for hickory. Blue gum is used in small amounts, for the same purpose, but, unless given a long seasoning, is likely to warp and twist.

INSTRUMENTS, MUSICAL.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 2.1 per cent used in this industry.

Accordions; cross band veneering on pianos; moldings in pianos and player pianos; rack-boards on pipe organs.

Accordions: $\frac{1}{4}$ inch thick.

Moldings: surfaced on two sides, clear, 1 inch thick.

Rack-boards: $\frac{3}{4}$ to 1 inch thick.

Sitka spruce. Oregon; Washington.

Backs, ribs, and sounding boards for pianos; pipe organ construction.

Free from sap, not liable to crack, shrinks evenly, resonant.

Rough, clear, 1 inch thick.

NOTE.—One manufacturer estimates that 40,000 feet of spruce is shipped each year from Los Angeles to eastern manufacturers of musical instruments.

American mahogany (Mexican mahogany). Mexico; Central America.

Of total amount of American mahogany manufactured 0.5 per cent used in this industry.

Accordions; benches; moldings on pianos and player pianos; pianos; pipe organ cases.

Hard, good grain, fine finish, does not split.

Rough, clear, 1 inch thick; some crotch mahogany; 1,500 feet of veneer, $\frac{1}{8}$ inch thick, used.

Sugar pine. California.

Pianos and player pianos; piano keys; pipe organs.

Some objection to its use in pipe organ work on account of its price, pitch-galls, and large percentage of sapwood.

Rough or surfaced, clear, 1 to 2 inches thick.

By-products: small pieces glued together for veneer cores.

Red birch. New England; Lake States; Middle West.

Of total amount of red birch manufactured 0.2 per cent used in this industry.

Pipe organ cases.

Finishes to imitate mahogany.

Rough, first grade, 1 inch thick.

Black walnut. South; Middle West.

Of total amount of black walnut manufactured 1.8 per cent used in this industry.

Accordions; benches; pianos; moldings on pianos and player pianos; veneer cross band work on pianos.

Hard, beautiful finish.

Accordions: veneer $\frac{1}{4}$ inch thick.

Moldings: rough, clear, 1 inch thick.

Pianos, benches: burl, 1 inch thick, or burl veneer, $\frac{1}{8}$ inch thick.

2,500 square feet of veneer used in this industry.

Oregon maple. Oregon.

Of total amount of Oregon maple manufactured 9.8 per cent used in this industry.

Action work and cases on pianos.

Hard, strong, good finish.

Rough, best, 2 to 3 inches thick.

White oak, quarter-sawed (eastern oak). South; Middle West.

Of total amount of quartered white oak manufactured 0.1 per cent used in this industry.

Piano benches, legs and pilasters; pipe organ cases.

Hard; good flake.

Rough, clear, 1 to 2 inches thick.

Benches: 1,000 feet of veneer, $\frac{1}{8}$ inch thick, used.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 0.2 per cent used in this industry.

Facings and skeletons of pianos.

Strong, tough.

Surfaced on two sides, clear, 1 inch thick.

Australian mahogany. Australia.

Of total amount of Australian mahogany manufactured 100 per cent used in this industry.

Pianos, benches.

Beauty of finish.

Rough, crotch, veneer, $\frac{1}{8}$ inch thick.

Redwood. California.

Of total amount of redwood manufactured 0.1 per cent used in this industry.

Cases for pianos and player pianos; pipes and chests for pipe organs.

Light, easily worked.

Cases: surfaced on two sides, clear, 1 inch thick.

Pipes, chests: rough, clear, 1, 2 and 3 inches thick.

By-products: small pieces glued together for laminated veneer cores.

NOTE.—There is some prejudice in the trade against the use of redwood for piano parts, although it should be fit for this purpose.

White oak, plain (eastern oak). Middle West; South.

Piano and pipe organ cases.

Strong, fine finish.

Rough or surfaced, clear, 1 to 3 inches thick.

Douglas fir (Oregon pine, Washington fir). Oregon; Washington.

Backs and frames of pianos and player pianos; veneer cores.

Strong, cheap, takes veneer well.

Surfaced on two sides, 1 to 2 inches thick: frames, clear stock: backing, common grades.

Eastern maple (rock maple, hard maple). New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 1.6 per cent used in this industry.

Action work on pipe organs; benches; pianos; pin blocks and tuning pins in pianos; veneering in accordions.

Hard, light, strong, easily worked, good finish.

Rough, clear, $\frac{1}{4}$ to 2 inches thick: 4,500 feet of high figured veneer used.

Oregon ash. Oregon.

Of total amount of Oregon ash manufactured 4.1 per cent used in this industry.

Action work on pianos.

Rough, best, all thicknesses.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Pipe organs.

Rough, clear, 1 to 2 inches thick.

TABLE 18. INSTRUMENTS, MUSICAL.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Redwood	156,200	61.8	$36 22	$5,658	156,200	
White oak (plain)	22,200	8.8	114 77	2,548		22,200
Douglas fir	16,400	6.5	27 02	443		16,400
Eastern maple	15,915	6.3	117 42	1,869		15,915
Yellow poplar	12,000	4.7	93 33	1,120		12,000
Sitka spruce	6,500	2.6	85 46	555		6,500
American mahogany	6,250	2.5	171 20	1,070		6,250
Sugar pine	4,700	1.9	62 02	291	4,700	
Red birch	3,000	1.2	65 00	195		3,000
Black walnut	2,015	0.8	227 30	458		2,015
Oregon maple	2,000	0.8	63 00	126		2,000
White oak (quarter-sawed)	1,870	0.7	138 00	258		1,870
Eastern ash	1,600	0.6	110 00	176		1,600
Australian mahogany	1,000	0.4	135 00	135		1,000
Oregon ash	600	0.2	110 00	66		600
Lawson cypress	500	0.2	65 00	33		500
Total	252,750	100.0	$59 35	$15,001	160,900	91,850

INSTRUMENTS, PROFESSIONAL AND SCIENTIFIC.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Of total amount of Lawson cypress manufactured 0.3 per cent used in this industry.

Pencil blocks.

Strong; finishes well; whittles easily.

Rough, common and shop, 1 inch thick.

By-products: shavings used for bedding cattle.

NOTE.—The blocks are shipped to Germany.

Red birch. New England; Lake States; Middle West.

Of total amount of red birch manufactured 0.4 per cent used in this industry.

Rubber stamp mounts.

Red color; fine finish.

Moldings, $\frac{1}{8}$ to 1 inch thick.

Eastern maple. New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 0.6 per cent used in this industry.

Backing for rubber stamps; bench tops and vises; level rods; palettes; triangles; tripod legs in surveying instruments; T-squares.

Hard; fine grain; does not warp.

Backing: finished, 3-16 to 3 inches thick.

Bench tops, vises: rough, clear, 1 to 2 inches thick.

Level rods, tripod legs: rough, No. 1, 1 inch thick.

Triangles, T-squares, palettes: surfaced, No. 1, $\frac{1}{8}$ inch thick.

Western yellow pine (white pine). California.

Biological cases.

Rough, clear, 1 to 1½ inches thick.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 0.4 per cent used in this industry.

Tripod legs on surveying instruments.

Tough, takes good finish; does not check.

Rough, first quality, 1½ to 2 inches thick.

American mahogany (west coast mahogany). South and Central America.

Of total amount of American mahogany manufactured 0.2 per cent used in this industry.

Surveying instrument cases.

Strong, stands extremes of heat and cold without distortion.

Rough, clear, ½ inch thick.

Redwood. California.

Map cases.

Light, easily worked.

Rough, clear, ½ and 1 inch thick.

Sugar pine. California.

Drawing boards; extension level rods.

Light, does not check or warp.

Rough, clear, 1 inch thick.

Incense cedar. California.

This material has proven to be a good wood for the cheaper grades of pencils. Two large pencil manufacturing concerns are now utilizing it for this purpose.

TABLE 19. INSTRUMENTS, PROFESSIONAL AND SCIENTIFIC.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Lawson cypress	10,000	30.9	$13 00	$130		10,000
Red birch	6,250	19.3	120 00	750		6,250
Eastern maple	5,937	18.3	84 88	504		5,937
Western yellow pine	4,000	12.3	48 00	192	4,000	
Eastern ash	2,500	7.7	135 00	337		2,500
American mahogany	2,000	6.2	175 00	350		2,000
Redwood	1,220	3.8	43 86	54	1,220	
Sugar pine	500	1.5	100 00	50	500	
Total	32,407	100.0	$73 04	$2,367	5,720	26,687

LAUNDRY APPLIANCES.

Douglas fir—Not specified.

Eastern ash—Not specified.

Boxwood sawdust.

Of total amount of boxwood sawdust manufactured 25.0 per cent used in this industry.

Chemically prepared trays, etc.

Colorless; free from acid and resin; can be finely pulverized; takes acid and stain well.

Kiln dried, screened, 35 pound sacks.

American mahogany sawdust.

Chemically prepared trays, etc.

Natural color.

Kiln dried, screened, 35 pound sacks.

Western yellow pine sawdust (white pine).

Laundry floors, trays, etc.

Bleaches well; takes color and stain.

NOTE.—The finely pulverized sawdust is mixed with chemicals, according to a more or less secret process. It forms a strong compound, which can be laid like plaster. Sanitary, waterproof, and has considerable decorative value.

Lawson cypress (white cedar, Port Orford cedar) sawdust.

See western yellow pine sawdust.

TABLE 20. LAUNDRY APPLIANCES.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Douglas fir	2,500	83.3	$45 00	$112		2,500
Eastern ash	500	16.7	110 00	55		500
Total	3,000	100.0	$55 83	$167		3,000
	Pounds.		Per M.			Pounds.
Boxwood sawdust	43,750		$657 00	288		43,750
American mahogany sawdust	2,000		11 00	22		2,000
Total				$477		

MACHINE PARTS.

Douglas fir (Oregon pine, Washington fir, yellow fir). Oregon; Washington.

Of total amount of Douglas fir manufactured 0.1 per cent used in this industry.

Frames of mill machinery; oil derrick construction; portable rigs.

Strong; cheap.

Rough, clear and select, 1 to 12 inches thick.

Redwood. California.

Mill machinery construction; engine frames.

Fairly strong; nails well; used where dampness is a factor, or where the color is desired as a part of the machines.

Mill machinery: surfaced on two sides, clear, 1 inch thick.

Engine frames: rough, common, 2 to 8 inches thick.

White oak, plain (eastern oak). South; Middle West.

Of total amount of white oak manufactured 0.1 per cent used in this industry.

Cylinder blocks; machine timbers.

Strong; tough; durable.

Rough, clear, 1 to 8 inches thick.

Sitka spruce. Oregon; Washington.

Mill machinery.

Surfaced on two sides, good grades, 1 inch thick.

Eastern maple (hard maple). New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 1.1 per cent used in this industry.

Brake band blocks; friction blocks; mill cogs.

Strong; tough; true to form when worked up.

Rough or surfaced, clear, 1 to 8 inches thick.

Hickory. South; Middle West.

Of total amount of hickory manufactured 1.4 per cent used in this industry.

Friction blocks; springs and eccentric slats on flour and feed mill machinery.

Springy; tough.

Surfaced, clear, 3 to 4 inches thick.

Sugar pine. California.

Special machines.

Light, easily worked.

Rough, clear, 1 inch thick.

California blue gum. California.

Of total amount of California blue gum manufactured 7.2 per cent used in this industry.

Driving blocks in oil well work.

Logs, dry, 8 to 12 inches in diameter.

Western yellow pine (yellow pine). California.

Flooring on concrete mixers.

Cheap.

No. 1 common.

TABLE 21. MACHINE PARTS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Douglas fir	117,100	46.8	$29 12	$3,410		117,100
Redwood	58,500	23.4	35 61	2,084	58,500	
White oak (plain)	30,000	12.0	70 00	2,100		30,000
Sitka spruce	15,000	6.0	30 00	450		15,000
Eastern maple	11,000	4.4	110 50	1,215		11,000
Hickory	8,500	3.4	113 08	961		8,500
Sugar pine	4,000	1.6	90 00	360	4,000	
California blue gum	4,000	1.6	80 00	320	4,000	
Western yellow pine	2,000	0.8	23 00	46	2,000	
Total	250,100	100.0	$43 77	$10,946	68,500	181,600
Lignum vitæ	1,000	lbs., 4c per lb.		40		1,000
				$10,986		

MACHINERY AND APPARATUS, ELECTRICAL.

Eastern maple. New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 1.6 per cent used in this industry.

Bases for relays; brake-pads; electric cabinets; forms for winding electric coils; telephone wire moldings.

Close grained; hard; tough; for moldings it will receive screws both endwise and crosswise.

Rough or surfaced, clear and select, ½ to 6 inches thick.

White oak, plain (eastern oak). Middle West; South.

Bases for relays; controllers; electric battery trays; electric cabinets.

Hard; strong; tough.

Rough or surfaced, ½ to 8 inches thick.

Siberian oak, plain (Japanese oak). Japan; Siberia.

Of total amount of plain Siberian oak manufactured 0.6 per cent used in this industry.

Electric battery trays and trim.

Rough, No. 1 and 2, ⅜ to 1 inch thick.

Black walnut. South; Middle West.

Of total amount of black walnut manufactured 3.7 per cent used in this industry.

Electric cabinets.

Boards, planks and blocks, 1 to 6 inches thick.

TABLE 22. MACHINERY AND APPARATUS, ELECTRICAL.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Eastern maple	15,850	40.6	$77 28	$1,225		15,850
White oak (plain)	12,750	32.7	77 92	993		12,750
Siberian oak (plain)	6,250	16.0	82 00	513		6,250
Black walnut	4,200	10.7	75 00	315		4,200
Total	39,050	100.0	$78 00	$3,046		39,050

MATCHES.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Tough; splits well.

Bolts, best quality.

PATTERNS.

Redwood. California.

Of total amount of redwood manufactured 0.5 per cent used in this industry.

Local patterns.

Soft; cheap; easily worked; does not warp or twist; shrinks very little in California climate.

Rough, clear, 1 to 4 inches thick.

Sugar pine. California.

Of total amount manufactured 0.2 per cent used in this industry.

Patterns, models.

Soft; non-resinous; easily worked; glues and nails well; durable; does not warp.

Patterns: rough, clear, 1 to 4 inches thick.

Models: surfaced, clear, ¼ to 4 inches thick.

Douglas fir (Oregon pine, Washington fir). Oregon; Washington.

Foundry flasks.

Wears well.

Rough, medium grades, 1 to 6 inches thick.

Spanish cedar. Mexico.

Of total amount of Spanish cedar manufactured 3.1 per cent used in this industry.

Standard and ornamental patterns.

Soft; open grained; strong; easily carved; smooth finish; does not split or warp; holds sharp corners and edges.

Rough or surfaced, clear, 1 to 3 inches thick.

Western yellow pine (white pine). California.

Common patterns and models.

Light; fairly strong; easily worked.

Rough or surfaced, clear, 1 to 2 inches thick.

American mahogany (Honduras mahogany). Central America.

Of total amount of American mahogany manufactured 1.3 per cent used in this industry.

Plain and ornamental patterns.

Solid; close grained; easily worked; carves well; holds shape well; wears well and long in sand.

Rough, clear, 1 to 4 inches thick; as thin as 3-16 inch thick for ornamental patterns.

Eastern maple. New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 0.5 per cent used in this industry.

Patterns; models; mold and core boxes; standard patterns.

Straight; close grained; strong; easily worked.

Rough or surfaced, No. 1, ¼ to 4 inches thick.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 0.7 per cent used in this industry.

Small patterns and models.

Close grained; tough; easily chiseled.

Rough, first grade, ¼ to 3 inches thick.

Philippine mahogany (Narra). Philippine Islands.

Of total amount of Philippine mahogany manufactured 4.4 per cent used in this industry.

Standard patterns.

Lasts well in sand.

Surfaced, clear 1¼ and 2 inches thick.

By-products: sawdust used in the manufacture of chemically prepared floors, trays, washboards, etc.

White oak, plain (eastern oak). Middle West; South.

Patterns; models.

Resists wearing action of sand.

Patterns: rough, clear, 1 to 2 inches thick.

Models: surfaced, clear, ¼ to 4 inches thick.

TABLE 23. PATTERNS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Redwood	517,000	74.9	$42 81	$22,133	517,000	
Sugar pine	59,350	8.6	66 39	3,940	59,350	
Douglas fir	49,090	7.1	21 73	1,067		49,090
Spanish cedar	20,450	3.0	151 72	3,103		20,450
Western yellow pine	18,000	2.6	80 83	1,455	18,000	
American mahogany	15,200	2.2	195 19	2,967		15,200
Eastern maple	5,100	0.7	87 96	448		5,100
Yellow poplar	4,100	0.6	108 54	445		4,100
Philippine mahogany	1,500	0.2	170 00	255		1,500
White oak (plain)	500	0.1	120 00	60		500
Total	690,290	100.0	$51 97	$35,873	594,350	95,940

PLANING MILL PRODUCTS.

Redwood. California.

Of total amount of redwood manufactured 44.9 per cent used in this industry.

Exterior finish chiefly; interior finish.

Contains no pitch; easily worked; good finish; imitates mahogany; does not split; holds paint well; durable when exposed to weather.

Rough, all grades, 1 to 12 inches thick.

By-products: brackets, core stock for veneered doors, flower and surveyor's stakes; small moldings; spindles, stair balusters; shavings for horse bedding; sawdust for packing ice and litter in poultry houses.

NOTE.—Some manufacturers prefer redwood from Humboldt and Del Norte counties.

Douglas fir (Oregon pine, red fir, yellow fir, Washington fir). California; Oregon; Washington.

Of total amount of Douglas fir manufactured 35.9 per cent used in this industry.

Flooring; chiefly interior finish.

Strong; works easily; cut slash grain it gives a beautiful finish; imitates more costly woods, especially oak; does not scar readily, when used as flooring it is often stained to represent hardwoods.

Rough, clear, 1 to 2 inches thick; surfaced, $\frac{7}{8}$ inches thick.

By-products: beehive supplies, core stock for veneered doors, garden and surveyor's stakes, small moldings; sawdust and shavings for packing ice.

NOTE.—Some manufacturers claim that the fir from Washington is softer than that from Oregon, easier to work, and does not split so easily.

Western yellow pine (white pine, mountain pine). California; Oregon; Nevada; Arizona.

Of total amount of yellow pine manufactured 0.8 per cent used in this industry.

Interior finish.

Soft; good grain; easily worked; good natural finish; takes paint well; owing to its color takes a good enamel finish.

Rough, all grades, 1 to 4 inches thick.

By-products: small moldings.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Of total amount of Lawson cypress manufactured 57.0 per cent used in this industry.

Interior finish.

Soft; durable; finishes to imitate mahogany; best wood for enamel finish on account of its tight grain.

Rough, clear and select, 1 to 2 inches thick.

By-products: core stocks for veneered doors; small moldings.

Sugar pine. Oregon; California.

Of total amount of sugar pine manufactured 3.8 per cent used in this industry.

Cut siding; interior finish; moldings.

Light; soft; easily worked; handsome; holds nails well; takes enamel finish.

Rough, clear, 1 to 2 inches thick.

By-products: core stock for veneered doors.

White oak, plain (eastern oak). Middle West; South.

Of total amount of plain white oak manufactured 4.4 per cent used in this industry.

Flooring; interior finish.

Hard; good polish and appearance; wears well.

Flooring: surfaced, first grade, 5-16, $\frac{3}{8}$ and $\frac{7}{8}$ inch thick.

Finish: rough, clear, 1 to 2 inches thick: 155,000 square feet of veneer, 1-16, $\frac{1}{8}$ and 3-16 inch thick, used.

By-products: cores for veneered work; parquetry floors; small moldings; surveyor's stakes.

Siberian oak, plain (Japanese oak). Japan; Siberia.

Of total amount of plain Siberian oak manufactured 66.6 per cent used in this industry.

Interior finish: moldings; parquetry and strip floors.

Beauty of finish.

Rough, No. 1 and 2, 1 to $1\frac{1}{4}$ inches thick.

Red birch. New England; Lake States; Middle West.

Of total amount of red birch manufactured 45.9 per cent used in this industry.

Interior finish; flooring.

Hard; strong; beautiful grain; finishes to imitate more costly woods; brings out the design in inlaid floors.

Finish: rough, first and second grades, 1 to 2 inches thick: 31,500 square feet of veneer, $\frac{1}{8}$ inch thick, used.

Flooring: rough, first and second grade, 1 to $1\frac{1}{2}$ inches thick; or, surfaced, clear $\frac{7}{8}$ inch thick.

By-products: cores for veneered work, short veneers for facing table tops; sawdust for refrigeration; shavings for stable bedding.

Eastern maple (hard maple, white maple). New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 56.9 per cent used in this industry.

Interior finish; strips and parquetry floors.

Hard; light; easily worked; polishes well; imitates more costly woods.

Finish: rough, clear, 1 to 2 inches thick, some bird's-eye maple.

Flooring: principally surfaced, some rough, first and second grades, 5-16 to 1 inch thick.

By-products: moldings; surveyor's stakes.

White oak, quarter-sawed (eastern oak). South; Middle West.

Of total amount of quartered white oak manufactured 35.9 per cent used in this industry.

Interior finish; panels; strip and parquetry floors.

Hard; strong; fine finish; polishes well.

Finish: rough, first grade, 1 inch thick, used.

Panels: 10,360 square feet of veneer, 1-16 inch thick, used.

Flooring: surfaced, clear, 5-16, $\frac{3}{8}$, $\frac{7}{8}$ and 1 inch thick.

American mahogany (tobasco mahogany). South and Central America; West Indies.

Of total amount of American mahogany manufactured 30.0 per cent used in this industry.

Interior finish; strip, inlaid, and parquetry floors.

Hard; beautifully grained; easily worked; polishes well; glues and joins well.

Finish; rough, first and second grade, $\frac{5}{8}$ to 6 inches thick; 86,000 square feet of veneer, 1-20 and 3-16 inch, used.

Flooring: rough, first and second grade, $\frac{7}{8}$ to $1\frac{1}{2}$ inches thick, used.

By-products: sawdust and shavings for stable bedding.

Sitka spruce. Oregon; Washington.

Of total amount of Sitka spruce manufactured 0.4 per cent used in this industry.

Interior finish.

Light, cheap.

Rough, clear and select, 1 inch thick.

Siberian oak, quarter-sawed (Japanese oak). Siberia; Japan.

Of total amount of quartered Siberian oak manufactured 58.1 per cent used in this industry.

Interior finish.

Beauty of grain.

Rough, first and second grade, 1 to 2 inches thick.

By-products: short veneers for facing table tops.

Beech. South; Middle West.

Of total amount of beech manufactured 100.0 per cent used in this industry.

Inlaid floors.

Brings out inlaid designs.

First and second grade, 1 to $1\frac{1}{2}$ inches thick.

Red fir. California.

Of total amount of red fir manufactured 2.6 per cent used in this industry.

Interior finish.

Good grain.

Rough, 1 to 4 inches thick.

Genisaro (Jenizaro.)

Of total amount of genisaro manufactured 44.9 per cent used in this industry.

Interior finish.

Beauty of grain.

Rough, first, second and third grades, 1 to 2 inches thick; 25,000 square feet of veneer, 1-20 and 3-16 inch thick, used.

Juana costa. Mexico.

Of total amount of juana costa manufactured 100.00 per cent used in this industry.

Interior finish.

Beauty of grain.

Rough, clear, 1 to 2 inches thick.

By-products: short veneers for facing table tops.

White fir. California.

Of total amount of white fir manufactured 0.5 per cent used in this industry.

Flooring; moldings.

Logs, all sizes and grades.

Incense cedar. California.

Of total amount of incense cedar manufactured 2.3 per cent used in this industry.

Flooring; moldings.

Logs, all sizes and grades.

Black walnut. South; Middle West.

Of total amount of black walnut manufactured 32.8 per cent used in this industry.

Inlaid floors; interior finish.

Appearance: polish brings out inlaid designs.

Floorings: surfaced, $\frac{7}{8}$ inch thick, or rough, No. 1 and 2, 1 to $1\frac{1}{2}$ inches thick.

Finish: rough, clear, 1 to 2 inches thick.

Philippine mahogany (Narra). Philippine Islands.

Of total amount of Philippine mahogany manufactured 71.0 per cent used in this industry.

Interior finish.

Rough, No. 1, 1 to 3 inches thick.

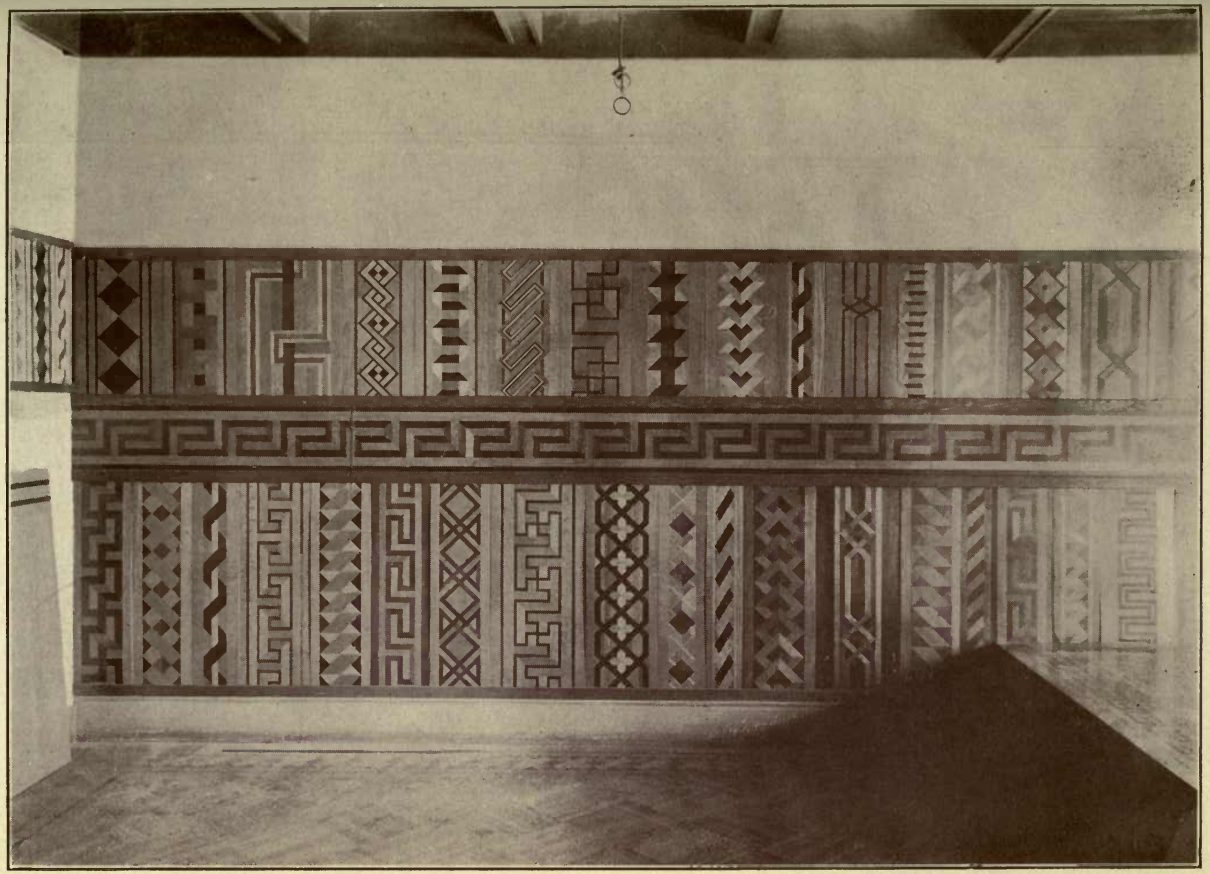

PLATE VII. Display of samples of oak, birch, maple, walnut, and South American wood flooring.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 1.5 per cent used in this industry.

Inlaid floors; interior finish.

Hard; good appearance; polishes well.

Flooring: thin strips, best grade, 5-16 inch thick.

Finish: rough, clear, 1 to 2 inches thick.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 1.8 per cent used in this industry.

Cores for panel work; interior finish.

Cores: 5,000 square feet of rotary cut veneer, 3-16 inch thick, used.

Finish: rough, clear, $\frac{5}{8}$ to $1\frac{1}{2}$ inches thick.

By-products: moldings; short veneers for facing table tops.

Red Bean. Australia.

Of total amount of red bean manufactured 100.0 per cent used in this industry.

Parquetry; strip floors.

Rough, clear, 1 inch thick.

Circassian walnut. Turkey.

Of total amount of Circassian walnut manufactured 90.6 per cent used in this industry.

Interior finish.

Beauty of grain.

Rough, first grade, 1 inch thick and over.

Red gum. Middle West; South.

Of total amount of red gum manufactured 1.3 per cent used in this industry.

Interior finish.

Rough, clear, 1 to 2 inches thick.

Koa. Hawaiian Islands.

Of total amount of koa manufactured 91.8 per cent used in this industry.

Interior finish.

Rough, first grade, 1 inch thick and over; 500 square feet of veneer, 1-20 inch thick, used.

African mahogany. Africa.

Of total amount of African mahogany manufactured 16.3 per cent used in this industry.

Inlaid floors; interior finish.

Rough, No. 1 and 2, 1 to 2 inches thick.

Oregon oak. Oregon.

Of total amount of Oregon oak manufactured 0.2 per cent used in this industry.

Interior finish.

Rough, merchantable to clear, all thicknesses.

Prima vera (white mahogany). Mexico.

Of total amount of prima vera manufactured 7.2 per cent used in this industry.

Interior finish.

Rough, No. 1, 1 to 2 inches thick.

Elm. Michigan; Middle West.

Of total amount of elm manufactured 1.6 per cent used in this industry.

Panels.

Finished, $\frac{1}{4}$ to $\frac{5}{8}$ inch thick.

Teak. Burmah.

Of total amount of teak manufactured 2.7 per cent used in this industry.

Interior finish.

Rough, clear, 1 inch thick.

Spanish cedar. Mexico.

Of total amount of Spanish cedar manufactured 0.3 per cent used in this industry.

Interior finish.

Rough, clear, 1 to 2 inches thick.

Red oak. South; Middle West.

Of total amount of red oak manufactured 1.9 per cent used in this industry.

Interior finish.

Rough, No. 1, 1 to 4 inches thick.

TABLE 24. PLANING MILL PRODUCTS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Redwood	49,080,378	49.8	$25 72	$1,262,347	49,080,378	
Douglas fir	39,034,046	39.6	28 21	1,101,151	6,044,415	32,989,631
Western yellow pine	2,165,011	2.2	45 07	97,577	2,165,011	
Lawson cypress	1,756,257	1.8	50 81	89,235	92,830	1,663,427
Sugar pine	1,317,060	1.3	43 87	57,779	1,317,060	
White oak (plain)	1,050,507	1.1	94 06	98,812		1,050,507
Siberian oak (plain)	694,425	0.7	90 82	63,066		694,425
Red birch	684,750	0.7	78 76	53,936		684,750
Eastern maple	579,747	0.6	77 36	44,849		579,747
White oak (quarter-sawed)	540,675	0.5	88 39	47,790		540,675
American mahogany	341,751	0.3	179 55	61,362		341,751
Sitka spruce	301,000	0.3	22 75	6,848		301,000
Siberian oak (quarter-sawed)	200,412	0.2	118 75	23,800		200,412
Beech	160,000	0.2	100 00	16,000		160,000
Red fir	122,000	0.1	32 79	4,000	122,000	
Genisaro	112,190	0.1	125 35	14,063		112,190
Juana costa	90,500	0.1	114 36	10,350		90,500
White fir	62,500		25 00	1,563	62,500	
Incense cedar	62,500		25 00	1,563	62,500	
Black walnut	37,000		134 86	4,990		37,000
Philippine mahogany	23,990		153 85	3,691		23,990
Ash	10,700		70 00	749		10,700
Yellow poplar	10,310		73 00	753		10,310
Red bean	10,000		120 00	1,200		10,000
Circassian walnut	7,250		183 45	1,330		7,250
Red gum (Missouri)	6,000		85 00	510		6,000
Koa	5,625		155 55	875		5,625
African mahogany	5,500		213 33	1,173		5,500
Oregon oak	5,000		100 00	500		5,000
Prima vera	2,643		151 35	400		2,643
Elm	2,500		75 00	188		2,500
Teak	2,445		190 23	465		2,445
Spanish cedar	2,000		140 00	280		2,000
Red oak	1,750		122 86	215		1,750
Total	98,488,422	100.0	$51 20	$3,073,410	58,946,684	39,541,738

PRINTING MATERIAL.

Cherry. Middle Atlantic States.

Of total amount of cherry manufactured 86.8 per cent used in this industry.

Backing for zinc and copper plates; mounting cuts.

Solid; tough; easily worked; nails fairly well; does not warp; strong enough to uphold impression in printing press.

Surfaced, well seasoned, 15-16, $\frac{7}{8}$ and 1 inch thick.

NOTE.—The strips are glued together to make boards 12 inches wide.

TABLE 25. PRINTING MATERIALS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Cherry	6,575	100.0	$153 88	$1,012		6,575

PULLEYS AND CONVEYORS.

Douglas fir (*Oregon pine*). Oregon; Washington.

Pulley stiles.

Strong; cheap.

Rough; all grades and sizes.

White oak, plain (*eastern oak*). Middle West; South.

Conveyor slats.

Strong.

Surfaced, clear, 3 inches thick.

PULP AND PAPER.

White fir. California.

Pulp.

Long, strong fiber.

Cordwood, bodywood of tree, 6 to 12 inches in diameter.

Red fir. California.

Pulp.

Cordwood, bodywood of tree, 6 to 12 inches in diameter.

Lodgepole pine (*tamarack*). California.

Small quantities of this are also used, mixed with red and white fir.

PUMPS.

Douglas fir (*Oregon pine*). Oregon; Washington.

Pump frames and skids.

Strong; easily worked; holds its shape.

Rough, select and common, $\frac{3}{4}$ to 10 inches thick.

TABLE 26. PUMPS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Douglas fir	49,980	100.0	$22 39	$1,119		49,980

REFRIGERATORS, KITCHEN CABINETS.

Douglas fir (Oregon pine, Washington fir). Oregon; Washington.

Of total amount of Douglas fir manufactured 0.2 per cent used in this industry.

Brine tanks; cold storage rooms; floors; framework; ice boxes; joists; outside finish; refrigerators; studding.

Strong; cheap; easily worked.

Floors; outside finish; surfaced, clear, $\frac{3}{8}$ to 1 inch thick.

Framework: rough, clear, 2 inches thick.

Joists, studding: rough, merchantable, $\frac{1}{2}$ to 6 inches thick.

Sitka spruce. Oregon; Washington.

Inside walls and shelves of cold storage rooms and refrigerators.

Tough; odorless.

Surfaced on one side, select, 1 inch thick.

Siberian oak, plain (Japanese oak). Japan; Siberia.

Of total amount of plain Siberian oak manufactured 0.7 per cent used in this industry.

Ice boxes; refrigerators.

Surfaced on two sides, No. 1: $\frac{3}{8}$ inch thick for ice boxes; $1\frac{1}{8}$ and $1\frac{3}{4}$ inches thick for refrigerators.

Redwood. California.

Mud sills for brine tanks, ice boxes, refrigerators, etc.

Durable against decay in damp places.

Rough, common, 1 to 6 inches thick.

White oak, plain (eastern oak). Middle West; South.

Flooring and outside finish for cold storage rooms and refrigerators.

Hard; durable against decay and wear.

Surfaced on two sides, first and second grades, 1 to 3 inches thick.

Eastern maple (white maple). New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 0.1 per cent used in this industry.

Cold storage rooms; finish; ice boxes; refrigerators.

Surfaced on one or two sides, No. 1 and 2, $\frac{3}{8}$ to $1\frac{3}{4}$ inches thick.

American mahogany. South and Central America.

Panel work on ice refrigerators and cold storage rooms.

Veneer.

TABLE 27. REFRIGERATORS AND KITCHEN CABINETS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California.	Grown out of California.
	Feet, board measure.	Per cent.	F. o. b. factory.		feet, board measure.	feet, board measure.
Douglas fir	208,600	76.9	$26 06	$5,436		208,600
Sitka spruce	44,500	16.4	36 52	1,625		44,500
Siberian oak (plain)	6,800	2.5	90 00	612		6,800
Redwood	6,000	2.2	32 50	195	6,000	
White oak (plain)	3,000	1.1	70 00	210		3,000
Eastern maple	1,500	0.6	60 00	90		1,500
American mahogany	800	0.3	125 00	100		800
Total	271,200	100.0	$30 49	$8,268	6,000	265,200

ROLLERS, SHADE AND MAP.

Sitka spruce. Oregon; Washington.

Battens and frames for scenery rollers.
Light; tough; cheap; works easily.
Surfaced on four sides, clear, 1 inch thick.

Sugar pine. California.

Battens and frames for scenery rollers.
Clear; light; straight; fairly tough; works easily.
Surfaced on four sides, clear, 1 inch thick.

Douglas fir (Oregon pine). Oregon; Washington.

Frames for scenery rollers.
Strong.
Surfaced on four sides, clear, 1 inch thick.

Redwood. California.

Moldings and rounds for mounting maps.
Light; easily worked.
Surfaced, clear, 1 inch thick.

SADDLES AND HARNESS.

Sugar pine. California.

Saddle trees.
Fairly pliable; an easy burden on a horse.
Rough, shop, 2 inches thick.

Douglas fir (Oregon pine). Oregon; Washington.

Saddle trees.
Hard; strong; cheap; comparatively light.
Rough, merchantable, 4 inches thick.

Sitka spruce. Oregon; Washington.

Saddles.
Light; tough; an easy burden on a horse.
Rough, select, 1 inch thick.

SASH, DOORS, BLINDS, AND GENERAL MILLWORK.

Redwood. California.

Of total amount of redwood manufactured 36.9 per cent used in this industry.

Balusters; cabinet work; columns; doors; posts; sash; screen stock; stairs.

Balusters, columns, posts: durable against decay; rough, common, to clear, 4 to 10 inches thick; chiefly used where exposed to weather.

Cabinet work: light, easily worked; rough, select, 1 inch thick.

Doors, sash: contains no pitch, soft, easily worked, finishes well, takes paint readily, does not shrink, stands exposure to the weather; rough, clear, 1 to 12 inches thick.

Screen stock: nails and weathers well; rough, clear, 1 inch thick.

Risers, stringers, exterior stair work: light, durable against decay; rough, clear, 1 to 1½ inches thick.

By-products: balusters, brackets, small turnings, wedges; sawdust used for packing ice, poultry-house litter, and sweeping; shavings used for stable bedding.

Western yellow pine (white pine). California.

Of total amount of yellow pine manufactured 13.6 per cent used in this industry.

Doors; grills; inside screens; sash.

Doors, sash: light, soft, fairly strong, easily worked, nails well in thin strips, takes good natural finish or can be made to imitate more costly woods; shrinks little, does not warp or check. not so good as sugar pine, but cheaper; rough, shop, 1 to 4 inches thick.

By-products: ⅜ inch strips used in the manufacture of picture frames; scraps glued together for veneered doors and plaster cores; sawdust for packing ice and stable bedding; shavings for stable bedding.

Douglas fir (Oregon pine, Washington fir, mountain pine). California; Oregon; Washington.

Of total amount of Douglas fir manufactured 32.1 per cent used in this industry.

Balusters; cabinet work; columns; doors; mantels; newel posts; risers; stepping stringers; window frames.

Balusters, columns, newel posts: good, smooth finish; rough, select and common, 2 to 4 inches thick.

Doors: fine finish (especially in slash grain effects), capable of imitating oak and other hardwoods; hardness prevents scarring; should be thoroughly kiln dried to prevent checking, warping and opening of pitch seams; rough, clear or select, 1 to 3 inches thick.

Risers, stepping stringers: strong, tough, cheap, easily worked, durable under wear; rough, clear, 1 to 4 inches thick.

Window frames: hard, cheap, good grain, fine finish, especially adapted for pulley-jambs; rough, common to clear, 1 to 2 inches thick.

By-products: balusters, brackets, ceiling cores, cores for veneered work, corner blocks, cresting, piling sticks, small spindles, stakes, wedges.

Sugar pine. California; Oregon.

Of total amount of sugar pine manufactured 34.1 per cent used in this industry.

Doors; sash; screen frames.

Soft; straight grained; good finish; shrinks little; not likely to warp; stands exposure to the weather.

Rough, all grades, 1 to 4 inches thick.

By-products: balusters, brackets, box-shooks, ceiling cores, core stock for veneers, corner blocks, cresting, piling sticks, plaster cores, small moldings, surveyor's stakes, washboard stock; shavings for packing; sawdust for stable bedding; $\frac{3}{8}$ inch strips run into picture frames.

Sitka spruce. Oregon; Washington.

Of total amount of spruce manufactured 5.4 per cent used in this industry.

Cabinet work; doors, screen windows.

Cheap; works easily; stands up well.

Cabinet work: rough, clear or select, 1 to 4 inches thick.

Screen windows: rough, clear, 4 by 4 inches.

Incense cedar. California.

Of total amount of incense cedar manufactured 93.3 per cent used in this industry.

Doors; sash.

Available; cheap; required to be cut in logging other species.

Rough, shop grades, 1 to 2 inches thick.

White fir. California.

Of total amount of white fir manufactured 3.6 per cent used in this industry.

General mill work.

Available; cheap; logged with more desirable species.

Rough, shop grades, 1 to 2 inches thick.

Red fir. California.

Of total amount of red fir manufactured 8.7 per cent used in this industry.

Doors, sash.

Available; cheap; logged with more desirable species.

Rough, shop and common, 1 to 2 inches thick.

Lawson cypress. Oregon.

Of total amount of Lawson cypress manufactured 9.3 per cent used in this industry.

Cabinet work; doors; grills; mantels; reversible sash; sash; screens; shoes and strips for sash.

Tough; good finish; durable against decay.

Rough, clear and select, 1 to 2 inches thick.

By-products: cores for veneered work, pencil slats, washboard stock; sawdust for cleaning purposes; shavings for stable bedding.

White oak, plain (eastern oak). Middle West; South.

Of total amount of plain white oak manufactured 0.9 per cent used in this industry.

Cabinet work; doors; sash; stair work.

Hard; strong; easily worked; good finish; durable against wear.

Doors, sash (greater portion veneered): rough, clear, 1 to 2 inches thick.

Risers: rough, clear, 1 to 2 inches thick.

Stepping: rough, first grade, 1 to 1½ inches thick.

Stringers and posts of greater thicknesses.

By-products: garden stakes, post tops, small moldings and turnings, wedges; sawdust manufactured into a sweeping compound.

American mahogany. Mexico; South and Central America.

Of total amount of American mahogany manufactured 15.5 per cent used in this industry.

Cabinet work; doors; general stair work; mantels; newels and stringers on stairs; sash; veneered screens.

Beauty of finish.

Rough, first and second grade, ⅝ to 4 inches thick; 100,000 board feet of logs; 27,500 square feet of veneer, 1-20, 1-16, ⅛ and 3-16 inch thick, used.

White oak, quarter-sawed (eastern oak). Middle West; South.

Of total amount of quartered white oak manufactured 8.7 per cent used in this industry.

Cabinet work; doors; mantels; newels; risers, stepping and stringers on stairs; sash.

Strong; fine finish.

Rough, first grade, 1 to 4 inches thick; 23,500 square feet of veneer, 1-16 and ⅛ inch thick, used on cabinet work and doors.

Japanese oak, plain (Siberian oak). Japan; Siberia.

Of total amount of plain Japanese oak manufactured 7.6 per cent used in this industry.

Cabinet work; stepping; veneered doors.

Strong; fine finish.

Rough, No. 1 and 2, 1 to 6 inches thick; small amount of veneer, $\frac{1}{8}$ inch thick, used on doors.

Yucca. California.

Of total amount of Yucca manufactured 35.5 per cent used in this industry.

Fancy screens.

White; light; fibrous; flexible; easily molded to form; decorative.

Logs: turned to veneer 1-16 inch thick.

Black walnut. South; Middle West.

Of total amount of black walnut manufactured 18.0 per cent used in this industry.

Cabinet work; stairs.

Beauty of finish.

Veneer and rough lumber, first and second grades, 1-16 to 4 inches thick.

Eastern maple (white maple). New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 1.5 per cent used in this industry.

Cabinet work.

Rough, clear, 1 to 3 inches thick; some bird's-eye.

Red birch (white birch). New England; Lake States; Middle West.

Of total amount of red birch manufactured 0.8 per cent used in this industry.

Cabinet work; screen frames; stairs; veneered doors and sash.

Rough, common to clear, 1 to 2 inches thick.

Screen frames: surfaced on two sides, clear, 1 inch thick; 7,500 square feet of rotary cut veneer, $\frac{1}{8}$ inch thick, used.

Japanese oak, quarter-sawed (Siberian oak). Japan; Siberia.

Of total amount of quartered Japanese oak manufactured 2.7 per cent used in this industry.

Cabinet work; newels, stepping and stringers on stairs.

Strong; fine finish.

Rough, No. 1, 1 to 2 inches thick.

By-products: post tops and small turnings.

Hickory. South; Middle West.

Of total amount of hickory manufactured 1.3 per cent used in this industry.

Turnings.

Boards, planks, blocks, 1 to 6 inches thick.

Spanish cedar. Mexico.

Of total amount of Spanish cedar manufactured 0.9 per cent used in this industry.

Balusters; newels and rails on stairs.

Turns well; good finish.

Rough, clear, 1 to 6 inches thick.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 0.8 per cent used in this industry.

Cabinet work.

Rough, clear and select, 1 to 4 inches thick.

Australian blue gum. Australia.

Of total amount of Australian blue gum manufactured 32.3 per cent used in this industry.

Turnings.

Boards, planks, blocks, 1 to 6 inches thick.

Oregon maple. Oregon.

Of total amount of Oregon maple manufactured 14.6 per cent used in this industry.

Mantels.

Good finish.

Rough, first grade, 1 to 4 inches thick.

Genisaro (Jenizaro). Mexico.

Of total amount of Genisaro manufactured 1.1 per cent used in this industry.

Cabinet work; stairs.

Rough, clear and select, 1 to 4 inches thick.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 0.4 per cent used in this industry.

Cabinet work; carved work; mantels.

Works easily; good finish.

Cabinet work: surfaced on two sides, clear, $\frac{1}{2}$ inch thick.

Mantels: rough, first grade, 1 to 2 inches thick.

Pepperwood (California laurel). California.

Of total amount of pepperwood manufactured 30.7 per cent used in this industry.

Cabinet work; mantels.

Strong; good finish.

Cabinet work: rough, No. 1 and 2, 1 to 6 inches thick.

Mantels: No. 1, $1\frac{1}{2}$ inches thick.

African mahogany. Africa.

Of total amount of African mahogany manufactured 3.0 per cent used in this industry.

Screen frames.

Surfaced on two sides, clear and select, 1 inch thick.

Prima vera (white mahogany). Mexico.

Of total amount of prima vera manufactured 2.4 per cent used in this industry.

Cabinet work; stairs.

Close grained; solid; beautiful finish.

Rough or surfaced, clear, 1 to 4 inches thick.

Philippine mahogany. Philippine Islands.

Of total amount of Philippine mahogany manufactured 1.8 per cent used in this industry.

Veneered doors and sash.

Veneer, 1-20 and $\frac{1}{8}$ inch thick.

Red gum. Middle West; South.

Stair work.

Rough, first grade, 1 and $1\frac{1}{4}$ inches thick.

TABLE 28. SASH, DOORS, BLINDS, AND GENERAL MILLWORK.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Redwood	40,374,603	30.7	$19 95	$805,473	40,374,603	
Western yellow pine	36,160,100	27.5	20 11	727,179	36,160,100	
Douglas fir	34,903,050	26.5	25 55	891,773	4,795,600	30,107,450
Sugar pine	11,930,303	9.1	27 50	328,084	11,887,803	42,500
Sitka spruce	3,639,500	2.8	20 74	75,483		3,639,500
Incense cedar	2,570,000	2.0	17 75	45,620	2,570,000	
White fir	500,000	0.4	25 00	12,500	500,000	
Red fir	402,000	0.3	10 00	4,020	402,000	
Lawson cypress	286,350	0.2	48 82	13,980		286,350
White oak (plain)	214,075	0.2	121 28	25,964		214,075
American mahogany	175,838	0.1	163 69	28,784		175,838
White oak (quarter-sawed)	130,951	0.1	113 16	14,819		130,951
Japanese oak (plain)	79,175		97 77	7,741		79,175
Yucca	60,000		60 00	3,600	60,000	
Black walnut	20,336		140 71	2,862		20,336
Eastern maple	15,472		95 34	1,476		15,472
Red birch	12,331		127 90	1,577		12,331
Japanese oak (quarter-sawed)	9,453		120 09	1,135		9,453
Hickory	8,400		75 00	630		8,400
Spanish cedar	6,123		117 13	717		6,123
Eastern ash	5,300		136 60	724		5,300
Australian blue gum	4,200		75 00	315		4,200
Oregon maple	3,000		50 00	150		3,000
Genisaro	2,745		160 51	441		2,745
Yellow poplar	2,000		85 00	170		2,000
Pepperwood	1,600		71 88	115	1,600	
African mahogany	1,000		165 00	165		1,000
Prima vera	895		154 68	138		895
Philippine mahogany	625		320 00	200		625
Red gum (Missouri)	73		84 00	6		73
Total	131,519,498	100.0	$22 78	$2,995,841	96,751,706	34,767,792

SHIP AND BOAT BUILDING.

Douglas fir (Oregon pine, Washington fir, Puget Sound pine). California; Oregon; Washington.

Of total amount of Douglas fir manufactured 15.3 per cent used in this industry.

Decking and planking; framing for dredges, launches, sailing vessels, wooden steamers, etc.; keelsons; knees.

Decking and planking; hard, good finish; does not sliver; durable; rough, clear, 1 to 6 inches thick.

Framing, strong, comes in long lengths; rough, clear and select, up to 18 by 18 inches. Keelsons: rough, clear and select, 6 by 12 inches. Knees: butt-fir required.

By-products: boat-wedges, blocking, interior and exterior finish, moldings, window frames.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Of total amount of Lawson cypress manufactured 15.5 per cent used in this industry.

Boats; cabin finish; decks; launch hulls; launches; outside planking; scuttles; yachts, etc.

Light; strong; good finish; holds fastenings well; does not shrink or warp; durable against decay and wear.

Rough, clear and select, 1 to 4 inches thick.

By-products: moldings for interior and exterior finish, small plugs and spindles, wedges, window frames.

White oak, plain (eastern oak). Middle West; South.

Of total amount of plain white oak manufactured 1.3 per cent used in this industry.

Cabin finish; cleats; fenders; frames; gunwales; keels, rails; stem and stern posts.

Strong; bends well; holds fastenings; durable.

Finish: rough, No. 1, 1 to 2 inches thick.

Frames, stem and stern posts: rough, No. 1, 2 to 18 inches thick.

Keels: rough, No. 1, 3 to 6 inches thick.

By-products: moldings for interior finish, plugs, wedges.

Western yellow pine (yellow pine). California.

Cabin finish for boats and launches.

Fairly strong; does not sliver.

Rough, clear, $\frac{3}{8}$ to $1\frac{1}{2}$ inches thick.

Australian ironbark (ironwood). Australia.

Of total amount of ironbark manufactured 99.2 per cent used in this industry.

Bitts; fenders principally; keels; rudder-stocks; stem and stern posts.
Strong; tough; wears well; durable against decay and marine-borers.
Rough, or surfaced on one side, 1 to 16 inches thick.
Fenders: clear, 1 to 4 inches thick.
By-products: plugs, wedges.

Teak. Burmah.

Of total amount of teak manufactured 95.6 per cent used in this industry.
Finish; outside companionways; rails; seats.
Beauty; durability.
Rough, clear and select, 1 to 2½ inches thick.

Sugar pine. California.

Of total amount of sugar pine manufactured 0.2 per cent used in this industry.
Finish; planking; ship doors and windows.
Good grain; does not shrink or warp; durable against decay.
Rough, clear and select, 1 to 3 inches thick.

Redwood. California.

Frames for arks, barges, launches, motor-boats and rowboats; interior cabin finish on boats, launches and river steamers; planking and sheeting on launches, small boats and yachts; tanks and partitions on river steamers.
Easily worked; durable against decay.
Frames: structural sizes.
Finish: surfaced, clear, 1 to 2 inches thick.
Planking and sheeting: rough, clear, 1 to 3 inches thick.
By-products: plugs, wedges.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 6.7 per cent used in this industry.
Finish: joiner work; light decking; trimmings on boats and launches.
Lighter than oak; strong; easy to work.
Rough, clear and select, ½ to 2 inches thick.

Locust. Lake States; Middle West.

Of total amount of locust manufactured 100.0 per cent used in this industry.
Tree nails.
Hard; durable in water.
Logs; turned material; rough lumber, No. 1, 1⅜ inches thick.
By-products: insulator pins.

Sitka spruce. Oregon; Washington.

Inside flooring in boats and launches; oars; sculls; spars for boats and launches.

Flooring: rough, clear, 1 inch thick.

Oars, sculls: light, strong, tough; rough, clear, 2 to 3 inches thick.

Spars: light, straight, strong; rough, clear, 4 to 8 inches thick.

American mahogany (Mexican mahogany). Mexico; South and Central America.

Of total amount of American mahogany manufactured 3.7 per cent used in this industry.

Interior finish; joiner work; panels; rails.

Beauty of finish.

Rough, clear, 1 to 2 inches thick.

Eastern maple. New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 3.2 per cent used in this industry.

Decks; sheathing.

Rough, clear, 1 inch thick.

Japanese oak, plain (Siberian oak). Japan; Siberia.

Of total amount of plain Japanese oak manufactured 2.9 per cent used in this industry.

Frames for boats and launches; foundations.

Strong.

Rough, clear and select, 1 to 10 inches thick.

Prima vera (white mahogany). Guatemala.

Of total amount of prima vera manufactured 67.9 per cent used in this industry.

Interior work.

Rough, No. 1 and 2, 1 to 2 inches thick.

Red birch. New England; Lake States; Middle West.

Of total amount of red birch manufactured 0.7 per cent used in this industry.

Combings; finish in boats and launches.

Rough, clear, 1 inch thick.

Spanish cedar. Mexico.

Of total amount of Spanish cedar manufactured 1.7 per cent used in this industry.

Boats.

Rough, best, 1½ to 2 inches thick.

Australian blue gum. Australia.

Of total amount of Australian blue gum manufactured 61.5 per cent used in this industry.

Cleats; fenders; frames; foundations; gunwales; keels; rails; stem and stern posts.

Strong; tough; easily worked.

Rough or surfaced on one side, 1 to 16 inches thick.

Australian hickory. Australia.

Of total amount of Australian hickory manufactured 100.0 per cent used in this industry.

Cleats; fenders; frames; foundations; gunwales; keels; rails; stem and stern posts.

Hard; tough.

Rough, clear, 1 to 16 inches thick.

Genisaro (Jenizaro). Mexico.

Of total amount of genisaro manufactured 2.5 per cent used in this industry.

Cabin finish.

Rough, all sizes and grades.

White oak, quarter-sawed (eastern oak). Middle West; South.

Of total amount of quartered white oak manufactured 0.3 per cent used in this industry.

Fenders; gunwales; keels.

Strong; durable.

Rough, clear, 1 to 6 inches thick.

African mahogany. Africa.

Of total amount of African mahogany manufactured 6.0 per cent used in this industry.

Cabin finish.

Rough, No. 1, 1 inch thick.

Cherry. Middle Atlantic States.

Of total amount of cherry manufactured 6.6 per cent used in this industry.

Cabin finish.

Rough, any size and grade.

Red oak. Middle West; South.

Of total amount of red oak manufactured 0.5 per cent used in this industry.

Cabin finish; decking.

Strong; durable.

Rough, No. 1 and 2, 2 inches thick.

Osage orange. South; Middle West.

Of total amount of osage orange manufactured 100 per cent used in this industry.

Pilot wheels.

Rough, No. 1, 2 to 6 inches thick.

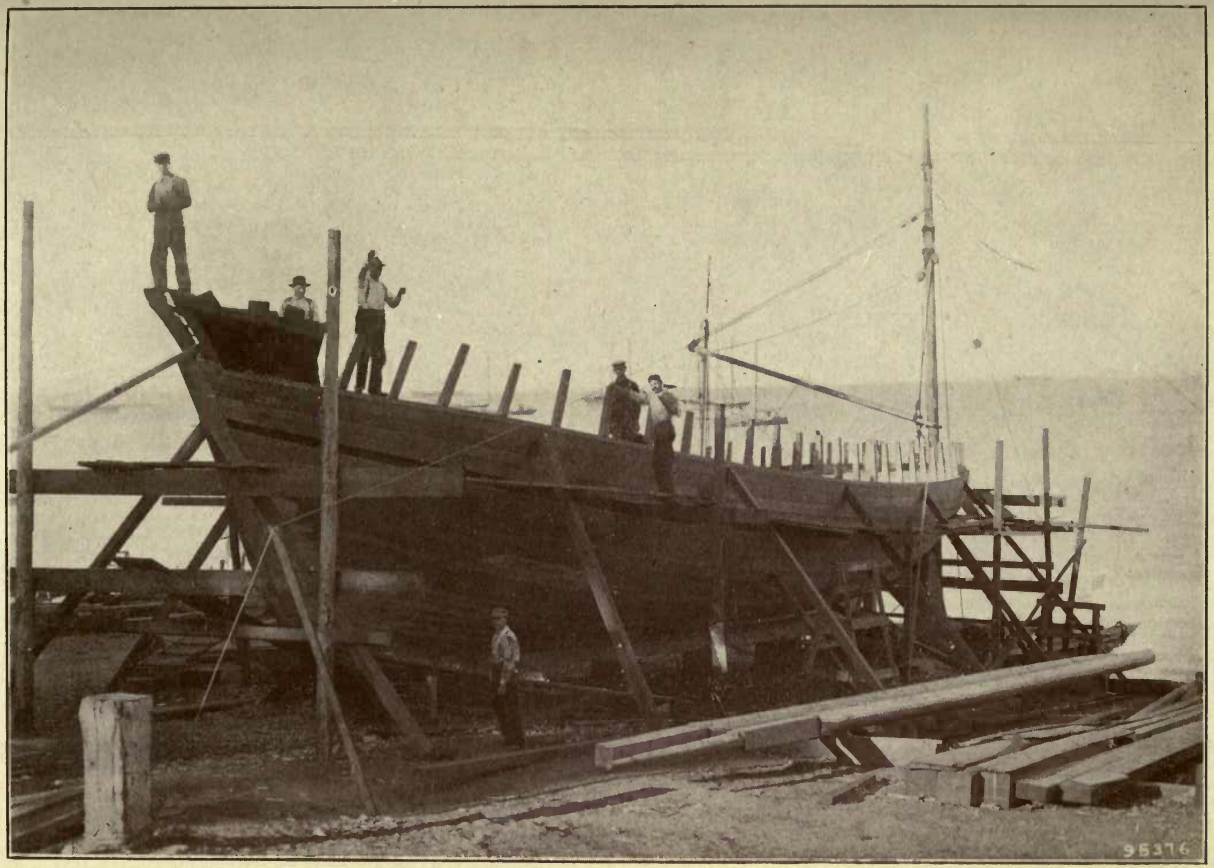

PLATE VIII. Power schooner in course of construction at the boatyard.

TABLE 29. SHIP AND BOAT BUILDING.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California.	Grown out of California.
	Feet, board measure.	Per cent.	F. o. b. factory.		feet, board measure.	feet, board measure.
Douglas fir	16,641,000	91.0	$35 09	$583,933	2,000,000	14,641,000
Lawson cypress	477,420	2.6	64 64	30,863		477,420
White oak (plain)	315,000	1.7	117 94	37,151		315,000
Western yellow pine	153,000	0.8	32 34	4,948	53,000	100,000
Australian ironbark	150,800	0.8	111 23	16,773		150,800
Teak	85,850	0.5	163 90	14,071		85,850
Sugar pine	75,000	0.4	59 60	4,470	75,000	
Redwood	67,000	0.4	33 46	2,242	67,000	
Eastern ash	47,000	0.3	107 85	5,069		47,000
Locust	45,000	0.2	40 00	1,800		45,000
Sitka spruce	44,500	0.2	38 69	1,722		44,500
American mahogany	41,700	0.2	200 75	8,371		41,700
Eastern maple	33,000	0.2	85 45	2,820		33,000
Japanese oak (plain)	30,000	0.2	122 08	3,663		30,000
Prima vera	25,000	0.1	150 00	3,750		25,000
Red birch	11,000	0.1	150 00	1,650		11,000
Spanish cedar	10,500	0.1	130 00	1,365		10,500
Australian blue gum	8,000		123 44	987		8,000
Australian hickory	6,500		105 00	683		6,500
Genisaro	6,250		150 00	937		6,250
White oak (quarter-sawed)	5,000		137 50	688		5,000
African mahogany	2,000		175 00	350		2,000
Cherry	500		150 00	75		500
Red oak	500		100 00	50		500
Osage orange	50		100 00	5		50
Total	18,281,570	100.0	$39 84	$728,436	2,195,000	16,086,570

SIGNS.

Redwood. California.

Of total amount of redwood manufactured 0.1 per cent used in this industry.

Braces; faces; posts; stakes.

Available in wide pieces; does not warp or check; stands outside exposure; has no pitch to work out and destroy the painted surface.

Braces: 1 by 3 inches. Faces: rough or surfaced, medium grades, 1 to 4 inches thick. Posts: 4 by 4 and 3 by 4 inches. Stakes: 1 by 3 inches.

Douglas fir (Oregon pine). Oregon; Washington.

Faces; frames; stakes.

Strong; takes paint well; gives fair service.

Faces: surfaced, clear, $\frac{1}{2}$ to $1\frac{1}{2}$ inches thick.

Frames: rough, medium, 1 inch thick.

Stakes: rough, common, 1 to 4 inches thick.

TABLE 30. SIGNS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California.	Grown out of California.
	Feet, board measure.	Per cent.	F. o. b. factory.		feet, board measure.	feet, board measure.
Redwood	129,000	83.2	$31 56	$4,071	129,000	
Douglas fir	26,000	16.8	22 81	593	5,000	21,000
Total	155,000	100.0	$30 09	$4,664	134,000	21,000

SPORTING AND ATHLETIC GOODS.

Eastern maple. New England; Lake States; Middle West States.

Of total amount manufactured 6.2 per cent used in this industry.

Bowling alley work.

Hard; smooth.

Surfaced, clear, 1½ by 3 inches.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 0.4 per cent used in this industry.

Billiard and pool tables.

Surfaced, plain, 1 to 1½ inches thick.

White oak, plain (eastern oak). Middle West; South.

Billiard and pool tables.

Strong; fine finish.

Rough, clear, 1 to 2 inches thick.

Black walnut. South; Middle West.

Rails on card, billiard and pool tables.

Hard; beautiful finish.

Rough, clear, 1 inch thick.

NOTE.—Very small quantity used.

Lignum vitæ. South America.

Bowling balls.

Hard.

Round timbers, 7 inches in diameter.

NOTE.—Very small quantities used.

TABLE 31. SPORTING AND ATHLETIC GOODS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California.	Grown out of California.
	Feet, board measure.	Per cent.	F. o. b. factory.		feet, board measure.	feet, board measure.
Eastern maple	62,800	95.4	$78 64	$4,939		62,800
Yellow poplar	2,000	3.0	38 00	76		2,000
White oak (plain)	1,000	1.6	45 00	45		1,000
Total	65,800	100.0	$76 89	$5,060		65,800

TANKS.

Redwood. California.

Of total amount of redwood manufactured 11.8 per cent used in this industry.

Beer, water, and wine vats and tanks, mud sills for tank frames, water troughs; wooden stave pipe.

Ease of working; durability against decay; resistance to fire, ability to withstand a hot sun without shrinking or warping.

Tanks: rough, clear and select, 6 to 10 inches thick.
Staves: 2 or 3 by 6 inches.
Bottoms: 2 or 3 by 12 inches.
Mud sills: rough, common, 2 inches thick.
Pipe: rough, clear, 1 to 6 inches thick.
By-products: balusters, brackets, spindles, in which all material $1\frac{3}{8}$ by $1\frac{3}{8}$ by 8 to 10 inches long may be utilized; sawdust for packing ice; shavings for stable bedding.

Douglas fir (Oregon pine, red fir). Oregon; Washington.
Of total amount of Douglas fir manufactured 2.1 per cent used in this industry.
Tank bodies and foundations; door pieces and frames; water (hot and cold), wine, and chemical tanks; wooden stave pipe.
Strong; good container; durable against decay.
Bodies: rough, clear and select, 1 to 6 inches thick.
Foundations: rough, medium grades, 6 by 6 inches.
Door-pieces: rough, clear, 4 by 6 and 4 by 12 inches.
Frames: rough, common to clear, 1 to 10 inches thick.
Pipe: rough, clear, 2, 3, 4 and 6 inches thick.

Oregon oak. Oregon.
Of total amount of Oregon oak manufactured 99.8 per cent used in this industry.
Tanks and pipe.
Strong; durable.
Rough, clear and common, 2, 3, 4, and 6 inches thick.

White oak, plain (eastern oak). Middle West; South.
Of total amount of plain white oak manufactured 0.3 per cent used in this industry.
Pipe; tanks; vats.
Bends well; durable.
Rough, common to clear, $1\frac{1}{2}$ to 6 inches thick.

Western yellow pine (white pine, yellow pine). California.
Small tanks.
Soft; works easily; sap does not stain.
Rough or surfaced on two sides, clear, 1 to 2 inches thick.

White oak, quarter-sawed (eastern oak). Middle West; South.
Of total amount of quartered white oak manufactured 0.8 per cent used in this industry.
Tanks.
Bends well; durable.
Rough, clear, 1 to 2 inches thick.

Sugar pine. California.

Hot grease vats; small tanks; troughs; water boxes.

Soft; nails well; resists decay.

Rough or surfaced on two sides, clear and select, 1 to 3 inches thick.

Sitka spruce. Oregon; Washington.

Tanks.

Tasteless; durable.

Rough, clear, $\frac{1}{2}$ to $1\frac{1}{2}$ inches thick.

Eastern maple (hard maple). New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 0.2 per cent used in this industry.

Acid tanks and vats.

Hard.

Rough, clear and select, $1\frac{1}{2}$ to 2 inches thick.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Tanks and vats.

Bends well; durable.

Rough, clear, and select, 1 to 2 inches thick.

TABLE 32. TANKS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Redwood	12,851,938	74.7	$34 70	$445,958	12,851,938	
Douglas fir	2,234,322	13.0	45 49	101,639		2,234,322
Oregon oak	2,000,000	11.6	48 00	96,000		2,000,000
White oak (plain)	75,000	0.4	110 00	8,250		75,000
Western yellow pine	15,000	0.1	32 00	480	15,000	
White oak (quarter-sawed)	11,401		120 00	1,368		11,401
Sugar pine	10,750		74 19	798	10,750	
Sitka spruce	7,500		47 00	353		7,500
Eastern maple	2,000		110 00	220		2,000
Lawson cypress	1,400		60 00	84		1,400
Total	17,209,311	100.0	$38 08	$655,150	12,877,688	4,331,623

TRUNKS AND VALISES.

Sitka spruce. Oregon; Washington.

Of total amount of spruce manufactured 1.9 per cent used in this industry.

Trunk boxes and trays.

Light, soft, tough, easily worked; nails without splitting.

Shooks; rough or surfaced lumber.

Boxes: medium grades, $\frac{3}{8}$ to $\frac{3}{4}$ inch thick.

Box ends: $\frac{5}{8}$ inch thick.

Trays: $\frac{1}{4}$ inch thick.

By-products: doll trunks, small tool cases.

Western yellow pine (white pine). California.

Of total amount of yellow pine manufactured 0.1 per cent used in this industry.

Trunk boxes and trays.

Light, fairly strong, easily worked.

Rough, clear, 1 to 1½ inches thick; or surfaced, clear, ¼ to ¾ inch thick.

By-products: sample cases.

Black cottonwood. Oregon; Washington.

Of total amount of black cottonwood manufactured 5.1 per cent used in this industry.

Trunk bodies.

Light; tough; does not warp.

Rough mill run, 1 inch thick: 500 square feet of 3-ply veneer, ⅜ to ⅝ inch thick, used.

Eastern cottonwood. Middle West.

Of total amount of eastern cottonwood manufactured 88.8 per cent used in this industry.

Trunk bottoms, sides and trays.

Fibrous; light; strong; tough; flexible.

Surfaced veneer, 3 to 5 ply, 1-16, ⅛, ¼, ⅜, ½ and ⅝ inch thick.

Elm. Michigan; Middle West.

Of total amount of elm manufactured 20.9 per cent used in this industry.

Trunk slats.

Strong; tough; easily worked.

Surfaced, clear, ¼, ⅜ and ⅝ inch thick.

By-products: small sample cases.

Sugar pine. California.

Sample cases; trunks.

Light weight.

Surfaced, select, ¼ to ⅜ inch thick.

Red gum. Middle West; South.

Of total amount of red gum manufactured 2.1 per cent used in this industry.

Sample cases; trunks.

Clear; smooth; strong; tough; does not warp.

Veneer, 3 ply, 3-16 to ⅝ inch thick.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 1.1 per cent used in this industry.

Trunk sides.

Light; tough.

Surfaced, clear, ¼ to ⅜ inch thick.

Basswood. Middle West.

Of total amount of basswood manufactured 7.8 per cent used in this industry.

Trunk boxes.

Light; tough.

Rough veneer, 3 ply, 1-16 and $\frac{3}{8}$ inch thick.

Chestnut. Atlantic States.

Of total amount of chestnut manufactured 100.0 per cent used in this industry.

Trunk slats.

Large grain; strong.

Surfaced, clear, $\frac{1}{4}$ by 2 inches.

By-products: small sample cases.

TABLE 33. TRUNKS AND VALISES.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Sitka spruce	1,296,850	64.3	$23 94	$31,047		1,296,850
Western yellow pine	353,000	17.5	21 38	7,548	353,000	
Black cottonwood	255,500	12.7	18 68	4,773		255,500
Eastern cottonwood	43,725	2.1	98 20	4,294		43,725
Elm	33,460	1.7	106 95	3,578		33,460
Sugar pine	11,000	0.5	112 00	1,232	11,000	
Red gum (Missouri)	9,915	0.5	85 47	847		9,915
Eastern ash	7,935	0.4	135 00	1,071		7,935
Basswood	5,500	0.3	38 18	210		5,500
Chestnut	1,000	0.0	45 00	45		1,000
Total	2,017,885	100.0	$27 08	$54,645	364,000	1,653,885

VEHICLE AND VEHICLE PARTS.

Hickory. South; Middle West.

Of total amount of hickory manufactured 91.8 per cent used in this industry.

Axle-beds; axles; bent stock; blocks; bolsters; felloes; frames; gears; poles; reaches; rims; runs; shafts; sills; singletrees; spokes; spring-bars; tongues; truck-stakes.

Elastic; light; strong; tough; bends well; durable.

Rough, clear, 1 to 4 inches thick, old and second growth.

By-products: brake and spring blocks, hook and tool handles.

White oak, plain (eastern oak). Middle West; South.

Of total amount of white oak manufactured 2.3 per cent used in this industry.

Auto tops; auto-top bars; beds; bolsters; brake-blocks; coupling poles; doubletrees; felloes; flooring; frames; footboards; gears; hounds; panels; reaches; ribs; sills; spokes; standards; stocks; tongues; wagon bodies; whiffletrees.

Strong; tough; durable against wear and decay.

Rough, clear, ½ to 4 inches thick.

Auto-top bars: 8 feet 4 inches by 1 inch by 1½ inches.

By-products: brake and spring blocks; bung starters; hook and tool handles; mallets.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 81.2 per cent used in this industry.

Auto body panels; bodies; boxes; buggy, surrey and wagon body sides, buggy and wagon beds; moldings; panels; seats.

Close grained; light; smooth; soft; easy to work; pliable; finishes and paints well; does not check or warp.

Rough or surfaced, clear, ⅜ to ⅞ inch thick.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 64.9 per cent used in this industry.

Auto tops; axle beds; body frames on autos; bodies; buggy sills; cross pieces; flooring; footboards; framing; gears; panels; poles; rails; reaches; ribs; seats; shafts; sills; spring bars; truck poles; tongues; wheels.

Strong for its weight, tough, elastic; works easily; bends well; retains its shape; does not split or warp.

Rough No. 1 and 2, 1 to 3 inches thick; old and second growth used.

Douglas fir. Oregon; Washington.

Of total amount of Douglas fir manufactured 0.3 per cent used in this industry.

Bars, beams and stringers on wagons; beds and floors of wagons; bottoms of delivery and express wagons; cross bars; doubletrees; footboards; frames; fruit trucks; hay wagon bodies.

Light; strong; tough; cheap; durable; wears well.

Bottoms and floors of heavy wagons: rough, clear, 1 inch thick.

Bottoms and floors, delivery and express wagons: ½ to 2 inches thick.

Cross-bars, doubletrees: former 2 by 4, latter 3 by 6 inches.

Footboards: ¾ and 1 inch thick.

Frames, beds, bodies: rough, clear and select, 1 to 8 inches thick.

NOTE.—Some California Douglas fir is used locally; and is considered stronger and tougher than that from Oregon and Washington.

Red birch (black birch, white birch). New England; Lake States; Middle West.

Of total amount of red birch manufactured 18.5 per cent used in this industry.

Felloes; filler boards on automobile dashes; hubs; poles.

Strong; tough; bends well.

Logs, 12 to 14 inches in diameter; or rough lumber, first and second grades, 1 to 6 inches thick.

Filler boards: finishes to imitate mahogany; surfaced, first and second grades, 13-16 inch thick.

By-products: brake and spring blocks, hook and tool handles.

Sitka spruce. Oregon; Washington.

Of total amount of spruce manufactured 0.3 per cent used in this industry.

Bodies; bottoms; cheap; panels; linings; roofs; seats ;sides.

Cheap; durable.

Rough, clear, $\frac{1}{2}$ to $1\frac{1}{2}$ inches thick. Side linings and panels: veneer, 1-10, 1-12, 1-16 thick.

Western yellow pine (white pine, yellow pine). California.

Cart and wagon bodies; flooring and seats on buggies, carts, surreys and wagons; panels.

Light; strong.

Surfaced on two sides, clear and select, 1 to 4 inches thick.

Red oak. Middle West; South.

Of total amount of red oak manufactured 80.2 per cent used in this industry.

Carriage work.

Rough, No. 1 and 2, 1 to 4 inches thick.

By-products: strap handles.

Eastern maple (hard maple, rock maple). New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 7.2 per cent used in this industry.

Axle beds; felloes; wagon blocks and floors.

Hard; tough; does not check.

Rough, first grade, 1 to 6 inches thick.

California blue gum. California.

Of total amount of California blue gum manufactured 25.2 per cent used in this industry.

Axle beds; bolsters; poles; reaches; shafts; tongues; bars.

Available; strong.

Rough, clear, 1 to 4 inches thick.

NOTE.—One manufacturer reports having made felloes for a set of wagon wheels out of this material, which gave good service the first summer; but which rotted to pieces in contact with the ground when stored under a shed for the winter. Another manufacturer reports its use to be satisfactory while moisture is retained, becoming very brittle when thoroughly dry. The latter uses it because he can get it shaped to desired forms, thus eliminating waste from his own operations.

White oak, quarter-sawed (eastern oak). Middle West; South.

Of total amount of quartered white oak manufactured 0.8 per cent used in this industry.

Wagons.

Strong; durable.

Rough, clear, 1 to 4 inches thick.

Redwood. California.

Bodies for automobiles and sight-seeing auto cars; linings and roofs for wagons and automobiles.

Bodies: rough, clear, 1 to 6 inches thick.

Linings, roofs: $\frac{3}{8}$ inch thick and upward.

Japanese oak, plain (Siberian oak). Japan; Siberia.

Of total amount of plain Japanese oak manufactured 0.5 per cent used in this industry.

Bolsters; cheap work; fillers on automobile dashboards.

Strength; finish.

Rough, common to select, 1 to 3 inches thick.

American mahogany. South America.

Of total amount of American mahogany manufactured 0.2 per cent used in this industry.

Fillers on automobile dashboards; finish; sash on automobiles.

Beauty of grain.

Rough or surfaced, first and second grades, $\frac{3}{8}$ to 4 inches thick.

Black walnut. South; Middle West.

Of total amount of black walnut manufactured 1.8 per cent used in this industry.

Fillers on automobile dashboards.

Surfaced, No. 1 and 2, 13-16 inch thick.

Australian ironbark. Australia.

Of total amount of Australian ironbark manufactured 0.8 per cent used in this industry.

Poles, reaches.

Hard; strong; tough.

Surfaced, common, 1 inch thick.

Basswood. Middle West.

Of total amount of basswood manufactured 1.5 per cent used in this industry.

Panels.

Rough, No. 1 and 2, $\frac{3}{8}$ and $\frac{1}{2}$ inch thick.

Sugar pine. California.

Wagon repairs.

Surfaced, clear, 1 and $1\frac{1}{2}$ inches thick.

Philippine mahogany (Narra). Philippine Islands.

Of total amount of Philippine mahogany manufactured 3.0 per cent used in this industry.

Filler boards on automobile dashes.

Surfaced No. 1 and 2, 13-16 inch thick.

Australian blue gum. Australia.

Of the total amount of Australian blue gum manufactured 6.2 per cent used in this industry.

Beams and stringers.

Strong; tough.

Rough, No. 1, 1 to 12 inches thick.

By-products: brake and spring blocks, hook and tool handles.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Wagon repairs.

Surfaced, clear, 1½ inches thick.

Spanish cedar. Mexico.

Side linings.

Rough, clear, ⅜ to 6 inches thick.

TABLE 34. VEHICLE AND VEHICLE PARTS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Hickory	567,771	18.1	$109 50	$62,171		567,771
White oak (plain)	553,062	17.6	114 59	63,375		553,062
Yellow poplar	458,899	14.6	100 46	46,101		458,899
Eastern ash	455,663	14.5	89 31	40,695		455,663
Douglas fir	285,610	9.1	40 19	11,479		285,610
Red birch	276,550	8.8	60 86	16,832		276,550
Sitka spruce	216,646	6.9	47 43	10,276		216,646
Western yellow pine	121,800	3.9	33 12	4,034	121,800	
Red oak	75,000	2.4	50 00	3,750		75,000
Eastern maple	73,350	2.3	65 55	4,808		73,350
California blue gum	13,950	0.4	109 96	1,534	13,950	
White oak (quarter-sawed)	12,500	0.4	110 00	1,375		12,500
Redwood	6,000	0.2	43 33	260	6,000	
Japanese oak (plain)	5,800	0.2	87 07	505		5,800
American mahogany	2,814		208 44	587		2,814
Black walnut	2,000		160 00	329		2,000
Australian ironbark	1,200		80 00	96		1,200
Basswood	1,080		80 00	86		1,080
Sugar pine	1,000		60 00	60	1,000	
Philippine mahogany	1,000		160 00	160		1,000
Australian blue gum	800		91 56	73		800
Lawson cypress	500		60 00	30		500
Spanish cedar	500		120 00	60		500
Total	3,133,495	100.0	$85 74	$268,667	142,750	2,990,745

WOOD CARVINGS.

Redwood. California.

Carvings.

Soft; easily carved.

Rough, vertical grain, clear, all thicknesses.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 1.1 per cent used in this industry.

Carved frames and chandeliers.

Soft; adapted to gilding.

Rough, No. 1, 1 to 4 inches thick.

Sugar pine. California.

Carvings.

Soft; carves well.

Surfaced on two sides, clear, $\frac{7}{8}$ to $1\frac{1}{4}$ inches thick.

Western yellow pine. California.

Carvings.

Soft; carves well.

Surfaced on two sides, common, $\frac{7}{8}$ inch thick.

TABLE 35. WOOD CARVINGS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California. feet, board measure.	Grown out of California. feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Redwood	10,500	48.8	$44 28	$465	10,500	
Yellow poplar	6,000	28.0	100 00	600		6,000
Sugar pine	3,000	13.9	46 67	140	3,000	
Western yellow pine	2,000	9.3	40 00	80	2,000	
Total	21,500	100.0	$59 77	$1,285	15,500	6,000

Black cottonwood. Oregon; Washington.

Of total amount of black cottonwood manufactured 49.9 per cent used in this industry.

Candy and coffee drums, candy pail covers; pail stock; veneered barrels.

Light; fibrous; odorless; pliable; does not split in nailing.

Stave bolts: rough lumber, or surfaced on one side, clear, 7-16 to $\frac{3}{4}$ inch thick: rotary cut veneer, $\frac{1}{8}$, 3-16 and $\frac{3}{4}$ inch thick.

Sitka spruce. Oregon; Washington.

Of total amount of Sitka spruce manufactured 3.3 per cent used in this industry.

Butter tubs; curtain poles; pail stock; step ladders.

Butter tubs; pail stock: soft, light, strong, odorless, tasteless, especially good container for butter, olives, etc.

Stave bolts: rough or planed and jointed lumber, clear, select, $\frac{3}{8}$ to $1\frac{1}{2}$ inches thick.

Ladders: light, strong, tough, nails well, not likely to split, stands rain and sun without checking: rough, clear and select, 1 to $1\frac{1}{2}$ inches thick.

By-products: crates, dowels, fruit boxes, handles, roof cleats and jacks, washboard frames; broken heads and staves worked up into small keg heads; sawdust for butcher shop floors and litter in chicken houses; shavings for stable bedding.

Douglas fir (Oregon pine). Oregon; Washington.

Of total amount of Douglas fir manufactured 0.5 per cent used in this industry.

Awning boards; coat hangers; flag poles; frames, finish and flooring on portable buildings; house and orchard ladders; tent frames, flooring, poles and stakes.

Fairly light; hard; stiff; straight grained; strong; tough; cheap; wears well.

Awning boards: surfaced on one or four sides, select, 1 and 1¼ inches thick.

Coat hangers: surfaced, common to clear, 1 inch thick.

Flag poles, tent masts: rough, clear and select, 6 to 10 inches thick.

Flooring: surfaced on one side, common to clear, 1 inch thick.

Ladder poles, back legs: rough or surfaced, clear and select, 2 by 2 inches.

Ladder steps: rough or surfaced, select, 1 by 3 inches.

Ladder braces: rough, clear and select, 1 and 1¼ inches thick.

Ladder tongues: 2 by 2 inches.

Ladder tops: clear and select, 1 inch thick.

Tent and awning poles: surfaced on one side, half round, or surfaced on four sides, clear, 2 by 2 to 4 by 4 inches.

By-products: rockers, sewing tables, tent stakes.

Sugar pine. California.

Of total amount of sugar pine manufactured 1.2 per cent used in this industry.

Carved letters; drain boards chiefly; tent stakes; wash tray frames.

Light, soft; easily worked; stands alternate wetting and drying well.

Carved letters: surfaced on two sides, common ⅞ inch thick.

Drain boards, wash tray frames: rough, all grades, 1 to 1½ inches thick.

Tent stakes, stand battering without splitting: surfaced, select, 1 to 1½ inches thick; made from waste of box factories.

By-products: beehive supplies; dresser brackets; small turnings; sawdust and shavings used for horse bedding and chicken house litter.

Redwood. California.

Of total amount of redwood manufactured 0.3 per cent used in this industry.

Bowls, dishes; frames and standards for window display novelties; jeweler's trays; novelties; plaques; roof boards on ordinary and roller awnings; trays.

Bowls, dishes, plaques, trays: wood burns readily under the electric needle and becomes intensely black: bolts, or rough or surfaced lumber, all grades up to 2 inches thick.

Frames, standards for novelty displays: light, cheap, easily worked: surfaced, clear, $\frac{1}{2}$ inch thick.

Jewelers' trays, surfaced, common, $\frac{1}{4}$ and $\frac{3}{8}$ inch thick: after manufacture covered with paper, leatherette, or velvet.

Novelties: plain, fancy, and burl redwood; boards, planks, blocks: fancy and burl redwood show exquisite markings when polished.

Roof boards: does not warp or twist, durable against weather; surfaced on four sides, clear and select, 1 inch thick.

By-products: balusters, brackets, ceiling cores, corner blocks, cresting, stakes.

Western yellow pine (white pine). California.

Awnings; drain boards chiefly; tent poles.

Awnings, tent poles: straight grained, fairly strong: surfaced on four sides, select, 2 inches thick.

Drain boards: light, soft, easily worked, does not warp: rough, clear, 1 to 2 inches thick.

Eastern ash (white ash). Middle West; South.

Of total amount of eastern ash manufactured 14.2 per cent used in this industry.

Extension ladders; steam table; carving boards.

Light; tough.

Ladders: turned, best, $1\frac{1}{4}$ inches thick.

Carving boards: surfaced, clear.

Yucca. California.

Of total amount of yucca manufactured 40.9 per cent used in this industry.

Decorative articles; tree protectors; waste baskets.

Light; fibrous; white; flexible; easily molded to decorative form.

Logs: turned to veneer 1-16 inch thick.

Lawson cypress (white cedar, Port Orford cedar). Oregon.

Of total amount of Lawson cypress manufactured 1.8 per cent used in this industry.

Blinds and rolling partitions; bowls; drain boards; souvenir novelties; trays.

Drain boards: durable against decay; does not split, warp or stain.

Blinds and partitions: lightness coupled with strength, beauty of finish.

Novelties, trays: best wood for pyrography or needle burning.

Rough, clear and select, 1 to 2 inches thick.

White fir. California.

Of total amount of white fir manufactured 0.2 per cent used in this industry.

Raisin trays.

Logs, all grades and sizes.

Incense cedar. California.

Of total amount of incense cedar manufactured 1.0 per cent used in this industry.

Raisin trays.

Logs, all grades and sizes.

White oak, plain (eastern oak). Middle West; South.

Bowls; coat hangers; jewelry trays; ladder rings; store ladders; trays.

Strong; good finish.

Bowls, ladders, trays: clear and select, 1 to 2 inches thick.

Coat hangers: surfaced, clear, 1 inch thick.

Jewelry trays: surfaced, clear, $\frac{1}{4}$ inch thick.

Oregon ash. Oregon.

Of total amount of Oregon ash manufactured 85.6 per cent used in this industry.

Extension ladders.

Strong; tough.

Turned best, $1\frac{1}{4}$ inches in diameter by 16 inches long.

Orange. California.

Of total amount of orange manufactured 100 per cent used in this industry.

Bowls; souvenir novelties; trays.

Takes good polish.

Logs; trunks, branches: also rough lumber, clear, 1 to 2 inches thick.

Yellow poplar (whitewood). Middle West; South.

Of total amount of yellow poplar manufactured 0.7 per cent used in this industry.

Jewelers' boxes and trays.

Light; good color and finish.

Surfaced, first quality, $\frac{1}{8}$ to $\frac{7}{8}$ inch thick.

Eastern maple. New England; Lake States; Middle West; South.

Of total amount of eastern maple manufactured 0.5 per cent used in this industry.

Extension ladders; ladder rungs; tracks for store ladders.

Strong; wears well.

Rough, No. 1 and 2, $\frac{7}{8}$ to 2 inches thick.

By-products: roof jacks.

Hickory. South; Middle West.

Of total amount of hickory manufactured 0.4 per cent used in this industry.

Extension ladders.

Light; tough.

Fumed, best, 1¼ inches in diameter.

Pepperwood (California laurel). California.

Of total amount of pepperwood manufactured 38.5 per cent used in this industry.

Novelties.

Good polish; fine finish.

Logs; good quality.

Manzanita. California.

Of total amount of manzanita manufactured 100.0 per cent used in this industry.

Novelties; souvenirs.

Hard; polishes well.

Roots, trunks, branches, good quality.

Red birch (white birch). New England, Lake States; Middle West.

Of total amount of red birch manufactured 0.1 per cent used in this industry.

Extension ladders; rungs; tracks for store ladders.

Strong; tough.

Extension ladders: turned, best, 1 inch diameter by 17 inches long.

Rungs, tracks: rough, select, 1½ inches thick.

Mountain mahogany, and mountain lilac. California.

Of total amount of mountain mahogany and mountain lilac manufactured 100 per cent used in this industry.

Novelties.

Hard; fine polish.

Bundles, good quality, all sizes.

American mahogany. South and Central America.

Jewelry trays.

Fine finish.

Surfaced, first grade, ¼ by 1¼ by 10 to 12 inches.

Black walnut. Middle West; South.

Of total amount of black walnut manufactured 0.2 per cent used in this industry.

Same as American mahogany.

Lignum vitæ.

Flag pole tops.

Hard.

Round timbers, 7 inches in diameter.

Olive.

Souvenirs.

Hard; polishes well.

Trunks and branches.

TABLE 36. WOODENWARE AND NOVELTIES.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
Black cottonwood	2,499,300	38.2	$16 50	$41,238	649,300	1,850,000
Sitka spruce	2,227,614	34.1	32 11	71,529		2,227,614
Douglas fir	598,775	9.2	31 39	18,795	3,500	595,275
Sugar pine	418,563	6.4	74 06	30,999	418,563	
Redwood	296,500	4.5	28 00	8,302	296,500	
Western yellow pine	158,500	2.4	37 26	5,906	158,500	
Eastern ash	100,000	1.5	85 00	8,500		100,000
Yucca	69,000	1.1	62 61	4,320	69,000	
Lawson cypress	54,250	0.8	29 44	1,597		54,250
White fir	31,250	0.5	16 50	515	31,250	
Incense cedar	31,250	0.5	16 50	516	31,250	
White oak (plain)	13,343	0.2	84 30	1,125		13,343
Oregon ash	12,500	0.2	40 00	500		12,500
Orange	8,450	0.1	90 00	761	8,450	
Yellow poplar	5,000	0.1	60 00	300		5,000
Eastern maple	5,000	0.1	100 00	500		5,000
Hickory	2,730		110 00	300		2,730
Pepperwood	2,000		80 00	160	2,000	
Manzanita	2,000		27 50	55	2,000	
Red birch	1,930		80 00	154		1,930
Mountain mahogany	1,000		15 00	15	1,000	
Mountain lilac	1,000		15 00	15	1,000	
American mahogany	700		300 00	210		700
Black walnut	235		89 36	21		235
Total	6,540,890	100.0	$30 02	$196,333	1,672,313	4,868,577

MISCELLANEOUS.

White fir. California.

Of total amount of white fir manufactured 60.1 per cent used for paper pulp and other miscellaneous uses.

Sitka spruce. Oregon; Washington.

Of the total amount of Sitka spruce manufactured 10.5 per cent used for shade and map rollers, etc.

Red fir. California.

Of the total amount of red fir manufactured 59.8 per cent used for paper pulp, etc.

Douglas fir (Oregon pine). Oregon; Washington.

Of the total amount of Douglas fir manufactured 0.4 per cent used for gates and fencing, pulleys and conveyors, etc.

Lawson cypress (Port Orford cedar). Oregon.

Of the total amount of Lawson cypress manufactured 6.7 per cent used for matches, etc.

PLATE IX. Stock drying room of vehicle factory, showing oak and hickory spokes, and elm hubs.

Redwood. California.

Of the total amount of redwood manufactured 0.1 per cent used for gates and fencing, etc.

Western yellow pine (white pine). California.

Of total amount of western yellow pine manufactured less than 0.1 per cent used for dowels, etc.

White oak, quarter-sawed (eastern oak). Middle West; South.

Of the total amount of quartered white oak manufactured 3.8 per cent used for miscellaneous purposes.

Sugar pine. California.

Of the total amount of sugar pine manufactured 0.1 per cent used for saddles and harness, shade and map rollers, etc.

California blue gum. California.

Of the total amount of California blue gum manufactured 66.9 per cent used for miscellaneous hardwood purposes.

Eastern maple. New England; Lake States; Middle West; South.

Of the total amount of eastern maple manufactured 2.0 per cent used for miscellaneous purposes.

Sycamore. California.

Of the total amount of sycamore manufactured 100.0 per cent used as 3 and 5 ply cores for panels, $\frac{1}{8}$ inch thick.

White oak, plain (eastern oak). Middle West; South.

Of the total amount of plain white oak manufactured less than 0.1 per cent used for pulleys and conveyors, etc.

Hickory. Middle West; South.

Of the total amount of hickory manufactured 0.2 per cent used for handles, etc.

American mahogany. Central and South America.

Of the total amount of American mahogany manufactured less than 0.1 per cent used for miscellaneous purposes.

Philippine mahogany (Narra). Philippine Islands.

Of the total amount of Philippine mahogany manufactured 2.0 per cent used for miscellaneous purposes.

Basswood. Middle West.

Of the total amount of basswood manufactured 0.4 per cent used for miscellaneous purposes.

Broom corn. California; Oklahoma.

Brooms.

Boxwood sawdust.

Chemically prepared bathroom floors, drain boards, etc.

Rattan. India, via New York.

Miscellaneous uses.

Ebony.

Miscellaneous uses.

TABLE 37. MISCELLANEOUS.

Kinds of wood.	Quantity used annually.		Average cost per 1,000 feet.	Total cost.	Grown in California, feet, board measure.	Grown out of California, feet, board measure.
	Feet, board measure.	Per cent.	F. o. b. factory.			
White fir	8,250,000		$8 00	$66,000	8,250,000	
Sitka spruce	7,033,000		13 17	92,620		7,033,000
Red fir	2,750,000		8 00	22,000	2,750,000	
Douglas fir	469,000		15 18	7,117		469,000
Lawson cypress	207,500		34 00	7,055		207,500
Redwood	133,000		21 27	2,829	133,000	
Western yellow pine	90,000		14 00	1,260	90,000	
White oak (quarter-sawed)	57,500		105 00	6,037		57,500
Sugar pine	40,000		53 75	2,150	40,000	
California blue gum	37,000		80 00	2,960	37,000	
Eastern maple	20,000		155 00	3,100		20,000
Sycamore	17,000		12 47	212	17,000	
White oak (plain)	3,000		96 67	290		3,000
Hickory	1,000		200 00	200		1,000
American mahogany	1,000		90 00	90		1,000
Philippine mahogany	677		50 00	34		677
Basswood	250		120 00	30		250
Broom corn	113	tons.	104 78	11,840	83	30
Boxwood sawdust	131,250	lbs.	6 57	863		131,250
Rattan	10,000	lbs.	80 00	800		10,000
Ebony	500	lbs.	50c per lb.	250		500
Total				$227,737		

DIRECTORY OF MANUFACTURERS BY INDUSTRY.

Agricultural Implements.

Anderson Barngrover Manufacturing Company—San Jose
Best Manufacturing Company, The—San Leandro
Briggs, J. Smith—Los Angeles
Chilson Automatic Plow and Traction Manufacturing Company—San Francisco
Davenport, L. M., Company—Los Angeles
Fresno Agricultural Works—Fresno
Hardwood Planing Mill Company—San Jose
Holt Manufacturing Company—Stockton
Houser-Haines Manufacturing Company—Stockton
Junior Monarch Hay Press Company—San Leandro
Killifer Manufacturing Company—Los Angeles
Knapp, H. G. & Son—San Jose
Los Angeles Brush Manufacturing Company—Los Angeles
Moore, A. D.—Visalia
Prahsen, W. B.—Stockton
Rose, T. T., & Co.—Alameda
Schmeiser Manufacturing Company—Davis
Shaw, H. C., Company, The—Stockton
Stearns & Harray—Oakdale
Stillman, R. P.—Watts
Stockton Tool Works—Stockton
Vallejo Carriage Works—Vallejo
Wilson, Richard F.—Stockton

Artificial Limbs.

Chicago Artificial Limb Company—San Francisco
Dickson & Bull Company—Oakland
Milligan, Geo. R. E., Company—Los Angeles
Pacific Surgical Manufacturing Company—Los Angeles
Yucca Manufacturing Company—Los Angeles
Yucca Wood and Leather Company—Los Angeles

Boxes and Crates—Packing.

Algoma Lumber Company—Los Angeles
Beach, G. G., & Co.—Placerville
Brookings Lumber and Box Company—Highland
California Pine Box and Lumber Company—San Francisco
California White Pine Lumber Company—Loyalton
Chase, S. H., Lumber Company—San Jose
Chanslor & Lyon Motor Supply Company—San Francisco
Coast Manufacturing and Supply Company—Fitchburg
Eagle Box and Manufacturing Company—Oakland
Enterprise Paper Box Company—San Francisco
Farnsworth Electric Works—San Francisco
Fleishhacker, A., & Co.—San Francisco
Frasier Bros.—Ukiah
Fresno Flume and Lumber Company—Fresno
Gladding, McBean & Co.—San Francisco
Grants Pass Box Company—San Francisco
Kenyon, S. Y., Basket Company—San Francisco
Lamoine Lumber and Trading Company—Lamoine
Lawrence, H. F.—Wright
Los Angeles Basket Company—Los Angeles
Los Angeles Box and Lumber Company—Los Angeles
Los Angeles Casket Company—Los Angeles
Madary Planing Mills—Fresno

Mahoney, M. F.—Los Angeles
Meese & Gottfried Company—San Francisco
Mercantile Box Company—San Francisco
Oakland Box Factory, Inc.—Oakland
Pacific Basket and Barrel Company—San Francisco
Pacific Box Factory—San Francisco
Pacific Coast Basket Factory—San Francisco
Pacific Shingle and Box Company—Santa Clara
Petaluma Box Company—Petaluma
Peterson, H. A.—Soquel
Russ Lumber and Mill Company—San Diego
Sierra Nevada Wood and Lumber Company—Hobart Mills
Sinkinson, J. H., & Sons—Santa Cruz
Smith, C. A., Lumber Company—Bay Point
Southern California Box Company—Los Angeles
Standard Box Company—San Francisco
Standard Lumber Company—Sonora
Taylor, A. A., & Son—Stockton
Terry Lumber Company—Bella Vista
Thatcher Lumber Company—Shingletown
Thiebaut Bros.—San Francisco
Truckee River Box Company—Truckee
Weed Lumber Company—Weed
Weston Basket and Barrel Company—San Francisco
White & De Hart Company—Watsonville
Wilson & Willard Manufacturing Company—Los Angeles
Wilson, Richard F.—Stockton

Boxes—Tobacco.

Korbel Box Factory—San Francisco
Machris Bros.—Los Angeles
Pacific Cigar Box Factory—Oakland

Brooms.

Eagle Broom Works—Los Angeles
Excelsior Broom Factory—Los Angeles
Hemingway Bros.—Stockton
Simpson Brush Company—San Francisco
Washington Broom Factory—San Francisco

Brushes.

Los Angeles Brush Manufacturing Company—Los Angeles
Schwarz, F. R.—San Francisco
Simpson Brush Company—San Francisco

Bungs and Faucets.

D. & B. Pump and Supply Company—Los Angeles
Ray, W. S., Manufacturing Company—San Francisco
Waas, Henry, Company—San Francisco

Car Construction.

Bradford, F. G., Mill Company—San Francisco
Hammond Elevator Company—San Francisco
Holman, W. L., Company—San Francisco
Pacific Electric Railway Company—Los Angeles

Caskets and Coffins.

Pacific Burial Case Company—Los Angeles
Pacific Manufacturing Company—Santa Clara
San Francisco Casket Company—San Francisco
Southern California Box Company—Los Angeles
Western Casket Company—Oakland

Chairs.

California Souvenir Company—Los Angeles
Eames Tricycle Company—San Francisco
McKurty, N., Rattan Company—San Francisco

Cooperage.

Brown & Nugent—San Francisco
Bucking, D., & Son—San Francisco
California Barrel Company—San Francisco
Humboldt Cooperage Company—Arcata
Levitt, S.—San Francisco
Petzold, August, & Co.—San Francisco
Western Cooperage Company—Los Angeles
Weston Basket and Barrel Company—San Francisco
Windler, Geo.—San Francisco

Dairymen's, Poulterers' and Apiarists' Supplies.

Albers, Henry, Company—Los Angeles
Mammoth Hatchery—Los Angeles
Miller Hive and Box Company—Los Angeles
Simpson, R. A., Manufacturing Company—Oakland

Elevators.

Baker Iron Works—Los Angeles
Hammond Elevator Company—San Francisco
Kelsey & McEvoy—San Francisco
McKain Manufacturing Company—Los Angeles
Otis Elevator Company—San Francisco
Pogue & Petersen—Los Angeles
Roberts, L. V., Machine Works—San Francisco
San Francisco Elevator Company—San Francisco
Wells & Spencer Machine Company—San Francisco

Fixtures.

Bahr Woodworking Company—San Francisco
Banta, A. J.—Sacramento
Bateman, Wm.—San Francisco
Bell & Rosslow—San Francisco
Braas & Kuhn Company—San Francisco
Black, A. W., Planing Mill—Los Angeles
Bradford, F. G., Mill Company—San Francisco
Braendlein, Geo., & Son—San Francisco
Breuner, John, Company—Sacramento
Brunswick-Balke-Collender Company—Los Angeles
Bungalow Furniture Manufacturing Company—Los Angeles
Burnett & Sons—Sacramento
Burnham-Standeford Company—Oakland
California Fixture Company—San Francisco
California Showcase Company—Los Angeles
Chase, S. H., Lumber Company—San Jose
City Refrigerator and Fixture Company—Los Angeles
Cresmer Manufacturing Company—Riverside
Diamond Patent Showcase Company—San Francisco
Dillman, J. M.—Long Beach
East Side Mill and Lumber Company—Santa Cruz
Emanuel, L. & E., Inc.—San Francisco
Enterprise Supply and Manufacturing Company—Stockton
Eureka Mill and Lumber Company—Oakland
Eureka Planing Mill Company—Los Angeles
Forbes, A. J., & Son—San Francisco
Franzen, W. F.—San Diego
Fresno Planing Mill Company—Fresno
Gilt Edge Cabinet Works—Los Angeles
Gourley, Fred—Los Angeles
Gripton, Walter A.—Pasadena
Gurnee Planing Mill—Hanford

Haas Woodworking Company—San Francisco
Harris & Eyre Company—Los Angeles
Harksel, Julius—San Diego
Hermann & Co.—San Francisco
Hersko, S., & Co.—San Francisco
Hertenstein, A. & Son—San Francisco
Home Manufacturing Company—San Francisco
Hubbard & Carmichael Bros.—San Jose
Inlaid Floor Company—San Francisco
Kopp, G. W.—Sacramento
Kulchar, S., & Co.—Oakland
Levi, B., Fixture Shop, The—San Francisco
Levin Showcase and Fixture Company—San Francisco
Lodi Mill and Manufacturing Company—Lodi
Lorenz, F. A.—San Francisco
Los Angeles Planing Mill Company—Los Angeles
Mahoney, M. F.—Los Angeles
McGiven Cabinet Company—Los Angeles
Meek, T. H., Co.—San Francisco
Millard, J. H., & Son—San Francisco
Mitscher, H. & Son—Stockton
Niederer, J. Co.—Los Angeles
Ocean Shore Manufacturing Company—San Francisco
Ostrowski, Frank S. & Son—San Francisco
Pacific Butchers' Supply Company—San Francisco
Pacific Coast Planing Mill Company—Los Angeles
Pendleton, S. H., Lumber and Mill Company—Santa Ana
Pierce, F. J. Co.—Pasadena
Powell, Robert—Stockton
Roberts & Clark—Stockton
Rosenzweig, H.—San Francisco
Sacramento Builders' Supply Company—Sacramento
Schafer, Geo.—San Francisco
Schemp, J. F. & Co.—San Francisco
Schneider, M. & Sons—Stockton
Simmer, John, Co.—San Francisco
Sink, Leo—Los Angeles
Southern California Hardwood and Manufacturing Company—Los Angeles
Standard Furniture and Fixture Manufacturing Company—San Francisco
Sterling Showcase Manufacturing Company—Oakland
Swift Bros.—Marysville
Townley Mill and Lumber Company—San Francisco
Turlock Lumber Company—Turlock
Union Supply Company—Monterey
Weber, C. F., & Co.—San Francisco
Weber Showcase and Fixture Company—Los Angeles
Western Planing Mill—San Francisco
Western Planing Mill—Sacramento
Western Woodworking Company—San Francisco
Wilson & Hanson Co.—Los Angeles

Frames and Molding.

Franklin Street Planing Mill—San Francisco
Green's—Los Angeles
Gage, Harold J.—Stockton
Kanst Art Company—Los Angeles
Parker, Harold—Pasadena
Royar Bros.—Los Angeles
Sanborn, Vail & Co.—Los Angeles

Furniture.

Allen, Wm. M.—Red Bluff
Bailey-Schmitz Company—Los Angeles
Barker Bros., Inc.—Los Angeles
Braas & Kuhn Co.—San Francisco
Black, A. W., Planing Mill—Los Angeles
Braendlein, Geo. & Son—San Francisco
Breuner, John, Company—Sacramento
Bungalow Furniture Manufacturing Company—Los Angeles
Burns, Rodney—Eureka
California Mill Company—San Francisco
California Souvenir Company—Los Angeles
Capital Furniture Manufacturing Company—Sacramento
Cavanagh Mill and Lumber Company—Petaluma
Christ, C. H.—Stockton
Cleese, John P., Company—San Francisco
Cottrell, J. A., Molding Mill Company—Eureka
Coulter's Rattan Works—San Francisco
Cowan, H. D.—Pasadena
Crescent Feather Company—San Francisco
Emanuel, L. & E., Inc.—San Francisco
Eureka Mechanical Shop—Eureka
Eureka Mill and Lumber Company—Oakland
Eureka Sash, Door and Molding Mills—Eureka
Eureka Sash, Door and Molding Mills—San Francisco
Forbes, A. J. & Son—San Francisco
Frank, J. & Co.—San Francisco
Franzen, W. F.—San Diego
Fredericks, Jos. & Co—San Francisco
Friedrichs, H.—San Francisco
Fuller, Meisner Company—Lodi
Furniture Shop, The—San Francisco
Galley, E. T., Cabinet Company—Los Angeles
Gilt Edge Cabinet Works—Los Angeles
Gripton, Walter A.—Pasadena
Harris & Eyre Company—Los Angeles
Hawthorne Furniture and Manufacturing Company—Hawthorne
Henderson Manufacturing Company—Oakland
Hodgkins & Co.—Ontario
Hoey, John & Co.—San Francisco
Holtzclaw-Stubbs-Shriner Company—Los Angeles
Home Manufacturing Company—San Francisco
Hubbard & Carmichael Bros.—San Jose
Hustler Planing Mill—Redlands
Inlaid Floor Company—San Francisco
Karmel, Marten—Los Angeles
Klingler, G. J.—Santa Cruz
Klopstock Bros.—San Francisco
Lauxen & Catts—Stockton
Levi, S. Fixture Shop—San Francisco
Lodi Mill and Manufacturing Company—Lodi
Lorenz, F. A.—San Francisco
Manhattan Furniture Company—Los Angeles
Marshall & Stearns Company—San Francisco
McGiven Cabinet Company—Los Angeles
McKurty, N. Rattan Company—San Francisco
Millard, J. H. & Son—San Francisco
Mitscher, H. & Son—Stockton
Monrovia Manufacturing Company—Monrovia

Nichols, J. H.—San Jose
Ochlmann, L.—San Francisco
Ovenshire Information Cabinet Company—Los Angeles
Pacific Coast Planing Mill Company—Los Angeles
Pacific Coast Rattan Company—Oakland
Pacific Spring Bed Company—West Berkeley
Peerless Manufacturing Company—Oakland
Pomona Planing Mill—Pomona
Roether, Charles—Los Angeles
Rother, Emil—San Francisco
Russ Lumber and Mill Company—San Diego
San Francisco Mantel Company—San Francisco
Santa Rosa Manufacturing Company—Santa Rosa
Schneider, M. & Sons—Stockton
Sink, Leo—Los Angeles
Southern California Hardwood and Manufacturing Company—Los Angeles
Sterling Furniture Company—San Francisco
Stevenson Company—San Francisco
Thiebaut Bros.—San Francisco
Townley Mill and Lumber Company—San Francisco
Union Supply Company—Monterey
United Studios, Inc.—San Francisco
Van Vorst & Berman Company—Los Angeles
Veal Reed Chair Company—Los Angeles
Wall Bed and Fixture Company—Los Angeles
Warnholz, Wm. H.—San Francisco
Western Planing Mill—San Francisco
Western Woodworking Company—San Francisco
Wilson & Hanson Company—Los Angeles
Yamato Co., Inc., The—Los Angeles

Gates and Fencing.

Biescar Bros.—Los Angeles
Mission Lumber Company—San Francisco

Handles.

Egerer Bros.—Los Angeles

Instruments, Musical.

Bartlett Music Company—Los Angeles
Deitemeier Piano Company—San Francisco
Emery, C. F.—Los Angeles
Galleazzi Giuseppe—San Francisco
Harris, M. M. Company—Los Angeles
Pierce, Walter S.—San Francisco
Salyer-Baumeister Company—Los Angeles
Whalley, Thomas W.—South Berkeley

Instruments, Professional and Scientific.

California Artwood Company—Los Angeles
California Map Company—Los Angeles
Chipron Stamp Company—Los Angeles
Levi, S., Fixture Shop—San Francisco
Pacific Rubber Stamp Company—Los Angeles
Sanborn, Vail & Co.—Los Angeles
Wittenberg, Chas.—Napa
Yucca Wood and Leather Company—Los Angeles

Laundry Appliances.

Ray, W. S., Manufacturing Company—San Francisco
Woodfibre Company—Los Angeles
Woodstone Manufacturing Company—Los Angeles

Machine Parts.

Aermotor Company ---------- Oakland
Brown & Dauser Company ---------- Fullerton
Jackson, Byron Iron Works ---------- Los Angeles
Lauritzen Implement Company ---------- Fresno
Los Angeles Pump Supply Company ---------- Los Angeles
Madsen & Graham Iron Works ---------- Los Angeles
McKain Manufacturing Company ---------- Los Angeles
Pomona Planing Mill ---------- Pomona
Press, W. G., Company ---------- Eureka
Reed, W. H., & Co. ---------- San Francisco
Samson Iron Works ---------- Stockton
Stillman, R. P. ---------- Watts
Stockton Iron Works ---------- Stockton
Stockton Tool Works ---------- Stockton
Taylor, A. A., & Son ---------- Stockton
Wagner, Jos., Manufacturing Company ---------- San Francisco
Wallace Concrete Machinery Company ---------- Los Angeles

Machinery and Apparatus, Electrical.

Butte Engineering and Electric Company ---------- San Francisco
Electric Novelty Works ---------- San Francisco
Farnsworth Electric Works ---------- San Francisco
Haas Woodworking Company ---------- San Francisco

Matches.

Independent Match Company ---------- San Francisco

Paper Pulp.

Floriston Pulp and Paper Company ---------- San Francisco

Patterns.

Advance Machine Company ---------- Los Angeles
Baker Iron Works ---------- Los Angeles
Bisch & Salzmann ---------- Los Angeles
Bottomley, C. M. ---------- Stockton
California Pattern Works ---------- San Francisco
Capitol Machine Works ---------- Los Angeles
Chicago Pattern Shop ---------- Los Angeles
Dreger, E. F., Pattern Company ---------- San Francisco
Empire Pattern Works ---------- Oakland
Greenberg's, M., Sons ---------- San Francisco
Haase, A., Inc. ---------- San Francisco
Los Angeles Pump Supply Company ---------- Los Angeles
Madsen & Graham Iron Works ---------- Los Angeles
McLure & Burton ---------- San Francisco
Meese & Gottfried Company ---------- San Francisco
Moore & Scott Iron Works ---------- San Francisco
Newman, J. ---------- Oakland
Phillips Iron Works ---------- Los Angeles
Reed, W. H., & Co. ---------- San Francisco
Sacramento Pattern Shop ---------- Los Angeles
Samson Iron Works ---------- Stockton
Santa Rosa Manufacturing Company ---------- Santa Rosa
Smith, J. C., Pattern Works ---------- San Francisco
Standard Foundry, Inc. ---------- East Oakland
Star Pattern Shop ---------- Los Angeles
Stockton Iron Works ---------- Stockton
Thomas & Carlson ---------- San Francisco
Union Iron Works ---------- San Francisco
Up-to-Date Pattern Company ---------- Los Angeles
Walker & Hener ---------- San Francisco
Wilson & Neff ---------- San Francisco
Wessing, F. W. ---------- San Francisco

Planing Mill Products.

Acme Planing Mill—San Francisco
American Floor Company—San Francisco
Anaheim Planing Mill—Anaheim
Anderson Bros. Planing Mill and Manufacturing Company—San Francisco
Antioch Lumber Company—Antioch
Banta, A. J.—Sacramento
Bateman, Wm.—San Francisco
Bell & Rosslow—San Francisco
Binet Bros.—Oroville
Blackman, E. L., Company—Oakland
Bradford, F. G., Mill Company—San Francisco
Braendlein, George & Son—San Francisco
Bruce Lumber and Mill Company—Berkeley
Breuner, John, Company—Sacramento
Buell, G. A., Company—San Francisco
Burnett & Sons—Sacramento
Burnham-Standeford Company—Oakland
California Mill Company—San Francisco
California Planing Mill and Lumber Company—Los Angeles
California Standard Planing Mill Company—Oakland
Capital Furniture Manufacturing Company—Sacramento
Central Lumber Company—Oakland
City Mill and Manufacturing Company—Los Angeles
Clay Street Planing Mill—Oakland
Coöperative Hardwood Floor Company—Los Angeles
Corlett, W. H.—Napa
Cottrell, J. A., Molding Mill Company—Eureka
Cresmer Manufacturing Company—Riverside
Crown City Manufacturing Company—Pasadena
Dobson & Creagmile—Berkeley
Dreger, E. F., Pattern Company—San Francisco
East Side Mill and Lumber Company—Santa Cruz
Emanuel, L. & E., Inc.—San Francisco
Empire Planing Mill—San Francisco
Engstrum, F. O., Company—Los Angeles
Enterprise Supply and Manufacturing Company, Inc.—Stockton
Eureka Mechnical Shop—Eureka
Eureka Mill and Lumber Company—Oakland
Eureka Planing Mill Company—Los Angeles
Eureka Sash, Door and Molding Mills—Eureka
Eureka Sash, Door and Molding Mills—San Francisco
Franklin Street Planing Mill—San Francisco
Fresno Flume and Lumber Company—Fresno
Fuller, Meisner Company—Lodi
Galley, E. T., Cabinet Company—Los Angeles
Graves, Frank, Sash, Door and Mill Company—Los Angeles
Griffith Lumber Company—Santa Ana
Hardwood Interior Company—San Francisco
Harris & Eyre Company—Los Angeles
Hayward Lumber Company—Long Beach
Herrings Mill, Inc.—San Francisco
Hihn-Hammond Lumber Company—Santa Cruz
Hillcrest Company—San Diego
Hodgkins & Company—Ontario
Hoerl, J. F.—Stockton
Holden-Deuprey Company—San Francisco
Hughes Manufacturing and Lumber Company—Los Angeles
Humboldt Milling Company—Fortuna
Hustler Planing Mill—Redlands

Inlaid Floor Company—San Francisco
Kopp, G. W.—Sacramento
Kulchar, S., & Co.—Oakland
Lazier, S. W., Planing Mill—Santa Barbara
Liefer Mill and Supply Company—Los Angeles
Lodi Mill and Manufacturing Company—Lodi
Loma Prieta Lumber Company—Watsonville
Los Angeles Planing Mill Company—Los Angeles
Madary's Planing Mill—Fresno
Martin, Geo. S.—Pasadena
Marysville Mill and Manufacturing Company—Marysville
MacCully, Judson—Oakland
Melrose Lumber and Supply Company—Oakland
Miller, A. W., Manufacturing Company—Riverside
Myzelle & Imhoff Company—San Bernardino
Niederer, J., Company—Los Angeles
Niles Lumber and Milling Company—Niles
Ocean Shore Manufacturing Company—San Francisco
Ochlmann, L.—San Francisco
Pacific Coast Planing Mill Company—Los Angeles
Pacific Manufacturing Company—Santa Clara
Pacific Portable Construction Company—Los Angeles
Pacific Sash and Door Company—Los Angeles
Parkinson, J. F., Company—Palo Alto
Pasadena Manufacturing Company—Pasadena
Pendleton, S. H., Lumber and Mill Company—Santa Ana
Plant, Wm., & Co.—San Francisco
Pomona Planing Mill—Pomona
Powell, Robert—Stockton
Premus, W. C., Planing Mill—San Francisco
Redwood Manufacturers' Company—Black Diamond
Redwood Manufacturers' Company—Oakland
Reinhardt Lumber and Planing Mill Company—San Francisco
Richardes Bros.—San Francisco
Roberts & Clark—Stockton
Russ Lumber and Mill Company—San Diego
Russell, Fred J.—Hayward
Sacramento Builders' Supply Company—Sacramento
Sacramento Planing Mill and Furniture Company—Sacramento
Salinas Planing Mill—Salinas
San Diego Planing Mill—San Diego
Santa Clara Valley Mill and Lumber Company—San Jose
Santa Rosa Manufacturing Company—Santa Rosa
Schneider, M. & Sons—Stockton
Seymour Bros.—Redlands
Sierra Building Company—Pacific Grove
Sierra Nevada Wood and Lumber Company—Hobart Mills
Spencer Street Planing Mill—San Francisco
Stockton, A. L., Lumber Company—San Francisco
Swift Bros.—Marysville
Taylor, A. A. & Son—Stockton
Townley Mill and Lumber Company—San Francisco
Turlock Lumber Company—Turlock
Union Planing Mill—Stockton
Union Supply Company—Monterey
Valencia Planing Mill—San Francisco
Vance Redwood Lumber Company—Samoa
Vance Redwood Lumber Company—Eureka
Visalia Planing Mill—Visalia

Waas, Henry, Company—San Francisco
Western Planing Mill—San Francisco
Western Planing Mill—Sacramento
White, D. G.—Sierraville
Work, T. A., Company—Pacific Grove

Printing Materials.

Aristo Engraving Company—Los Angeles
Bryan-Garnier Company—Los Angeles
Los Angeles Engraving Company—Los Angeles
Riley-Moore Engraving Company—Los Angeles
Star Engraving Company—Los Angeles

Pulleys and Conveyors.

Acme Planing Mill—San Francisco

Pumps.

Jackson, Byron Iron Works—Los Angeles
Rose, T. T., & Co.—Alameda
Wilson, Richard F.—Stockton

Refrigerators and Kitchen Cabinets.

Brunswick-Balke-Collender Company—Los Angeles
City Refrigerator and Fixture Company—Los Angeles
Golden Gate Refrigerator Company—San Francisco
Jones-Behrens Company—San Francisco
Mitscher, H., & Son—Stockton
Pacific Coast Cork and Insulating Company—San Francisco
Sacramento Builders' Supply Company—Sacramento
Santa Rosa Manufacturing Company—Santa Rosa
Schafer, Geo.—San Francisco

Rollers—Shade and Map.

Flagg, Edwin H.—Los Angeles

Saddles and Harness.

California Saddle and Tree Company—Petaluma

Sash, Doors, Blinds and General Millwork.

Algoma Lumber Company—Los Angeles
Anaheim Planing Mill—Anaheim
Anderson Bros. Planing Mill and Manufacturing Company—San Francisco
Antioch Lumber Company—Antioch
Banta, A. J.—Sacramento
Bisbee-Fishburn Company—Los Angeles
Bisch & Salzmann—Los Angeles
Blomberg & Eck—Los Angeles
Boller, John A. M.—San Francisco
Benham, J. B.—Long Beach
Brown & Dauser Company—Fullerton
Buell, G. A., Company—San Francisco
Burnett & Sons—Sacramento
Burnham-Standeford Company—Oakland
California Wood Turning Works—Oakland
Camm & Hedges Company—Petaluma
Chase, S. H., Lumber Company—San Jose
City Mill and Manufacturing Company—Los Angeles
Cottrell, J. A., Molding Mill Company—Eureka
Cresmer Manufacturing Company—Riverside
Crown City Manufacturing Company—Pasadena
Dean Reversible Window Company—San Francisco
Dillman, I. M.—Long Beach
Dobson & Creagmile—Berkeley
East Side Mill and Lumber Company—Santa Cruz
Emanuel, L. & E., Inc.—San Francisco
Empire Planing Mill—San Francisco

Engstrum, F. O., Company—Los Angeles
Enterprise Supply and Manufacturing Company—Stockton
Eureka Mechanical Shop—Eureka
Eureka Mill and Lumber Company—Oakland
Eureka Planing Mill Company—Los Angeles
Eureka Sash, Door and Molding Mills—Eureka
Eureka Sash, Door and Molding Mills—San Francisco
Flynn, J. F.—Pasadena
Forbes, A. J. & Son—San Francisco
Fresno Planing Mill Company—Fresno
Frey, J. W.—Los Angeles
Graves, Frank, Sash, Door and Mill Company—Los Angeles
Gurnee Planing Mill—Hanford
Harris & Eyre Company—Los Angeles
Hayes, W. A.—San Francisco
Hertenstein, A., & Son—San Francisco
Hihn-Hammond Lumber Company—Santa Cruz
Hillcrest Company—San Diego
Hipolito Screen and Sash Company—Los Angeles
Hodgkins & Co.—Ontario
Hoerl, J. F.—Stockton
Holden-Deuprey Company—San Francisco
Holmes Planing Mill Company—San Francisco
Hubbard & Carmichael Bros.—San Jose
Hughes Manufacturing and Lumber Company—Los Angeles
Hustler Planing Mill—Redlands
Klemm, J. G.—San Francisco
Kopp, G. W.—Sacramento
Kunny Bros.—Los Angeles
Lamoine Lumber and Trading Company—Lamoine
Lazier, S. W., Planing Mill—Santa Barbara
Liefer Mill and Supply Company—Los Angeles
Loma Prieta Lumber Company—Watsonville
Loyd, C. E.—Los Angeles
Los Angeles Planing Mill Company—Los Angeles
Martin, Geo. S.—Pasadena
Marysville Mill and Manufacturing Company—Marysville
McKee Bros.—San Francisco
Melrose Lumber and Supply Company—Oakland
Miller, A. W., Manufacturing Company—Riverside
Myzelle & Imhoff Company—San Bernardino
National Lumber Company—Los Angeles
Nichols, J. H.—San Jose
Pacific Manufacturing Company—Santa Clara
Pacific Portable Construction Company—Los Angeles
Pacific Sash and Door Company—Los Angeles
Panama Woodworking Company—San Francisco
Parkinson, J. F., Company—Palo Alto
Pasadena Manufacturing Company—Pasadena
Pierce, F. J., Company—Pasadena
Porter, W. F., Inc.—San Francisco
Redwood Manufacturers' Company—Oakland
Redwood Manufacturers' Company—Black Diamond
Reinhart Lumber and Planing Mill Company—San Francisco
Roberts & Clark—Stockton
Rother, Emil—San Francisco
Russ Lumber and Mill Company—San Diego
Sacramento Builders' Supply Company—Sacramento
Sacramento Planing Mill and Furniture Company—Sacramento
Salinas Planing Mill—Salinas

Sanborn & Stewart—San Francisco
Sanborn, Vail & Co.—Los Angeles
San Francisco Mantel Company—San Francisco
Santa Clara Valley Mill and Lumber Company—San Jose
Santa Rosa Manufacturing Company—Santa Rosa
San Vicente Lumber Company—Santa Cruz
Schussler Bros.—San Francisco
Seymour Bros.—Redlands
Sierra Building Company—Pacific Grove
Sierra Nevada Wood and Lumber Company—Hobart Mills
Sinkinson, J. H., & Sons—Santa Cruz
Smith, C. A., Lumber Company—Bay Point
Soule Reversible Window Company—San Francisco
Southern California Hardwood and Manufacturing Company—Los Angeles
Standard Door and Sash Company—Los Angeles
Standard Lumber Company—Sonora
Standard Screen and Manufacturing Company—Los Angeles
Stockton, A. L., Lumber Company—San Francisco
Swift Bros.—Marysville
Thatcher Lumber Company—Shingletown
Thurman Door Company—Madera
Townley Mill and Lumber Company—San Francisco
Turlock Lumber Company—Turlock
Union Blind and Ladder Company—Oakland
Union Planing Mill—Stockton
Valencia Planing Mill—San Francisco
Vance Redwood Lumber Company—Samoa
Vance Redwood Lumber Company—Eureka
Visalia Planing Mill—Visalia
Waas, Henry, Company—San Francisco
Wagner & Lee—San Francisco
Weed Lumber Company—Weed
Western Planing Mill—San Francisco
Western Planing Mill—Sacramento
Western Woodworking Company—San Francisco
West Side Planing Mill—Los Angeles
White, D. G.—Sierraville
Wilson, David & Maguire—San Francisco

Ship and Boat Building.

Anderson, H. P.—San Francisco
Banner Island Boat Works—Stockton
Beetle, J. C.—Elmhurst
Bendixen, H. D., Shipbuilding Company—Eureka
Bowes & Andrews—San Francisco
Brundage Paint and Construction Company—Terminal Island
California Mill Company—San Francisco
California Navigation and Improvement Company—Stockton
Cryer, Wm.—East Oakland
East Side Mill and Lumber Company—Santa Cruz
Fellows, Joe, Yacht and Launch Company—Wilmington
Grant, J., Shipyard—Stockton
Hardwood Planing Mill Company—San Jose
Jarvis Bros. Shipyard—Antioch
Jones-Behrens Company—San Francisco
Keenan, Thos. R.—San Francisco
Larson, Al.—East San Pedro
Moore & Scott Iron Works—San Francisco
Munder, Wm., & Sons—San Francisco
Schultze-Robertson-Schultze—San Francisco
Stephens Bros.—Stockton

Thomsen, H. C.---San Francisco
Twigg, John, & Sons---San Francisco
Union Iron Works---San Francisco
Western Boat Works---Long Beach
Wilmington Transportation Company---San Pedro

Signs.

Carr, F. L.---Pasadena
Dromgold Sign Company---Los Angeles
Hernich, Ed R.---Los Angeles

Sporting and Athletic Goods.

Brunswick-Balke-Collender Company---Los Angeles
California Artwood Company---Los Angeles
California Souvenir Company---Los Angeles
California Wood Turning Works---Oakland
Pacific Coast Billiard Table Company---Los Angeles

Tanks.

Herbert, Vogel & Mark Co.---San Francisco
Jones, J. R. L.---Oakland
Kopp, G. W.---Sacramento
Lawson Bros.---San Francisco
Niles Lumber and Milling Company---Niles
Pacific Coast Cork Insulating Company---San Francisco
Pacific Coast Planing Mill Company---Los Angeles
Pacific Tank and Pipe Company---San Francisco
Pendleton, S. H., Lumber and Mill Company---Santa Ana
Prahser, W. B.---Stockton
Redwood Manufacturers' Company---Oakland
Redwood Manufacturers' Company---Black Diamond
Rose, T. T., & Co.---Alameda
Russ Lumber and Mill Company---San Diego
Simpson, R. A., Manufacturing Company---Oakland
Sink, Leo---Los Angeles
Stillman, R. P.---Watts
Turlock Lumber Company---Turlock
Wilson, Richard F.---Stockton
Windler, Geo.---San Francisco

Trunks and Valises.

Brusau, H.---Los Angeles
Burroughs-White Trunk Company---Los Angeles
Crown City Trunk Factory---Pasadena
Enterprise Trunk Factory---Los Angeles
Featherweight Trunk Company---Los Angeles
Hirschfelder & Meaney---San Francisco
Malm, C. A., & Co.---San Francisco
Matthews, F. B., Trunk Factory---Los Angeles
Mead, Geo. R.---Los Angeles
Mission Trunk Factory---San Francisco
Oakland Trunk Factory---Oakland
Pacific Trunk Factory---Los Angeles
Racine-Los Angeles Trunk Company---Los Angeles
Reliable Trunk Factory---Los Angeles
San Diego Trunk Company---San Diego
Southern California Box Company---Los Angeles

Vehicles and Vehicle Parts.

Anaheim Planing Mill---Anaheim
Anderson & Buffham---San Francisco
Anderson & Company---San Francisco
Artana, L., & Son---San Jose
Arth, Geo. V.---Oakland
Auto Repair Company---Oakland

Auto Top Manufacturing Company—San Francisco
Beacon Auto-Body Company—Los Angeles
Beecraft, A. T.—San Francisco
Bennett, Henry & Son—Sacramento
Bowman Carriage Company—Sacramento
Broedel, M.—San Jose
Brusch, C. H.—Sacramento
Bussey & Scarlett Company—New Monterey
Cappuro, Angelo—San Francisco
Carmean Buggy Company—Los Angeles
Cather & Kennedy Manufacturing Company—Los Angeles
Central Avenue Carriage Works—Los Angeles
Chabot, J. & Son—Oakland
Chanslor & Lyon Motor Supply Company—Los Angeles
City Front Wagon Works—Oakland
Compton & Warnock—Hanford
Consolidated Vehicle Company—San Francisco
Cooper, T. J.—San Francisco
Courtney, C. D.—San Francisco
Crosetti & Co.—San Jose
Crowe & Hasselbach—San Francisco
Crown Carriage Company—Los Angeles
Darling, P. P.—Monterey
Davenport, L. M., Company—Los Angeles
Dillman, I. M.—Long Beach
Dudley, E. C.—San Francisco
Dumont, Chas. A.—San Francisco
Durocar Manufacturing Company—Los Angeles
Earl Automobile Works—Los Angeles
Eureka Carriage Works—San Francisco
Falkenstein, C.—San Francisco
Farrell, Thomas J.—Los Angeles
Fleming, Chas. F.—Hanford
Frediane, Ditano & Biagni—San Francisco
Fry, H. P.—Oakland
Gaehwiler, John & Son—San Francisco
Gheffoli, B., & Co.—San Francisco
Ghiotto, Andrew G.—San Francisco
Grave, B., Company—San Francisco
Greeninger's, A., Sons—San Jose
Griffith Lumber Company—Santa Ana
Guidi, A., & Co.—Oakland
Hamelin, Wm.—Oakland
Hardwood Planing Mill Company—San Jose
Henderson, M. P. & Son—Stockton
Herold, Chas.—San Francisco
Hustler Planing Mill—Redlands
Imperial Carriage Works—Long Beach
Jaquith, E. J.—Los Angeles
Jens, Wm.—San Francisco
Justice, J. B.—Los Angeles
Kaeppler Warren Company—Los Angeles
Keller, J. W.—San Francisco
Killeen & Gratton—San Francisco
Kleiber & Co.—San Francisco
Klein, Chas. & Co.—San Francisco
Larkins & Co.—San Francisco
Larsen & Krogh—Fresno
Lauritzen Implement Company—Fresno
Lembi & Petri—San Francisco
Lewis, Thomas—San Francisco

PLATE X. Stock drying and storeroom of vehicle factory, showing oak and hickory rims, and birch and elm hubs.

Libbey, Chas. A.---Stockton
Lloyd's Carriage Works---Los Angeles
Lodi Mill and Manufacturing Company---Lodi
Los Angeles Carriage Works---Los Angeles
Luken's Carriage Works---Santa Cruz
Marcotti, P. F.---Los Angeles
Market Carriage Works---Los Angeles
Maxey, J. E.---Los Angeles
Mehegan, P. J.---San Francisco
Meister, A. & Sons Co.---Sacramento
Mitchell, J. H.---San Francisco
Modern Vehicle Company---San Francisco
Moore, A. D.---Visalia
Morgan, W. & Co.---San Francisco
Nielson, John I.---San Francisco
Northey, N. S.---East Oakland
Nugent Covey Wagon Company---San Francisco
Oakland Wagon Works---Oakland
Pacific Coast Auto Top Company---Oakland
Pearson, O. W.---Los Angeles
Peters & Hubert---San Jose
Phelan, S. F.---Stockton
Pierotti, Joseph, & Sons Company---Oakland
Pike Automobile and Wagon Works---Los Angeles
Pomona Planing Mill---Pomona
Ragan, J. W.---San Francisco
Rentschler, F. J.---San Francisco
Reynolds, J. J.---Los Angeles
S. J. S. Co.---Stockton
Santa Cruz Carriage Works---Santa Cruz
Scheid, Joseph W.---San Francisco
Schelbert & Scannavano Company---San Francisco
Sohst Carriage Company---Oakland
Spinney & Oughin---San Francisco
Standard Carriage Works---Los Angeles
Standard Wagon Works---Los Angeles
Steacy, W.---Lodi
Stearns & Harray---Oakdale
Sullivan, Wm. I.---San Francisco
Sunset Carriage Factory---Stockton
Thomson Carriage Company---San Francisco
Thomson Graf Elder Company---San Francisco
Tremain, E. E.---Stockton
Truscott, A. & Son---Stockton
Vallejo Carriage Works---Vallejo
Vetter, Aug. & Son---San Francisco
Waterhouse & Lester Company---San Francisco
Waterhouse & Lester---San Jose
Wertsch, Wm., Company---San Francisco
Western Wagon Shop---Los Angeles
Wheeler, F. W.---Oakland
Wilbert, M. L. & Sons---San Francisco
Work, T. A., Company---Pacific Grove
Zerry Bros.---Los Angeles

Wood Carvings.

Beregsasy, J.---Los Angeles
California Grill Works---San Francisco
Holder, Al.---Los Angeles
Karmel, Marten---Los Angeles
Roduner, Chas. G.---Los Angeles

Woodenware and Novelties.

Anchor Tent and Awning Factory—Los Angeles
Atkinson, Geo. F.—San Francisco
Bradford, F. G., Mill Company—San Francisco
Bruce Lumber and Mill Company—Berkeley
Burns, Rodney—Eureka
California Artwood Company—Los Angeles
California Barrel Company—San Francisco
California Souvenir Company—Los Angeles
California Standard Planing Mill Company—Oakland
California Woodturning Works—Oakland
Campbell, O. A.—Los Angeles
Cavanagh Mill and Lumber Company—Petaluma
Daehler Novelty Company—Los Angeles
Driver, Aber & Co.—San Leandro
Eagle Box and Manufacturing Company—Oakland
Edmunds, H. H. & Son—San Jose
Fishbeck, C. W.—Pasadena
Flynn, J. F.—Pasadena
Fresno Flume and Lumber Company—Fresno
Fresno Tent and Awning Company—Fresno
Henderson Manufacturing Company—Oakland
Hertenstein, A. & Son—San Francisco
Hoegee, Wm. H. Co., Inc., The—Los Angeles
Hoerl, J. F.—Stockton
Humboldt Cooperage Company—Arcata
Jones, J. R. L.—Oakland
King Advertising and Sign Company—Los Angeles
Kopp, G. W.—Sacramento
Larsan Ladder Company—San Jose
Lee, Fred A.—San Jose
Levi, B., Fixture Shop, The—San Francisco
Lorenz, F.—San Francisco
Los Angeles Ladder Company—Los Angeles
Mayers, T. & J.—San Francisco
Mellus Bros. & Co.—Los Angeles
Miller Hive and Box Company—Los Angeles
Mission Lumber Company—San Francisco
Muhs & Lochbaum Company—San Francisco
National Tent and Awning Company—Los Angeles
Pacific Novelty Company—Los Angeles
Pacific Tent and Awning Company—Fresno
Plummer, W. A., Manufacturing Company—San Francisco
Pomona Ladder Company—Pomona
Royar & Nughba—Los Angeles
Russell, Fred J.—Hayward
Sanborn, Vail & Co.—Los Angeles
Sinkinson, J. H. & Sons—Santa Cruz
Spencer Street Planing Mill—San Francisco
Stockton, A. L., Lumber Company—San Francisco
Sun Tent and Awning Company—San Francisco
Swanfeldt Tent and Awning Company—Los Angeles
Thoms Awning Company—San Francisco
Union Blind and Ladder Company—Oakland
Valencia Street Planing Mill—San Francisco
Waggoner Extension Ladder Company—Stockton
Wise & Downie—Los Angeles
Woodfibre Company—Los Angeles
Woodstone Manufacturing Company—Los Angeles
Yucca Manufacturing Company—Los Angeles
Yucca Wood and Leather Company—Los Angeles

CALIFORNIA STATE BOARD OF FORESTRY
BULLETIN No. 4
G. MORRIS HOMANS, State Forester

STREET AND HIGHWAY PLANTING

BY

BEN Y. MORRISON

Printed at the State Printing Office, Sacramento, California. Friend Wm. Richardson, Superintendent.

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CONTENTS.

American Elm planted on side street and properly cared for.

Dedicated

to

Highway Improvement

of

California.

ACKNOWLEDGMENT.

There are now before the public many books which cover in part much of the work offered in this bulletin. None of them to our knowledge, however, deal with the questions from the strictly Californian standpoint of view and this is absolutely necessary in a state where there are so many factors which necessitate minor changes in the routine of many planting operations. We have, therefore, followed closely or distantly many of the eastern works according as they aided our point of view. We have gained from many publications both from books put forth by private individuals and those valuable publications from the various experiment stations.

In addition to the generous store of information to be gleaned from the press there have been many California friends who have given freely of their time and information because they believed that a popular bulletin on this subject would be worth while and arouse greater interest in the public mind toward the beautification of our city streets. Especial thanks are due to Dr. H. M. Hall of the State University for valuable criticisms and suggestions; to Miss Katherine Jones for assistance in many ways; to Mr. J. H. Reed of Riverside, who gave generously of his time and information; to Miss Kate Sessions of San Diego and Mr. Ernest Braunton of Los Angeles. Among others who should be mentioned are Mr. John Morley, Mr. Max Watson, Mr. Leonard Coates, Mr. Frank Gore, Mr. J. C. Hardman, and many others. To all of these friends we extend our heartiest thanks and appreciation.

It has been our aim and our desire to make the contents of this bulletin as practical and simple as possible. There is now a widespread interest in shade trees abroad in our State and we hope that this bulletin may be of some value in stimulating that interest and in bringing about more active and intelligent planting operations which will make our state as much talked of for its magnificent avenues as for its wonderful natural wealth and beauty.

EXECUTION OF PLANTINGS

THE spirit of the twentieth century, by popular consent, is one of progress. Progress strides forward only by measures of law and order. This is inevitable, else she would defeat herself by her own struggles. There was a time when cities grew up as they would, but now they are being planned. Progress has set the irrevocable stamp of her disapproval on all haphazard procedure. To be sure, there are still flagrant violations of this new idea and many cities that might easily remodel their plans are wilfully negligent and still more cities are blocking the efforts of their own enthusiasts by stubbornly refusing any co-operation among the members of their own community.

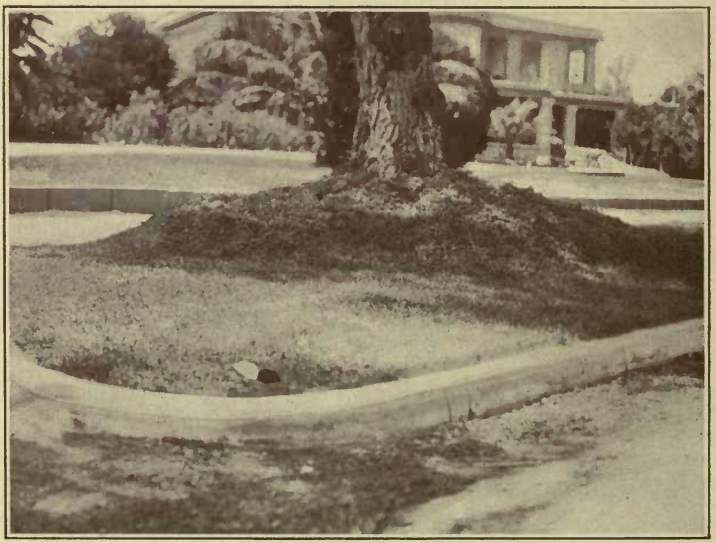
And this lack of interest arises in most cases from a doubtless sincere conviction that civic beautification is a waste of money. It has been demonstrated and can be demonstrated times without number, if proper methods are followed, that civic improvement is one of the best and biggest factors of community life. First of all there is a large rise in the value of real estate. This, of course, is partly due to the cost of the improvements, but aside from the additional expense, there is a value put upon those intangible things which are expressed in the new atmosphere of elegance and refinement. And this same atmosphere which is appreciated for its indirect influence upon money matters, has an uplifting influence upon the citizens which is rarely appreciated until it is removed. And anything which, in any way is of value in raising human standards and ideals, is surely worthy of unbiased consideration. When these direct and indirect effects of civic improvement are fully advertised; when public opinion has fully realized that they are for the public and that the expense of their production can be reduced to a minimum; and when these matters shall be intrusted to experts to handle, then we shall have sufficient and valuable legislation, a hearty support from every one and a healthy civic pride which will mean success to any community.

But to come to the phase of the problem that most directly concerns us here, let us turn to the planting which is done along the streets and highways of our State. With certain exceptions for which due credit must be given, we find a supreme lack of order throughout the planting which has been done already.

To some minds there is the open question of the desirability of planting of any sort. There are some localities where it is seriously stated that trees are not desired. In one city that comes to mind, it was urged

Plate 1.

Old specimens stranded by change of grade.



One way of treating a change of grade.

that the summer temperature was so low, and the prevalence of fogs so great, that trees would be a menace to health. But at this point one might suggest that there are trees and trees. There are species which are undeniably objectionable for excessive shade; but there are also trees whose shade amounts to almost nothing. There are others whose form would destroy all air currents in any street, particularly in a narrow one, but there are yet others which would never branch across the street at any age. Again the method of planting would affect this matter of light and air.

Then aside from the eminently essential question of health, we have the no less vital, if somewhat less appreciated point of æsthetics. To the average mind, there is a certain stimulation to be gained from the consideration of any noble work well done. The tree, as it stands perfect in detail and form, expressing an individuality as striking as any human being, is or should be an inspiration to every beholder. Aside from the beauty of a tree as a unit, there is a still greater charm when it takes its place in the great scheme of a well executed planting. The absence of trees and the sense of bareness is a proverbial co-ordination in the present day mind. The ever-quoted examples of Washington and Paris furnish the most striking instances of well planned and well executed plantings. It is a wonderful and inspiring sight to look down long avenues and there see plantings of trees which extend several miles and which give promise of becoming the pride and admiration of generations to come.

We have earnestly believed and do believe that there is perhaps no one thing that may appear in any city that so adds to its finished appearance or to its refinement as a well planned and well executed planting of trees along its streets. Above all things else, let the plan be good.

The logical outcome of any plan, of any good plan, is unity. Do not imagine that uniformity means the restriction to a single tree, so that wherever one would look that tree would dominate the landscape. Such a proceeding would violate the much abused and yet often neglected principle of variety. But the concensus of opinion demands that the uniform work should be strictly adhered to for each street in towns and cities. In the country more latitude is permissible. (There are some valid arguments against this, of which more hereafter.) The desirability of this is most evident when one considers the results now seen. In a certain city, where up to the present time, all planting has been at the discretion or better notion of the property holders, some queer combinations arise. For example, the east side of one block shows: one chamærops, one oleander, one chamærops, six white elms, six liriodendrons, one vacant lot, two umbrella trees, four silver maples, a Canary Island date palm and a walnut! Across from this mixture there are

Plate 2.

If planting must precede street work, plant on the level of the proposed grade and avoid results as in Plate 1.

Good planting of palms, but note light shade.

but twelve trees: two umbrellas, four chamærops palms and six elms. Another characteristic lot runs like this: four grevilleas, two walnuts, six lindens, vacant lot, two big-leaf maple, and four lindens. While across the street are two silver maples, two horse chestnuts, two elms, six blanks, four hawthornes and two elms. Imagine, if you can, any symmetry or satisfaction in this young nursery. Here we have variety with a vengeance, but no trace of unity or coherence.

If we were to analyze the conditions on that block, we should find that there we have the following state of affairs:

1. One evergreen against six deciduous species.
2. Four unplanted lots, offering at least four chances for new species and times of planting.
3. Two short lived species against five medium and long.
4. One globular dwarf; four medium globular; one urn-shaped; and two straggling.
5. Six individual cases are such poor nursery stock they can never mature.
6. Four individuals are nearly always disfigured with fungus and four are a constant source of litter.

Are these reasons not sufficient to warrant one's saying that twenty-odd most estimable property holders had best resign their woes to one, who knows what he is about? As it happened both these cases are from one town, but they can be duplicated everywhere.

It is to make impossible the repetition of such work, to encourage new efforts and to stimulate popular interest along more rational lines that this bulletin has been prepared. It has been our aim, throughout the entire study to gather information of actual work, which has been completed long enough to have borne the test of time, and to secure photographs which shall illustrate these points beyond all question.

CHAPTER II.

SELECTION OF TREES FOR STREET USE.

If then, in accordance with the views just expressed, we are to proceed upon a plan which shall produce an effect which is to approximate the ideal street as closely as possible, we must have an ironclad standard by which every species suggested for planting along the highways or streets must be tried before selection. And here it might be noted, that there must be a different interpretation of this standard for each situation, as the same rule could not possibly apply for all sites. In regulating this standard we must keep the effect of the planting at maturity

Figure 1.

constantly in mind. What might seem eminently satisfactory in young trees might prove impossible in the case of mature specimens. This question of size and shape at maturity must then regulate the selection of the species, the order of planting and the spacing in the parking, according to the width of the street. Furthermore, the available amount of care must be considered, for certain trees will produce good specimens with a lack of attention which would prove disastrous to others. If the planter will bear all these facts, and many more, in mind, and have a sufficiently high ideal of the model street, there is no reason why the ideal should not be approximated in all cases.

The ideal street should be marked by many fundamental characteristics. Its width should be proportionate to its use and location and never stinted; it should be supplied with adequate drainage facilities, wide parkings and good sidewalks. Wires of all kinds should be laid underground. One telephone company in Riverside has already co-operated in this regard with good results. In other towns, notably Berkeley, Pasadena, and San Jose, many of the poles are located in the back yards giving a similar good result. The parkings should be planted uniformly throughout the entire length of the street unless soil conditions prevent. Furthermore, the trees should be of uniform size and shape. This is made possible only by a simultaneous planting of trees of the same age and a subsequent pruning throughout their growth which shall be necessary to maintain such uniformity. This shape should always be one which would allow free circulation of light and air. This factor is assisted by judicious spacing along the parkings.

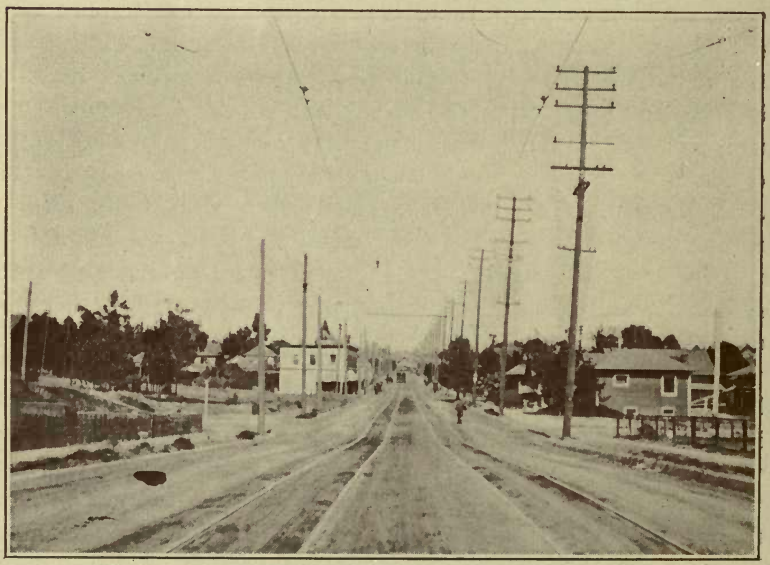
The species must be one which does not have drooping branches to interfere with the lighting of the street, either natural or artificial, or must stand constant pruning. In special cases where electric wires of any sort occur, some concession must be made to them. But the question of surface wiring is, we hope, a temporary one, for the time should be fast coming when all such wiring will be put underground. The details which are of concern, should be chiefly those of the tree and not of the telephone or lighting companies. Furthermore, the head of the tree must be neither too dense or too open; it should be erect and not drooping; and the leaves should keep in good condition until falling. The ideal street should offer a perspective as in Fig. 1.

Again, the species selected must be relatively free from the attacks of insects and fungi. It would be impossible to find a tree which was entirely immune, but there are some trees which are more resistant than others. A case in point would be the hawthorne, which, in the Santa Clara Valley and bay regions, is infected with scales and aphids, in the excreta of which flourishes the sooty mould fungus which annually disfigures the trees. These conditions are, of course, controllable, but the time, energy, and expense entailed make it obvious that the æsthetic value of the hawthorne does not justify such effort in order to have it on the street.

The question of shade is very important in some parts of California and not so much so in others. In spite of the mildness of the climate, we find ourselves dependent on the sun for our comfort. For this reason alone, evergreen species should be considered with considerable hestitation, especially on streets running due south and west. In addition, evergreens hold the moisture and by preventing rapid evaporation bring

Plate 3.

Well designed planting, but rather poor choice of species. Compare Plate 7.



A fine opportunity for good work.

about bad conditions on the road or highway. But of this question of deciduous versus evergreen species, more later.

Spacing often spoils a good tree. A case in point is the frequent use of *Acacia melanoxylon*. This is an excellent tree in many ways. Its natural mode of growth is symmetrical and fairly rapid; the scale insects which attack it rarely produce serious effects; it lives to a considerable age and throughout its existence needs but little attention to pruning; it is fairly free from litter and is indifferent to cultural conditions. Here is a tree with a desirable set of qualifications which in almost every case is planted in such a fashion that it becomes very undesirable. When planting this acacia it should be borne in mind that it is an evergreen of a green black color and of a density of growth which produces a very intense dark shade. Moreover it is a tree which needs abundant room for development. This fact is one which is frequently overlooked, since we can find many instances where it is set at intervals of some twenty-five or thirty feet so that a solid hedge of trees has developed, completely shutting off the sun from the houses behind them until about noon. Furthermore, any air that may be in circulation is effectually shut off. The solution of the problem is easy. If one feels that *Acacia melanoxylon* is necessary to his happiness, buy specimens that are headed high; prune out enough branches to keep the head from being too dense and plant at least fifty feet apart, preferably alternating across the street. In the case of very wide streets, this last precaution is, of course, unnecessary.

The question of litter is no small matter in the appearance of the city. And the tree which is untidy should have no preference over less annoying trees in the scheme of civic decoration. A case of a very common malefactor is the ever popular umbrella tree (*Melia azadarach*). This tree, which is almost invariably headed too low, causes a litter in the spring at flowering time; in the autumn the leaflets drop; then the petioles, and last of all—intermittently through the winter—the berries and the panicles that bore them. Here we have a case of constant litter for about two thirds of the year, which certainly outweighs the possible beauty of foliage or flower. Another instance is the grevillia, where the litter from falling leaves and broken branches is quite incessant.

And last, but not least, from the practical and economical standpoint, is the longevity of the tree. The desire for immediate effect often overthrows proper discretion. Most of the trees which will give quick results, for example, the umbrella tree, the Carolina poplar, the silver maple, *Acacia pycnantha, Acacia retinodes* and many more, do not give permanent or lasting results, and the effort spent on them is quite wasted. Then, when they have reached maturity and fallen into decay,

more money and time will be required for their removal and replanting with proper species. Altogether it is more profitable to plant well in the first place than to resort to a makeshift.

Of course there are no species showing all these points, but some are better than others, and in certain localities some of these features may not be of much importance. But these should be points of consideration in the study of the local problem. And it is the local problem above all things which must determine the solution agreed upon.

CHAPTER III.

TREES FOUND IN THE REGIONS VISITED.

THE ACACIAS.

Throughout the south *Acacia Baileyana* is planted chiefly as an ornamental tree. At the best it rarely exceeds twenty feet in height. It is characterized by small but elegant pinnate foliage of a fine glaucous color, which contrasts well with the golden orange blooms which appear in January and the purplish red seed-pods which mature later in the season.

The style of growth is such that the tree appears at its best when the lower branches are not trimmed away but lie upon the ground. The branches grow in rather a loose fashion and unless some care is given the trees will grow into unshapely specimens. Unfortunately, this tree is not long lived and often begins to show its decline when from ten to twenty years old.

Acacia armata rarely becomes large enough to be classed as even a small tree and is of so prickly a habit that it would not be desirable for street use. For shrubbery and perhaps for roadside planting in dry soil it might be used to advantage.

Acacia decurrens dealbata (Plate 1, No. 1) is a fine species with pinnately compound foliage and a magnificent floral display in February or thereabout. Unfortunately, unless care is given, the habit of the tree will be bad. This is a tree which must be carefully selected among the nursery specimens and cared for to induce a good trunk with erect growing limbs. As the tree stands pruning very well, it is only a matter of care and attention in the first five or six years of the tree's life.

The objection is sometimes raised that this tree is particularly liable to raise the sidewalks. This is quite true, especially if it has been planted on a parking that is two feet or less in width. It has been demonstrated, however, that this tree can be root pruned in such a fashion that this can be obviated.* In the experiments tried a young tree was root pruned every year for three years at the same time that the top was cut back. All the roots were cut off from the tap root for as great a distance as three feet from the surface with no harm to the tree. Of course when root pruning is resorted to the corresponding pruning of the top must be heavier than it would be if nothing were

*Mr. Ernest Braunton.

Plate 4.

1, Acacia decurrens dealbata; 2, A. retinodes; 3, A. longifolia; 4, A. melanoxylon.

done to the roots. The tree treated according to this system shows but a slight decrease in size from the trees which have grown as they would.

One advantage of this tree which is rarely mentioned is, that in maturity, the head becomes quite open, so that the shade cast is light, though entirely sufficient to all demands.

The tree is a rapid grower and forms a specimen of considerable size in a very short time. Mature individuals need a great sufficiency of room for their development and should not be crowded. From actual experience it has been found that at three years of age trees planted thirty-six feet apart were too close. It is to be desired that fifty feet be the minimum distance and sixty or seventy-five feet is not to be thought undesirable.

Acacia decurrens mollis is a form quite similar to the foregoing. The chief popular differences are the more glaucous color of the foliage and the later blooming flowers. These flowers are not so showy as those of the dealbata form, as they are of a very much lighter shade of yellow. Indeed, at times they appear as merely a yellowish white.

The same requirements for planting, pruning both of tops and roots, and so forth, are needful as in the case of *A. decurrens dealbata.*

Acacia longifolia (Plate 1, No. 3) is one of the acacias to be avoided in street work. When young it is quite similar to *A. melanoxylon* which is desirable, but when the mature head begins to form, which it does at an early age, the character of the tree begins to show. The trunk rarely assumes an upright position and usually twists into some horizontal shape, dividing into two or three large limbs which sooner or later become so heavy that they break from their own weight. This is very frequent since the wood is extremely brittle. As there are so many better acacias, this one may be quite ignored for street work. The most like it is the following:

Acacia melanoxylon (Blackwood) (Plate 1, No. 4) is perhaps the most common of all the acacias in the southern part of the State. It is a rapid grower and easily and cheaply raised from seed. Its blossoms are quite insignificant, although the seeds and seed-pods are quite in evidence later on, and the foliage is quite a dark green and very fresh in appearance. This dark color is objectionable to many and certainly is bad when emphasized by the close planting which commonly prevails. If plantings are made with but twenty-foot spaces between trees in five years time the trees will be almost a solid hedge. Although the citizens do not hesitate to complain both vehemently and long on account of the funereal darkness, they rarely make any move to remove the alternate trees.

Because the blackwood will stand a maximum of abuse, it has been woefully neglected. Because a seedling eighteen inches high will make a tree of some fifteen to twenty feet, speaking conservatively, in five

years' time, without any special care in planting or afterwards, is no reason why such treatment should be advocated or tolerated. *Acacia melanoxylon* will stand more water than any other of the acacias and hence is best for parkings where there is grass. Too abundant water supply leads to the production of a superficial root system. Furthermore, unless there is special care taken at planting time, this tree will form a surface root system which will not support a tree of any size against heavy winds.

This acacia grows in many ways. The prevailing type is the pyramidal one, but there is great individuality among the trees of this shape. Some trees will grow four times as rapidly as their neighbors which have had the same care. By four times as rapidly is meant a growth in height only, as the more slowly growing forms usually make a better spread. It has been found necessary and practicable both at Riverside and Los Angeles to do something to make these trees more uniform. After experimenting it was found that a severe topping, as much as one third at the age of four or five years, made the desired change. There are specimens in the streets of Riverside and in some parts of Los Angeles which have been treated in this fashion very successfully. Those trees which are inclined to be spindly have become broader and have spread out into a good umbrageous head. Of course, discretion must be used in making this cut, as some trees will not need so heavy a cut as others. In the central and northern parts of the State the irregularity of growth is not so marked and many fine specimens may be found which do not need the severe heading back.

Figure 2.

Acacia retinodes (Plate I, No. 2) is often found on the streets. This is the type to which the horticultural variety *Acacia floribunda* belongs. It has all the undesirable features of the more common *Acacia floribunda.* While it is frequently found it is to be urged that its use be discontinued and those now in place relegated to the shrubbery where they belong. That form often offered by the trade as *A. floribunda* is not a distinct species, but a free growing form of *A. retinodes.* The variety is a very handsome form of acacia, which is practically everblooming. The foliage is attractive and fresh throughout the year, and the new growths which appear nearly the year round bear quantities of fragrant blossoms.

Unfortunately, this acacia grows in a very bad habit for street work. The trunk is often divided quite close to the ground and seems to prefer an oblique direction of growth to an upright one. Like all other acacias, however, it is very tractable and can be trained to a good form. This means constant attention, and constant attention for any street tree makes it undesirable on account of the expense. If the tree can be given the care needed, it will make a fine species for narrow streets where a low planting is wanted. The shade cast at maturity is only fairly heavy, though like most of the other species which have phyllodia, it is more dense than the pinnately leaved forms.

Albizzia lopantha (Fig. 2), sometimes known as *Acacia lopantha*, is another tree to be avoided. It makes a phenomenal growth and is rather attractive while young, but is very short lived and the mature form is anything but desirable. It is very dirty and frequently litters the street with broken limbs and seeds. It is useful, however, in seaside plantings, as it will often thrive where other vegetation will be severely stunted.

THE MADRONE.

This native tree (*Arbutus Menziesii*) is found growing to perfection in the northwestern part of the State, where, with the Douglas fir, it is

Figure 3.

a predominant feature in the landscape. It is a fair sized tree with smooth red bark on the smaller limbs, broad shining evergreen leaves, and large terminal panicles of white flowers which are followed by

showy orange and orange-red berries. The tree casts a very dense shade which is quite cold in damp weather and should be used with considerable caution. It calls for a wide road and plenty of space in the parking. It needs a moist atmosphere to make its best appearance and hence is generally found in the northern part of the State in a better appearing condition than in the more arid south.

THE MAPLES.

Acer macrophyllum (Fig. 3), the native big-leaf maple, has been freely planted in the parks of the southern cities but has not been tried out on the street so far as could be discovered. This form is even less common than *Acer saccharinum* (silver maple), although it far excels

Figure 4.

Figure 5.

it in merit. The big-leaf maple, which ranges from Oregon southward, grows in the canyons of the southern part of the State to some extent and has proven a fine tree in the parks. The shade is good, the foliage desirable and the tree of good shape.

In the northern and central parts of the State it is one of the best street trees, although it has not been used as much as might be desired. In Berkeley there are several fine plantings, notably on Piedmont avenue, where the trees, though young, show great beauty of development. As this tree is native of the coast states and is found through southern Oregon, we find, as might be expected, good specimens throughout all of the northern counties.

Acer negundo Linn., and its var. *Californica* (Fig. 4), the box elder, is common throughout the south, both on the streets and in private yards. In nearly every case, even in situations where water and attention were limited, fine trees were being made. The foliage is an attractive light green and gives a pleasant shade. In some cases the samaras seem to be quite persistent, but in many other instances they are not. The wood of this tree is somewhat brittle and hence is open to the same objections as the silver maple. The tree is planted in considerable

Figure 6.

quantity, nevertheless, and in most instances has proven entirely satisfactory. The specimens noted in the coast towns are quite as good as those in the interior, and vice versa. It is also found in good condition throughout all of the rest of the State, and in many places is one of the favorite trees.

Acer platanoides Linn. (Fig. 5), the Norway maple, was noted in but few cases and all of these were in private yards. In all cases the trees were young and very poor specimens. So far as could be learned this species has not had an extensive trial in the south, but in the northern and central parts of the State the tree matures in great perfection. It

is not found in the best condition in the San Joaquin Valley or in any place where there is a great heat in the summer season, for like all eastern maples it does not enjoy the dry heat of California summers.

Acer saccharinum Linn. (Fig. 6), the common silver maple, is often planted in the parkings, where it is desirable because of its quick growth. Like most rapidly growing trees, however, it is not long-lived and the wood is very brittle. The foliage is attractive and the tree of good form, standing severe pruning, but the light nature of the wood makes it an easy victim of the storms that come, of the fungi that thrive in the open wounds, and of many insects.

Figure 7.

Acer saccharum Marsh (Fig. 7), the hard maple, was found in Fairmount Park at Riverside. Although these specimens were on low ground where there was sufficient water, they had a starved appearance. There is some chance that the soil was the factor which caused the trouble, but this is not certain. The trees were some twenty-five feet in height, but they did not look at all happy. This species is found in good condition in the northern part of the State, but is not to be recommended for street work, because, of all the maples, it is perhaps the least tolerant of street conditions.

The maples are one of the families of fine trees which, in the south, come under the ban of the eastern tourist. His rule in some parts of southern California is so complete that his edict that "he did not come to see bare branches, but sunshine, verdure and flowers," has become

the goal of all planting, and although a few unfortunate creatures still yearn to watch the unfolding of bud and leaf in that fashion peculiar to the deciduous trees, the vast majority of citizens plant their rows of evergreens, and in spite of the dense shade of certain winter days, persist in their protest that evergreens only are desirable. But in the other parts of the State the maple finds a welcome place, and many watch for the yellow bloom of the Norway and big-leaf maples, the red blooms of the silver maple, and the gay autumn foliage, with the same delight that is felt in those sections where the trees are native or freely planted.

THE AILANTHUS.

The Tree of Heaven (*Ailanthus glandulosa* Desf.) is a tree often found in the "downtown" districts where there is much dust and smoke, because it is one of the trees which will stand considerable dirt in the atmosphere. Under these circumstances it has little chance to root sucker, which is its most undesirable feature, although such suckers often appear in cellars and alleyways where there is apparently little chance for any favorable growth.

The tree attains considerable size and bears large compound leaves which often color highly in the autumn. The flowers are borne in large terminal panicles. The male, or staminate flowers, which are borne on separate trees from the female or pistillate flowers, have a rather sickening odor, to which various discomforts are popularly attributed. The samaras of the pistillate tree are often a vivid red in the autumn and of no small beauty, though after the leaves have fallen the persistent seeds are not attractive.

THE CHINA WOOD-OIL NUT.

This tree (*Aleurites*) has been planted in a small way near the University Citrus Experiment Station at Riverside and in other isolated locations about the State. There the trees have been kept low and do not show a form suitable for street use. At first sight they suggest the mulberry, with large cordate leaves of downy texture. The nuts are borne in large green fruits, and have caused several severe cases of poisoning among too curious small boys.* The tree on the whole does not appear promising for our work.

THE ARAUCARIAS.

Araucaria bidwellii, A. imbricata, and *A. excelsa* are all common throughout the southern part of California. There are a notable number of fine *Araucaria excelsa* (Norfolk Island pine) in Santa Barbara, and farther south this species gives place to Bidwell's form. There are many excellent specimens of this far into the inland country. In most places there are but few of *A. imbricata,* commonly known as the

*According to information received at the station.

monkey puzzle. The chief beauty of these trees lies in perfection of form. In order to attain this the tree should have room to develop the lower branches. This consideration makes them quite useless for street work, though in a few rare cases *A. excelsa* has actually been planted on a parking space.

These species all do well through the central and northern parts of the State, excepting in exposed localities or where the frost is severe. The Norfolk Island pine is most commonly found in the bay region, though there are many good specimens of the other two species. Besides these three there are other araucarias to be found in the State, but their occurrence is not general.

BAUHINIA FORFICATA.

Bauhinia forficata is a rare tree which will hardly ever gain a place as a street tree, on account of its tenderness. The tree as it grows in Santa Barbara is a tree which would hardly recommend itself for street work. It has peculiarly shaped leaves and very showy flowers, which attract considerable attention, but its tenderness makes it useless for street work, though highly desirable for private grounds where special care can be given.

THE BIRCHES.

Betula alba laciniata pendula (Fig. 8), the weeping cut-leaved birch, is fairly common in parks and private yards, but, in the south, is not planted as a street tree, as is often done farther north. Wherever it has been planted it has grown fairly well, and in the north it is one of the more popular trees for narrow streets or positions where a marked contrast in growth has been desired.

Figure 8.

This is a tree, and all the other varieties of *Betula alba,* which needs care while it is young to insure a good strong leader which will carry the drooping head well out of the pedestrian's way. If this has been cared for, the tree forms a good head and makes a fine small tree for a narrow street where a light shade is desired. Unfortunately the tree is not a long-lived one and has to be replanted from time to time. The tree is also subject to diseases which at times render it untidy. In most places, however, the tree is as yet in good condition.

CÆSALPINIA.

This is in reality a large shrub and not a tree in the proper sense of the word and is rarely found in the parking spaces. At best it is of somewhat straggling growth and needs frequent severe prunings to keep it in shape. The foliage is of a light green nature, being highly compounded, and the flower clusters are very showy, with brilliant yellow petals and long red-anthered stamens.

Figure 9.

THE CAMPHOR TREE.

The camphor tree (*Cinnamomum camphora*) (Fig. 9) is a great favorite through the southern part of California because of its shapely form and shining light-green leaves, which keep a very fresh appearance through the summer months. The young growing tips have a reddish pink coloring which also adds to the attractiveness of the tree. And it is by no means confined to southern California, for good specimens may be found throughout the State, especially large ones being noted in Chico.

The one peculiarity of the species is the fact that trees which apparently are in equally good situations will not respond equally to the same care. It is the general opinion, however, of those who have cared for this tree that a little extra care, in the form of watering or, in extreme cases, fertilizing, will bring about the desired uniformity of growth.

Like most of the other evergreen trees, there is some dropping of leaves throughout the year but there is not an excessive litter. The

fruit is a small whitish berry, rich in oil, but very inconspicuous on the tree and not noticeable underfoot. The camphor, as a whole, seems one of the first class trees for the city street, provided, of course, there is a wide parking and a considerable amount of care, for the first five years, at least.

THE BEEFWOODS OR SHE-OAKS.

The various *Casaurinas* have all been used in the parking spaces but perhaps the most desirable one is the species *C. stricta.*

This tree has a very peculiar characteristic form, which tells of its drought-resisting qualities, and which, in the more mature trees, is somewhat suggestive of the habit of the pines. The trees are not of strikingly beautiful appearance and are likely to be disfigured by the dust which accumulates on them and the reddish discoloration due to the forming of the winter buds, but have considerable claim upon the attention from their oddity.

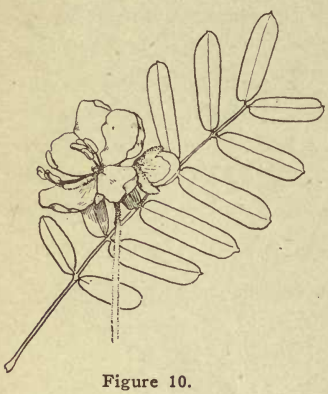


Figure 10.

Aside from these facts, however, the tree has some peculiarities which make it invaluable in certain localities. First and foremost is its resistance to alkali. The exact per cent which can be tolerated is not at hand, but it is reported that a considerable quantity of alkali will not affect the vigor of the tree in any visible degree. And like most of the alkali-resistant plants, the tree will tolerate long periods of drought. Moreover, under favorable conditions, the tree is of fairly rapid growth, and will give light shade in a reasonable time.

This tree was noted in good condition throughout the south and the interior valleys, but it is less frequently planted in the bay region and farther north, though it grows successfully in many of these situations. When, however, there is no real necessity for a tree of such marked adaptions to arid conditions, there is little justification for its use.

THE CASSIAS.

The most frequent cassia (*C. tomentosa*) (Fig. 10) is properly a large shrub or small tree and not suitable for parking use where shade is the only object. To be sure, it is rarely found so planted, but occasionally it does occur. It is a leguminous plant with terminal panicles of showy yellow flowers which are followed by pendant legumes. Altogether it is too brittle and too short-lived to be considered as an ornamental tree of great value, though it might be used in situations calling for special treatment.

THE CHESTNUTS.

The chestnut (*Castanea* sp.) occurs as rare specimens all through the State. So far as is known, no specimens were found in the parkings in the south, but there were some magnificent trees in private yards. In rare cases it had been planted in the north, but the best specimens, which are not many, are to be found in plantings other than those in the street.

Figure 11.

By natural habit the tree is usually of symmetrical shape and requires little care toward that end. The foliage is good and the flowering in these sections is inconspicuous. The trees for the most part do not fruit. This is a tree for which no recommendation can be made, for lack of evidence. Certainly it should not be planted on narrow streets or streets with narrow parkings.

THE CATALPAS.

The catalpas (principally *C. speciosa*) occur scatteringly, both in private yards and in the street work. At best it does not appear to be very happy in the south, though isolated specimens do occur which seem to be thriving. In the north, however, many good trees may be found, but so many more desirable trees may be selected for street work that it is not to be considered in most instances.

The tree is of symmetrical growth; has large light green leaves and showy panicles of white flowers in the spring. So far as was noticed there was little maturing of fruit in the south, but doubtless this cannot be depended upon, as the trees fruit freely in the north. The tree is of fairly rapid growth and reasonably free from insect pests. As to its permanent value only experiments can tell.

Somewhat resembling the catalpas is the Empress tree (*Paulownia imperialis*) (Fig. 11). The only objection to this tree is that the woody seed-pods are very persistent. The lavender flowers are rather showy and the foliage is large and attractive.

THE CEDARS.

The Mt. Atlas cedar (*Cedrus atlantica*) is found less frequently than the deodar. Perhaps this is accounted for by its less rapid growth and its less showy appearance in the first years of its life. The difference in growth, however, is slight and the full beauty of the tree at maturity should be considered. The needles are much shorter and darker as compared with those of the deodar.

The deodar itself (*C. Deodara*) is a fine tree with good foliage of a semi-glaucous tint. The tips of the young shoots have a pendant nature which adds much to the grace of the tree.

Both of these trees are conifers and are open to the common objection of the necessity for pruning away of the lower branches. This has been done, however, on specimen trees with no very bad result.

There is no question but that the deodar makes a noble avenue tree. However, the problems connected with its use call for considerable ingenuity and a careful study of local conditions. The prospective planter must remember that there will come a time when the tree will have a spread at the base of at least forty feet and that there will be some tendency for large roots to show near the surface for some twenty feet. Moreover the shade cast will be very thick so that alternate planting may be advisable. Furthermore, there will be a dropping of needles which will be of considerable annoyance to any abutting property holders who have a lawn. (It might be pertinent to note at this point that English ivy (*Hedera helix*) does well as a ground cover under these trees.) For all these problems no hard and fast rule can be made.

This tree does not tolerate freezing or even heavy frosts, but was noted in good growth from San Diego to Ukiah and Chico, so that it may be planted through considerable range in this State.

THE CAROB TREE.

The Carob tree or St. John's Bread Tree (*Ceratonia siliqua*) (Fig. 12) is found in increasing numbers throughout the south. This is a

Figure 12.

newer tree of great beauty. The foliage is of a deep and peculiarly shining green which is in no way diminished through the summer

Figure 13.

months. The tendency of the tree is to form a broad rounded top of considerable size. The foliage is evergreen, compound and the fruits

are legumes, the flowers being rather inconspicuous. The number of seeds produced seems to vary greatly, some trees producing but few and others great quantities. The fleshy part of the fruit in the pod is edible, but is not of sufficient note to be considered, though it is reported as good food for hogs.

For the objectionable points we must note two or three things. This tree, true to its evergreen nature, drops its leaves continually and even more freely than some of the other broad-leaved evergreens commonly found. Again, the tendency of growth is peculiar. The type of crown is a low, broad, rounded head. This head is often formed, in fact is usually formed, in well-cared-for trees by the division of the leader into five or six almost co-ordinate branches. One or two of these may take the place of the leader and divide similarly farther up, but usually there is but one division. As time goes on these branches attain great size and from their own weight and tendencies of habit assume a more or less horizontal position. While the wood is not exceptionally brittle, specimens of considerable size are often split by the weight of the branches in such a way that the shape of the tree is hopelessly ruined. See Fig. 13.

Of course the logical solution of the problem is for some enthusiastic nurseryman to make a study of the training of these trees with the hope of securing trained specimens which will be suitable for street work. The effort to thwart natural habits is a tedious operation—the result, if successful, must demand a price which some will be loath to invest. But it is to be hoped that the time is fast coming when all the nursery stock used for streets will be first class only.

This tree in its best development is confined almost entirely to southern California. About the bay we find most of the trees, though still very young, assuming a shrubby rather than a tree-like habit.

THE CYPRESSES.

The Arizona cypress (*Cupressus Arizonica*) is one for which Dr. Franceschi entertains considerable hope. Coming from the mountains of Arizona, it will stand considerable cold and drought. Like the Guadalupe cypress, it has a silvery color, though as a tree it never becomes so large or spreading.

The Guadalupe cypress (*Cupressus guadalupensis*) is met with frequently and often forms a finer tree than the Monterey. Popularly speaking the two are quite similar, except that the Guadalupe cypress has a striking blue color to the foliage. The glaucous color varies somewhat, but is usually of fairly deep tint. This tree does not seem to be as short lived as the Monterey species, although many think that it will go the same way. Time will be the only test and for that we must wait.

The commonest cypress is, of course, the Monterey cypress (*Cupressus macrocarpa*) (Fig. 14). This has been planted freely and is still being largely used in spite of the fact that in the Redlands-Riverside district, its age is limited to forty or fifty years at best with a period of marked shabbiness commencing anywhere from the twentieth to the thirtieth year on. No one has as yet ascertained the cause of the injury or the remedy, although there are many conjectures. This decline in vigor is to be noted to a more slight degree throughout the other parts of the State, but is not so marked or so objectionable as in the south.

The Italian or Oriental cypress (*Cupressus sempervirens* var. *fastigiata*) is often found, and often in the most absurd places. Its tall columnar form gives a formal effect which can not be gainsaid. This very shape also makes it practically useless as a shade tree.

Figure 14.

The problem, then, is simplified to the question—is there a place for so formal a tree as the Indian cypress? No one will venture to say that such a place may not be found. Street planting at best is more or less formal through force of necessity. The placing of lights and poles for practical purposes must be mathematical, and the symmetrical planting of the trees is more satisfactory than an irregular or "landscaped" planting, if such a term may be used. This is true, unless, with extreme emphasis on the exception,—unless the paving of the streets and sidewalks, the construction of the lights and the type of architecture of the residences are all of such exalted type that specially designed planting is absolutely necessary. Then it is to be hoped that the planting will be intrusted to one who shall have the same intelligence and care as those who designed the residences. Landscape work on the street is a most trying form of work and calls for a sane mind and considerable native ingenuity.

Lawson's cypress (*Chamæcyparis Lawsoniana*) while not a true cypress is considered here for convenience in grouping common names. This tree is a tree which is found on the parkings and even under the best of circumstances does not belong there. It produces a very dense shade and considerable litter. It will survive on poor soil and with little water, but at best looks rather untidy. On the lawn where it can have the lower limbs preserved it makes a beautiful specimen.

THE CEDRELAS.

This is a group of trees which have not been tried out, to our knowledge, on street parkings. They are deciduous trees with compound foliage of a showy size and smooth high trunks. Dr. Franceschi speaks favorably of *Cedrela fissilis* in his report for the "Pomona Journal of Economic Botany."*

THE LOQUATS.

The loquats (*Eriobotrya japonica*) are rarely found on the parking and while of considerable artistic merit from the point of view of the individual, they are not of sufficient size or of such a nature as to warrant their use on even a narrow street. The litter is considerable all through the year.

They appear to succeed equally well from north to south along the coast and almost as well in the interior, in situations where freezing is not severe.

EUGENIA.

Of all Eugenias, *myrtifolia,* is certainly the most common. This is a tree with small evergreen leaves of good character, rather inconspicuous flowers and pinkish berries. The foliage, however, is its chief claim to beauty, the young shoots showing a red color which contrasts well with the older leaves. The style of growth is columnar and hence semi-formal. The tree stands pruning and trimming and can be used for most formal situations. The columnar habit suggests that it might be used on narrow streets where excessive shade is objectionable.

THE EUCALYPTS.

Trees of this family are found in every part of the State and are all more or less known. A large number of species are utilized in roadside work in many places. Some of these species are acceptable, but the general consensus of opinion is that for the city all but perhaps one or two species have no place at all upon the parkings and, in many minds, there is no doubt even for these few. The following are descriptions of some of the commonest ones and are given, not as recommendations, but as data gathered.

Eucalyptus amygdalina Labill (Plate 2, Fig. 2). This is a species of medium size attaining, in some cases, a good height with bark more or less deciduous, showing whitish in the younger stages. The branchlets are of somewhat drooping habit. The leaves are rather narrow, but are narrowest in the variety *angustifolia.* The flowers are borne crowded in small umbels in the axils of the leaves and are not particularly showy. *E. amygdalina* var. *angustifolia* is probably better than the type for general use. It certainly is more delicate and grace-

*December, 1911. Vol. I, No. 4.

ful. Unfortunately, the tree has a somewhat straggling habit unless cared for with considerable pains in the youngest stages. This tree has been used successfully in Pasadena. It is recommended for wide streets, and of these only for such as have *very wide* parkings.

Eucalyptus calophylla, R. Br. This tree came to notice in a particularly fine specimen at Redlands. It is a tree of fair size with broad leaves and terminal corymbs of showy white flowers which give the tree a striking appearance at time of blossoming. The tree noted was in full bloom in the early part of August, but this feature can not be depended upon. This species does well in southern California, while all of the specimens noted in the bay region were somewhat stunted.

E. citriodora Hook. This species is commonly known as "lemon-scented gum," and botanically is often grouped as a variety of *E. maculata*. It is a tree with smooth, grayish-white bark and medium-sized leaves which have a strong lemon-like odor. The flowers are white, borne in axillary umbels. They are not particularly showy, but are freely and markedly visited by the bees, which obtain considerable nectar from them. This is a species needing at least roadside planting.

E. cornuta Labill (Plate 2, No. 4). The Yate is a species forming a small to medium-sized head. The largest specimen noted is at Berkeley, on the University campus. It is a tree with a spreading top, rather broad leaves, and umbels of flowers peculiar for their beak-like caps and long greenish-yellow stamens. These features often attract popular notice. The var. *Lehmannii* has even more striking flowers in this regard, but at best it is but a large shrub. So far as was noted this tree did not occur in street work, and so no recommendation can be offered either for or against it.

E. corynocalyx F. v. Mueller (Plate 3, No. 3). The sugar gum is used rather freely in San Diego. It is found in most cases as a small tree with broad foliage and rather slender tops. In most places the practice of beheading has been carried on, so that in many cases there was but a compact head of new shoots. This is hardly advantageous to the beauty of the tree, but it has been necessary in order to keep the tree within bounds. The tree is fairly popular and certainly has distinctive and attractive foliage.

E. crebra, F. v. Mueller, is a form with small or medium-sized tree, rather good sized leaves and many small flowers produced freely in short panicles. This was not noted in the regular plantings and is not to be recommended.

E. erythronema Turcz. This is one of the most ornamental of the smaller eucalypts. At present it is not very commonly found, but is worthy of considerable notice. It is a small tree of not very rapid

growth, with medium-sized dark green leaves and axillary umbels of brilliant crimson flowers. They are not as large as the flowers of *E. ficifolia,* but are very freely produced and are quite as showy. The tree has a good, erect, pyramidal habit. It was called to our attention in San Diego, where an excellent specimen was shown. This tree, perhaps, has a place on the streets.

E. ficifolia, F. v. Mueller (Plate 3, No. 4). This is perhaps the commonest of the showy forms of eucalyptus. The tree is one of medium size, very similar in all general respects to *E. calophylla,* except in certain characteristics of seeds, seed vessels and seedlings. The flowers also are nearly always of a more brilliant color, ranging from orange scarlet through crimson. This character does not always hold on first inspection, as some of the forms of *E. calophylla* are deep red in color. It is a small tree at best and has been used successfully in the streets where the parking is of sufficient width to accommodate the roots without danger of injury to sidewalk or curb.

E. globulus Labill (Plate 3, No. 1). Blue gum is, of course, the commonest eucalypt grown in California, and is too well known to need description here. For it no place can be urged among the trees for the city. Its beauty is undeniable, but its extreme size makes it unsafe at times, causes breaking of curbs and sidewalks, necessitates extremely large parking spaces at any rate, often interferes with water pipes and in every way makes it inevitable that it should be given a place on a wide boulevard in the country, where its great beauty and size may be fully developed without interfering with the factors which go to make city streets desirable in every way.

E. goniocalyx, F. v. M. This is a medium-sized tree with large leaves of a shape somewhat similar to that of the blue gum leaves. The bark is rough on the trunk and somewhat deciduous on the upper limbs. The flowers are borne in axillary umbels and are not showy.

Since the leaves are rather pale in color and freely spotted it is known in some parts of Australia as the "Victorian spotted gum."

E. leucoxylon, F. v. M. This species is commonly found and is often called the white ironbark. It is a fairly tall tree, branching fairly well down the trunk, with light-colored bark which is deciduous. The flowers occur in axillary umbels and are quite uniformly three in number. They are white in color and not particularly striking.

This species is not one of marked individuality, but is a good tree and may find a place in some highway work.

It is quite closely related to *E. sideroxylon,* which it resembles in most ways, except in the bark and in several less conspicuous matters. The var. *rosea* of the latter has pretty rose-pink flowers.

Eucalyptus melliodora Cunn. This is another species attaining considerable size. It is popularly known as the "honey-scented gum." It branches freely, bearing narrow lanceolate leaves, somewhat falcate, of rather thick texture, about three or four inches long.

The flowers are small, borne in crowded axillary umbels, and are not showy.

E. piperita Sm. This form is commonly called the "peppermint stringy bark." It is a tall tree with rough persistent bark and large, thick, scented leaves, resembling in shape those of the blue gum. The flowers are rather small and many are borne in crowded axillary umbels. As might be easily seen, they are not showy.

E. polyanthema Schau (Plate 2, No. 3). This tree, commonly called the red box tree, varies from a small to a large sized tree. Its bark is rough and persistent. The foliage is rather characteristic, varying from orbicular to ovate, and is of a distinctive gray-green color. The flowers, though small, are produced in large terminal panicles, so that they are rather showy. This tree has been recommended for street work by some, but no plantations have been noted to date.

E. pulverulenta Sims. This species is nearly always a small tree. The foliage is quite characteristic, with sessile leaves, varying from cordate to ovate in shape and showing a marked glaucous or even nearly white appearance which is quite marked. The flowers are borne usually in three-flowered umbels. They are not very showy and the chief value of this species lies in the marked color of the foliage.

E. Risdoni Hook. This form, sometimes called "drooping gum," is a small or medium-sized tree with smooth bark and sessile, ovate leaves of a very characteristic form and grayish color. The flowers are small, white, and borne in axillary umbels. They are not particularly showy. The drooping habit of the branchlets and the characteristic foliage make the tree a striking ornamental one.

It has been recommended by some for street work, but so far as noted has not been tried out.

E. rostrata Schlect (Plate 3, No. 2). This form is quite near *E. tereticornis* and resembles it closely in many ways, but having as a rule somewhat narrower foliage. The characteristics often given for the caps do not hold in many cases. The tree attains considerable size, thrives best in fairly moist soil, tolerating flooding from time to time and even a large per cent of salt in the soil. It is as hardy as the blue gum.

E. rudis Endl. This species is a medium sized tree, branching freely. It has rough persistent bark and a marked drooping habit of the branches, which gives it a very picturesque appearance. The

Plate 5.

1. Eucalyptus viminalis; 2, E. amygdalina; 3, E. polyanthemos; 4, E. cornuta var. Lehmannii.

Plate 6.

1, Eucalyptus globulus; 2, E. rostrata; 3, E. corynocalyx; 4, E. ficifolia.

foliage is thick and strongly scented. The flowers are numerous, but quite inconspicuous since the stamens are not showy. The leaves show considerable variation, on one tree varying from ovate to falcate. This tree would perhaps be acceptable for a wide street with very wide parkings.

E. tereticornis Sm. This species is very similar to *E. rostrata,* described above. Like it, it prefers a moist subsoil and will stand excess of water at times.

E. viminalis Labill (Plate 2, No. 1). This tree, commonly called the "manna gum," is a large tree of great beauty. It branches freely and often has a good spreading form. The bark varies in texture, either showing a white deciduous color or a rough dark color. The leaves are rather narrow. The flowers are white, borne in axillary umbels, almost always three-flowered. This feature is one which superficially separates it from *E. Stuartiana,* F. v. M., the "apple-scented gum," which it much resembles.

The following species have been reported from California. They are taken from Dr. Hall's list for the new edition of Bailey's Cyclopedia of American Horticulture:

Eucalyptus acmenioides.
E. amygdalina.
E. amygdalina var. *augustifolia.*
E. amygdalina var. *radiata.*
E. amygdalina var. *regnans.*
E. buprestium.
E. calophylla.
E. citriodora (syn. *E. maculata* var. *citriodora*).
E. coccifera.
E. coriacea.
E. cornuta.
E. cornuta var. *Lehmannii.*
E. corymbosa.
E. corynocalyx.
E. cosmophylla.
E. crebra.
E. decipiens.
E. diversicolor.
E. doratoxylon.
E. drepanophylla.
E. eugenioides.
E. eximia.
E. ficifolia.
E. globulus.
E. goniocalyx.
E. gunii.
E. haemastoma.
E. hemiphloia.
E. macrorrhynca.
E. marginata.
E. megacarpa.
E. melliodora.
E. microcorys.
E. microtheca.
E. obliqua.
E. occidentalis.
E. paniculata.
E. pilularis.
E. piperita.
E. Planchoniana.
E. platypus.
E. polyanthema.
E. populifolia.
E. pulverulenta.

E. Ravertiana.
E. redunca.
E. resinifera.
E. Risdonii.
E. robusta.
E. rostrata.
E. rudis.
E. saligna.
E. salmonophloia.
E. siderophloia.
E. sideroxylon.
E. Sieberiana.
E. stellulata.
E. Stuartiana.
E. tereticornis.
E. tetraptera (shrub).
E. viminalis.

Most of these are trees of varying size. But the great majority of them occur as specimens owned by people or concerns particularly interested in eucalypts. Of course we are not in position to recommend one way or another, but it is well to keep posted with all the forms to be found in the State, since among the newer species we may find individuals which are more suited for our purposes than those which are now commonly employed.

THE FICUS.

Aside from the commercial figs, the commonest of these trees is probably the "Moreton Bay Fig" (*Ficus macrophylla*). This makes a magnificent tree, with its smooth gray trunk and large, shining, dark-green leaves. It is a broad-leaved evergreen, with leaves resembling the common "rubber plant" (*Ficus elastica*) of the nurserymen. The tree has fruits resembling a small fig, which never become soft as do the edible figs. These fruits and the leaves make a considerable litter at all times; this is especially true of the leaves. In nearly all the specimens noted, the appearance of roots near the surface of the ground was very considerable. To be definite, a twenty-foot parking would be the minimum parking, and is none too wide. It has been suggested by one who has practiced root pruning on other trees that root pruning may be the solution of this problem.

In planting it should be borne in mind that this tree is disfigured by heavy winds, and that as the tree attains great size and produces a very dense shade they should be planted at least eighty feet apart and used only on streets of suitable width.

Dr. Franceschi recommends *F. retusa, F. rubiginosa,* and *F. bellingeri.* The first one has been tried out, the two latter have not. Like the Moreton Bay fig, these are all large trees and suited only to *wide avenues.*

THE ARIZONA ASH.

This ash (*Fraxinus velutina* Torr.) is the one found frequently in the south and is deservedly popular when one considers what it will attain under adverse conditions.

The tree itself resembles the other ashes, with large compound leaves, inconspicuous blossoms, and large panicles of green samaras in the fall. In Los Angeles the foliage was a good dark green, but in San Bernardino, where the tree is largely planted, the foliage assumes a gray-green color. The shade, while rather light, is entirely sufficient. The tree is, of course, deciduous.

Other species of ash are to be noted, especially farther north, where the Oregon ash (*Fraxinus oregona* Nutt.) is often found. This forms a good tree which is worthy of attention for the sake of variety. (*Fraxinus ornus* is also found in rare cases. This does not become so large a tree and is not so desirable for our purposes.

THE GINKGO TREE.

This tree (*Ginkgo biloba*) (Fig. 15) has been the subject of considerable comment. It is a tree of unique appearance, having a very characteristic style of branching and a wealth of fine foliage. The

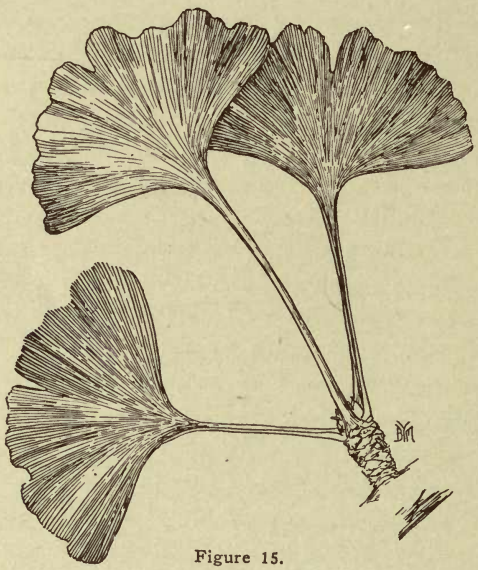


Figure 15.

foliage resembles a single one of the pinnæ of the maiden hair fern on a large scale, hence the name "Maiden Hair Tree" is sometimes used.

As the species is diœcious, pistillate flowers do not occur on every tree, which is fortunate, as the mature fruits have an unpleasant odor when crushed. Other than this there are no great objections to be offered. The species is deciduous.

Care should be taken to stake the plans well during the first years, as the wood is somewhat brittle in those stages, but not noticeably so afterwards.

So far, all the specimens noted in southern California are rather

young, and most of them were in parks or lawns. Those few on the streets seemed to be thriving, as did those in the parks. Further experience must be had before this tree can be recommended for general planting. At present in some places it certainly looks promising. Farther north there are many older specimens, and as the tree is quite hardy it may be that it will prove even more useful in the north than in the south.

THE SILK OAK OR GREVILLEA.

The silk oak (*Grevillea robusta*) is common throughout all the south, and everywhere is proving a common source of trouble. When young the trees have considerable beauty of form and foliage and the blossoming of the mature trees is most gorgeous. But unfortunately the leaves are continuous and abundant in dropping and the wood is so brittle that the tree should be cut back to stubs every year for safety's sake. This proceeding inevitably ruins the specimen. Furthermore, the roots have great capacity for entering the water-pipes, and once in, they form dense sponge-like masses of fibrous rootlets.

Altogether the *Grevillea,* while a handsome tree, demands too much care to keep it in respectable condition to earn a permanent place for itself on the streets. Many towns are removing it from the streets, and it is to be hoped that the citizens who raise a considerable commotion at "the wholesale destruction" will stop to think that the *Grevillea* has habits which make it useful only in private estates where it can have constant care and dense shrubbery to hide the continuous litter of the falling leaves.

This tree is reasonably hardy and may be found in good condition through the northern central part of the State. But it does not do as well there as in the south.

THE KENTUCKY COFFEE TREE.

This is a common eastern deciduous tree (*Gymnocladus dioica*) with large compound leaves and panicles of greenish-white flowers followed by bulky fruits, the seeds of which have rarely been used as a substitute for coffee.

THE WALNUTS.

The walnuts (*Juglans* sp.) of various species and horticultural kinds are all frequently found in the parkings. Often they are the remnant of some old orchard, but more frequently they are the deliberate choice of the owner, who desires to derive not only shade but profit from his trees. If we consider the sprawling form of young walnuts which have the frequent waterings of the parking, and the fact that they attain great size, and furthermore, that they or their insect visitors exude a gummy substance which makes the pavement very unsightly for at least two months of the year—if we consider these things, we can see

that the walnut is certainly not desirable for narrow streets, and if useful at all, is best suited to broad highways on the edge of town. Here it may develop to its greatest perfection and will not interfere in any way. Many of the native walnuts appear as magnificent specimens, which deserve great admiration. But an immense specimen may not always look well when it is put in the artificial conditions of the parking.

THE JACARANDA.

The Jacaranda (*Jacaranda mimosæfolia*) is an ornamental tree attaining perfection only in the coast cities of the south where the frost is not severe. It bears large and delicate pinnate leaves and good sized panicles of showy purple flowers in July and August. The growth of the plant is inclined to be somewhat straggling and an occasional corrective pruning may be necessary. Too heavy or too frequent pruning will have the same effect as heavy frosts, namely, of removing the new wood, which will produce the flowers for the following season.

Owing to its small size this tree is suitable only for narrow streets or for alternation with more rank-growing species which will provide sufficient shade. As it has a tendency to form many leaders quite early in life, nursery stock should be selected with care and watched that the frost or other agencies do not kill the leader before it has reached a sufficient height.

Figure 16.

THE IRONWOOD.

This tree (*Lyonothamnus floribundus* var. *asplenifolius*) (Fig. 16) is a native of southern California in limited areas along the southern coast islands. It is an evergreen species with large fernlike leaves of a

shining dark green color and showy clusters of flowers. The tree is not very spreading by nature but produces a good head of foliage. It is of fairly rapid growth, and of considerable interest, as it is a native.

The litter from the foliage is not excessive, but the real difficulty would lie in obtaining a sufficient stock, as it is both rare and expensive. Time and demand, however, will probably change this latter feature.

As to its use on the street, no results can be offered. Certainly it would prove hardy enough, but possibly other characteristics not now looked for would develop. It is, at any rate, a tree worthy of some consideration.

THE CRAPE MYRTLE.

This species (*Lagerstræmia indica*) is not in reality anything more than a small tree, and owing to its slow growth it must be considered chiefly as a large shrub. As it does excellently in the interior and makes a fine showing there it is often found in the parking spaces.

The bush has small refined evergreen foliage and bears large terminal panicles of showy flowers which vary in color from white to pink to dark pinkish crimson.

It has been successfully trained in tree form, but this is tedious work and hence expensive, so that it would probably be out of the question. As it is, the tree is certainly useful for wide parkings between other trees or for such streets where a dense shade is not desired. This shrub is hardy, and is useful not only in the south but as far north as one might think of using it in this State.

LAGUNARIA.

Lagunaria patersonii is an exotic tree bearing dark green leaves resembling somewhat those of the camellia both in texture, shape and color. The flowers, however, look more like the mallow blooms and unfortunately are of a rather dull purplish pink, with very prominent and ugly calyces, which are persistent to such a degree that they often disfigure the entire tree. This tree also appears to catch and hold much of the dust from the streets and roads, giving it a very untidy appearance. In style of growth it is rather too columnar for every use, and from its general characteristics it is rather more suitable for parks and plantings in private yards than for street purposes.

In the north it has an additional bad feature of shedding about one half of its leaves during the winter. It is neither strictly deciduous nor strictly evergreen.

THE LAUREL.

The laurel (*Laurus pseudocerasus*) is rarely found in the parkings, and wisely, as the foliage is of a very dark green color and gives a heavy shade. As far as appearance goes the tree has everything to recommend it for use in parks, but not in the street parkings.

One thing should be remembered, and that is, that this species is a good harbor for many scale insects. It is true that many of them are not those of first importance on the citrus fruits, but it is possible that a free planting of this species might change the proportion of occurrence or might make a new host for the most destructive forms.

The pepper tree is in many cases proving too expensive to warrant further planting, on account of its harboring the black scale, and with this example before us, it would hardly be wise to proceed to plant a possible subject for the repetition of such trouble.

THE INCENSE CEDAR.

This native tree (*Libocedrus decurrens*) (Fig. 17) is one frequently met with in isolated cases. In some instances the specimens are of exceptional beauty, with abundant semi-drooping evergreen foliage and branches, and with the aromatic odor of the cedars. When the tree has not sufficient mosture the tips of the branches are apt to drop out and give the tree a very ragged appearance.

The style of growth is columnar and the tree is not remarkably disfigured by the removal of the lower branches, as is the case with so many

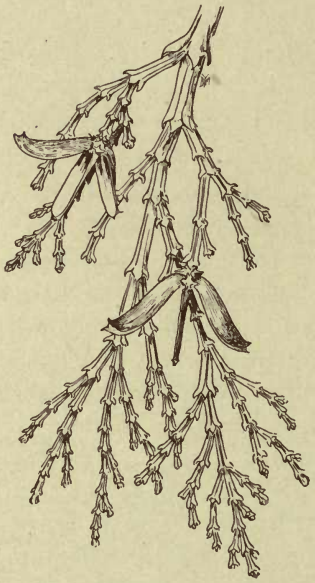


Figure 17.

conifers. In many ways the tree resembles the Lawson cypress, except that the pendant character of the tips of the branches is a distinctive characteristic.

The shade is very dense, and as the tree is not a very rapid grower it can not be recommended for every situation. This question had best

be decided upon the ground. As the tree is very hardy and withstands considerable drought when once established, it may be used through a large range of territory from the north to the south throughout the State.

THE JAPANESE PRIVET.

This privet (*Ligustrum lucidum*) (Fig. 18) is the one chiefly found. At best it is but a small tree. The foliage is evergreen; the leaves are large, oval, and of a dark green color, which is often disfigured as the leaves seem to hold the dust very badly. This fact, and the fact that the large panicles of greenish white flowers turn a dingy reddish-brown on fading, gives the plant a very untidy appearance at certain seasons of the year. The flowers have a sickly sweet fragrance, which is not strong but which proves very unpleasant to many people, and are followed later in the summer by dark blue berries which are not unsightly.

Figure 18.

If this tree is used, care should be taken in selecting nursery stock which has an unbranched leader for at least seven or eight feet, as the head is formed very low after branching begins. Constant care should be given to prevent the growth of suckers, as these develop with amazing rapidity and soon spoil the shape of the tree. On account of its shape this tree needs a wide parking and should not be planted where heavy shade is desired, as the tree is not of particularly rapid growth when kept to a single leader, although it eventually forms a tree of some size, which at maturity will give abundant shade.

THE SWEET GUM.

The sweet gum (*Liquidambar styraciflua*) (Fig. 19) is a native of the eastern states and is not often found in this State. So far as was noted there were no large specimens to be found. All of the young trees seemed vigorous and in good form, and it would be well to keep this species in mind for future work. The specimens particularly in mind were at Monrovia, others at San Jose, Oakland, Berkeley, Ukiah, and Chico.

The tree is deciduous, of very good habit, bearing five-lobed leaves of a somewhat star-like form, of a good green color which in the east takes

on splendid autumn tints. This point has not been noted for California. The fruits are contained in a peculiar warty, ball-shaped structure which hangs pendant after the fashion of the sycamore fruits. These fruits are abundant but are not of particular trouble from point of view of litter.

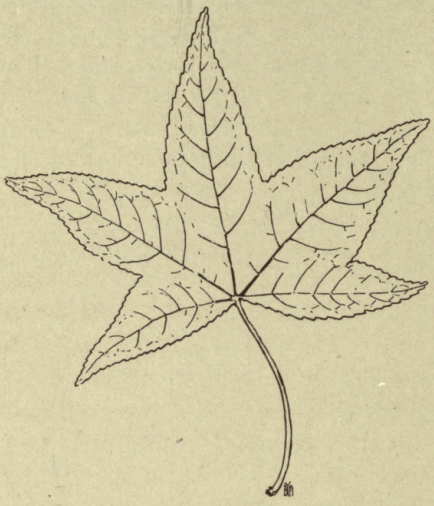


Figure 19.

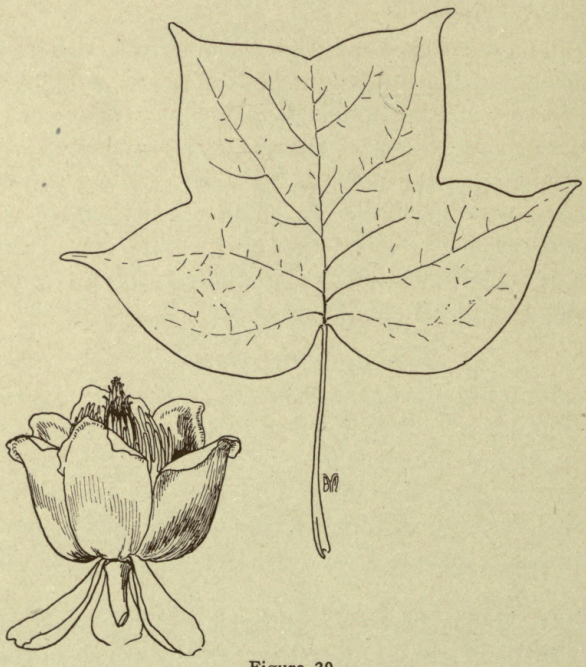


Figure 20.

THE TULIP POPLAR.

The tulip poplar or tulip tree (*Liriodendron tulipifera*) (Fig. 20) is not commonly found in the southern part of the State, although it does well from San Jose northward. It is a deciduous eastern tree with curiously shaped foliage which resembles no other foliage. The flowers are not very conspicuous though of considerable beauty. They are tulip-shaped, of a greenish yellow color with an orange flame in the center of each petal. The stamens and carpels are rather conspicuous, and at the time of the falling of the winged achenia attract some attention.

Those trees noted in San Jose had attained considerable size before fruiting and did not seem to flower so freely as those in the east.

This tree has not been tried for street use in southern California. We are not recommending it. It is to be hoped some one will risk his reputation among his fellows and try it to settle the matter finally. Belonging, as it does, to the Magnolia family, it is characterized by its fleshy roots and rootlets. These are indicative of its water-loving habits. In some parts of the east it is native, and grows well upon heavy clay soils of no great fertility, so that there may be some latitude on these points. If some situation can be found where there is soil of fair fertility and reasonable water supply, it might be worth a trial.

The tree, though not of rapid growth here, attains great size at maturity, hence it should not be used on narrow streets. The habit of growth is good, but care should be taken to keep the leader unbranched for ten or twelve feet. Branching below this point ruins the shape of the tree. It has been noted in some localities that the wood is brittle; whether or not this is true for California remains to be demonstrated. With this in mind it would hardly be well to plant the tree where it would be subject to heavy winds.

THE MAGNOLIA.

The magnolia most commonly found is *Magnolia grandiflora*. This tree is too well known to necessitate more than a mere mention of its large shining green leaves and handsome white flowers, which are highly fragrant.

This tree assumes a natural pyramidal shape, and at maturity attains such size that it is suitable only for wide streets, even though for many years, owing to its medium slow growth, it may appear to be inadequate. Planters considering this species should remember that the litter is considerable and continuous. Furthermore, the shade is of a very black, dense quality. As to situations, care must be taken to see that the tree has an abundance of water, as it is a water-loving species, and if stinted in water supply assumes a poor, light green color of foliage with a noticeable lessening of vigor and length of life.

Certainly for most city streets it would not be desirable, but for wide boulevards where the soil mosture is plentiful or artificial watering is easily available, it might be useful.

There are many other magnolias worthy of consideration, especially in the northern part of the State. Some of these are deciduous species of considerable individuality. In Japan there are many fine avenues of magnolias and we may gain some inspiration from their use in that country.

THE UMBRELLA TREE.

This tree (*Melia azedarach* and var. *umbraculiformis*) is one of the most common trees found. This is perhaps due to its very rapid growth and hence its quickness in giving adequate shade. Where it is well grown it forms very handsome specimens. But in ninety-nine cases out of a hundred it is not well grown, with the result that branching begins too low down; too many branches are formed, and large portions are broken out by any chance wind. This light nature of the wood makes it an easy prey to fungus troubles, so that after pruning or a splitting of the trunk, decay is often brought about even in cases where care is taken.

Of course under proper nursery treatment the heading can be brought to a reasonable height and the number of branches properly restrained. But even if these points were removed the excessive litter would give the tree a low place in the scale of species. The large compound leaves first drop their leaflets and then the rachis and petiole by degrees. Fruits also are very abundant, and as the flesh of the berry is very slippery underfoot, it is often unsafe. Some serious accidents have been attributed to the fruits. It has been noted in some parts of the south, Redlands particularly, that certain specimens of the var. *umbraculiformis* bears less fruit than the more spreading type. This variety is the more common form, as the other tree is less desirable even in popular estimation, though it does escape the notice of many, in the younger stages.

Although this tree has undue popularity for a deciduous species, it cannot be recommended for permanent plantings. And although isolated specimens may be found in many places where they appear to advantage, it is the consensus of opinion that as a street tree it is not to be considered in the future.

THE MULBERRIES.

The black mulberry (*Morus rubra*) and the white mulberry (*Morus alba*) are occasionally found in the parking spaces. But their style of growth, abundant fruit and irregularity of life make them unsuitable for plantings of any sort upon the street. Possibly they might be used in the country along the roads, but even then they would hardly warrant the expense of a permanent planting.

THE BANANA.

Various species of banana (*Musa*) are found through the south, but rarely on the parking. Owing to the fragility of the leaves they should not be used except in places free from winds. Even then it would be questionable if any reasonable decorative value would excuse their use. At any rate, shade would be secondary in importance.

THE OLEANDER.

The oleander (*Nerium oleander*) in all of its many horticultural varieties is often found upon the parking. Strange to say, in no case noted had there been any effort to keep the stem to a single leader. With what result? Everywhere, except where it was planted in the shrubbery, there was a large straggling bush often covering the sidewalk and at such a height that it would strike all passersby.

Here, again, is a case where careful nursery practice is of prime importance should this tree be used at all, and it is quite possible to conceive of its use on narrow streets, with wide parkings where shade is a secondary matter. It would be well in such plantings to choose only one or two varieties, as too great a contrast of colors gives a messy appearance.

This has been used with considerable success as a shrub, to alternate with the Canary Island date palm. Since both of these species need wide parkings, the oleander can be allowed to grow in its bushy form without disturbing pedestrians.

THE OLIVE.

The olive (*Olea europea*) as it is now found in the parkings is in most cases a remnant of some old orchard. It is planted by choice, however, in some instances. This practice is one which can hardly be recommended.

If the tree be considered as a unit it has many desirable features. The style of growth is distinctive, especially the gnarled buttress; and the color of the foliage also adds a pleasing note of contrast.

The shape is one which makes it practically impossible to head it up to such a point that it will give any shade. This same style of growth necessitates a large parking space. But more important than either of these objections is the fact that the tree is a favorite host plant of the black and other scales. This fact would make it undesirable in all citrus growing districts, as the expense of spraying or fumigating shade trees is an expense which can not be termed as strictly necessary.

THE PARKINSONIA.

This tree (*Parkinsonia aculeata*) is in reality a small tree or large shrub, and so far as noted did not occur on the parkings. The leaves are very delicately compounded with very small leaflets. The

style of growth is very irregular; flowers yellow, showy. It is of some interest because it is a native, but is more desirable as a shrub than as a tree.

THE PINES.

The pines are often found on the streets, but the popular practice now is to use them only for roadside plantings. Here they are often useful.

Pinus canariensis, the blue pine, is a tree attaining a considerable size, is of rapid growth and stands some drought. It is characterized by long drooping needles of a glaucous color. Stump sprouts.

The tree has slender branches and forms, at maturity, a broad round-topped head, though in its youth it has the pyramidal form characteristic of conifers.

Pinus halepensis, the Jerusalem or Aleppo pine, is a form with short needles of a somewhat grayish color, of slender habit, with an open head, the younger branches often assuming a peculiar twisted appearance. So far as could be discovered, there were no very old specimens to show mature form.

This is a species of no striking beauty, but lays claim to usefulness from its great indifference to drought and considerable amounts of alkali. For this reason it has a usefulness which will discount whatever it may lack in æsthetic value, although it is not a poor looking specimen.

Pinus pinea, is a tree with shining green needles, which are quite long, and slender branchlets. At maturity it forms a broad flat-topped crown with horizontal branches characteristic of many pines. This form has considerable pictorial value, as the even umbrella-like shape is quite distinctive. It is commonly called the "stone pine." It is not hardy in regions where there are heavy frosts, but excellent specimens are to be seen in Capitol Park in Sacramento.

Pinus radiata, the Monterey pine, is gradually being discarded in most parts of the south, on account of the fact that it is subject to an obscure disease, presumably fungoid in its nature, which attacks the tree when it has attained considerable size with disastrous results. So far no remedy has been noted.

Other than this the tree has much to recommend it. It is of rapid growth, attractive color (though some people consider it rather dark), and fairly long duration.

Pinus strobus, the white pine of the east, is found occasionally in private yards. While a handsome tree with considerable individuality, it is not a tree which can be recommended, since there is no data concerning it on hand.

THE PITTOSPORUMS.

The Pittosporums are shrubby plants which in time attain the proportions of trees. This latter state can be hurried by care in the nursery. They are not excessively rapid growers, and since they do not give a heavy shade, although they are evergreen, they are useful for some narrow streets. They are of somewhat stiff habit, so that they give rather formal effects, and are not spreading, so that shade is not particularly conspicuous.

Pittosporum crassifolium (Fig. 21) is found as a small sized tree in many parts of the State. The leaves are medium sized, of a dark green color and covered with fine silvery hairs on the lower surface. The flowers, which appear in the early spring, often excite considerable

Figure 21.

Figure 22.

comment on account of their dark reddish brown color. They are followed in the late summer by inconspicuous fruits which burst open showing the seeds. This species is rather slow growing and requires considerable time to abtain the dimensions of a tree. It should therefore be sparingly used for street work.

Pittosporum eugenoides (Fig. 22) is perhaps the one most commonly found. It is very often used for hedges, but with proper care and sufficient length of time to mature it forms a good small tree with very bright colored foliage for an evergreen. The green is a distinct yellow green and forms a strong contrast to other trees. The leaves are oval to oblong in shape, often with undulate margins; the flowers come in clusters and are not conspicuous, being of a yellowish green color; these are followed by small green berries. The tree forms a rounded crown of considerable beauty.

Pittosporum rhombifolium is a species not common in California, but is worthy of consideration. At best it is a medium-sized tree with fair-sized smooth green leaves. Flowers are inconspicuous and are followed by yellow berry-like capsules. This tree is more tree-like and erect in habit than some of the other species.

Pittosporum tenuifolium. This species is somewhat like *P. eugenoides,* but is characterized by smaller leaves and very shining black stems. It is of rather slow growth and needs special training to induce a good tree-like form. It is in some ways more delicate and graceful in appearance than *P. eugenoides.*

Figure 23.

Pittosporum undulatum (Fig. 23). This form is usually found as a plant in high hedges or windbreaks. It has rather larger leaves than any of the preceding and they are of a thick texture and darker color. The flowers are in terminal clusters, whitish, and are followed by showy dull yellow berries. Where it has developed into a tree it forms an excellent broad spreading crown, but not a great height of trunk.

THE SYCAMORES OR PLANE TREES. (Figs. 24, 25, 26.)

Of the three species of plane trees the oriental plane is considerably the best form. This has proven the most desirable deciduous species in many parts of the city of Los Angeles.

The foliage is large, of a good green, and drops fairly late in the season. The fruits are often persistent through the winter and break up before falling, so that the litter is not especially noticeable. The bark of the upper branches scales off, leaving a shining white trunk which is characteristic of the genus.

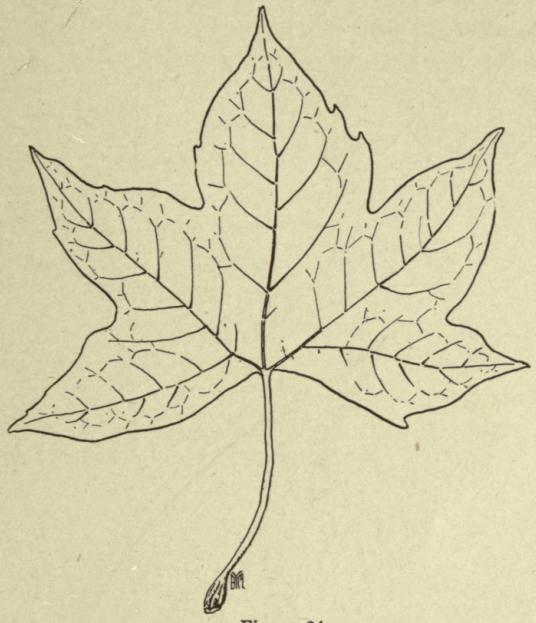


Figure 24.

The botanical differences between the oriental plane (*Platanus orientalis*) and the native varieties *Platanus occidentalis* of the east and *P. racemosa* of California) are not striking from the popular point of view, but it has been found that the native forms are freely attacked by a fungous disease which disfigures the trees all summer and often prevents foliation, producing death to many limbs.

Aside from this, the oriental form assumes a more symmetrical habit of growth. The trees at maturity are broad spreading trees of semi-pyramidal shape, while the native form is often very irregular. Both species need considerable water, as they inhabit bottom lands and creek borders in their native haunts. In spite of this they do very well in the city with ordinary care, and in some cities, notably Paris, have become one of the dominant trees of the city.

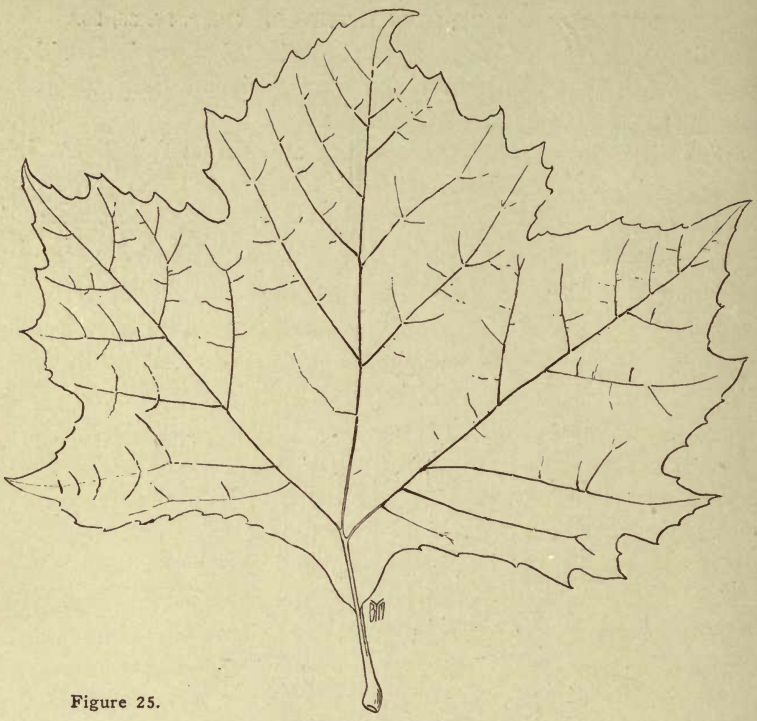


Figure 25.

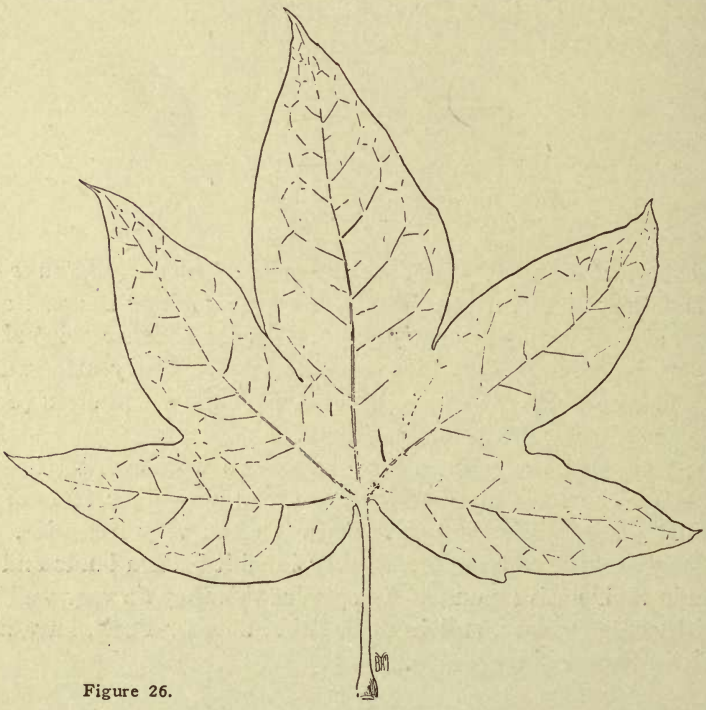


Figure 26.

THE POPLARS.

The poplars for street trees are at best makeshifts. They are rapid growing trees, reaching maturity quickly and showing rapid signs of decline. They sucker freely and obnoxiously, and fill all the neighboring top soil with fine roots which quickly impoverish the soil.

The silver poplar (*Populus alba*) is a tree of considerable beauty, with whitish bark and tremulous leaves with conspicuous white lower surfaces to the shining dark green leaves. Like the other poplars it is short-lived, has brittle wood, and suckers badly.

Cottonwood (*Populus deltoides*) resembles the Lombardy poplar in many ways, but has more slender twigs and a more spreading habit of growth.

Fremont's poplar (*Populus Fremontii*) is a native species, somewhat like the silver poplar in color, but differing from it in that it becomes a much larger tree. It is especially desirable in the interior valleys, since it thrives there under adverse conditions.

The Lombardy poplar (*P. nigra* var. *italica*) is too well known to need a detailed description. Its peculiar pyramidal style of growth has undeniable charm when well used in roadside and other plantings, but the tree has so many bad family characteristics that it is questionable if its use is advantageous on the streets. It seems probable that it would do better in private plantings where it could receive the constant attention which is necessary for its well-being.

Figure 27.

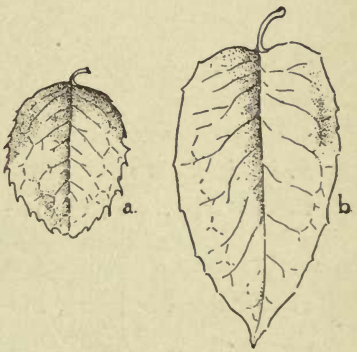


Figure 28.

THE FLOWERING PLUM AND THE CATALINA CHERRIES.

The Catalina cherries (*Prunus ilicifolia* and *Prunus integrifolia*) (Fig. 27) are quite different as to the style of growth and the shape of

the leaf. Otherwise they are quite similar; so similar that there is doubt in many minds that they are distinct species.

They are native plants with shining evergreen leaves, producing a foliage often used for decorative purposes. The blossoms are inconspicuous, of a greenish white color, and are followed by small fruits of a dull purplish red color. Some seasons these are very abundant and other seasons seem scarce. In times of great abundance they are somewhat of a nuisance underfoot. The Catalina cherry (*Prunus integrifolia*) is the more vigorous form, with large leaves and somewhat more rapid growth. (Note Fig. 28.)

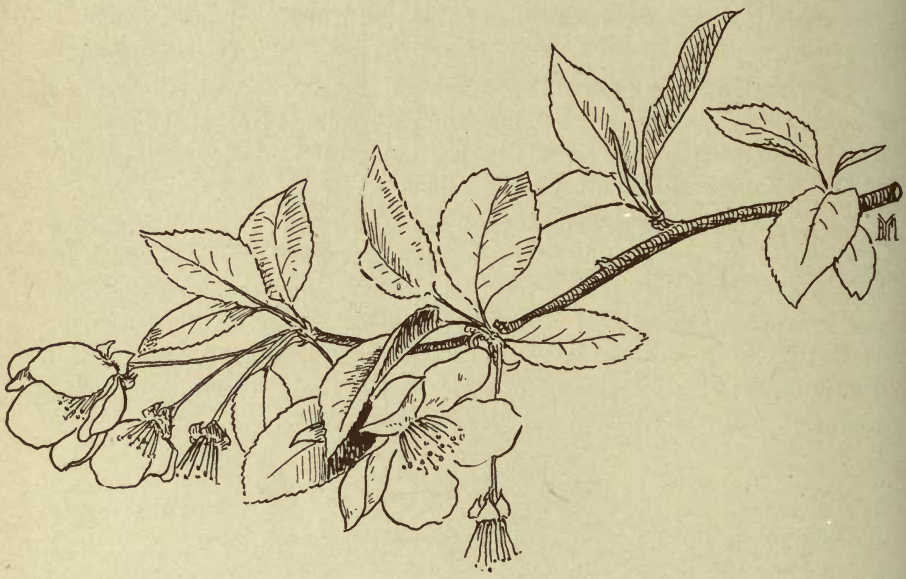


Figure 29.

Mature specimens have a good form, somewhat pyramidal, and attain a moderate size. The shade is of such a density that the trees should not be planted too closely together.

P. illicifolia is often called "California holly."

Prunus Pissardii (Fig. 29) is sometimes found on the parkings. This is a small tree of considerable beauty at flowering time with its myriads of pinkish white flowers, reddish twigs and budding reddish leaves. Unfortunately, however, the mature foliage retains its purple color and hence is not suited for so conspicuous a planting. The tree is not of great longevity and hence cannot be considered permanent, and if the leaves were of a green color it might find considerable use on narrow streets where a maximum of sunlight was desired.

THE OAKS.

The use of the oaks for street planting is one of the indications that popular attention is turning to the matter of street planting. A few years ago most people would have been impatient at the thought of using oaks for shade trees. Now it has been demonstrated that some oaks make as rapid growth as many species of trees commonly used. Of course there is variation among the different species of oak; and, similarly, it must be admitted that they are not suitable for plantings where quick results are wanted, but in spite of this, their permanence and charm of individuality recommend them to the planter who is seeking an expression which shall be most perfect in its way. The characteristic live oak which is found throughout the State would not, at first thought, seem a suitable species for street use.

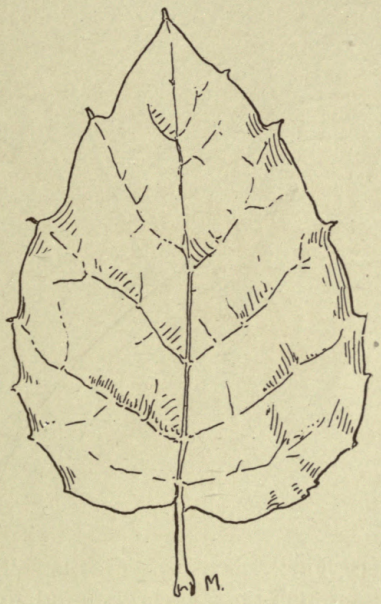


Figure 30.

This oak (*Quercus agrifolia*) (Fig. 30) has been used, however, rather extensively in Hollywood and Garvanza and the young trees give great promise. One thing appears in their development, and that is great irregularity in rate of growth and in many cases a tendency to bad form. The gnarled top-heavy branches which are so admirable in private yards are hardly suitable for street use. This question of irregularity is one which must be dealt with in a most thoughtful way. To confine the trees to a rigid form would remove all individuality and yet the individuality must be kept within bounds.

A very wide parking is the first thing to be obtained and constant

attention to the shaping is the next item. The irregularity in the rate of growth can be regulated to a reasonable degree by attention to the watering with extra waterings for backward trees, and even a mulch of street sweepings or rich manure in extreme cases. For those trees which show a leader inclined to grow in an oblique or horizontal position, the old practice of tying the limb to an upright pole is the best method. Any suckers or shoots from the butt should be cut off promptly, for if encouraged or let alone the tree will show a tendency to assume a scrubby bush-like form, so that considerable effort will be required to bring it back to good shape.

Figure 31.

Quercus californica (Fig. 31), often called "Kellogg's oak," is another native species which is commonly found through certain parts of the northwest. It is a deciduous species of marked beauty. At present the nursery supply of this species would be very limited in most regions. Now that native species are receiving the attention which they deserve this matter will have to be remedied.

The valley oak (*Quercus lobata*) (Fig. 32) is another native species worthy of a place. In many places it is badly infested by certain gall-producing insects and by growths of various mosses, which render the tree unsightly. In those parts of the State where it is one of the dominant features of the landscape its use is to be recommended.

The tanbark oak (*Quercus densiflora*) (Fig. 33), which is not a true oak though closely related, is a tree which is a dominating species in

certain regions. As it is of considerable beauty it, too, might find a welcome place in certain parts of the State.

A few young specimens of the pin oak (*Quercus palustris*) (Fig. 34), common in the eastern states, were noted in Los Angeles. They were

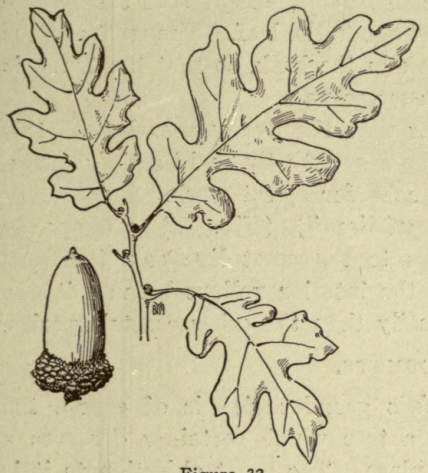


Figure 32.

Figure 33.

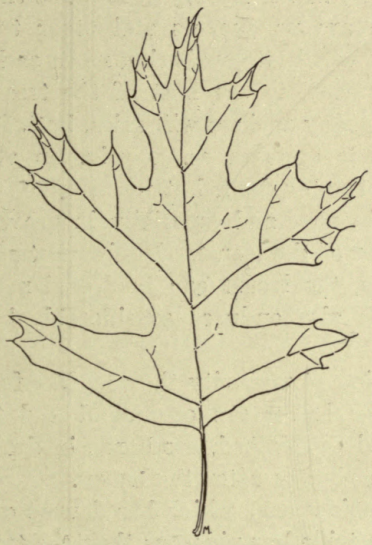


Figure 34.

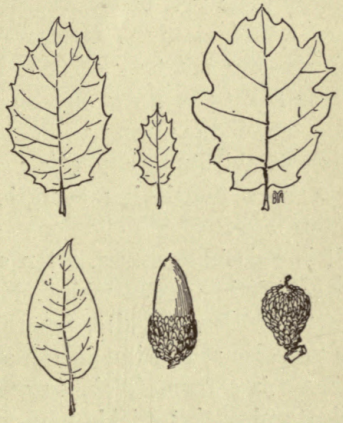


Figure 35.

very young trees but were in very good form, except that the leaders needed straightening. Perhaps this is a tree which would warrant further experimentation, and, if satisfactory, would lead to the trial of other deciduous oaks from the eastern states.

A very good specimen of the English oak (*Quercus pedunculata*) was noted in Santa Barbara. Perhaps there are others of this species through the south. Investigation of its occurrence might lead to its use.

The cork oak (*Quercus suber*) is a fine tree resembling from a popular view point the live oak as to foliage, except that the foliage is more contracted, giving a convex shape to the leaf. The most curious point, however, is the growth of cork in the bark, so that the trunk is covered with large fold-like corky excrescences.

This tree needs rather more water than the live oak, and when this demand can be satisfied, it will make a growth that will satisfy many, even those prejudiced against the oaks for street work.

The interior live oak (*Quercus wislizenii*) (Fig. 35) corresponds very closely in most characteristics to the coast live oak (*Quercus agrifolia*). It is better for use in the interior valleys because it can stand the extremes of heat more easily than the other coastal species.

THE LOCUSTS.

The common black locust (*Robinia pseudacacia*) is of course the species most in evidence. This is a tree which certainly deserves a place, but it should be kept in its place. The great objection to it is its habit of suckering. This propensity seems to vary greatly, as there are often noted blocks where there are no suckers and other trees under apparently the same condition which are suckering more or less freely. Often where mutilation has come to the butt of the tree or to large roots just below the surface, many suckers will arise, but often there would seem no excuse for their appearance. Again, on very dry gravelly soil they seem to be more abundant, but not always.

This ability to grow and do well in poor and especially in gravelly soil is one of the strong points in favor of the locust. In circumstances which would stunt any other species, the locust can be found many times in a flourishing condition. It also endures considerable heat and drought.

It is a deciduous tree, often assuming at maturity the vase-like form characteristic of the white elm. The leaves are compound and the flowers which are white, fragrant and pea-shaped, are borne in drooping panicles appearing in the spring, shortly after the leaves.

There is a form (*Robinia pseudacacia rosea*) which has flowers of a delicate pink tint. This is perhaps a trifle less vigorous than the type. It can be found planted on the parkings in many places in San Jose.

A species, *Robinia Bessoniana,* has been very highly recommended and has been noted in a few instances. Here the style of growth is quite different, being dwarf-like and giving a low rounded head.

THE WILLOWS.

Of all the willows, the old weeping willow (*Salix Babylonica*) is perhaps the most frequent in use. Owing to the brittle nature of the wood it is hardly suitable. Again, trees of weeping habit, like those of colored or variegated foliage, are rather the exception in the vegetable kingdom and their use on streets would be a violation of general principles.

THE PEPPER TREE.

The pepper tree (*Schinus molle*) is perhaps the most common exotic tree found in southern California. Everywhere one turns there is the omnipresent bright green foliage of the pepper. Nevertheless the pepper is beginning to fall into disrepute. For one thing it is a particularly acceptable host to the black scale. To be sure, if the trees are cut back past all the green wood and the trimmings burned, all the scale insects are destroyed for a time, but this means endless work. Fumigation is practically impossible, and spraying is not sufficiently effective to warrant even its consideration.

Again, at Riverside and other towns where the pepper is freely planted they are finding that the tree needs constant trimming. The young branches are pendant, often for five feet or more. This of course makes the tree a nuisance to pedestrians. Furthermore, if the tree is cut back to stub, although it reclothes itself very promptly, there is usually precipitated a hubbub of indiscriminate popular criticism, and it is quite true that the trees are temporarily ruined in appearance.

Any one considering the use of the pepper should remember that—

1. The pendant habit of young growth means continued pruning.
2. The black scale infests it.
3. It needs very wide parkings on account of the irregularity of the trunk and the breaking of pavements.
4. It requires extra care when young, with staking and pruning, to encourage a good form.

None of these matters are insurmountable difficulties, but they are matters entailing considerable labor and expense and should not be overlooked.

THE BIG TREES.

The sequoia (*Sequoia gigantea*) is commonly found through the south, but rarely on the parking. It would need, of course, a wide parking, and a great length of time to mature. While most of the specimens were of reasonable size and looked fairly happy, probably none would appear so well under street conditions.

The redwood (*Sequoia sempervirens*) (Fig. 36) is found quite freely on the parkings, though in no cases were trees on the parkings of any great age or size. The habit of redwood while young is at best rather straggling, and even at maturity it is often far from symmetrical. Furthermore, it is a tree which one considers as a tree to be planted in masses or groups rather than in formal lines. The planting of adjacent property could of course make this matter less noticeable. The redwood does better nearer the coast than the other specie of sequoia.

Figure 36.

The redwood alternated with the magnolia has been planted along one of the highways in Los Angeles County and considerable interest is felt in the outcome.

THE STERCULIAS.

The *Sterculias* are found in considerable number throughout the State. They are trees suggesting somewhat in style and color of foliage the camphor. The trees grow quite differently, however, the shape assumed by the *Sterculia* being usually quite inferior to that of the camphor. The trunk is quite smooth but swells largely at the butt, giving a peculiar pyramidal shape. The branches grow away from the leader at large angles and after attaining considerable size the heavy pendant seed-pods at the tips pull them over to very bad positions. These pods are of considerable size and drop throughout the year, the flowers appearing through the spring and summer, and in *Sterculia diversifolia* are not particularly striking or conspicuous.

Figure 37.

S. diversifolia (Fig. 37) has lanceolate ovoid foliage with leaves which may show one, three or five lobes or mixture on one tree.

S. ovalifolia has somewhat smaller foliage and it is not lobed.

THE TAMARICK.

The tamarick (*Tamarix* sp.) is rarely more than a large shrub, and the stems are of such awkward shapes and tendencies that it is difficult to train them to a single leader. The foliage is a light green mass, the leaves being inconspicuous and the branches showing a similar green

color. In the spring or fall, according to the species, the plant is covered with small but multitudinous flowers which are faintly fragrant. This genus has no place in the ordinary city work save in shrubbery masses, but is very useful near the seashore where other shrubbery does not thrive, as these species do well in the sandy soils and near the ocean. It has also been noted in thriving condition in situations where it had to withstand considerable drought.

THE BALD CYPRESSES.

These trees are trees of particular beauty and always attract considerable attention wherever they are used. They are coniferous trees and are striking in that they are deciduous and not evergreen as would be expected. The leaves resemble somewhat those of the redwood, but are of a shining light green color which is very distinctive and attractive. They have not been used extensively in this State, but those specimens which were noted are excellent ones. The common bald cypress is a native of the swampy region of southeastern United States. As would be suspected from this, these are water-loving species, but they do not need the excess of moisture afforded in swamp conditions, and thrive excellently where there is any reasonable water supply.

The Montezuma cypress (*Taxodium mucronatum*) was noted in many places, especially in Santa Barbara. Here the trees were not of great size and had been planted in the park, where the lower branches lay on the ground. In spite of the fact that these trees have never been noted on the parking spaces, they are of such distinctive color and form and of such striking individuality that they seem to tempt a trial on the street. This is not a recommendation, but a plea that some one will be a pioneer and settle the matter.

The common bald cypress (*Taxodium distichum*) was not noted, but is quite similar to the above, except that the foliage is a trifle larger than that of the preceding. There are splendid specimens of this tree at Berkeley.

THUYA sp.

Various species of arbor-vitæ are to be found throughout the State. Some of these are native, but most of them are introduced species. They are trees resembling in general characteristics the incense cedar and Lawson cypress. They are most desirable for street work, but are entirely useful in park work, as the group offers a considerable variety of color and texture, which is a desirable feature among evergreen foliage plants.

THE LINDENS.

The lindens (*Tilia* sp.) are commonly found on the parkings, but rarely in systematic plantings. They form shapely trees with a semi-globular head. The leaves, however, are very coarse, and in those species whose leaves are covered with many fine hairs often turn a very

dingy, rusty color during the autumn months. The blossoms, which are not very showy, are quite fragrant and are freely visited by bees. These flowers are followed by small berries, which are often conspicuous because of the peculiar blade-like structure from which they grow, which aids in their distribution by the wind.

Both American and European forms have been noted. (*Tilia americana; Tilia europea.*)

Figure 38.

THE BRISBANE BOX.

This tree (*Tristania conferta*) (Fig. 38) is a handsome evergreen tree, with broad shining leaves somewhat resembling the broader forms of eucalyptus leaves. The tree bears clusters of rather showy white flowers.

The tree has a good oval, pyramidal form and is a sightly tree. Its chief objectionable feature is the fact that the leaves drop in larger or smaller intervals throughout the year.

THE ELM.

The elm, and chiefly the American elm (*Ulmus americana*) is not often found in the southern part of the State because there are so many better trees. It grows well both in the coast and in the interior towns, and in the interior is especially valuable because it withstands the extreme summer heat better than most deciduous species.

In nearly every case where the elm has an opportunity to sucker

it will do so and when these suckers gain any headway it is almost impossible to eradicate them. Occasionally, if conditions are just right, a very abundant crop of seedlings will appear, but this is not often, and, as is the case with most seedlings, mortality is very high and the rest can easily be destroyed. This feature of suckering is enough to blacklist the elm in many places, and is most noticeable in the case of the cork elm (*U. racemosa*) and its varieties.

THE CALIFORNIA LAUREL.

This is a native tree (*Umbellularia californica*) which occasionally has been left on the parkings. Under advantageous conditions it makes a very handsome tree. Since it usually grows along streams and washes in the canyons, the trees often become top-heavy, produce too many leaders and a very light root system, with the result that heavy winds or rains often blow them down. Isolated trees have come to our notice, which, on the other hand, have been kept to a single leader and have been planted where they had to make a firm root system. Here they have attained striking size and symmetry.

Of course, it can be urged that the shade cast is very dark; that the wood is at best rather brittle; and that the fruits are large and unpleasant underfoot. All of these are valid objections, but if the trees are set far enough apart and in a position not subject to violent winds, the first two can be, in a large measure, overcome. The latter has no remedy. It is, perhaps, needless to note that the laurel makes its best growth where there is considerable soil moisture, but not enough to cause the formation of a superficial root system.

This is a tree open for trial. It has not, as yet, been proven, and we can only urge that plantings be made at some suitable place where the public is willing to contribute to our general fund of knowledge by a demonstration.

The following lists are at best generalizations and as such are to be used with extreme caution. A statement of fact in one locality may be entirely without weight in another community. In using the appended tables, the planter must compare the data given with actual results as shown by trees in his neighborhood. It is impossible to give lists which will hold for all parts of this State. We have here considerable sectional variation in soil, temperature and moisture conditions, as well as variations within the section. This latter may be noted especially in soil and moisture conditions even in the length of a single street in some districts.

Do not, therefore, accept the lists as final. Use them as a starting point and modify as your conditions must demand. A few points may be useful as guides in original work.

1. If your summer temperature is high and humidity low, do not use many deciduous species of eastern origin. Do not use conifers,

with few exceptions, as the dust conditions are particularly trying to them.

2. If the water supply is slight (*i. e.* the natural supply after trees are established), do not select species needing abundant soil moisture.

3. If there is alkali, use trees which will tolerate such amounts as may be present.

4. Select trees which will harmonize with native vegetation. Do not plant species characteristic of arid regions in the semi-humid parts of the State and do not plant trees characteristic of humid regions in the arid portions of the State. While all street work must be artificial to a slight degree, there is a certain fitness of things which is essential.

Trees causing considerable litter all the year.

Albizzia lopantha.
Eucalyptus species.
Eriobotrya japonica.
Ficus macrophylla.
Grevillea robusta.
Lagunaria patersonii.
Magnolia grandiflora.
Melia azadarach.
Morus alba.
Morus rubra.
Sterculia diversifolia.

Trees causing litter from fruit.

Albizzia lopantha.
Castanea sp.
Eriobotrya japonica.
Eucalyptus.
Ficus species.
Ginkgo biloba.
Grevillea robusta.
Melia azadarach.
Morus species.
Olea europea.
Pistacia terebinthus.
Prunus ilicifolia.
Prunus integrifolia.
Robinia pseudacacia.
Schinus molle.
Tilia europea.
Ulmus species.
Umbellularia californica.

Conifers useful only on widest roads where wide parking space is available.

Araucaria species.
Cedrus atlantica.
Cedrus deodara.
Cupressus arizonica.
Cupressus guadelupensis.
Cupressus macrocarpa.
Pinus species.

Trees especially short-lived in good form.

Acacia Baileyana.
Acacia pycnantha.
Acacia lopantha.
Acer saccharinum and its varieties.
Albizzia lopantha.
Betula alba and its varieties.
Cupressus macrocarpa.
Pinus radiata.
Platanus occidentalis.

Trees needing abundant soil moisture.

Acer species.
Betula alba.
Ginkgo biloba.
Liquidambar styraciflua.
Liriodendron tulipifera.
Magnolia grandiflora.
Quercus suber.
Sequoia sempervirens.
Taxodium species.
Umbellularia californica.

Trees which will endure drought.

Acacia species.
Casaurina species.
Cupressus arizonica.
Eucalyptus sp.
Fraxinus velutinus.
Koelreuteria paniculata.
Libocedrus decurrens.
Pinus halepensis.
Quercus agrifolia.
Quercus lobata.
Quercus wislizenii.
Robinia species.
Triacanthos glandulosa.

Small Trees.

Acacia retinodes.
Betula alba.
Cæsalpinia species.
Cassia tomentosa.
Eriobotrya japonica.
Eucalyptus erythronema.
Eucalyptus polyanthemos.
Eucalyptus pulverulenta.
Eucalyptus Risdonii.
Jacaranda mimosæfolia.
Lagerstrœmia indica.
Liguustrum lucidum.
Nerium oleander.
Pittosporum species.
Tamarix species.

Native trees of interest.

Acer macrophyllum.
Acer negundo var. californica.
Lyonothamnus floribundus and var. asplenifolius.
Prunus integrifolia.
Quercus agrifolia.
Quercus californica (Kelloggii).
Quercus lobata.
Quercus wislizenii.

The following species of palms and related plants were noted. Those marked with a star are the most desirable of their class:

Chamœrops excelsa—Of rather shabby appearance.
Chamœrops humilis—Similar to preceding, but more slender.
**Cocos plumosa*—Very good in frost-free places.
Dracœna draco—Too bulky for parkings.
Dracœna ind visa—Poor.
**D. australis*—Shabby in age.
**Phœnix canariensis*—Good for very wide parkings.
**P. Dactylifera*—Suckers badly.
P. reclinata—Suckers badly.
P. roebellini—For pots or lawns only. Small.
Seaforthia elegans.
Erythea edulis—Rapid fan palm.
Washingtonia filifera—Fan palms; wide parking.
**Washingtonia robusta*—Fan palm; less parking than above.

The following table gives in brief many of the essential points for most of our common trees. In making a choice, however, this table should not be the final test. It would be beneficial to refer to the descriptions in Chapter III, and local conditions should also be consulted.

Essential Points in

Species		Average height, feet	Growth	Age, years	Soil requirements
Common name	Scientific name				
Kangaroo thorn	Acacia armata	25	Rapid	Medium	Tolerant
Bailey's acacia	Acacia baileyana	30	Rapid	Short	Tolerant
Silver wattle	Acacia decurrens dealbata.	65	Rapid	Long	Tolerant; do not over water.
Black wattle	Acacia decurrens mollis.	65	Rapid	Long	Tolerant
Long-leaved acacia	Acacia longifolia	25	Rapid	Short	Tolerant
Blackwood	Acacia melanoxylon	65	Rapid	Long	Tolerant
——— ———	Acacia retinodes	20	Medium	Medium	Tolerant
Tree of Heaven	Ailanthus glandulosa	50	Rapid	Medium	Not exacting
Albizzia	Albizzia lopantha	40	Rapid	Short	Not exacting
Madrone	Arbutus menziesii	45	Medium	Medium	Not exacting
Bidwells' araucaria	Araucaria bidwellii	50	Slow	Medium	Rather tolerant
Norfolk Island pine	Araucaria excelsa	75	Slow	Long	Rather tolerant
Monkey puzzle	Araucaria imbricata	50	Slow	Medium	Rather tolerant
Big-leaf maple	Acer macrophyllum	65	Rapid	Long	Tolerant
Box-elder	Acer negundo	50	Rapid	Medium	Tolerant
Norway maple	Acer platanoides	75	Rapid	Long	Rather tolerant
Red maple	Acer rubrum	50	Rapid	Medium	Fairly tolerant
Silver maple	Acer saccharinum	90	Very rapid	Medium	Tolerant
Hard maple	Acer saccharum	90	Slow	Medium	Intolerant
Butterfly tree	Bauhinia forficata	20	Medium		Intolerant
White birch and varieties.	Betula alba and varieties.	45	Medium	Short	Fairly tolerant
Cæsalpinia	Cæsalpina sp.	20	Slow	Short	
Beefwood	Casaurina stricta	35–45	Medium	Medium	Tolerant
Cassia	Cassia tomentosa	20	Medium	Short	Tolerant
Chestnut	Castanea dentata	100	Slow	Long	Fairly tolerant
Indian bean	Catalpa speciosa	50	Medium	Medium	Fairly tolerant
Cedrela	Cedrela fissilis	60	Medium		Fairly tolerant
Mount Atlas cedar	Cedrus atlantica	75	Medium	Long	Fairly tolerant
Deodar cedar	Cedrus deodara	75	Medium	Long	Tolerant
Carob tree	Ceratonia siliqua	50	Medium	Medium	Tolerant
Lawson's cypress	Chamæcyparis lawsoniana.	65	Medium	Long	Fairly tolerant
Arizona cypress	Cupressus arizonica	50	Medium	Medium	Tolerant
Guadelupe cypress	Cupressus guadelupensis.	50	Medium	Medium	Tolerant
Monterey cypress	Cupressus macrocarpa.	75	Medium	Short	Fairly tolerant
Italian cypress	Cupressus sempervirens.	60	Medium	Short	Fairly tolerant

Propagation of Common Trees.

Deciduous or evergreen (conifers)*	Value for street planting	Suitable for what width of street, feet	Valuable features.	Disagreeable features.
Evergreen	Useless		Resistant to great heat and drought.	Very thorny; grows as a straggling shrub.
Evergreen	Poor	Narrow	Beautiful foliage, flowers and fruit.	Very brittle wood and very short lived.
Evergreen	Good	Medium	Good foliage and flowers.	Needs wide parking; stump sprouts badly if trees are cut down.
Evergreen	Good	Medium	Good foliage and flowers.	Similar to preceding.
Evergreen	Poor		Showy flowers	Very brittle wood and bad habit of growth.
Evergreen	Good	Medium	Survives with minimum care.	Blows over easily where root run is shallow.
Evergreen	Fair	Narrow	Showy flowers; light shade.	Needs special nursery care to give good leader.
Deciduous	Fair	Medium	Good in downtown districts.	Wood rather brittle; root suckers.
Evergreen	Poor; except for seashore planting.		Good in sandy soils	Very dirty; becomes shabby and straggling.
Evergreen	Fair	Wide roads	A native of great beauty.	Gives a cold black shade; very disagreeable in winter.
*Evergreen	Poor	Roads	Trees of individual beauty.	Does not stand roadside conditions well.
*Evergreen	Poor	Roads	Trees of individual beauty.	Does not stand roadside conditions well.
*Evergreen	Poor	Roads	Trees of individual beauty.	Does not stand roadside conditions well.
Deciduous	Excellent	Medium	Fine native species	Needs wide parking; good in south.
Deciduous	Fair	Medium	Good foliage	Wood brittle; many insect enemies.
Deciduous	Excellent in north; poor in south.	Medium	Fine species	Like most maples it does not thrive in arid climate.
Deciduous	Fair	Medium	Fair species; not much planted.	Not a species worthy of first choice.
Deciduous	Fair	Medium	Excellent for a short time.	Wood brittle; needs constant care.
Deciduous	Poor	Medium	Fine foliage	Very intolerant of city conditions.
Evergreen	Useless		Showy flowers	Poor habit of growth; tender.
Deciduous	Fair	Narrow	Graceful form; white bark.	Rather short lived; insect pests.
Evergreen	Poor		Showy flowers	A tall shrub; not a tree.
Evergreen	Good for special places.	Narrow	Stands dust, heat and drought; some alkali.	Rather dull appearance at some seasons of the year.
Evergreen	Poor		Showy flowers in winter	A tall shrub; dirty.
Deciduous	Fair	Wide	Makes a fine tree	Subject to very deadly fungous disease.
Deciduous	Fair	Medium	Showy flowers	Not a first choice species.
Deciduous	Fair	Medium	Light shade	Has not been thoroughly tested.
*Evergreen	Good for roads	Wide roads	Stands some drought	Needs wide parking space.
*Evergreen	Good for roads	Wide roads	Stands some drought	Needs wide parking space.
Evergreen	Fair	Wide roads	Good foliage	Liable to split.
*Evergreen	Good for roads in north.	Wide roads	A native in northern counties.	Conifer, with broad base.
*Evergreen	Good for roads	Wide roads	Stands considerable dust, heat and drought.	Wide parking.
*Evergreen	Good for roads	Wide roads	Odd blue-green foliage	Wide parking.
*Evergreen	Poor		Native	Short lived.
*Evergreen	Poor		Very formal	Useful in private plantings.

Essential Points in Propagation

Species		Average height, feet	Growth	Age, years	Soil requirements
Common name	Scientific name				
Loquat	Eriobotrya japonica	30	Medium	Short	Fairly tolerant
Peppermint gum	Eucalyptus amygdalina.	80	Medium	Medium	Fairly tolerant
——— ———	Eucalyptus calophylla.	50	Medium	Medium	Tolerant
Lemon-scented gum	Eucalyptus citriodora.	100	Medium	Medium	Tolerant
Yate tree	Eucalytus cornuta	50	Medium	Medium	Tolerant
Sugar gum	Eucalyptus corynocalyx.	120	Medium	Long	Tolerant
——— ———	Eucalyptus ficifolia	45	Medium	Medium	Tolerant
Blue gum	Eucalyptus globulus	200	Rapid	Long	Tolerant
Red gum	Eucalyptus rostrata	200	Rapid	Long	Tolerant
Manna gum	Eucalyptus viminalis.	200	Rapid	Long	Tolerant
Moreton bay fig	Ficus macrophylla	60	Rapid	Long	Fairly tolerant
Oregon ash	Fraxinus oregona	50	Medium	Medium	Fairly tolerant
Arizona ash	Fraxinus velutina	75	Medium	Medium	Tolerant
Ginkgo	Ginkgo biloba	60	Medium	Medium	Fairly tolerant
Silk oak	Grevillea robusta	45	Medium	Short	Fairly tolerant
Jacaranda	Jacaranda mimosæfolia.	25	Medium	Short	Fairly tolerant
Walnuts	Juglans species	75	Slow	Long	Fairly tolerant
Varnish tree	Koelrueteria paniculata.	50	Medium	Medium	Tolerant
Crape myrtle	Lagerstrœmia indica	15	Slow	Medium	Fairly tolerant
Lagunaria	Lagunaria patersonii	30	Slow	Medium	Fairly tolerant
Laurel	Laurus pseudocerasus.	25	Medium	Medium	Tolerant
Incense cedar	Libocedrus decurrens	75	Medium	Long	Tolerant
Japanese privet	Ligustrum lucidum	40	Medium	Short	Tolerant
Sweet gum	Liquidambar styraciflua.	75	Slow	Long	Fairly tolerant
Tulip tree	Liriodendron tulipifera.	90	Slow	Long	Fairly tolerant
Ironwood	Lyonothamnus floribundus var. asplenifolius.	60	Slow	Medium	Tolerant
Bull bay magnolia	Magnolia grandiflora.	65	Slow	Medium	Fairly tolerant
Blue pine	Pinus canariensis	80	Medium	Medium	Fairly tolerant
Jerusalem pine	Pinus halepensis	50	Medium	Medium	Tolerant
Stone pine	Pinus pinea	75	Medium	Medium	Medium
Monterey pine	Pinus radiata	60	Rapid	Short	Fairly tolerant
Tarata	Pittosporum eugenioides.	40	Rapid	Medium	Fairly tolerant
Tawhiwhi	Pittosporum tenuifolium.	40	Rapid	Medium	Fairly tolerant
——— ———	Pittosporum undulatum.	40	Rapid	Medium	Fairly tolerant
Sycamore	Platanus occidentalis.	75	Medium	Medium	Tolerant
Oriental plane	Platanus orientalis	75	Medium	Medium	Tolerant
Western sycamore	Platanus racemosa	50	Medium	Medium	Tolerant
Silver poplar	Populus alba	35	Rapid	Short	Tolerant
Carolina poplar	Populus deltoides	50	Rapid	Short	Tolerant
Lombardy poplar	Populus nigra var. italica.	75	Rapid	Medium	Tolerant
Catalina cherry	Prunus ilicifolia	40	Medium	Medium	Tolerant
Flowering plum	Prunus pissardii	30	Medium	Medium	Fairly tolerant

of Common Trees—Continued.

Deciduous or evergreen (conifers)*	Value for street planting	Suitable for what width of street, feet	Valuable features.	Disagreeable features.
Evergreen	Poor		Very picturesque	Very dirty.
Evergreen	Fair	Wide roads	Stands some heat, and drought; var. Angustifolia is best.	
Evergreen	Fair	Medium	Showy flowers	All eucalypts produce heavy shade; are slightly subject to damage in wind storms; may give trouble if water pipes are not the best, and shed leaves which are rather slow to decompose.
Evergreen	Roads	Medium	Good for bees	
Evergreen	Fair	Medium		
Evergreen	Fair	Medium	Showy young growth	
Evergreen	Good	Narrow	Showy scarlet flowers	
Evergreen	Poor	Roads only	Valuable wood	
Evergreen	Fair	Roads only		
Evergreen	Good	Roads only		
Evergreen	Fair	Wide street	Heavy shade	Surface roots; litter.
Deciduous	Fair	Medium	Good foliage	
Deciduous	Good	Medium	Stands some heat, dust and drought.	Light shade.
*Deciduous	Good	Medium	Needs soil moisture	Rather stiff.
Evergreen	Poor	Narrow	Showy flowers	Very brittle wood; constant litter.
Evergreen	Poor	Narrow	Showy flowers	Tender; poor habit.
Deciduous	Fair	Wide roads	Nuts	Dirty in city.
Deciduous	Good	Medium	Stands some heat, dust, drought and alkali.	
Deciduous	Fair	Narrow	Shrub with showy flowers.	Slow growth.
Evergreen	Poor		Flowers	Very dirty; constant litter.
Evergreen	Poor			Litter; host for scale insects.
*Evergreen	Fair	Wide	Tolerant of rather varied conditions.	Dense shade.
Evergreen	Fair	Medium		Litter.
Deciduous	Medium	Wide	Fine foliage and habit of growth.	Slow growth.
Deciduous	Medium	Wide	Fine foliage and flowers.	Needs considerable soil moisture.
Evergreen	Medium	Medium	Desirable native	Somewhat rare; worthy of trial; some litter.
Evergreen	Fair	Medium	Fine flowers and foliage	Needs much water; constant litter.
*Evergreen	Roads	Medium	Good foliage	Litter.
*Evergreen	Good	Medium	Stands considerable drought and alkali.	Not especially beautiful among pines.
*Evergreen	Fair	Medium	Beautiful habit of growth.	
*Evergreen	Poor			Short lived.
Evergreen	Fair	Narrow	Good foliage	Needs special training.
Evergreen	Fair	Narrow	Good foliage	Needs special training.
Evergreen	Good	Medium	Good foliage	Needs special training.
Deciduous	Fair	Medium — wide.	Native	Fungous disease.
Deciduous	Excellent	Medium — wide.	One of the best	
Deciduous	Poor			Fungous disease.
Deciduous	Poor		Good foliage	Suckers badly.
Deciduous	Fair	Medium	Good foliage	Suckers badly; short lived.
Deciduous	Fair	Narrow — medium.	Picturesque form	Suckers badly; short lived.
Evergreen	Fair	Medium	Native; good foliage	Dirty fruits.
Deciduous	Fair	Narrow	Good flowers	Purple leaves.

Essential Points in Propagation

Species		Average height, feet	Growth	Age, years	Soil requirements
Common name	Scientific name				
Coast live oak	Quercus agrifolia	70	Slow	Long	Fairly tolerant
Kellogg's oak	Quercus californica (Q. kelloggii).	60	Medium	Long	Fairly tolerant
Valley oak	Quercus lobata	75	Slow	Long	Fairly tolerant
Pin oak	Quercus palustris	75	Medium	Long	Fairly tolerant
Cork oak	Quercus suber	60	Medium	Long	Fairly tolerant
Interior live oak	Quercus wislizenii	60	Medium	Long	Fairly tolerant
Locust	Robinia pseudacacia and var. rosea.	75	Rapid	Medium	Fairly tolerant
Pepper tree	Schinus molle	60	Rapid	Medium	Fairly tolerant
Big tree	Sequoia gigantea	150	Slow	Long	Rather intolerant
Redwood	Sequoia sempervirens.	200	Medium	Long	Rather intolerant
Flame tree	Sterculia diversifolia	60	Medium	Medium	Fairly tolerant
Bald cypress	Taxodium distichium.	60	Medium	Long	Fairly tolerant
Montezuma cypress	Taxodium mucronatum.	50	Medium	Medium	Fairly tolerant
American linden basswood.	Tilia americana	50	Medium	Medium	Fairly tolerant
European linden	Tilia europea	50	Medium	Medium	Fairly tolerant
Brisbane box	Tristania conferta	65	Medium	Long	Fairly tolerant
American elm	Ulmus americana	75	Medium	Long	Fairly tolerant
Cork elm	Ulmus racemosa	75	Medium	Long	Fairly tolerant
California laurel	Umbellularia californica.	50	Medium	Medium	Fairly tolerant

of Common Trees—Continued.

Deciduous or evergreen (conifers)*	Value for street planting	Suitable for what width of street, feet	Valuable features.	Disagreeable features.
Evergreen	Medium	Wide	Native	Often shows untidy appearance.
Deciduous	Good	Wide	Native	Supply limited in nurseries.
Deciduous	Medium	Wide	Native	Gall insects; moss.
Deciduous	Good	Wide	Eastern sepcies	Not thoroughly tested here.
Evergreen	Medium	Wide		Needs more water than some.
Evergreen	Fair	Medium	Very variable	Similar to coast live oak.
Deciduous	Medium	Medium	Showy flowers; will thrive in poor, gravelly soil.	Suckers.
Evergreen	Wide	Medium	Very green	Needs frequent trimmings.
*(Conifer)	Fair	Wide	Interesting native	Good for roads only on account of size.
*(Conifer)	Fair	Wide	Interesting native	Good for roads only on account of size.
Evergreen	Fair	Medium	Good foliage	Poor form of growth.
Deciduous	Fair	Medium	Beautiful trees	Needs much soil moisture.
Deciduous	Fair	Medium	More delicate than the bald cypress.	Needs much soil moisture.
Deciduous	Good	Medium	Flowers good for bees	Leavy; often "rusty."
Deciduous	Good	Medium	Flowers good for bees	Leavy; often "rusty."
Evergreen	Good	Medium	Handsome tree	Litter.
Deciduous	Good	Wide	Stand considerable summer heat.	Many insect pests.
Deciduous	Poor			Suckers very badly.
Evergreen	Fair	Wide	Handsome native	Liable to form shallow root system unless there is sufficient deep soil moisture; wind breaks.

CHAPTER IV.

THE LOCAL PROBLEM.

Before any reasonable planting can be done there must be a careful study of the street or streets to be planted. There should be a complete record, including statistics, as to the nature of the soil, the width of the street, parkings and sidewalks, the nature of the buildings—whether residential or business—the direction of the streets, and prevailing local sentiment.

California cities are particularly fortunate in regard to the matter of *soil*. In most cases it does not need to be especially considered. These soils do show great variation, and a knowledge of the variation is essential. A knowledge of the depth of soil is also of advantage. For example, in Santa Barbara streets which run from the hills to the water front, as State street does, show great differences in soil depth, the soil on the higher levels being much more shallow than that on the lower level. Again, in San Diego, all that part of town built on the mesa, which in most ways is the best residence district, has a great handicap in having hardpan very close to the surface of the soil. Here is a very large problem for San Diego to work out. The inevitable practice will be blasting. This necessitates that planting will be done before the street work is done, which is the wisest practice in any case. Of course this will entail extra labor and forethought, as the true level of the street must be ascertained in each case before planting. A sufficiently large area must be opened up for each tree so that it will not be a tiny pocket of good soil in a large mass of rocks. And good soil must be put in place. All of this means expense—and great expense.

The best way of meeting this expense is another problem. If the co-operation of the property holders is to be attained it is evident that an expense of forty or fifty dollars can not be demanded offhand for each hundred feet or so of frontage. Some way must be found to give time for payment, or some other way. San Diego has done much good municipal work in her forestry work and there is no doubt she will find a way out of this matter.

One other solution, which may lessen expenses slightly, was offered for San Diego by one who knows the conditions there. It was based on the fact that the climate of San Diego is of such mildness that it is not greatly dependent upon shade for its comfort. The idea was this: "Why not substitute a pergola treatment, with vines, to occur at intervals, instead of the trees. Not a large formal affair but a small pergola

adapted to the lines of an arbor, of real architectural merit and well planted." This is a tentative idea calling for much more thought before acceptance or rejectance.

The general requirements of trees are that the soil should be of reasonably fine texture, so that the water does not drain away too readily or stand too long so that baking is the result afterwards. Where the soil does not answer these requirements it is highly profitable to make some effort to improve it. In those towns where there is an adequate street-cleaning department, the sweepings, provided they do not contain too much rubbish, are often useful in adding humus to the soil. Where all the earth must be supplied, the best possible should, of course, be obtained.

The old saying that the spread of the roots is proportionate with the spread of the tops, often leads one to wonder how street trees can survive. For them the soil should be at least three feet deep and should be in good condition for as large a radial distance from the trunk as possible. With these conditions the trees can usually adapt themselves to their other limitations.

One point which is sometimes overlooked, is that soil which was below the original grade and is now surface soil may or may not be fit soil for planting. In very deep soils it does not make much difference, but usually the first three feet of soil are of better quality than the subsoil. A fill, on the other hand, often gives good soil for planting, depending, of course, upon the original source of the dirt. One danger might possibly arise, and that is, that the fill might be of more porous soil than the original grade, with the result that the water might stagnate along the old grade level. All these points must be cared for.

On most streets we find provision for planting made in strips of parking of varying widths along the outer edges of the pavement. These are broken only for driveways and entrance paths. The matter of width is one worthy of considerable attention. As we find them to-day they vary from eighteen inches up. Obviously it is absurd to plant a tree in an eighteen-inch parking, but it is done, and people wonder why the pavements are lifted. For the best success of the trees the parking space should be four feet at the very lowest, and a strong preference for ten-foot parkings. For some species, particularly palms, peppers, oaks, etc., fifteen feet is none too large.

The roadways vary largely in width and in many cases are too wide. The width must be determined, of course, by the amount and nature of the traffic along the street. Hence, residential streets need not be so wide as business streets. Extra width in residential districts means money wasted in paving, a greater surface to develop dust and a minimizing of parking space, thus bringing the dust closer to the homes

and to the pedestrian on the sidewalk. In talking with a street superintendent of a certain town which has very good streets, most of which are eighty feet in width, the opinion was expressed that thirty-five feet was sufficient space for the road, and that the rest should go into parking and pavement spaces. This would produce a spacing as in Fig. 39. Other arrangements might be made by varying the width of the parking, the width of the pavement, or width of the strip between pavement and property line, or by varying any two, or all three.

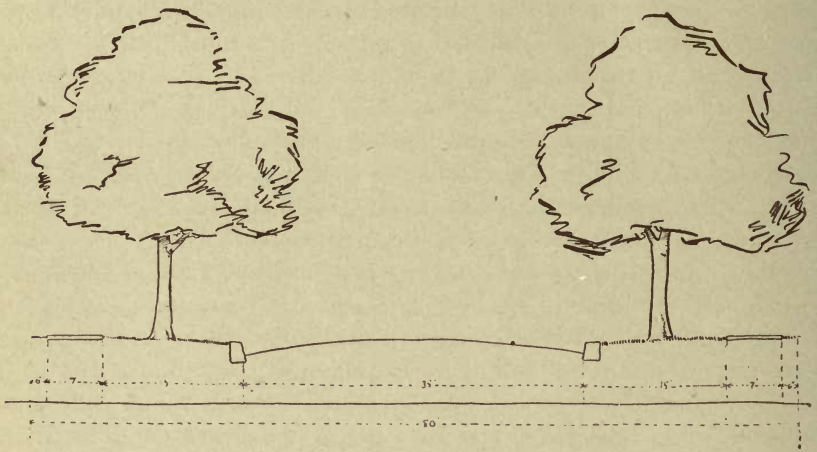


Fig. 39.

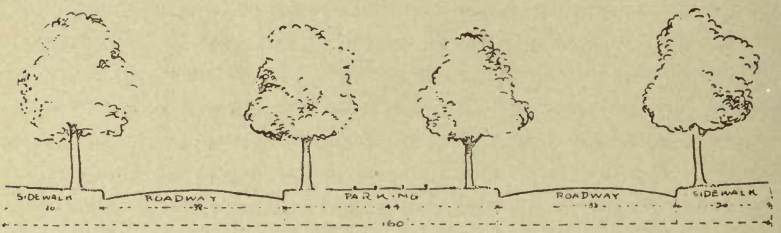


Fig. 40.

The question of a central parking space has two distinct phases. The first is the case of the residential street which is very wide, at least one hundred feet. Then a wide parking space can well be spared from the center of the roadway, and if judiciously planted will add much to the beauty of the street. In most cases this central space is used for shrubbery planting and for nothing else. Of course, in the case of still wider streets with a central car line, a planting of trees might well be used. This has been done in Washington, along Pennsylvania avenue, the diagram of which see in Fig. 40. The other phase of the central parking is the case of the narrow street flanked by tall buildings, where there are no side parkings, and a tree has best chance for life in the central space, where it can get a maximum of sun and air. Of

course this practice does not give wonderfully beautiful effects, but it has considerable merit over no planting at all, and if properly carried out might have considerable formal dignity.

The spacing in the parking depends largely upon the species. The distance between curb and sidewalk should be about half and half, with the tree nearer the sidewalk than the curb, if there is any difference. As to the spacing between specimens, one might generalize and say at least twenty feet more than the spread of the top at maturity, and for trees producing very dense or black shade twenty-five or thirty feet more. For palms, or trees whose maximum spread is soon attained, with little chance of an increase, the distance added need not be so great, but a planting of palms too closely set takes from their dignity and formality, rendering them rather less elegant. This spacing must be done with consideration of the best needs of the street, and not with regard to the property frontages, although most owners will doubtless object if there is not a tree in front of their place.

In most cases the plan will call for uniform spacing, but the problem of poles, lamp-posts, water hydrants, house water and gas connections will interfere, and then a respacing of all the trees should result and not merely the moving of the one specimen which can not go in place. Mr. Solataroff* gives the ruling that "trees should be kept away at least eight feet from lamp-posts and about ten feet from water hydrants." Another phase of the question of spacing, which may come up in the treatment of narrow streets, is the question of opposite or alternate planting. For extremely narrow streets the latter is advisable, but in other cases the former gives rather more attractive results.

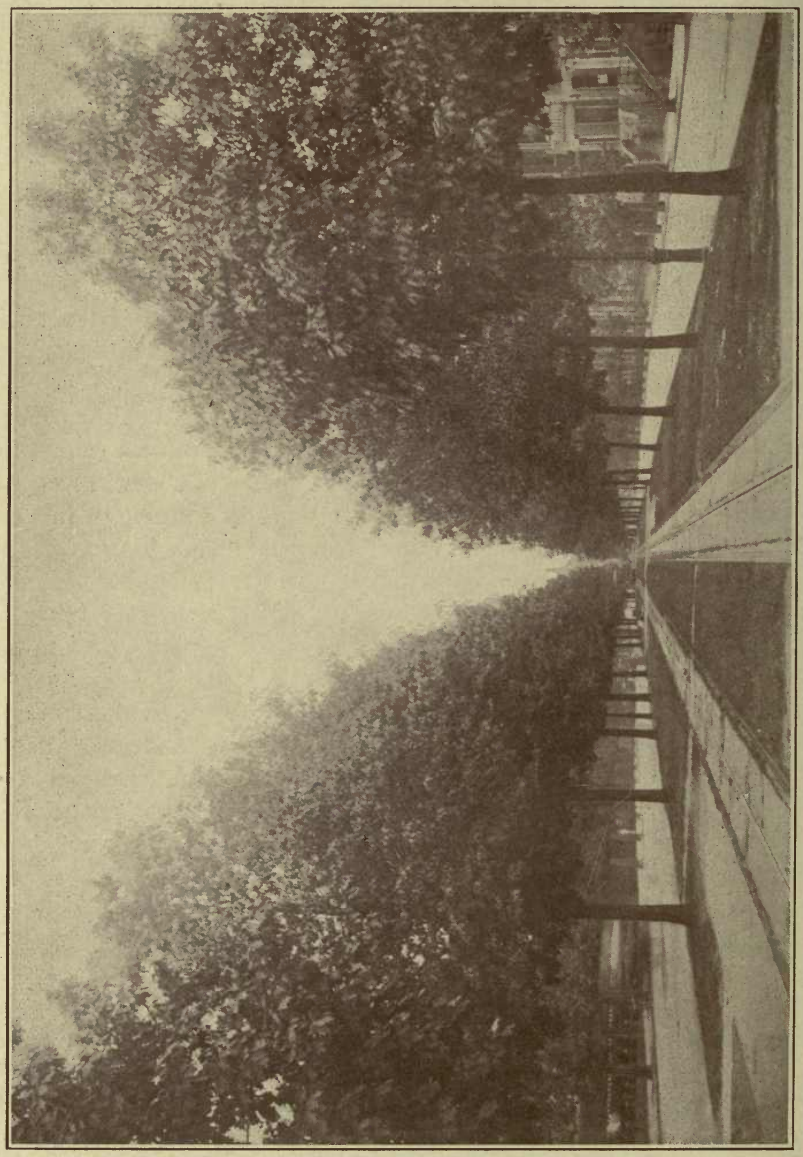
In Los Angeles it was noted that a few streets had been planted with trees between the inner edge of the sidewalk and the property line, leaving no other parking. This gives an excellent opportunity for the development of the tree, but is rather poor, since it gives a maximum of shade to the house with a minimum to the roadway and to the pedestrian. The effect is also somewhat unfinished. The use of a double row is never advisable, since a hedge-like growth soon results, which cuts off all light and air.

The question of one or more than one species to the street has many adherents on both sides, but the followers of indiscriminate planting have yet to produce a street in California which is really ideal. By indiscriminate planting is meant a mixture of species and not a combination of species in a definite plan to produce a certain landscape effect. The custom of alternating two species is very common, but from those examples noted it seems hardly as desirable as a planting of one species.

These are questions which must be determined on the ground and for which there is no help but a fine sense of the fitness of things.

*"Shade Trees for Towns and Cities," page 76.

Plate 7.



A model planting. Washington, D. C.

Plate 8.

The Deodar cedar. This picture shows the beauty of specimens with branches to the ground.

Double planting is often useful where the trees are of very slender habit.

CHAPTER V.

THE PLANTING OF STREET TREES.

At first thought it might seem that street trees would need no more careful planting than any other tree, but if we consider how much more artificial are the conditions under which it must live, we can see why special care should be paid to this feature. Here of course is the stumbling block for many ambitious enterprises. And that is, the expense of adequate preparation.

From actual practice it has been found that for best success a hole at least three feet in length for each of the three dimensions should be excavated. If the nature of the soil does not demand an addition of fertilizer, the top soil is put at the bottom and the lower soil brought to the top. In most cases it will pay best in the end to add some fertilizer. In some cities the street sweepings are saved and used for this purpose. These are quite excellent for lightening the consistency of the soil, but vary considerably in their value from the food standpoint. Again, if the soil is of a very clayey nature, the addition of lime is a valuable point to remember. Fig. 41 represents the method of work in a very good soil naturally approaching the ideal. Fig. 42 represents the method employed by a local stock company of citizens, which cares for their plantings, in Garvanza. This method is to be recommended over the preceding in any case. In cases of specially clayey soil this company adopts the following method of using lime to free the soil particles. Fig. 43.

It has been found that by the time the roots of the tree reach the lower levels (*a-a*), that the lime has spent itself and broken up the colloidal clay so that the soil is easily penetrated by the roots.

At all plantings arrangement is made for watering, Fig. 44. Usually the top six inches of soil is kept loose, so that it can be drawn back to form a rim and the hollow flooded. After the water has disappeared this loose material is thrown back as a mulch. For planting on hillsides the tree is placed as in Fig. 45. If, in addition to the dry soil mulch, stable litter or even dry grass can be added, it will be of advantage.

After planting, the tree should be staked, and for obvious reasons the stake should be on the side nearest the source of the prevailing winds. Usually one strong stake, eight to ten feet high, will suffice, and this can usually be removed after the sixth or seventh year.

These holes should be prepared before the trees are obtained, so that the soil may have time to settle.

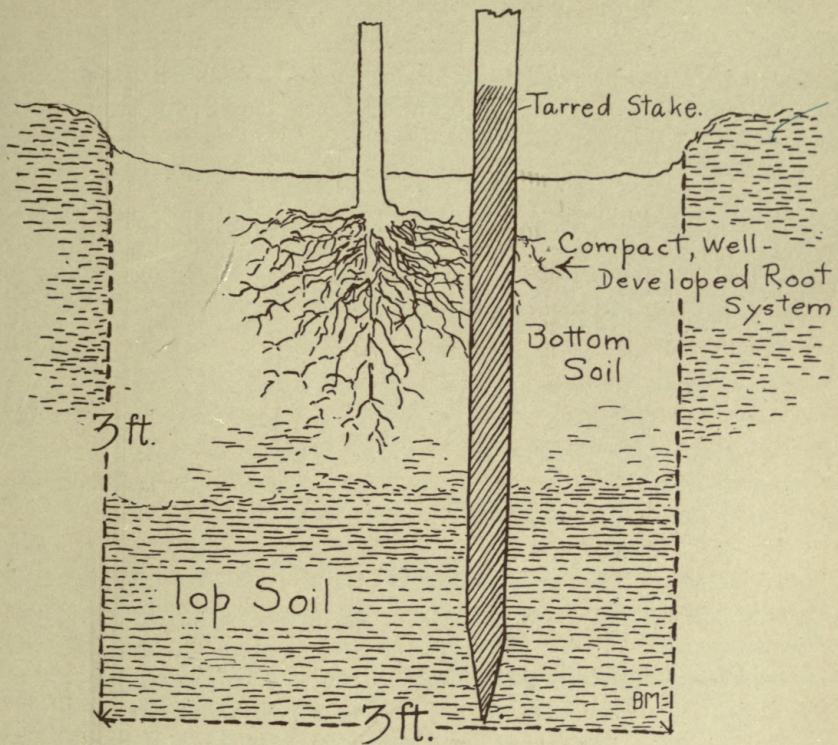


Fig. 41.

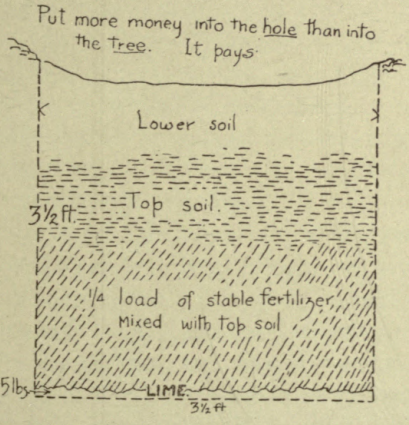


Fig. 42.

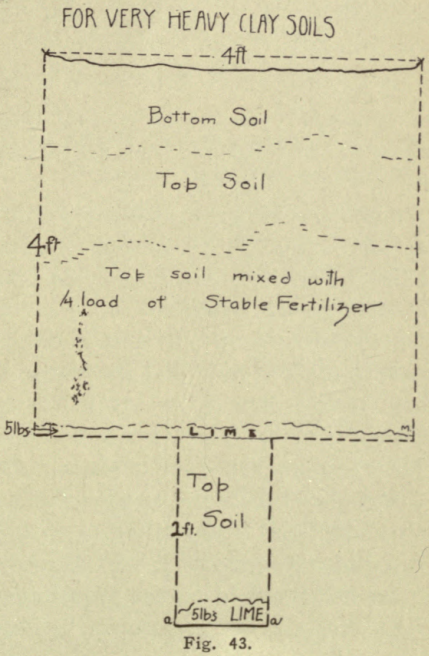


Fig. 43.

At this point it might be well to consider the tree for the planting. This tree, as it comes from the nursery, should have a good system of roots with a large proportion of fibrous roots. The main stem should be unbranched, so that it will keep unbranched for at least twelve feet. If this point is assured, there will not be so much pruning needed later to keep the tree in good form. Of course there are some species which will have to be headed even higher, but these cases can be determined in local practice. Since even with the greatest of care some of the root system is lost in transplanting, a corresponding reduction must be made in the top. This top pruning can be well done only by

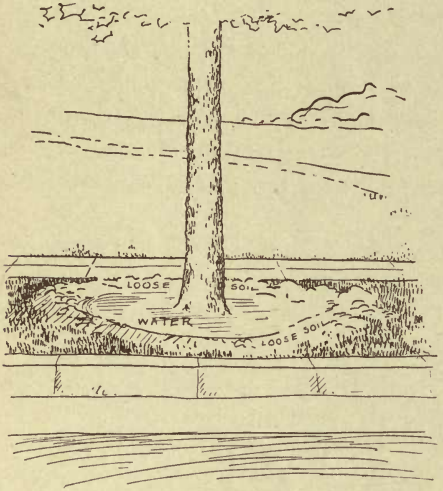


Fig. 44.

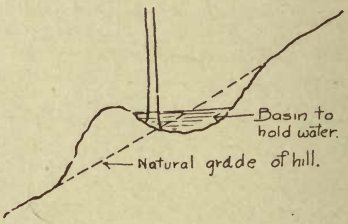


Fig. 45.

careful study of the individual tree, so that the new growth starting from the undeveloped buds will be able to grow along the most desirable lines.

Some species grow symmetrically by nature and call for little effort on the part of the nurseryman to maintain a good shape. On the other hand, there are a great many species which need considerable care. A case in point would be the popular camphor tree. This tree, as it usually occurs on parking places, is headed quite low. This is the nature of the tree. But according to competent nurserymen this habit can be overcome by a careful training in the nursery. The mature head of the camphor tree is broad and spreading, and if we have that head forming some five to six feet above the ground level, it is inevitable that it should interfere with pedestrians. At best the conditions are very artificial and limited, yet the utilitarian aspect of the problem can not be overlooked. So, then, when we accept our conditions, we must be forced to realize that for comfort to pedestrians, free play of light and air, our trees must be headed higher. How to induce this is

a problem for our nurserymen, and we must demand good materials from him and be willing to pay for the extra care that they must have.

Another case which demands special nursery care is that of the Texas umbrella tree. It is urged that this tree be abandoned for street work, but it offers such a good example that it is used here merely to illustrate the point in hand. If left to its own devices the tree branches a foot or so from the ground level and produces a multitude of co-ordinate branches, which produce a great thickening which is easily broken in wind or rain storms. The problem is this: Can branching be induced after a better leader has been formed, and can the young tree be pruned so that fewer branches are allowed to develop and hence a safer, stronger crotch be formed?

A somewhat different problem is confronted in the case of the Carob tree (*Ceratonia siliqua*). As was shown in Fig. 13, the tendency of the tree is to form several leaders which develop horizontally, and after developing great thickness split off, breaking with them much of the main trunk. This problem is more difficult to solve, and it is not as yet assured that it can be overcome.

So examples might be multiplied without number. The point of the matter is this: use only first-class nursery stock and expect to pay for it. Examine your trees; see that they are healthy and free from insect pests; see that they have developed normally, and are not trees which have made the best of bad conditions; see that they have grown vigorously, and have never been stunted or root-bound. Then give them a place to grow which gives them every opportunity for an optimum development, and then do not sit down and await results, but give them constant care, for one can not expect reasonable development with no care at all.

To all this there will probably be raised the objection of expense. Most assuredly there will be some extra expense, but these matters need not take very much more work than in ordinary nursery practice, and it is to the advantage of the nurseryman to turn out good specimens for municipal use. Furthermore, these plantings are being made for a great number of years, and an additional expenditure at the beginning may save an endless amount of worry, time and expense in correcting bad work later on. And bad work corrected is at best far less desirable than good work from the first.

The time to plant. This feature will vary somewhat according to the locality, the species, and the facilities for care afterwards. From general practice it might be said that it is safe to plant in the spring, after the hardest, coldest rains are over, until the early summer months. Some species are more tolerant and resistant than others, and can be planted all through the summer months. Many more species can be

Plate 9.

Note the tall columnar habit of Eugenia myrtifolia. Useful for formal plantings or for narrow streets.

Note the variety in texture of foliage. A desirable feature of park plantings.

Plate 10.

Young pepper trees (4 years old) trained to a single erect leader.

Fine old pepper trees of rather picturesque appearance.

planted all through the summer, and early fall as well, if they are specimens which have been grown in cans or tubs, or have been transplanted so often that a good mass of roots is formed. The advantage of this method is that the work is less of a shock to the tree, and provided a sufficient supply of water can be given afterwards, many of the less tolerant forms can be given this treatment. In using specimens from tubs or cans, care must be exercised that no deformed or root-bound specimens slip into the lot.

The safest generalization is, of course, that planting should be done just as new growth is starting, so that the tree may become established at once and not have the shock of losing foliage and roots which would come if it were moved after growth had started. Nevertheless, if the planter is willing to meet the difficulties, the question of time can be largely disregarded.

After planting has been accomplished, a small matter of great importance must not be overlooked. And that matter is the staking of the tree. In spite of all precautions at planting time the ground often settles, or subsequent rains or winds disturb the position of the young tree so that it begins to careen at an angle, and unless promptly corrected this crooked shape is kept for all time. The simplest method for preventing this, and the one which has been proven satisfactory and sufficient, is the single stake. As a general practice stakes from ten to fifteen feet in length should be used, with three feet below ground. The portion below ground should be tarred, so that it will not decay. If the tarred area is carried up for a foot above ground level the danger is lessened still more. If these are driven in about ten or twelve inches from the base of the tree the root will not be damaged, and the tree will be held in place. The usual practice is to tie the tree to the stake at several points with soft hemp rope. If this can be run through rubber hose, so much the better. After eight or ten years the trees have usually outgrown the need of the stake and it can be removed, repointed and retarred and used for other smaller trees.

In many cities it has been found that trees are subject to mutilation by horses especially. There are two methods of combatting this difficulty.

The way very commonly used in the East, and in a desultory way by private individuals in California, is to provide a guard of some description. These guards vary from a roll of two-inch hexagonal wire mesh to a wooden frame, such as is commonly used in Washington, D. C., (Fig. 46) or an elaborate iron guard. For old trees the wire mesh guard is entirely adequate, and for young trees a wire mesh guard, supplemented with stout stakes, will answer all purposes. The wooden guard is a little more effective and is reasonably durable. The only

advantage of the iron guard is its durability, and, in some cases, its beauty. Unfortunately, there are many times when it is not a thing of beauty. Of all these, the iron guard is the most durable and the most expensive, the expense in most cases being prohibitive.

Instead of incurring this expense, some of our southern California towns have enacted ordinances which prevent hitching to or near a tree, within a certain distance. At first there were a few violations, but now it is the accepted scheme of things and so far as was noted there are no cases of mutilation of bark or trunks of trees in those towns. Whether this would hold in a great city or not we can not say. Cer-

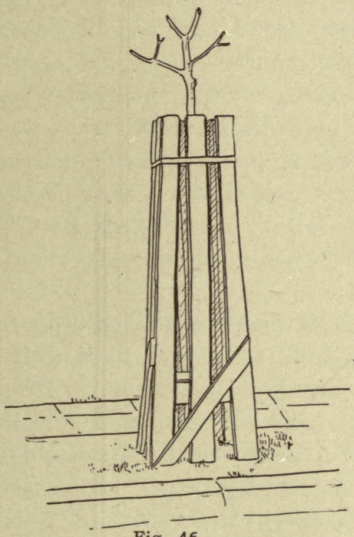


Fig. 46.

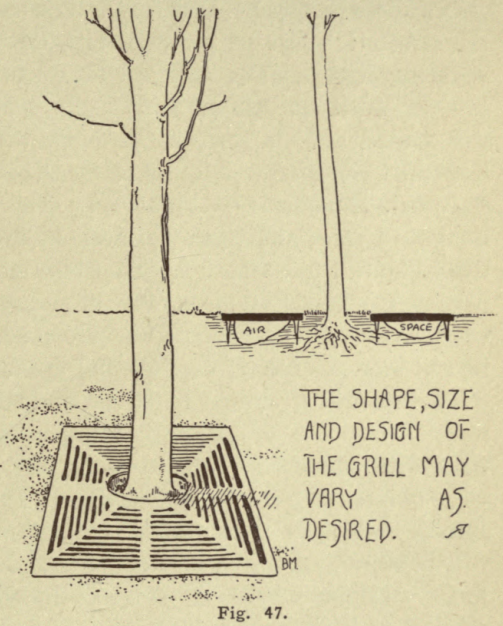


Fig. 47.

tainly the intense civic pride of these cities does much to make their respective ordinances effectual.

When we begin to have our trees uniformly throughout our towns, one other feature will rise to importance. That is: the use of grills in the down-town district. A grill is a cast-iron screen of some kind which is put over the soil about the base of a tree to prevent its being packed down by tramping. Every tree must have a certain area of unpaved soil about its base or it can not live and thrive. And in those parts of the town where there is a great amount of walking to and fro, the ground becomes packed down so that it is no longer easily permeated by air and water. In this state the tree can not thrive. It is to prevent this that the grill is useful. These grills are at best an item of considerable expense, but they are a means to an end which is worth far more

than any expense at first hand. Fig. 47 shows the appearance of a grill from the surface and in section.

All trees, of course, receive a thorough watering at the time of their planting, but there must be systematic watering after that. It has been found that it does not pay to leave watering to the individual property owners. At best they are prone to forget, and if the trees will show difference of treatment there will be irregularity in the planting which will mar the whole effect.

To prevent this it is desirable to have the watering done by the city. If the city takes charge the expense is kept down, and a systematic treatment is assured. During the first three years of the tree's life on the streets it must be watered with the greatest care. After its first watering it is usually watered every two or three weeks during the summer until the winter rains begin. The second year once a month will suffice, and, in some cases, every other month. The third season is usually confined to helping along the backward trees, with water for the others if necessary. Palms very often need it during a third season. Backward trees and trees which show irregular growth, as camphor or live oak, must have more frequent and more copious waterings than the normal specimens or more even growing species. Also, trees in situations which are more exposed or which are in soil which does not retain its soil mosture freely, need special attention.

The amount of water to be given to each tree varies according to many factors. Trees after planting need more than established trees; trees with shallow roots need more than deeply rooted trees; trees in very porous soil need more moisture than normal soils, and certain species need more than others. A case in illustration of the last point will be found among the acacias. *Acacia melanoxylon* will use all the water obtainable, while *A. decurrens dealbata* will suffer with the same amount and thrive with less. Every one would realize that a magnolia, a liriodendron or a sequoia would want more moisture than a eucalypt or a desert palm.

So far very little has been done in the way of fertilizing and cultivating the street trees. So far as was noted, but one case of artificial fertilization was seen. This case was a planting of acacias on a poor soil which was very rocky. The fertilizer used was barnyard manure mixed with the soil from the four-foot hole. Certainly these trees gave no evidence of poverty of soil. Similar instances have been found for individual trees which do not mature rapidly. Chemical fertilizers, chiefly mixtures of acid phosphate and muriate of potash, have been tried in the East with good results, but no records are at hand for their use here. Occasionally street sweepings are saved and incorporated with the soil, but their action is often as much physical as it is chemical.

As to cultivating—it is the general practice to keep the soil free from weeds and grass about the base of the trees. In most cases an effort is made, with varying success, to keep the soil stirred about the base of the trunk. This insures a dry mulch, and hence a preservation of water and an aeration of the soil, which is greatly to the advantage of the tree.

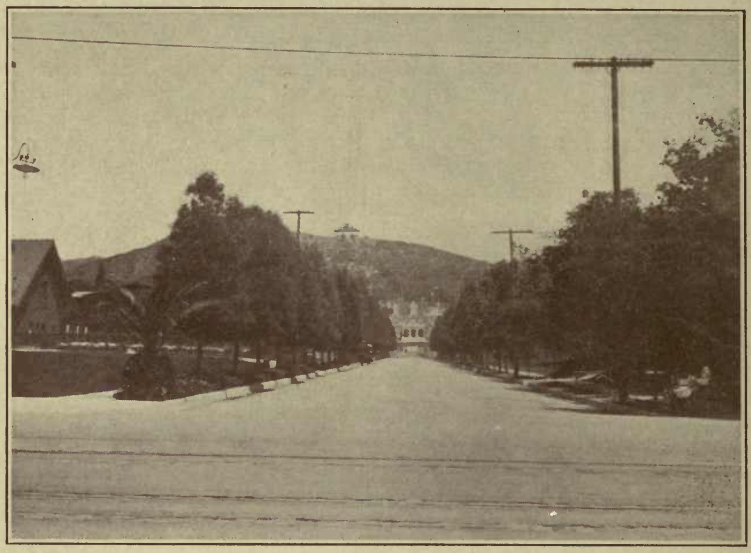
As has been stated before, in the consideration of the nursery stock, the training and pruning of the tree must begin in its earliest infancy. Since our street is laid out on formal geometrical lines, and its purposes are so strongly utilitarian, some concession must be made to service in the training of a tree. The chief work in the nursery is to insure one single straight leader. There may be strong lateral branches, but there must be one still more vigorous central leader.

As it is the Californian practice to plant trees from eighteen inches to three feet high directly in position, all further training must be done upon the street. Hence we can see the necessity of the firm, strong stake advocated before. As young trees of this size do well, there is no reason to discourage this practice. The only disadvantage is that in having trees spread over the city, some may escape notice. The tree comes from the nursery to the street with a single leader and many lateral branches. One by one these lateral branches are removed, throwing the strength into the main leader. This leader must be watched that it keeps an upright position. Eventually, the lateral branches will have been removed far enough up the trunk, and there they can be allowed to develop.

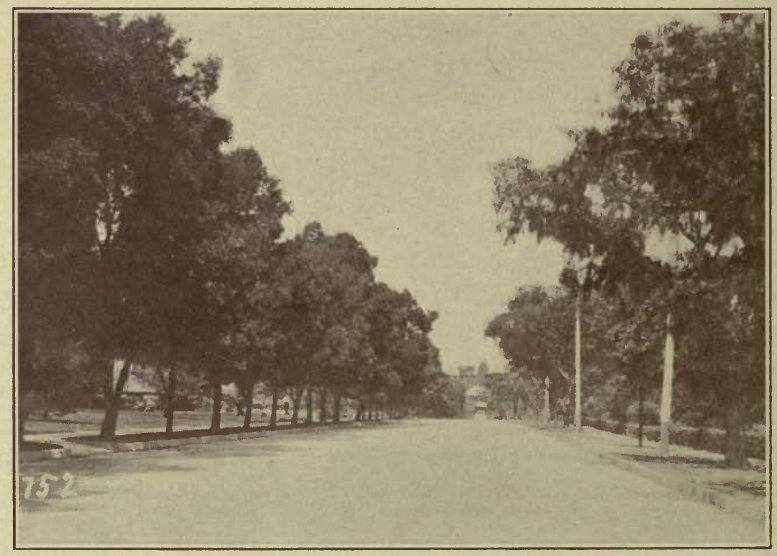
For most trees it is best to have but a single leader throughout the entire development. There are many exceptions, of course. But the greatest generalization is a single erect leader, with a few good lateral branches, which must branch in turn, and so on. In watching the growth of the tree certain primary lateral branches will be found stronger than others. Of these, certain ones will be more desirable. The less desirable ones with the weaker branches should be thinned out, and the lateral branches treated in a similar fashion for their secondary branches, until we have a symmetrical head. To determine what branches should be left, and which removed, one must study the natural habit of the tree and determine what procedure of pruning will give a least artificial appearance, unless a frankly artificial system of pruning is followed.

Certain other methods of pruning have come to notice. For example, it has been observed at Los Angeles and at Riverside that *Acacia melanoxylon,* if left to grow untouched, will produce a rather irregular pyramidal crown. If, however, the top is severely cut out when the tree is four or five years old, the resulting crown is more rounded and satisfactory. So far, all the trees so treated are but seven or eight years old, and the mature habit is as yet undetermined. In any event, the

Plate 11.

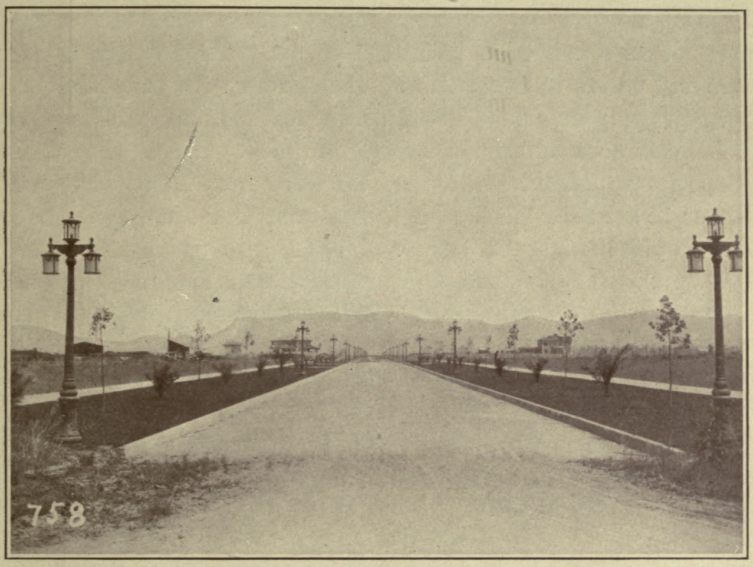


Short streets may appear as an approach to private grounds by careful planting.



Uneven planting spoils this picture. Notice the white poles; compare with dark poles above.

Plate 12.



Note wide parkings. Trees need as large an absorbing surface for air and water as possible.

untrained trees are very often of most unkempt and straggling habit. The tree has a fashion of forming several leaders, which develop along divergent lines with most unhappy results. Where, however, the trees develop well along natural lines it has a fine pyramidal style.

The common practice of beheading is often noted for eucalypts, peppers, poplars, umbrella trees and others. All of these trees have remarkable powers of refurnishing themselves with branches, but the practice certainly does not add beauty in most instances. The eucalypts can be kept in bounds in no other way in the city streets, *i. e.*, of course, those species which have the very tall columnar habit. Peppers are usually so treated for black scale infestations, and seem none the worse for it. Poplars, umbrella trees and others are usually so treated to reduce the amount of shade, and are hopelessly disfigured for a time. This practice has its value, but is not a legitimate phase of pruning but rather a makeshift for convenience.

If, however, the individual is studied and the pruning done yearly after active growth has ceased for the big pruning, and from time to time for small items which call for individual attention, there will be produced a uniformity which will aid the utilitarian aspect of the street equipment without affecting to any great degree the individuality of the specimens.

The highest form of pruning for street trees is that form which does not show in any way and yet effects the desired results. In accomplishing this, of course, great care is required. Constant attention during the first few years will regulate the form of the trunk and main branches. After this the pruning devotes itself largely to minor details. Constant observation will show any dead or diseased limbs, which should be promptly removed. In the same way branches which tend to grow at irregular angles can be curbed. In all cases where smaller branches are removed, care should be taken that the cut should be made just beyond a point where growth can be carried on in the desired direction. By this forethought oftentimes considerable work can be saved later. Should the crown become too dense, it should be thinned out from time to time. In doing this the inner branches should be removed and the smaller ones, so that the shape and outline of the tree will not be seriously modified.

All of these operations call for continuous work more or less all of the time. In California there is not, strictly speaking, any period when there is no growth of any kind; but it can be safely said that the greatest activity is in the spring and early summer. If, then, a minimum of pruning is performed during that time, with reasonable discretion, it may be carried on through the remainder of the year, leaving the heavy work till the winter, when the least amount of sap will be flowing.

In spite of the fact that much notice of it has been made in recent years, we still find many cases of bad pruning—so general rules for all prunings may not come amiss.

First of all, in large trees, commence pruning at the top of the tree and work downward, in this way saving labor of going back to dislodge any limbs which may have been caught; and, needless to emphasize, perhaps, the pruner should know from preliminary study just what he wants to cut before climbing the tree, as the aspect of the tree is very different in the crown from the aspect in the street. In making the cuts the saw should be held so that the plane of the cut is parallel to the axis of the trunk and reasonably close to the trunk, so that no stub, or even a suggestion of a swelling, will be left when the scar has healed.

The branches are often cut off with a stub of varying size left in place. This, in time, has formed about it a collar by the succeeding years' growth of new wood. The dead stub, however, gradually decays and breaks off, leaving an opening into the main trunk which offers an easy entrance for fungus growths or insect pests. The illustrations in Plate 4 indicate the progress in this case.

Again, unless the cut is properly made, the limbs split and tear away parts of the main trunk as they break. To prevent this, the cut should be made with an undercut first, and then an overcut, as shown in Fig. 48. This process may take more time, but it prevents such splitting, as is shown in Fig. 49. For smaller limbs, for which pruning shears are sufficient, this method can not be followed, but the dangers of splitting are not incurred.

Pruning shears are most often used to limit the growth of a lateral branch. In this case, of course, the process is simple, but care must be taken to make the cut so that a bud can carry on the growth of the branch, as under other circumstances the limb will always show as a stub. It is always well also to make the cut a short distance beyond the bud, because if too close to the bud evaporation will set in and spoil the bud, at least stunting it.

For all the larger cuts it has been found best to use a dressing of some kind of paint over the wound, and so prevent decay. If the wound is made in a proper fashion, leaving a flat surface parallel to the axis of the trunk or limb, the tissues of the cambium will grow and differentiate the cells of the bark, which eventually cover the entire scar, forming a cambium layer over the entire surface and a barky layer over that. The difference in the appearance of the bark will always show, but the functions of the tissues will be resumed in a normal fashion as though no branch had occurred. And the wood rings will be laid down about it, increasing the diameter of the trunk as though nothing had happened.

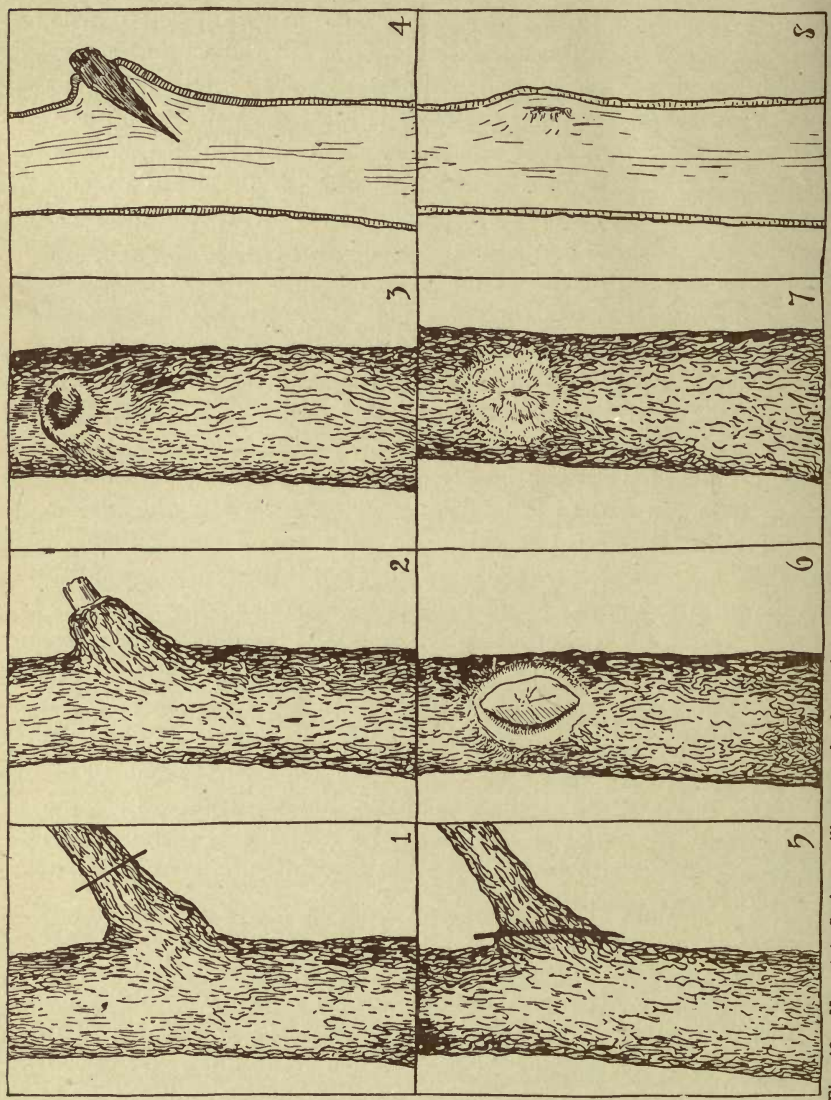


Fig. 48. Nos. 1-4, Series to illustrate the formation of a knot hole. Nos. 5-8, Series to show how proper pruning allows the plant tissues to cover the wound without enclosing any decay.

By using a dressing which will keep out moisture, decay is prevented, and at the same time any fungus spores are offered a poor chance for germination or growth. General practice has sanctioned the use of some paint preparation, usually of such a nature that it will penetrate into the surface for some little distance and not form a hard coat on the surface which will crack and chip off under the action of the weather. There is often used a preparation of coal tar. Providing this mixture does not contain any substances which are injurious to plant tissue, this is very satisfactory, but, from notes taken in the field, those who have used it say that it is a little harder to obtain and has no great advantage over a good paint mixture.

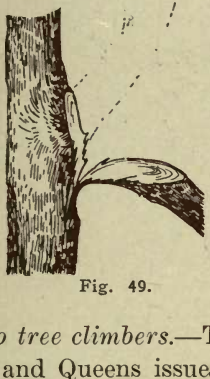


Fig. 49.

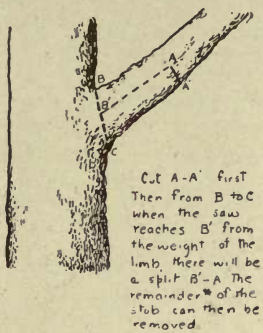


Fig. 50.

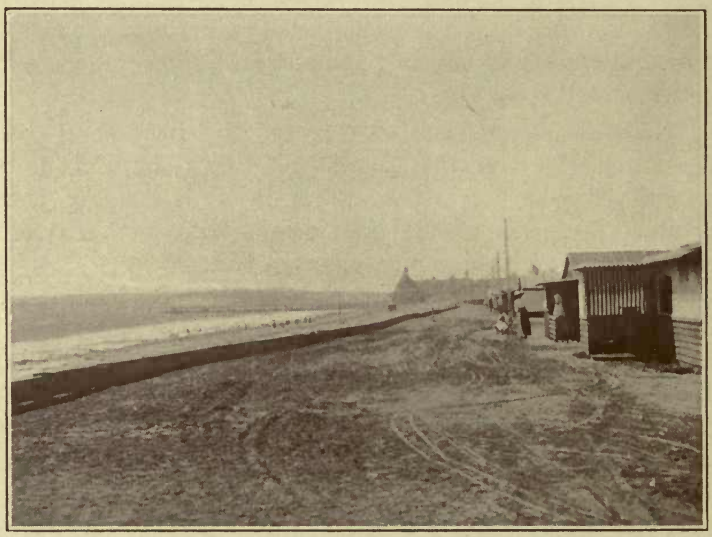
Hints to tree climbers.—The Department of Parks of the Borough of Brooklyn and Queens issues, in pamphlet form, the following "Hints to Tree Climbers" to its men:

"1. Before starting out on a tree, judge its general condition. The trunk of a tree that shows age disease, or wood-destroying insects generally has its branches in an unhealthy condition. Greater precautions should therefore be taken with a tree in this condition than with a young, vigorous tree.

2. The different kinds of wood differ naturally in their strength and pliability. The soft and brash woods need greater precautions than the strong and pliable ones. All the poplars, ailanthus, the silver maple, the chestnut, the catalpa and willow are either too soft or too brittle to depend on without special care. The elm, hickory and oak have strong flexible woods and are therefore safer than others. The red oak is weaker than other oaks. The sycamore and beech have a cross-grained wood and are therefore fairly strong. The linden has a soft wood, while the ash and gum,[1] though strong and flexible, are apt to split.[2]

[1]This refers to *Tulepo* or *Nyssa*, and *Liquidamber* sp., not eucalyptus.
[2]For more characteristic California trees, see Chapter III.

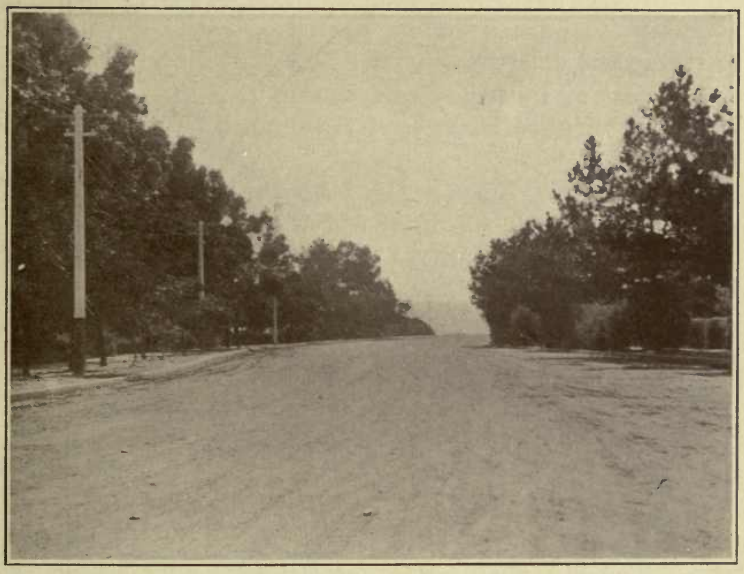
Plate 13.



Planted and unplanted beach drives. Palms cast some shade and yet not too much for summer pleasure seekers.

Plate 14.

This street has an ocean view. Its beauty is spoiled by the poles. These could be less conspicuous if the plantings were adequate.



Here is adequate planting, focusing the attention on the sea, which shows rather poorly in the plate. Poles should be dark.

3. Look out for a limb that shows fungus growths. Every fungus sends out a lot of fibres into the main body of the limb, which draw out its sap. The interior of the branch then loses all strength and becomes like powder. Outside appearances do not show the interior condition, but one can be sure that every time he sees a fungus cropping out, there is trouble behind it and the limb is not altogether safe.

4. When a limb is full of holes or knots, it generally indicates that borers have been working all kinds of galleries through it, making it unsafe. The silver maple and sycamore maple are especially full of borers, which in many cases work on the under side of the branch, so that the man in the tree looking down can not see its dangerous condition.

5. A dead limb with bark falling off indicates that it died at least three months before, and is therefore less safe than one with its bark tightly adhering to it.

6. Branches are more apt to snap on a frosty day when they are covered with an icy coating than on a warm summer day.

7. A rainy or drizzly day causes the branches of a tree to be slippery and greater precautions are then necessary.

8. Always use the pole-saw and pole-shear on the tips of long branches, and the pole-hook in removing dead branches of the ailanthus and other brittle trees, where it would be too dangerous to reach them otherwise.

9. Examine your ladder before using it.

10. Be sure of the strength of your branch before tying an extension ladder to it.

11. Do not slant the extension ladder too much.

12. Always watch the upper end of your ladder.

13. Do not forget to use the 'danger sign' on streets where falling branches are apt to injure careless passers-by.

14. Always consult your foreman before taking up any job where risk is involved."

CHAPTER VI.

INSECTS, FUNGI, INJURIES.

In many states the problem of the control of insect pests on shade trees is a far more serious one than in the State of California. Of course we are not without our difficulties in these matters, but our troubles are slight compared to the work of the states in many parts of the East.

It is inevitable, from the interdependence of organisms in nature, that the trees which are used for ornamental planting should furnish food for numerous insects. In natural conditions the trees, by their uneven distribution, may furnish rather scanty food to their insect enemies. Under the artificial treatment of our streets, great numbers of trees of the same species are brought together, and by the care which they receive attain a more uniformly successful development than they might in some natural situations. As we deliberately upset the balance by bringing these trees together and by giving them an opportunity for optimum development, we offer at the same time an opportunity for an abnormal development of the insect pests. That is, in most cases by aiding the growth of the tree, we aid the multiplication of the tree's enemies by making conditions more favorable to their development.

There are, however, many natural factors which work against the insect's rapid development, just as the insect tends to retard the tree's growth. In the development of the insect from the egg to its adult form there are certain transformations in which the insect passes from one stage of its development into another. Most insects develop from eggs laid by the female insect, which usually selects a place where food will be abundant, to deposit her eggs. The eggs, of course, make no demand upon the plant world, but the young larvæ which hatch from the eggs begin feeding almost immediately upon the plants needed for their development. During this stage of development the insect is often as destructive, or more so, than in its adult condition. Caterpillars are familiar examples of this stage of insect life, and illustrate the preceding statement. The adult condition of the caterpillar is what is known popularly as a butterfly or a moth. As butterflies and moths have mouth parts adapted only to the sucking of liquids, it is obvious that they can not accomplish the damage which the caterpillar may bring about with its strong mandibles for chewing leafy parts.

During this period of feeding the internal structure of the larva is storing up food and undergoing certain changes which, when they

have reached a certain state, cause it to become a pupa. This, like the egg, is a resting condition. The pupa of butterflies and moths is known as a cocoon or a chrysalis. While the insect is in the pupal state internal changes take place in the insect's structure which lead to its development as an adult insect.

Some insects do not have all of these stages in their development, but reach the adult condition by shorter periods; and certain forms, commonly some of the aphids, are born alive from the body to the parent insect. Since these things are so, it is easily seen that the study and life history of the insect will show just what time the insect will be most readily injured by the agencies of man. For it would be foolish to spray leaves with stomach poisons with the hope of poisoning adult moths, or killing the eggs they might have laid. The adult forms could not be hurt by the poison, as they have no way of eating the leaves, and the eggs would rarely be injured by the poisons, because if the poisons were strong enough to penetrate the egg cases or dehydrate the contents, the foliage would suffer. Of course strong contact poisons are used to kill eggs and adults of certain classes, as the scale insects, but these sprays are usually applied when there is no foliage on the tree. Since, then, it would be difficult to reduce the number of adults directly, it must be done indirectly. This is easily accomplished by having repeated sprayings at the time the larvæ are emerging from the eggs. As the larvæ feed upon the foliage, stomach poisons are effective and reduce the number of adults directly.

In other cases where the adults feed upon parts that may be readily poisoned, as in the case of certain leaf-eating beetles, stomach poisons may be used, but here the difficulty lies in the fact that the tissues of the body of the adult are very much less easily affected by the poisons than the tissues of the body in the larval state.

For the individual it would be both tiresome and purposeless to assume the task of finding out the life histories of the different insects. Most of them, certainly all of the important ones, have been carefully worked out by scientists over the country, and any citizen will find abundant expert information and advice at his command by applying to the state entomologist, or to the entomologists at the state experiment stations.

Because of the fact that the insects troubling shade trees, as well as other trees, are so ably handled by bulletins of this and other states, it is not intended to offer any discussion of the insects themselves, species by species. A few hints as to the intelligent handling of insects may be useful.

Insects fall into three general classes, according to the kind of injury they inflict.

Leaf-eating insects are those insects which in some stage of their development feed upon the leaves, and in some cases upon the tender growing tips of the shoots. These insects take the plant tissues into their bodies, and hence can be poisoned by those poisons that are known as "stomach" poisons. This means poisons whose toxic effect appears only after introduction within the body of the insect. The basis of these poisons is usually some form of arsenic. Caterpillars and leaf-eating beetles are examples of this class.

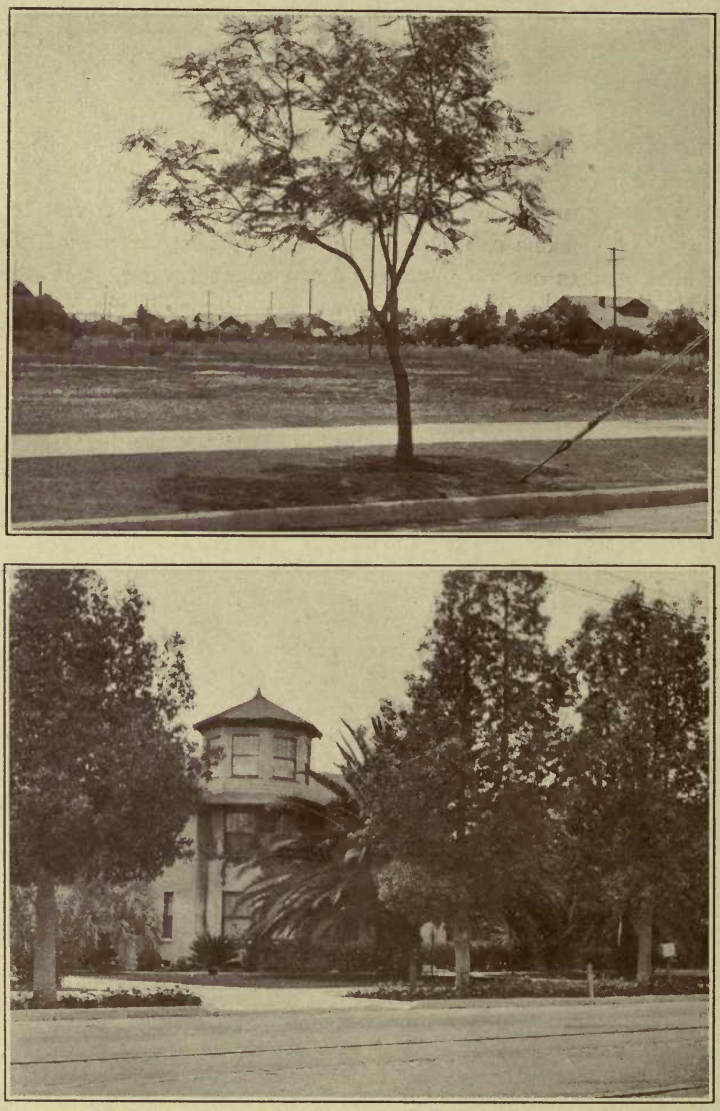
Sucking insects are those insects which do not destroy the plant tissues directly, but rob the plant of its juices, and affect its health only when their number becomes so considerable as to be felt by the host plant. As poisons can be applied only to the surface of plants, and as these insects eat no portion of the plant tissues, it is obvious that stomach poisons would be of no value. Resort is made to "contact" poisons. These materials are generally soaps or oils, which clog the breathing pores of the insect and hence smother it.

Borers are the third class of insects which attack trees, and are in many ways the most difficult to combat. Usually the larvæ are the forms that do the damage, though many beetles in the adult stage are equally destructive. When the larvæ hatch from the eggs they pass almost immediately through the bark of the tree and bore their galleries through the wood tissues, in some cases just below the bark and in other cases well into the heart wood. As the eggs are not easily destroyed, as they do not feed to any appreciable extent before entering the wood, and as the adults are flying insects, the only time for attack is after the larvæ have entered the wood.

If the borers are very numerous, the limbs or trees should be removed and burned. If the insects are few and careful attention can be given, hand work will often be effective. A flexible wire will often reach the larva if the wire is pushed firmly into the opening. If, afterwards, a few drops of carbon bisulfide is put in the opening and the hole closed with putty, the work will be assured. If the number of insects is very small, the bark may be opened along the gallery and the insect killed. As this causes considerable injury to the tree it is less desirable than the other methods.

Because no method has been devised as yet which will do away with the necessity for great caution and attentiveness on the part of the operator, the control work for borers is both tedious and expensive. It has been demonstrated, however, that a thorough concerted action will reduce the number of larvæ, and hence the number of adults; and later spraying will reduce the number of eggs which may be laid, so that after several seasons the borers may be checked and practically exterminated.

Plate 15.



Two trees with poor habit of growth, Jacaranda mimosaefolia and Sterculia diversifolia.

Note vase-shaped form of the elm. Contrast with the straggling pendulous form of the white birch. Shape often determines a tree's usefulness on certain streets.

Stomach Poisons.

Paris green:

1 pound Paris green.
3 pounds lime.
100 gallons water.

Arsenate of lead:

No. 1.—3 pounds arsenate of lead.
50 gallons water.

No. 2.—12 ounces acetate of lead.
4 ounces arsenate of soda.
15 to 20 gallons water.

Contact Poisons.

Common soap:

1 pound to 8 gallons water.

Lime-sulphur:

20 pounds lime.
14 pounds sulphur.
40 gallons water.

Whale-oil soap:

1 pound to 6 gallons water.

Kerosene emulsion:

2 gallons kerosene.
½ pound common soap.
1 gallon water.

There are many satisfactory sprays on the market under both these headings.

Aside from insect enemies, trees are subject to the attacks of various fungi. These diseases are not of as much importance as insect troubles because they are less frequent in their occurrence. Trees which are growing vigorously and are uninjured offer very poor ground for fungous attack. Most fungous diseases must find their way into a tree through some wound; and once inside of the tree it is almost hopeless to combat them.

Fungi are parasitic plants which live upon the elaborated materials of the host. As they possess no chlorophyll, they can not build up their food materials from the crude substance found in the soil. After the spores, which are the reproductive bodies of the fungus corresponding to the seeds of the flowering plants—after these spores find their way into the tissues of the plant they germinate and send out long delicate thread-like structures, which are called hypæ, and collectively form the mycelium. On the hypæ, in some forms, are small bodies, called haustoria, which penetrate the cell walls and absorb the cell contents. In other species the hypæ themselves penetrate cell walls

and absorb directly. This, of course, results in the starvation of the tree, and often various substances are given off by the fungus in its assimilation processes, which lead to the actual disintegration of the woody tissues and their subsequent decay.

The control of fungous diseases must be by preventive measures. Care should be taken that all wounds should be dressed immediately and the trees should be kept in a healthy condition.

Fungicides are of value in checking the spread of diseases by spreading a thin film of the material over the susceptible surfaces of the plant so that spores falling on it will be killed or the germinating hypæ will be killed. These preparations are usually solutions of copper salts.

Bordeaux mixture:

4 pounds copper sulphate.
4 pounds fresh lime.
50 gallons water.

Ammoniacal copper carbonate:

5 ounces copper carbonate.
3 pints ammonia (strong).
50 gallons water.

Often fungous diseases are found in connection with old wounds which have arisen in various ways, as breakage from wind and snow, improper pruning, or the lack of dressing on the cuts after pruning. The matter of proper dressing for wounds has been discussed, but it may be well to note at this point some of the ways in which old injuries may be repaired in some degree.

Slight wounds, as the abrasion of the bark, should not be neglected. Carefully cut away all the bark which is loosened from the wood, leaving a smooth edge, and paint the exposed wood with coal tar to prevent its drying out and to prevent the entrance of insects and fungus spores.

Large wounds should be treated correspondingly if they are fresh and upon the surface. If they are old wounds and have become cavities extending far into the trunk of the tree, they require more complicated treatment. This is especially true if fungous diseases have been at work. There are times when it is not worth while to repair such trees, but often valuable specimens may be saved by heroic treatment.

In repairing a cavity all the decayed and diseased wood must be removed, so that a surface of healthy tissue will be exposed. This surface is washed with an antiseptic solution and covered with molten coal tar. The cavity is then ready for filling. The manner of filling will vary slightly according to the size of the cavity. If the cavity is small, it will probably retain the filling, providing the cavity is larger than the opening into the cavity. This will prevent the filling from working loose and falling out. If the cavity is very shallow an extra

groove is cut to hold the cement. The surfaces of the cavities are often studded with nails to hold the filling tightly in place. Small cavities are filled with Portland cement, but the larger openings need the addition of broken stone and brick to form a firm foundation, and in cases where the excavations are extensive the use of steel rods is desirable. Often woven wire of varying size mesh is put into the cavity.

In filling openings of considerable size the work can be built up slowly, using an artificial framework to mould the front surface until the mixture sets. The cement should be mixed rather thin, so that when tamped it will settle evenly and thoroughly into all the cracks. In making the framework for the front of the mould and in filling any cavity (Fig. 50), it is essential that the outer surface of the new concrete filling does not come outside of the inner surface of the bark. If it

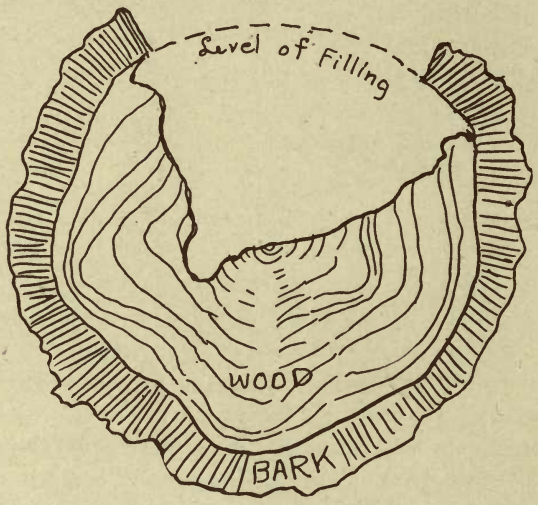


Fig. 51.

does not, the growing layers just under the bark will continue to grow, and in many cases will completely cover openings of some size. If it does exceed the growing level, the new wood in growing will set up a pressure which will ultimately crack the filling and make it fall out. In order to be sure of a clean, regular surface, it is well to trim an even margin all about the opening, painting the exposed surface with some coal tar preparation.

Oftentimes fine specimens will be split in a crotch between two of the larger limbs. The common practice of putting an iron band about the two limbs results in the inevitable girdling of the tree, unless the bands are of such a width that the tree can burst them. The more simple and correct method is illustrated in Fig. 51. In time the wood will grow about the nuts, which are sunk in the cement; or a bolt may be run directly through the limbs, and no chain will be needed.

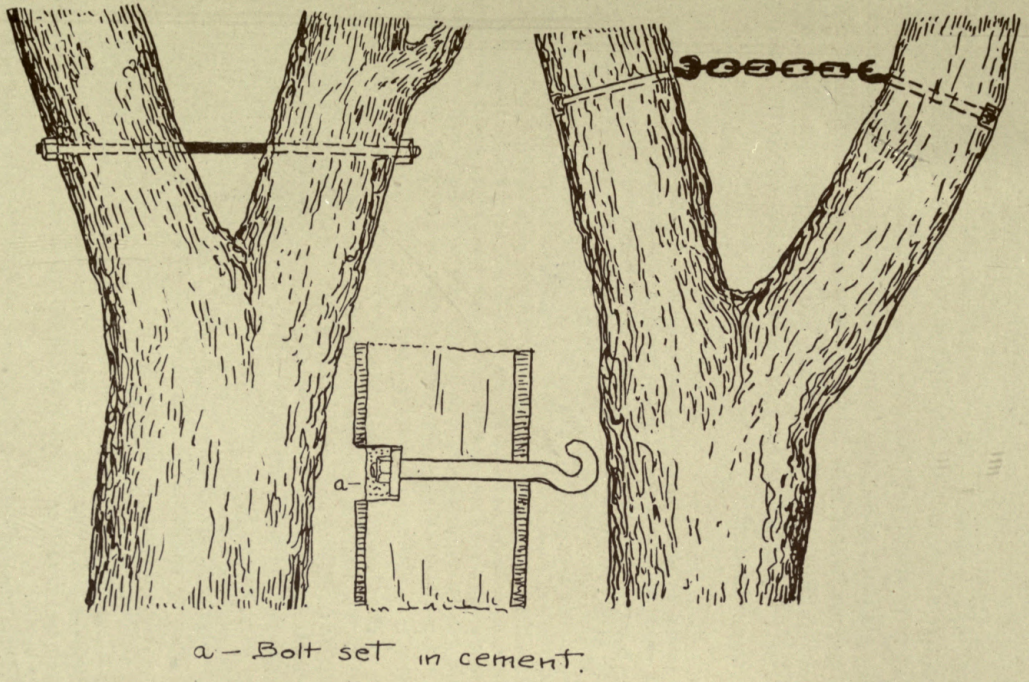


Fig. 52. Methods of bracing a weak crotch. a, Section to show the nut sunk in cement, after being put in place.

CHAPTER VII.

LEGISLATION.

The "county forestry" bill was passed during the 1913 session of the legislature and was signed by the Governor on April 23, 1913. This law makes it possible for the counties, if they so desire, to undertake systematic planting along the county highways. The opportunities for beautifying our wonderful highway systems are unexcelled; and the suggestions contained in this bulletin are offered by the State Board of Forestry that the new law may the more readily serve the purpose for which it was intended.

CHAPTER 51.

An act to amend an act entitled "An act to provide for the protection and preservation of shade and ornamental trees growing and to be grown upon the roads, highways, grounds and property within the State of California; and for the planting, care, protection and preservation of shade and ornamental trees, hedges, lawns, shrubs and flowers growing and to be grown in and upon such roads, highways, grounds and property; and to create county boards of forestry for such purposes; and to prescribe the duties and powers of such boards; and to authorize such boards to appoint county foresters; and to prescribe the duties and fix the compensation of county foresters; and to empower such boards to enforce all laws and adopt and enforce any and all lawful and reasonable rules for the protection, planting, regulation, preservation, care and control of such shade and ornamental trees, hedges, lawns, shrubs and flowers," approved April 28, 1909.

[Approved April 23, 1913.]

The people of the State of California do enact as follows:

SECTION 1. The board of supervisors in each and every county or city and county of the State of California may, in its discretion, appoint a county board of forestry, consisting of five persons, one from each supervisorial district, who shall serve without compensation, and who shall have exclusive charge and control of all shade and ornamental trees, hedges, lawns, shrubs and flowers growing or to be grown upon the public roads, highways, grounds and property within its respective county.

SEC. 2. Whenever the board of supervisors of any county or city and county in this state shall, by resolution or ordinance, elect to avail itself of the provisions of this act, such board shall, within two months thereafter, appoint five suitable and competent persons, one from each supervisorial district of such county or city and county, as a county board of forestry in and for such county, who shall serve as such without compensation; and may also fix the compensation of a county forester, to be appointed as hereinafter provided at a sum not to exceed one hundred and fifty dollars per month.

SEC. 3. The term of office of such county board of forestry shall be four years; *provided, however,* that the persons first appointed shall so classify themselves by lot that two of their number shall retire from office at the end of two years, two at the end of three years, and one at the end of four years. If any vacancy occurs in the office, such vacancy shall be filled, for the unexpired term, by the board of supervisors.

SEC. 4. Within ten days after notice of their appointment, the members of said county board of forestry shall organize by the election of one of their members as chairman and adopt suitable rules for their government.

SEC. 5. When organized, said county board of forestry may employ a suitable

and competent person as county forester to serve as such during the pleasure of the board and to prescribe the duties of such employee.

SEC. 6. Such forester, when appointed, shall execute a bond to said board, in the sum of one thousand dollars, for the faithful performance of his duties. He shall be the secretary of said board and shall perform such other duties as said board shall prescribe. Said forester shall have power and it shall be his duty to enforce the provisions of this act and all lawful orders of said board.

SEC. 7. Every county board of forestry appointed under the provisions of this act shall, within its respective county, have power over and jurisdiction to decide upon the variety, kind and character of trees, hedges, shrubs, lawns and flowers that shall be planted upon said roads, highways, grounds and property; and to determine all questions respecting the pruning, cutting and removal of any trees or hedges now growing and to grow thereon and the necessity therefor and the extent of and the manner in which said work shall be done; and, under the authority of the board of supervisors of its respective county, to plant and properly care for such trees, hedges, shrubs, lawns and flowers; and to enforce, carry out and effectuate the provisions of this act; *provided, however*, that said board, in the exercise of its powers and the performance of its duties hereunder, shall not interfere with the jurisdiction of the board of supervisors over the roads, highways, grounds and property in the improvement, care and general control thereof.

SEC. 8. It shall be unlawful for any person or corporation (except said board of forestry or its employees) in any county or city and county where a county board of forestry has been created and appointed under the provisions of this act, to trim, prune, cut, deface, destroy or remove any shade or ornamental tree or hedge growing or to grow upon any such road, highway, ground or property or to paint, place, attach to or put upon any such trees, hedges, shrubs, lawns or flowers, any sign, notice, advertisement or advertising device without the consent in writing of said board first obtained, or to plant any tree or hedge, on any such road, highway, ground or property without such written consent; *provided, however*, that nothing in this act shall give such county board of forestry any jurisdiction over any fruit or nut trees now growing along said roads, highways, grounds or property, except that such trees may not be removed without the consent of the said board of forestry.

SEC. 9. Every person who shall violate any of the provisions of section 8 of this act, shall be guilty of a misdemeanor.

SEC. 10. All moneys received as penalties for the violation of the provisions of of this act, shall be paid into the county treasury to the credit of the county board of forestry fund; which fund is hereby created, and the money thereof hereby appropriated for the expenses of said board in the carrying out of the provisions of this act and the policy and purposes herein provided.

SEC. 11. County boards of supervisors, whenever the provisions of this act are availed of, shall appropriate money for the use of said county board of forestry sufficient to pay the compensation of said county forester and for the necessary expenses of said county board of forestry.

SEC. 12. All acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

CITY ORDINANCES.

There are many ordinances in the several counties directed toward the planting and subsequent care of shade and ornamental trees. Some of these have proved most satisfactory, while others are of little value. The ordinance, which is effective in Riverside, is a simple one, and yet, from all reports, it is altogether effective in its operations.

ORDINANCE NO. 4 (NEW SERIES.)

An ordinance regulating the planting, removal and care of trees and shrubs in the streets of the city of Riverside.

The mayor and common council of the city of Riverside do ordain as follows:

SECTION 1. No trees or shrubs shall hereafter be planted in the public streets of the city of Riverside, except under the direction of the Board of Park Commissioners of said city.

SEC. 2. No trees or shrubs planted or growing in the public streets of said city shall be removed, except by the permission of said Board of Park Commissioners, and no trees in the streets shall be cut, pruned or trimmed except under the direction of said board; nor shall any one not authorized by the Board of Park Commissioners trench around or longside of any tree, plant, or shrub with a view to cutting the roots of same.

SEC. 3. Said Board of Park Commissioners shall exercise general care and supervision over all trees in the streets of said city, and shall select the variety of trees hereafter to be planted in the streets of said city.

SEC. 4. Any person violating any of the provisions contained in sections numbered 1 and 2 of this ordinance shall be deemed guilty of a misdemeanor, and shall be punished by a fine not exceeding one hundred dollars ($100), or be imprisoned for not exceeding thirty days, or by both such fine and imprisonment.

SEC. 5. All ordinances and parts of ordinances conflicting with the provisions of this ordinance are hereby repealed.

SEC. 6. This ordinance shall be in force and take effect thirty days after its adoption and approval.

SEC. 7. The city clerk shall certify to the passage and approval of this ordinance and cause the same to be posted as required by law.

Approved this twenty-fifth day of July, 1907.

The ordinances passed by the city of Redlands are somewhat more numerous, but are equally effective and satisfactory in operation.

ORDINANCES OF THE CITY OF REDLANDS, CALIFORNIA.

ARTICLE III.

SEC. 29. Subdivision 5. *Trimming trees.* It shall be unlawful for any person to permit the branches or foliage of any tree, plant, hedge or bush to obstruct the free passage of vehicles in the roadway of any street, or of pedestrians upon the sidewalk portion thereof, or to hang over such portion of such sidewalk within seven feet of the surface thereof.

SEC. 29. Subdivision 6. *Cutting trees.* It shall be unlawful for any person to cut or permit the cutting of any tree or the roots or branches thereof being or growing upon any street in said city, or to in any manner injure or impair the growth or life thereof, without first obtaining a permit so to do from the board of trustees or the tree warden, or tree commission; *provided*, that nothing herein shall prevent the proper trimming of trees as provided in subdivision 5 hereof.

ARTICLE X.

SEC. 80. *Appointment of commission.* There is hereby established a tree commission, to consist of three members to be appointed by the board of trustees and to serve at the pleasure of the board, and the executive officer of such commission shall be known as the tree warden.

SEC. 81. *Power and authority.* Said commission is hereby vested with power and authority to take charge of and supervise the care and maintenance of all public parks and the planting, trimming and removing of all trees upon the streets and public places of the city.

SEC. 82. *Planting of trees.* Said commission and said board of trustees, or either of them, shall have the right to direct the kind and variety of trees to be planted upon any of said streets, and it shall be unlawful for any person to plant

upon any such street any trees without first obtaining a permit so to do from said commission or said board of trustees.

SEC. 83. *Trimming and cutting without permit.* It shall be unlawful for any person to trim, cut, mutilate, or injure any tree, or the roots or branches thereof, or injure or impair the growth or life thereof, or to place or install upon any street any telephone pole, electric light, trolley, or power pole within six feet of the trunk of any tree growing upon such street without a permit so to do first obtained from said tree warden, or said commission, or said board of trustees; *provided*, that nothing herein shall prevent a proper trimming of trees to prevent obstruction to pedestrians or public travel, as required by subdivision 5 of section 29 of this ordinance.

ARTICLE XIX.

SEC. 288. *Failure or neglect to plant trees, when unlawful.* Whenever the tree commission or board of trustees shall grant to any person permission to remove any trees growing upon any public street, conditioned upon planting other trees in places thereof, it shall be unlawful for such person to fail or neglect to so plant such other trees within the times fixed for such planting by said commission or said trustees.

ARTICLE IV—ANIMALS.

SEC. 30. Subdivision 2. *Tying animals to trees.* It shall be unlawful for any person to tie or permit to be tied, any such animal to any shade or ornamental tree upon any sidewalk or street therein, or to be so tied that such animal can graze upon such sidewalk or street.

It will be noted that in the ordinances in force in Redlands and Riverside provision is made for planting by city authorities. In this one fact, more than in any other single feature, lies the success of the plantings in those towns. The city of San Bernardino has an excellent ordinance, but it does not vest definite authority for planting in the hands of one officer or set of officers. The result has been that only the negative advantages of their ordinance have become apparent.

Many other instances may be cited of towns where insufficient legislation defeats the value of such articles as may be in force.

Often the only mention of trees to be found in the statute books will be an ordinance forbidding the planting of certain species within definite distances from the water and sewer pipes. Oftentimes defective piping causes the difficulty, by allowing easy entrance to the roots of trees. It can not be disputed that the roots of trees, some more than others, will turn, in search of water, toward the pipes. This is especially true where there is any leakage, however slight, at any of the joints.

The town of Oroville has made most extensive study of this matter, and has a large list of trees which may not be used in the Oroville streets because of difficulty in roots seeking the water. It is to be hoped that the town will take up the matter of tree-planting along the best lines with the same enthusiasm that has been shown in blacklisting certain offending trees.

As an example of the means used to enforce popular attention, the following "Warning" may be of interest. The Los Angeles County

Board of Forestry has made considerable progress in their planting schemes and have ambitious plans for future work.

WARNING.

Do Not Cut or Trim Trees Along County Roads.

The Board of Forestry of Los Angeles County, duly created and organized, desires to call attention to the following provisions quoted from the law authorizing county boards of forestry, and prescribing the powers, duties, and jurisdiction of such boards. It is especially desirable that the public appreciate the necessity of securing permits before any cutting or planting of trees is undertaken on the county roads and highways. The board will appreciate the co-operation of the public in its work for the improvement of the county roads and highways, and will be especially glad to have unpermitted cutting of trees on these roads and highways called to its attention.

CHAPTER 729—LAWS OF THE STATE OF CALIFORNIA. APPROVED APRIL 28, 1909.

An act to provide for the protection of shade and ornamental trees growing and to be grown upon the roads, highways, grounds and property within the State of California; and for the planting, care, protection and preservation of shade and ornamental trees, hedges, lawns, shrubs and flowers growing and to be grown in and upon such roads, highways, grounds and property; and to create county boards of forestry for such purposes; * * * and to empower such boards to enforce all laws and adopt and enforce any and all lawful and reasonable rules for the protection, planting, regulation, preservation, care and control of such shade and ornamental trees, hedges, lawns, shrubs and flowers.

SEC. 7. The county boards of forestry * * * within their respective counties, may plant trees or cause the same to be planted, shall have exclusive power over and jurisdiction to decide upon the variety, kind and character of trees, hedges and shrubs that shall be planted upon said roads, highways, grounds and property; and to determine all questions respecting the pruning, cutting and removal of any trees, hedges and shrubs now growing and to grow thereon and the necessity therefor and the extent and the manner in which said work shall be done; * * *

SEC. 8. It shall be unlawful for any person or corporation * * * to trim, prune, cut, deface, destroy or remove any shade or ornamental tree, hedge or shrub growing or to grow upon such road, highway, ground or property or to paint, place, attach to or put upon any such trees, hedges or shrubs any sign, notice, advertisement or advertising device without the consent in writing of the board (County Board of Forestry) first obtained, or to plant any tree, hedge or shrub on any such road, highway, ground or property without such written consent.

SEC. 9. Every person who shall violate any of the provisions or sections of this act shall be guilty of a misdemeanor.

SEC. 12. All acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

For permits or information apply to

LOS ANGELES COUNTY BOARD OF FORESTRY,
Hall of Records.

Not all of the counties of the State have taken advantage of the opportunity given in the state law, and there are many roads freely traveled which would add much to the beauty of our State if they were well planted.

As a matter of interest, the laws of New Jersey and Pennsylvania are appended in full. These states have been the pioneers in this work and offer good examples of effective legislation.

NEW JERSEY.

[Laws of New Jersey. General Public Laws; Session of 1893.]

CHAPTER CCLXXXV.

An act to provide for the planting and care of shade trees on the highways of the municipalities of this state.

SECTION 1. *Be it enacted by the Senate and General Assembly of the State of New Jersey*, That in all the municipalities of this state there may be appointed, in the manner hereinafter provided, a commission of three freeholders, who shall serve without compensation, and who shall have the exclusive and absolute control and power to plant, set out, maintain, protect and care for shade trees in any of the public highways of their respective municipalities, the cost thereof to be borne and paid for in the manner hereinafter directed.

SEC. 2. *And be it enacted*, That it shall be optional with the governing body of any municipality whether this act shall have effect in, and such commissioners shall be appointed in, such municipality; and when any such governing body shall by resolution approve of this act and direct that such commissioners shall be appointed, then, from that time this act and all its provisions shall be in force and apply to such municipality, and such commissioners shall be appointed for terms of three, four and five years, respectively; and on the expiration of any term, the new appointment shall be made for five years, and any vacancy shall be filled for the unexpired term only; and in cities, the said appointment shall be made by the mayor thereof, and in townships by the chairman of the township committee, and in villages and boroughs by the chairman or president of the board of trustees or other governing body.

SEC. 3. *And be it enacted*, That whenever said commissioners shall propose to make any such improvements as setting out or planting any shade trees, or changing the same in any highways, they shall give notice of such contemplated improvement (specify the streets or portions thereof where such trees are intended to be planted) in one or more newspapers of their said municipality, if there be any newspapers published in said place, for at least two weeks prior to any meeting, in which they shall decide to make such improvement.

SEC. 4. *And be it enacted*, That the cost of planting and transplanting any trees in any highway, and boxes or guards for the protection thereof, when necessary, shall be borne by the real estate in front of which such trees are planted or set out, and the cost thereof as to each tract of real estate shall be certified by said commissioners to the person having charge of the collection of taxes for said municipality; and upon the filing of said certificate, the amount of the cost of said improvement shall be and become a lien upon said lands in front of which the trees were planted or set out, and the said collecting officer shall place the assessment so made against any property, and the same shall be collectible in the same manner as the other taxes against said property are collected.

SEC. 5. *And be it enacted*, That the cost and expense of caring for said trees, after being planted or set out, and the expense of publishing said notices, shall be borne and paid by a general tax to be raised by said municipality; said tax shall not exceed the sum of one tenth of one mill on the dollar annually on all the taxable property of said municipality, and the needed amount shall be each year certified by said commissioners to the assessor, and assessors of said municipality, and be assessed and raised as other taxes.

SEC. 6. *And be it enacted*, That this act shall take effect immediately.

Approved March 28, 1893.

Under chapter 169, section 97, of the laws of 1899, this act was repealed in so far as it related to or affected townships.

This act was amended in the years 1905 and 1906 so as to extend the jurisdiction of the shade-tree commissions over the public parks, and

to give the commissions the power to pass ordinances for the protection of shade trees on the public streets and in the public parks.

[Laws of New Jersey of 1905.]

CHAPTER 108.

A supplement to an act entitled, "An act to provide for the planting and care of shade trees on the highways of the municipalities of this State," approved March twenty-eighth, one thousand eight hundred and ninety-three.

Be it enacted by the Senate and General Assembly of the State of New Jersey:

SECTION 1. In any municipality which now has or hereafter shall take advantage of the act to which this is a supplement the commission appointed under the provisions thereof shall have exclusive control over the public parks belonging to or under the control of such municipality, or any department in the government thereof, with full power and authority to improve, repair, manage, maintain, and control the same.

SEC. 2. The said commission shall have full power and authority and is hereby empowered to pass, enact, alter, amend, and repeal ordinances for the protection, regulation, and control of such parks, and the trees, flowers, shrubs, statuary therein, and also for the protection, regulation, and control of all shade trees planted or growing upon the public highways of any such municipality, and to prescribe fines and penalties for the violation thereof and fix the amount of the same; the method now in use for the passing, enacting, altering, amending, and publishing ordinances in said municipality shall be the method used to pass, enact, alter, amend, repeal, and publish the ordinances therein mentioned.

SEC. 3. All moneys collected from fines or penalties for the violation of any ordinances of any such commission, and all moneys collected for assessments made upon the property for the cost of planting and transplanting any trees; and the boxes or guards for the protection thereof in any such city, shall be forthwith paid over to the proper municipal authorities and shall be placed to the credit of the said commission and subject to be drawn upon by the said commission in the manner provided by law for the payments of moneys in any such municipality.

SEC. 4. All acts and parts of acts inconsistent with this act are hereby repealed.

SEC. 5. This act shall take effect immediately.

Approved April 6, 1905.

[Laws of New Jersey of 1906.]

CHAPTER 186.

A supplement to an act entitled "An act to provide for the planting and care of shade trees on the highways of the municipalities of this State, approved March twenty-eighth, one thousand eight hundred and ninety-three."

Be it enacted by the Senate and General Assembly of the State of New Jersey:

SECTION 1. The said commission may prescribe penalties for the violation of any of their ordinances, and the courts which now or hereafter shall have jurisdiction over actions for the violation of ordinances of the municipality in which said commission has been or shall be appointed shall have jurisdiction in actions for the violation of such ordinances as the said commission shall enact; and said ordinances shall be enforced by like proceedings and processes, and the practice for the enforcement of said ordinances shall be the same as that provided by law for the enforcement of the ordinances of the municipality in which such commission exists.

SEC. 2. The officers authorized by law to serve and execute processes in the courts, as aforesaid, shall be the officers to serve and execute any process issued out of any court under this act.

SEC. 3. A copy of any ordinance or ordinances of said commission certified to under the hand of the clerk, secretary, or president of the said commission, shall be taken in any court of this state as full and legal proof of the existence of such ordinance or ordinances, and that all requirements of law in relation to the ordain-

ing, publishing, and making of the same, so as to make it legal and binding, have been complied with, unless the contrary be shown.

SEC. 4. This act shall take effect immediately.

Approved May 2, 1906.

[Laws of New Jersey of 1906.]

CHAPTER 245.

An act in relation to the control of public parks belonging to or under the control of any municipality of this state or any department in the government thereof.

Be it enacted by the Senate and General Assembly of the State of New Jersey:

SECTION 1. In any municipality which now has or hereafter shall take advantage of an act entitled "An act to provide for the planting and care of shade trees on the highways of the municipalities of this state, approved March twenty-eighth, one thousand eight hundred and ninety-three," the commission appointed under the provisions of said act shall have exclusive control of the public parks belonging to or under the control of such municipality or any department in the government thereof, with full power and authority to improve, repair, manage, maintain, and control the same.

SEC. 2. The said commission shall have full power and authority and is hereby empowered to pass, enact, alter, amend, and repeal ordinances for the protection, regulation, and control of such parks and the trees, flowers, shrubs, statuary, and other improvements therein, and to prescribe fines and penalties for the violation thereof and to fix the amount of the same. The method now or hereafter in use for the passing, enacting, altering, amending, repealing, and publishing ordinances in said municipality shall be the method used to pass, enact, alter, amend, repeal, and publish the ordinances herein mentioned, and said ordinances shall be enforced in the manner provided at the time of said enforcement by law for the enforcement of the ordinances of the commission authorized by the aforesaid act and any amendments or supplements thereof.

SEC. 3. This act shall take effect immediately.

Approved May 17, 1906.

In the years 1907, 1908 and 1910 the shade-tree law of 1893 was further amended. Under chapter 156 of the laws of 1907, section 1 was amended, making it optional with the governing body of any municipality to increase the number of members of the commission to five. Chapter 151 of the laws of 1908 amended section 2 so as to make it "optional with the body or board having charge of the finances of any municipality" whether the act of 1893 shall become effective. Under chapter 198 of the laws of 1908 and chapter 167 of the laws of 1910, the law of 1893 was amended as follows: "In any city or town in this state in which a park commission now exists, the governing body invested with the power of adopting the act to which this is a supplement, may, in the resolution adopting said act, provide that the said park commission shall also act as a shade-tree commission; and the act to which this is a supplement, and the amendments thereof and supplements thereto, shall take effect in said city or town, except that no independent shade-tree commission shall be appointed."

PENNSYLVANIA.

[Laws of Pennsylvania, Session of 1907.]

An act to provide for the planting and care of shade tree, on highways of townships of the first class, boroughs, and cities of the commonwealth of Pennsylvania, and providing for the cost thereof.

SECTION 1. *Be it enacted, etc.*, That in townships of the first class, boroughs, and cities of commonwealth of Pennsylvania there may be appointed, in the manner hereinafter provided, a commission of three freeholders, to be known and designated as the shade-tree commission of said township, borough, or city, who shall serve without compensation, and who shall have exclusive and absolute custody and control of, and power to plant, set out, remove, maintain, protect, and care for shade trees, on any of the public highways of the said townships, boroughs, and cities, the cost thereof to be provided for in the manner hereinafter stated; *provided*, that in townships, boroughs, or cities in which a commission for the care of public parks shall have been created, said commission shall, upon the acceptance of this act as provided in section two, be charged with the duties of the commission as above provided, and shall, for that purpose, be possessed of all the powers herein mentioned and granted.

SEC. 2. The commissioners of any township of the first class, or the council of any borough or city, in case of the commissioners, or by joint resolution in the case of the councils, accept the provisions of this act; and when such majority vote or joint resolution shall have been duly passed and approved, and such shade-tree commissioners appointed, or, in their stead, the duties and powers herein provided have been devolved upon an existing park commission, then, from that time and in that event, this act and all its provisions shall be in full force and application in such township of the first class, borough, or city, so accepting; and such commissioners shall be appointed, for terms of three, four and five years, respectively, and, on the expiration of any term, the new appointment shall be for five years, and any vacancies shall be filled for the unexpired term only; and in townships of the first class the said appointment shall be made by the commissioners thereof; and in boroughs, by the chief burgess, and in cities, by the mayor thereof; *provided*, that in cities where a commission exists for the care of public parks, the term and appointment of such commission shall not be changed by this act, but shall be and remain as provided by the act of the assembly, and by the ordinance of councils creating such commission for the care and maintenance of public parks. And such shade-tree commission shall, twice in every year, report in full its transactions and expenditures for the municipal fiscal year then last ended, to the authority under and by which it was appointed; *provided*, that an existing park commission, acting under this enactment, may embody its report in its regular report to the councils, as by law or ordinance provided.

SEC. 3. That when such shade-tree commissioners, or park commissioners so acting, shall propose the setting out or planting or removing of any shade trees, or the material changing of the same in any highway, they shall give public notice of the time and place appointed for the meeting at which such contemplated work is to be considered, specifying in detail the highways, or portion thereof, upon which trees are proposed to be planted, removed, or changed, in one or more—not exceeding two in all—of the newspapers published in said township, borough, or city once each week for at least two weeks prior to the date of said meeting.

SEC. 4. The cost of planting, transplanting, or removing any trees in any highway, and of suitable guards, curbing, or grating for the protection thereof when necessary, and of the proper replacing of any pavement or sidewalk necessarily disturbed in the doing of such work, shall be borne by the owner of the real estate in front of which such trees are planted, set out, or removed; and the cost thereof as to each tract of real estate shall be certified by the commissioners to the township commissioners, or to the presidents of the councils in boroughs and cities, and also to the person having charge of the collection of taxes, for the said township, borough, or city; and upon the filing of said certificates, the amount of the cost of such improvements, of which notice shall also be given to each property owner involved,

accompanied with a copy of the aforesaid certificate, together with a notice of the time and place for payment, shall be and become a lien upon said real estate, in front of which said trees have been planted, set out, or removed; said lien to be collectible, if not paid in accordance with notice as herein provided, in the same manner as other liens for taxes are now collectible against the property involved.

SEC. 5. The cost and expense of caring for said trees after having been planted or set out, and the expense of publishing the notices provided for in section three, shall be borne and paid for by a general tax, to be levied annually in the manner that taxes for township, borough, and city purposes are now levied in such townships of the first class, boroughs, or cities; such tax not to exceed the sum of one tenth of one mill on the dollar on the assessed valuation of the property in such townships of the first class, boroughs or cities; and the needed amount shall each year, in due time be certified by the shade-tree commissioners to the proper authorities charged with the assessment of taxes in said townships, boroughs, or cities, to be assessed and paid as other taxes are assessed and paid, and to be drawn against as required by said commissioners, in the same manner as moneys appropriated for township, borough, or city purposes are now drawn against in said townships, boroughs, or cities; *provided*, that the commissioners of any township of the first class, and the councils of any borough or city, accepting the provisions of this act, may provide for the expenses of the maintenance of trees on highways, in accordance with the provisions of this section by actual appropriation, equal to the amount certified to be required by the said commission, in lieu of the specific assessment above authorized.

SEC. 6. The commission, under which the provisions of this act shall be carried out, in any township of the first class, borough, or city, shall have power to employ and pay such superintendents, engineers, foresters, tree wardens, or other assistants, as the proper performance of the duties devolving upon it shall require; and to make, publish, and enforce regulations for the care of, and to prevent injury to the trees, on the highways of any township, borough, or city accepting the provisions of this act; and to assess suitable fines and penalties for violations of this act, provided such regulations shall have been published at least twice in one or more, not exceeding two, newspapers of the township, borough, or city involved, after having been submitted to and being approved by the commissioners of the township of the first class, or the councils of the borough or city affected; and such fines and penalties, so assessed for violations of this act, shall become liens upon the real property of the offender, and be collectible by the constituted authorities as liens for taxes upon real property are now collected.

SEC. 7. All the moneys due and collected from fines or penalties or assessments, in consequence of the acts of said shade-tree commission in enforcing this act, shall be paid to the treasurers of the townships, boroughs, and cities accepting its provisions, and shall be placed to the credit of said commission, subject to be drawn upon by the said commission for the purposes of this act.

SEC. 8. All acts and parts of acts inconsistent with this act are hereby repealed.

SEC. 9. This act shall take effect immediately; but its provisions shall not be and become binding upon any township, borough, or city until it has been duly accepted, as provided in section two.

Approved the thirty-first day of May, A. D. 1907.