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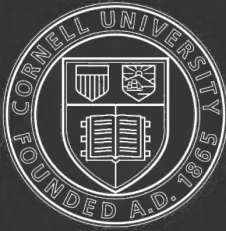
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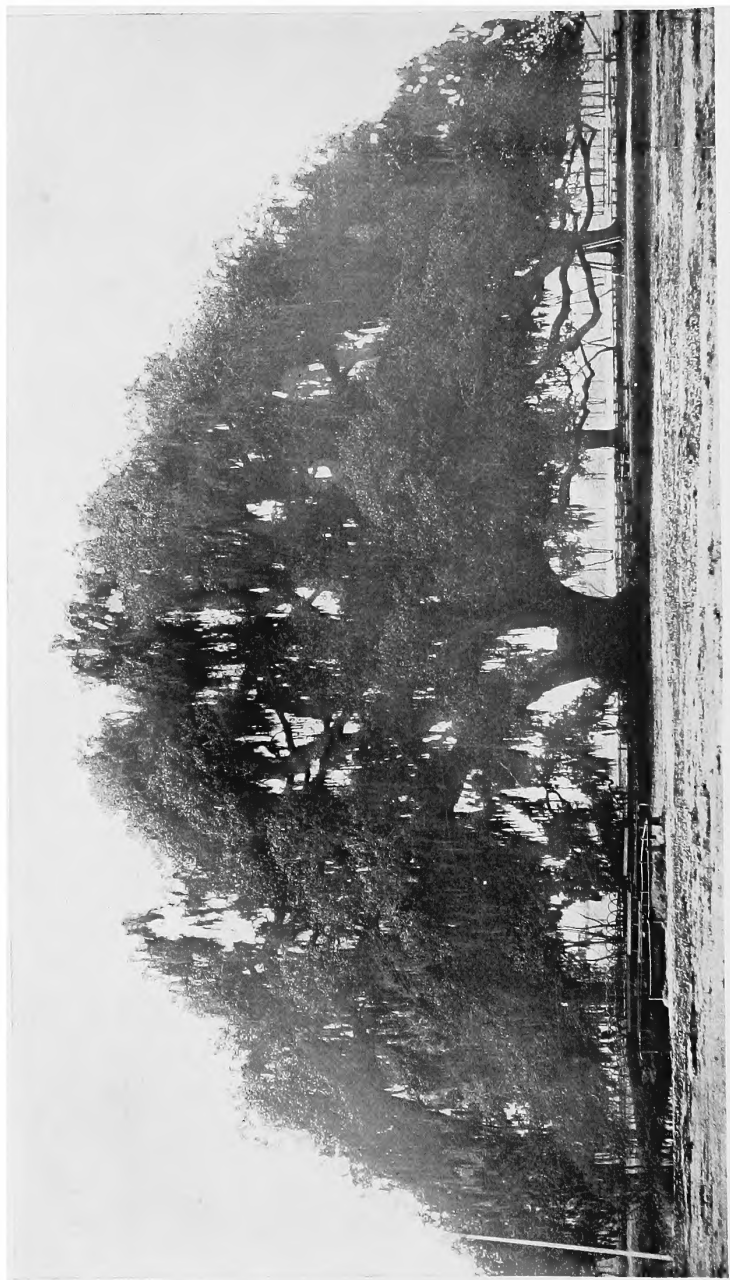
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Live Oak (*Quercus virginiana*), Louisiana.

THE
PRINCIPAL SPECIES OF WOOD:

THEIR CHARACTERISTIC PROPERTIES.

BY

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Member of the American Society of Civil Engineers, etc.*

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PREFACE.

THE following is a brief untechnical presentation of general features characterizing economically important species of wood. It is the result of notes originally brought together from many already existing sources and later augmented, and verified so far as possible for the present use, by personal observation. The work of preparation has not been as simple as the result would indicate, and although great care has been taken to check each fact, errors do no doubt exist, although it is not believed that there are important ones.

Engineers while writing upon woods have, save exceptionally, emphasized strength beyond most other properties. Other works for expert foresters or botanists are of necessity too special, voluminous, fragmental, or technical for the casual student. Some popular books on trees, as distinct from woods, are available. The present form is distinct from these and is intended for those who are not foresters or botanists, but who use woods or desire knowledge of their distinguishing properties. Allusions to trees, historical and other references, aside from those directly regarding woods, are made for completeness and in order to mark, distinguish, or separate the species.

Acknowledgments are particularly due to the publications of the U. S. Division of Forestry, to Prof. Sargent's studies as set forth in Vol. IX of the Tenth U. S. Census, to Dr. B. E. Fernow, to Mr. Raphael G. Zon for suggestions and for technical revision, to the *Northwestern Lumberman* and other trade

journals, to many dealers, who have been uniform in their courtesy, and incidentally to Mr. Morris K. Jesup, whose magnificent collection of woods at the New York Museum of Natural History has been available to the writer as to others. These, with other sources of information acknowledged by the writer, and suggested to others, are suitably arranged in the following list. Of the 155 illustrations, 138 are original, the drawings having been prepared under the supervision of the writer from actual specimens by Mr. Irving T. Worthy of Cornell University and several students of New York University, and the photographs by Mr. John Hopfengartner, Jr., of Westchester, New York City. Other illustrations are, so far as possible, acknowledged in place.

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COLOR, APPEARANCE OR GRAIN OF WOOD.

Jesup Collection at Museum of Natural History, New York City; Hough's American Woods (sections).

STRUCTURAL QUALITIES AND USES OF WOODS.

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AMERICAN SPECIES.

See foot-notes to species in question.

FOREIGN SPECIES.

Thos. Lazlett's "Timber and Timber Trees"; Report on Forests of Western Australia by J Ednie Brown; Catalogue Kew Botanical Gardens, London; Works Baron Ferd. von Mueller; "American Lumber in Foreign Markets" (Special Consular Reports, Vol. XI, U. S. State Dept.); *Stevenson's "Trees of Commerce"*; also see foot-notes, species in question.

GENERAL.

"*Forestry for Farmers*," *Fernow*, and other U. S. Forestry Division Publications, Vol. IX, Tenth U. S. Census; *Hough's American Woods (text)*; The Forester; The Northwestern Lumberman; The (New Orleans) Lumber Trade Journal; The New York Lumber Trade Journal; The Timber Trades Journal (London); "Lumber Trade of U. S." (Bureau Statistics U. S. Treas. Dept.); Trees in Winter, Huntington.

HISTORICAL.

Brockhaus, *Konversations-Lexikon*; Pliny, etc.

MEDICINAL PROPERTIES.

U. S. Dispensatory.

Books particularly useful to beginners are in italics. Names are repeated when books could not be particularly classed under one heading. Also see foot-notes under subjects in questions.

THE PRINCIPAL SPECIES OF WOOD.

INTRODUCTION.

A TREE has been defined as a woody plant that produces naturally and in its native place one principal erect stem with a definite crown of foliage. A plant thus attaining to the dignity of a tree is said to be arborescent.*

There are nearly five hundred distinct species of trees growing in the United States,† as well as many others peculiar to other countries, yet the great mass of wood everywhere utilized is derived from comparatively few of them.‡ Many woods will be more generally employed as their valuable properties become more familiar or as the supplies of wood now utilized continue to diminish.

The same tree is often called by different common names in different places. Nearly thirty names are thus applied to the longleaf pine (*Pinus palustris*). Such confusion can be avoided only by regarding the recognized botanical nomenclature.

The botanical name of a plant consists of two principal terms denoting genus and species. *Quercus*, for example, is

* Fernow, Introduction to U. S. Forestry Bul. No. 17.

† Dr. Fernow credits 495 trees to United States (Introduction to U. S. Forestry Bul. No. 17); Prof. Sargent, counting species only and excluding varieties, gives 422 (*Silva of North America*).

‡ "The principal timbers of commerce in the United States are the species known popularly as pine, fir, oak, hickory, hemlock, ash, poplar, maple, cypress, spruce, cedar, and walnut." ("The Lumber Trade of the United States," Treas. Dept., Bureau of Statistics.)

the generic name including all species of oak. *Alba*, *rubra*, and others are specific names denoting the said species. *Quercus alba* and *Quercus rubra* are completed terms. Genera are not fixed but differ with authorities, so that the abbreviated name of the botanist responsible for the classification adopted is often added, as *Quercus alba* Linn. and *Ulmus fulva* Michx.

A species is a collection of individuals that might well have sprung from some single root. A genus is a collection of related species. Genera are gathered into families. Families and genera differ with authorities. A variety includes individuals differing slightly from accepted species. Its name when existing is part of the specific name. "*Quercus robur* var. *pedunculata*" specifies a variety (*pedunculata*) of "red" or strong (*robur*) oak (*Quercus*). A variety of one botanist is sometimes a distinct species of another.

The size and character of the trunk, and the range, locality, or distribution of the tree, have much to do with the utility of the wood, since large or perfect timbers cannot be derived from species characterized by small or crooked trees, and since wood is always more used if it is widely distributed so as to be easily available.*

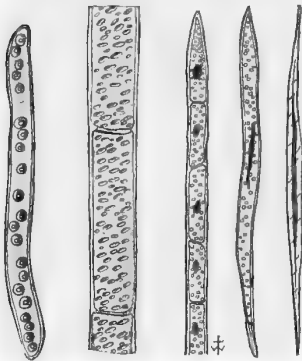


FIG. 1.—SOME WOOD ELEMENTS.

end with others of its kind; the pith-ray; the resin-duct, and others,—all of which are often popularly referred to as fibres.

* Fossils show that many species covered wider ranges than at present.

The character and the arrangement of cell-structures differ with species. Wood is hard, soft, light, heavy, tough, porous, elastic, or otherwise, because of these differences. Appearance is affected, and woods may be distinguished from one another, because of this fact.*

Most wood is used in "construction," that is, in mines, railways, houses, and ships, where demand is for size or quantity, and where finish and appearance amount to but little. Much wood is used in decoration and furniture, where appearance, appropriateness, and finish are called for; but these woods, although much in evidence, are infinitely less in quantity than those employed in construction. Some wood is required for implements, turnery, carvings, and small-piece work, where size is secondary and where qualities such as hardness, fine grain, and uniformity, controllable in small pieces, are primary. Some wood is used indirectly, as in the manufacture of paper-pulp, gunpowder, and chemicals. There are also by-products of trees, such as tanbark, turpentine, resin, nuts, and sugar.

The weight, strength, and other measurable properties of wood are variable. Weight varies from day to day as water is absorbed and evaporated. Strength differs with grain, age, moisture, specific gravity, and many other things. Two pieces from different portions of the same tree differ from each other. The proportions of sap and heart wood are seldom constant. Results from small specimens may differ from those obtained from larger ones.† The botanical accuracy of a specimen is not always certain, therefore figures relating to the physical properties of wood should be employed with greater caution than those relating to the more homogeneous metals.

Many of the experiments conducted to establish statements regarding the physical properties of wood have been defective

* Roth, U. S. Forestry Bul. No. 10, pp. 64-71. Also von Schrenk, U. S. Dept. Agriculture, Bureau Plant Industry Bul. No. 14, pp. 12-16.

† Only because imperfections are more likely in larger pieces. Large and small pieces of equally perfect wood are equally strong. (See Publications U. S. Forestry Div. and J. B. Johnson's "Materials of Construction," p. 462.)

in that while the conclusions were correct as applied to the specimens immediately studied, such specimens did not stand for the species at large. The recognition of difficulties, the selection of specimens, the scientific standardizing of methods so that results could be generally utilized, as distinct from the simple manipulation of specimens in testing-machines, have not been exhaustively attempted until recently.*

The experiments that have been made to determine the strength of woods may be grouped into the four following divisions:

(1) Experiments conducted by the U. S. Division of Forestry (Dr. B. E. Fernow, Chief), under the direction of Professor J. B. Johnson. About forty thousand tests were made, distributed over thirty-one American species, the results, so far as obtained, being undoubtedly the most valuable in existence. The detail considered and methods evolved have in a way reclassified the testing of woods and must influence all future efforts, but results are disappointing in that they have been obtained for so few species, and some of these of commercially secondary importance. These experiments are characterized as follows:

Completeness and Reliability of Records.
 Large and Small Test Pieces.
 Moisture Conditions Standardized at 12% Dry Weight.
 Samples from Representative Portions of Tree.
 Selection of Representative Trees.
 Uniformity of Methods.
 Large Number of Individual and Total Tests.
 Small Number of Species Covered.
 Specific Gravity Determinations.
 Soil and Forest Conditions Indicated.
 Botanical Accuracy Assured.

These experiments are originally described in Circular No. 15 and other publications of the U. S. Forestry Division, also in "Materials of Construction," by Professor J. B. Johnson.

(2) Experiments conducted for the Tenth U. S. Census by Mr. J. P. Sharpless at the Watertown (Mass.) Arsenal upon specimens botanically selected by Professor Sargent. These experiments are less complete in detail, and averages are based upon infinitely

* It should be noted that the selection and preparation of specimens require the exercise of more judgment than the simple testing of specimens, if the conclusions are to be such that they can be generalized from.

fewer tests for each species. So far as known most specimens were from butts. Nothing is known of moisture conditions save that specimens were "carefully seasoned." Tests were upon about twelve hundred specimens divided over four hundred and twelve species, allowing but a small number for each. The series is most valuable in that the species attempted were so numerous as to present an almost complete American series; in that the botanical identity of the specimens was beyond question, and because it gives a general idea of relative values. The results are frequently quoted and appear on the accompanying pages in spaces immediately following those occupied by, or set apart for, "Forestry" figures or their alternates. The tests are characterized as follows:

- Botanical Accuracy Assured.
- Specific Gravity Determinations.
- Uniformity of Methods.
- Limited Number of Individuals and Total Tests.
- Large Number of Species Covered.
- Small Test Pieces Only.
- Selection and Moisture Conditions Indefinite.

They are originally described in Vol. IX, Tenth U. S. Census; Executive Document No. 5, Forty-eighth Congress, First Session; in Catalogue of the "Jesup Collection," by Professor C. S. Sargent, and elsewhere.

(3) Experiments conducted upon full-sized pieces. The most reliable investigations under this head were either conducted by Professor Lanza, of the Massachusetts Institute of Technology, or else are noted by him in his work, "Applied Mechanics" (ed. 1895, pp. 673-711). They are valuable in that specimens were selected on a commercial rather than on a scientific basis. Professor Lanza claims that such actual pieces are less perfect and show approximately one half the unit strength developed by the more carefully selected smaller specimens. These experiments are characterized as follows:

- Life-sized Specimens.
- Miscellaneous Selections as if for Practical Construction.
- Moisture and Other Data Indefinite.

(4) All other experiments. Many experiments have been made from time to time which, while valuable, are not distinguished by any particular method or principle, such as separate the investigations noted in the preceding articles. Data as to selection of specimens, moisture, and other conditions are either incomplete or else absolutely lacking. Such tests are referred to as are noted in works of Hatfield, Trautwein, Lazlett, Rankine, Thurston, and others. Some of these series are exceedingly valuable comparatively. Professor Rankine and Mr. Lazlett experimented principally upon foreign woods.

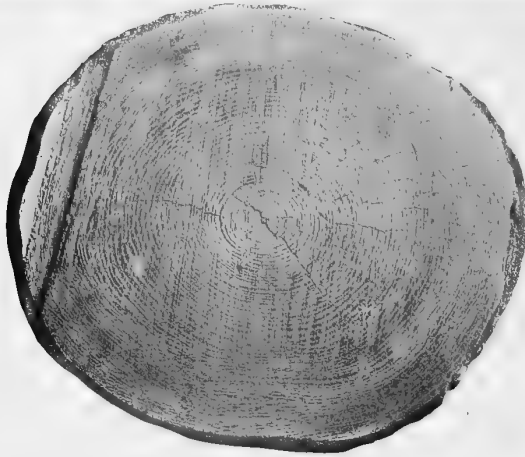
The figures established by the United States Division of Forestry and alluded to in item 1, page 4, appear, so far as they exist, upon the following pages. Where they do not exist, the leading spaces set apart for them are left vacant for other insertions as preferred. All coefficients are in pounds per square inch. Fractions of pounds in weight and lower figures in coefficients have been omitted as superfluous.

It is not always easy to determine the species of living trees, because forms in the forest differ from those in the open, because bark varies with age, and because fruit and leaves of many trees are lacking in the winter. It is easier to tell genus than species—that a tree is an oak, than whether it is a red or a pin oak. Experience is required in this connection.

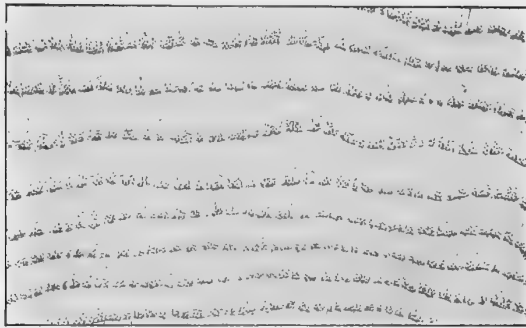
Trees are divided into two general divisions known as Exogens and Endogens.*

* This division coincides with that by which they are separated into Dicotyledons and Monocotyledons.

PLATE 2. EXOGENOUS STRUCTURE IN WOOD.
YEARLY RINGS OR LAYERS.



A section of a Longleaf Pine Tree.



A section of Oak showing "porous" structure in yearly layers. (Natural size.)

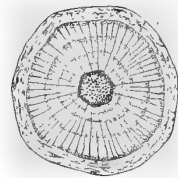


A section of Hard Pine showing "solid" structure in layers. (Natural size.)

EXOGENOUS TREES.

(*Dicotyledons.*)

Exogenous trees are those the trunks of which are built up by rings or layers, each deposited consecutively upon the outside of the others. A section exhibits first a central point or canal known as a pith-cavity, next and consecutively the annual layers, and finally the bark. The woods of this series are familiar to all. The oaks, pines, and practically all of the merchantable lumbers are among them. The forests are widely distributed, and the species are so numerous as to present an almost infinite range of possibilities.



The young wood of exogenous trees is porous. It permits the passage of sap and is known as sapwood (*Alburnum*). As a layer is enclosed by others and retreats from the surface of the tree, it becomes denser, its canals are filled with gums or tannin, color changes, and the result is heartwood (*Duramen*). This change goes forward rapidly in some trees, such as locusts, so that their sections appear to be almost wholly heartwood; other species require longer time, and sapwood then predominates.

Heartwood gives stability to the tree, but is not needed in its physiological processes. It is tougher; heavier, stronger, and more valued in construction. Sapwood is vitally essential to the life of the tree, but is lighter, weaker, less durable, and less valued in construction. Sapwood is pliable, and the sapwoods of several trees are valued for this reason.

Wood-making varies as it takes place in the springtime and in the summer. Consequent differences in the densities

FIG. 2.—SECTION BOX-ELDER, SHOWING PITH-CAVITY AT CENTRE.

of the deposits serve to mark the limits of the yearly rings. Some species, as the oaks and hickories, show pores throughout their spring woods which thus contrast with denser summer growths. Others, as Southern pines, change sharply, and their spring and summer growths appear as solid bands. In even climates, where seasons are not pronounced, growth is more regular and layers correspondingly less definite.*

The cellular structure of wood is principally vertical, a fact that explains the ease with which wood is split up and down. Beside the vertical, there are horizontal cells, that cross the tree, strengthen and bind the vertical cells, and assist in the life-processes of the tree. These horizontal cells form what are known as medullary or pith-rays and appear as simple lines or glistening plates according to the way in which the wood is cut. Woods differ in the size and number of these rays, which are by no means always visible to the eye (see plate 3).

Woods are easy or difficult to work in proportion as their fibres are arranged in a simple or a complicated manner. This is shown in the figures on plate 4. A knife pressed upon

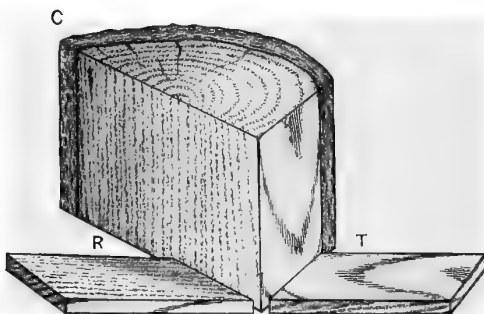
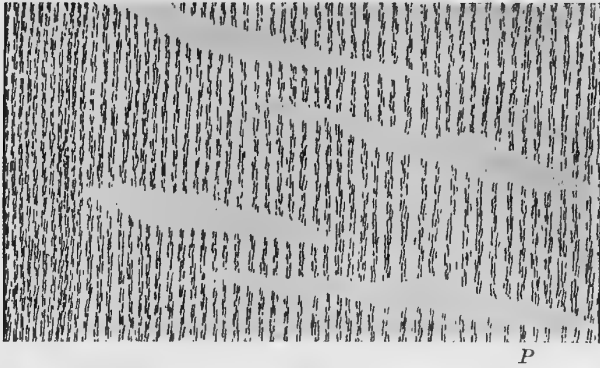
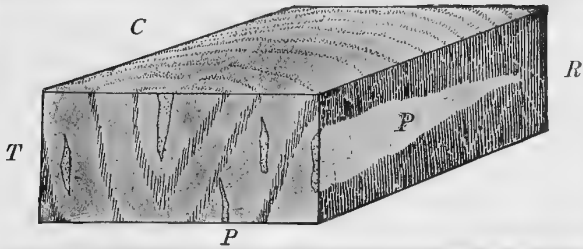


FIG. 3.

the oak must crush or cut into the fibres themselves, whereas with the pine it finds some natural passage between the cells. Wood may be cut so as to develop cross-sections (*C*, Fig. 3), radial sections (*R*), or tangential sections (*T*). The respect-

* Circular No. 16, U. S. Forestry Division.

PLATE 3. EXOGENOUS STRUCTURE IN WOOD.
MEDULLARY OR PITH RAY.



Actual appearances of pith ray, *PP*.

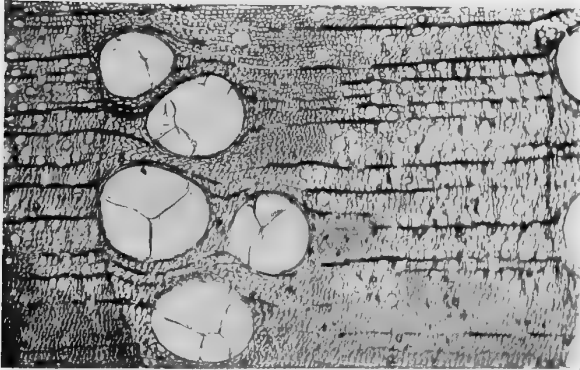
p



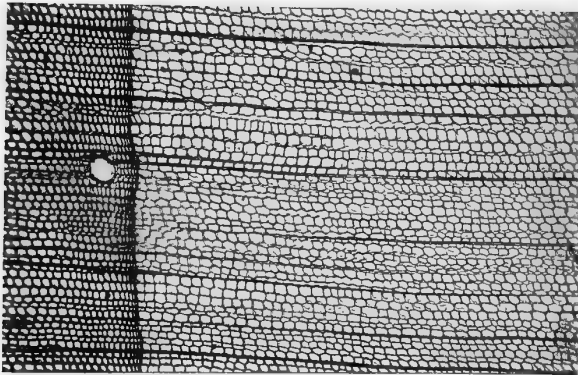
p

Microscopic enlargement of a tangential section of White Oak
showing large pith ray, *pp*.

PLATE 4. EXOGENOUS STRUCTURE IN WOOD.
(CROSS-SECTIONS, ENLARGED.)



Two yearly layers of White Oak. The larger pores were formed in spring, the smaller ones in summer. The small circles are ends of fibres. A knife pressed upon this surface would crush or cut into the cells. The mass would not split or separate evenly.



Two yearly layers of White Pine. The space in the outer or darker one is a resin-duct; the circles are ends of fibres (tracheids); pith rays are noticeable. A knife pressed upon this surface would find easy passage. The mass would separate easily.

ive markings are in a general way indicated on the boards in the figure.

Logs are sometimes sawn into quarters and then into pieces crossing and exposing the yearly rings. (See Fig. 4.) These "quarter-sawn" surfaces are structurally stronger and better, but are, by reason of waste or small pieces, more costly than others. The pith-rays of some woods, such as oaks, are very prominent when split as they are in "quarter-sawing," and the appearance of such woods is consequently improved.*



FIG. 4.

Exogenous trees are divided into broad-leaved trees and needle-leaved conifers. The broad, flat leaves of trees such as oaks and chestnuts gave rise to the former term, while the narrow resinous leaves of the pine and hemlock gave rise to the latter. The woods of the former group are usually referred to as hard woods, although some of them are very soft; those of the latter group are referred to as soft woods, although some of them are very hard. Most, but not all, of the broadleaf trees are deciduous, that is, they change their foliage every year; and most, but not all, of the needleleaf trees are evergreen, that is, the foliage is persistent. Needleleaf trees are also known as conifers, that is, cone-bearers.

It is usual to associate the terms broadleaf, deciduous, and hard wood; and likewise the terms needleleaf, conifer, evergreen, and soft wood. While generally correct, this is, as seen, not always so. A better division is into broadleaf trees or woods, and needleleaf conifers.

* Some woods, as birdseye maple, are well developed by the rotary cut. A revolving log is advanced against a tool which pares a broad thin ribbon suitable for veneered work.

BROADLEAF WOODS.

The trees affording these woods are found in natural forests and under cultivation in nearly every portion of the globe. The histories of some of them extend back to very remote periods. Their woods were the principal ones in construction until the advent of American soft woods. The oaks, elms, maples, and other so-called hard woods are of this group.

Broadleaf woods are characterized by complex fibre conditions, absence of resins, and greater weights.* They are composed of several kinds of cells and fibres, arranged without the regularity so noticeable in the conifers. Cross-sections exhibit numerous, often easily visible pores, arranged in zones or scattered throughout the rings (see plate 2). Pith-rays are numerous and more or less conspicuous, save in softer hard woods such as poplar. Woods are difficult to work in proportion as they are complicated in structure. The numerous members of the group vary from one another and present an extensive range of properties. Trees do not usually afford large pieces. Woods for cabinet work, implements, and other fine purposes are from this group. The total requirement is less than for needleleaf woods.

The leaves of broadleaf trees are easily distinguished from the resinous, usually evergreen ones of the conifers. Most of them are deciduous, that is, shed every season, although some are persistent, that is, "evergreen." "Broadleaf," "deciduous," and "hardwood" trees are the same.

* Neither resin-ducts nor resin exists in these woods, save sometimes in buds and leaves.

PLATE 5. WHITE OAK (*Quercus alba*).



White Oak.*Quercus alba* Linn.

Nomenclature.

White Oak (general). Stave Oak (Ark.).

Locality.

Widespread, north-central and eastern United States.

Features of Tree.

Seventy-five to one hundred feet in height. Three to six feet in diameter, fine shape and appearance. Grayish-white bark. Comparatively sweet ovoid oblong acorns in rough shallow cups. Rounded lobes or projections to leaves.

Color, Grain, or Appearance of Wood.

Heartwood brown with sapwood lighter. Annual layers well marked.

Medullary rays broad and prominent.

Structural Qualities of Wood.

Tough, strong, heavy, hard, liable to check unless seasoned with care. Durable in contact with the soil. Receives a high polish.

Representative Uses of Wood.

Ship-building, construction, cooperage, cabinet-making, railway ties, fuel, etc. Bark is rich in tannin.

Weight of Seasoned Wood in Pounds per Cubic Foot.

50 (U. S. Forestry Div.).*

46.

Modulus of Elasticity.

2,090,000 (average of 218 tests by U. S. Forestry Div.).*

1,380,000.

Modulus of Rupture.

13,100 (average of 218 tests by U. S. Forestry Div.).*

12,800.

Remarks.

A tree of the first economic importance. The most widely employed of all American oaks. Name refers to appearance of bark. The supply diminishing because of value of timber, also the sweetness of nuts cause them to be eaten by animals.

* See page 6.

Cow Oak.*Quercus michauxii* Nutt.

Nomenclature. (Sudworth.)

Cow Oak (local and common name). Swamp White Oak (Del., Ala.).

Basket Oak (Ala., Miss., La., Tex., Ark.). Swamp Chestnut Oak (Fla.).

Locality.

Southeastern United States, Delaware and Florida, westward along Gulf to Texas. Also southern Indiana and Illinois to Gulf. Best on rich bottoms in Arkansas and Louisiana.

Features of Tree.

Seventy-five to one hundred feet in height. Three to six feet in diameter, rough, light-gray bark with loose scaly ridges.

Color, Appearance, or Grain of Wood.

Heartwood light brown, light buff sapwood,, conspicuous medullary rays, close-grained.

Structural Qualities of Wood.

Hard, heavy, very strong, tough, durable, easily split.

Representative Uses of Wood.

Construction, agricultural implements, wheel stock.

Weight of Seasoned Wood in Pounds per Cubic Foot.

46 (U. S. Forestry Div.).*

50.

Modulus of Elasticity.

1,610,000 (average of 256 tests by U. S. Forestry Div.).*

1,370,000.

Modulus of Rupture.

11,500 (average of 256 tests by U. S. Forestry Div.).*

15,800.

Remarks.

The principal white oak of Southern States; edible acorns devoured by cattle, whence its name.

* See page 6.

Chestnut Oak. *Quercus prinus* Linn.

Nomenclature. (Sudworth.)

Chestnut Oak (local and common name).	Tanbark Oak (N. C.).
Rock Oak (N. Y., Del., Pa.).	Swamp Chestnut Oak (N. C.).
Rock Chestnut Oak (Mass., R. I., Pa., Del., Ala.).	Mountain Oak (Ala.).

Locality.

Maine to Georgia, westward intermittently to Kentucky and Alabama. Best development in southern Alleghany Mountain region.

Features of Tree.

Seventy-five to eighty feet in height, three or four feet in diameter. Leaves resemble those of chestnut.

Color, Appearance, or Grain of Wood.

Heartwood dark brown, sapwood lighter, close-grained, medullary rays conspicuous.

Structural Qualities of Wood.

Heavy, tough, hard, strong, and durable in contact with soil.

Representative Uses of Wood.

Largely used for railway ties. Bark rich in tannin.

Weight of Seasoned Wood in Pounds per Cubic Foot.

46.

Modulus of Elasticity.

1,780,000.

Modulus of Rupture.

14,600.

Remarks.

Prinus is a Greek name applied to a species of oak.

Post Oak. { *Quercus minor* Sargent,
 { *Quercus obtusiloba* Michx.

Nomenclature. (Sudworth.)

Post Oak (local and common name).	Overcup Oak (Fla.).
Iron Oak (Del., Miss., Neb.).	White Oak (Ky., Ind.).
Box White Oak (R. I.).	Box Oak (Md.).
Chêne étoilé (Quebec).	Brash Oak (Md.).

Locality.

East of Rocky Mountains—Massachusetts to northern Florida, westward intermittently to Nebraska and Gulf States.

Features of Tree.

Fifty to seventy feet in height, two to three feet in diameter. Low shrub in Florida. Blunt lobes or projections to leaves. Leaves clustered at ends of branches. Fine tree with rounded top.

Color, Appearance, or Grain of Wood.

Heartwood light or dark brown with lighter sapwood. Close-grained, annual rings well marked. Numerous and conspicuous medullary rays.

Structural Qualities of Wood.

Heavy, hard, strong, checks badly in drying. Durable in contact with soil.

Representative Uses of Wood.

Largely used, particularly in Southwest, for fencing, railway ties, and fuel; also for cooperage, construction, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

50 (U. S. Forestry Div.)*
52.

Modulus of Elasticity.

2,030,000 (average of 49 tests by U. S. Forestry Div.)*
1,180,000.

Modulus of Rupture.

12,300 (average of 49 tests by U. S. Forestry Div.)*
12,900.

Remarks.

Most common and widely distributed oak in Gulf States west of the Mississippi River. *Obtusiloba*, the Latin for blunt-lobed, refers to the shapes of the leaves. Wood seldom commercially distinguished from white oak.

* See page 6.

Bur Oak. *Quercus macrocarpa Michx.*

Nomenclature. (Sudworth.)

Bur Oak (local and common name).	Mossycup Oak (Mass., Pa., Del., Miss., La., Tex., Ark., Ill., Iowa, Neb., Kan.).
Overcup Oak (R. I., Del., Pa., Miss., La., Ill., Minn.).	Scrub Oak (Neb., Minn.).
Mossycup White Oak (Minn.).	Overcup White Oak (Vt.).

Locality.

New Brunswick, New England, westward intermittently to Montana and Texas.

Features of Tree.

Seventy to one hundred and thirty feet in height, five to seven feet in diameter. Deep opposite depressions to leaves. Mossy, fringed border at top of acorn-cup. Corky wings on young branches.

Color, Appearance, or Grain of Wood.

Heartwood rich brown, sapwood lighter, close-grained, broad conspicuous medullary rays.

Structural Qualities of Wood.

Heavy, hard, strong, tough, very durable in contact with ground.

Representative Uses of Wood.

Similar to those of *Quercus alba*.

Weight of Seasoned Wood in Pounds per Cubic Foot.

46.00.

Modulus of Elasticity.

1,320,000.

Modulus of Rupture.

13,900.

Remarks.

Extends farthest west and northwest of any other Eastern oak. Especially recommended for prairie planting.

White Oak. *Quercus garryana Douglas.*

Nomenclature. (Sudworth.)

White Oak (Cal., Oreg.). Oregon White Oak (Cal.).

Pacific Post Oak (Oreg.). California Post Oak.

Western White Oak (Oreg.).

Locality.

Pacific coast, British Columbia into California.

Features of Tree.

Sixty to ninety feet high, one and one half to two and one half feet in diameter. A small shrub at high elevations.

Color, Appearance, or Grain of Wood.

Heartwood light brown or yellow. Sapwood lighter, often nearly white. Compact structure. Distinctly marked annual rings. Medullary rays often conspicuous.

Structural Qualities of Wood.

Heavy, strong, hard, tough.

Representative Uses of Wood.

Ship-building, carriages, furniture, indoor decoration, fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

46.

Modulus of Elasticity.

1,150,000.

Modulus of Rupture.

12,400.

Remarks.

Locally important. The best substitute for Eastern White Oak produced on Pacific coast.

Red Oak.*Quercus rubra* Linn.

Nomenclature. (Sudworth.)

Red Oak (local and common name).

Black Oak (Vt., Conn., N. Y., Wis., Ia., Neb., So. Dak., Ont.).

Spanish Oak (Pa., N. C.).

Locality.

East of Rocky Mountains, Nova Scotia to Georgia, westward intermittently to Nebraska and Kansas, best in Massachusetts.

Features of Tree.

Ninety to one hundred feet in height. Three to six feet and over in diameter, brownish-gray bark smooth on branches. Leaves have sharp-pointed lobes, very large acorns in flat shallow cups. A fine complete tree.

Color, Appearance, or Grain of Wood.

Heartwood light brown or red, sapwood darker, coarse-grained, well-marked annual rings, medullary rays few but broad.

Structural Qualities of wood.

Heavy, hard, strong, inclined to check in drying, acid, inferior to white oak.

Representative Uses of Wood.

Works of secondary importance, clapboards, cooperage, fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

45 (U. S. Forestry Div.).*

40.

Modulus of Elasticity.

1,970,000 (average of 57 tests by U. S. Forestry Div.).*

1,600,000.

Modulus of Rupture.

11,400 (average of 57 tests by U. S. Forestry Div.).*

140,000.

Remarks.

Grows more rapidly than other oaks. Bark used in tanning.

* See page 6.

Pin Oak. *Quercus palustris* Muenchh.

Nomenclature. (Sudworth.)

Pin Oak (local and common name).	Water Oak (R. I., Ill.).
Swamp Spanish Oak (Ark., Kan.).	Swamp Oak (Pa., Ohio, Kans.).
	Water Spanish Oak (Ark.).

Locality.

Minnesota to Kansas, eastward intermittently to Massachusetts and Virginia.

Features of Tree.

Fifty to eighty feet in height, two to four feet in diameter. Full-rounded or pyramidal top, smooth thin bark, numerous small pin-like branches.

Color, Appearance, or Grain of Wood.

Heartwood variegated light brown, sapwood nearly white, coarse-grained, medullary rays numerous and conspicuous.

Structural Qualities of Wood.

Heavy, hard, strong, checks badly in seasoning.

Representative Uses of Wood.

Shingles, clapboards, construction, interior finish, cooperage.

Weight of Seasoned Wood in Pounds per Cubic Foot.

43.

Modulus of Elasticity.

1,500,000.

Modulus of Rupture.

15,400.

Remarks.

Palustris, the Latin for swampy, refers to favorite location of tree. The numerous slender secondary branches suggesting pins cause tree to be easily recognized, particularly in winter.

Spanish Oak. { *Quercus digitala* Sudworth,
 { *Quercus falcata* Michx.

Nomenclature. (Sudworth.)

Spanish Oak (local and common name).

Red Oak (N. C., Va., Ga., Fla., Ala., Mis., La., Ind.).

Spanish Oak (La.).

Locality.

New Jersey and Florida, westward intermittently to Illinois and Texas.

Features of Tree.

Thirty to seventy feet in height, two and one half to four feet in diameter. Variable foliage. Globular to oblong acorns.

Color, Appearance, or Grain of Wood.

Heartwood light red, sapwood lighter, coarse-grained, annual layers strongly marked, medullary rays few but conspicuous.

Structural Qualities of Wood.

Hard, heavy, strong, not durable, checks badly in drying.

Representative Uses of Wood.

Somewhat used for cooperage, construction, etc. Bark very rich in tannin.

Weight of Seasoned Wood in Pounds per Cubic Foot.

43.

Modulus of Elasticity.

1,900,000.

Modulus of Rupture.

16,900.

Remarks.

Dry barren soils. Grows rapidly.

Black Oak, Yellow Oak. } *Quercus velutina* Lam.
 } *Quercus tinctoria* Bartl.

Nomenclature. (Sudworth.)

Black Oak, Yellow Oak (local
and common names).

Yellow Bark, Yellow-bark Oak
(R. I., Minn.).

Dyer's Oak (Tex.).

Tanbark Oak (Ill.).

Spotted Oak (Mo.).

Quercitron Oak (Del., S. C.,
La., Kans., Minn.).

Locality.

East of longitude 96 degrees, Maine and Florida, westward
intermittently to Minnesota and Texas. Best in North
Atlantic States.

Features of Tree.

Ninety to one hundred and thirty feet in height, three to five
feet in diameter. Dark gray to black bark, yellow inner
bark. Acorns have bitter yellow kernels. Foliage turns hand-
somerly in autumn.

Color, Appearance, or Grain of Wood.

Heartwood light reddish brown, sapwood lighter, coarse grain,
annual layers strongly marked, thin medullary rays.

Structural Qualities of Wood.

Heavy, hard, strong, liable to check in drying, not tough.

Representative Uses of Wood.

Cooperage, construction, furniture, and decoration.

Weight of Seasoned Wood in Pounds per Cubic Foot.

45 (U. S. Forestry Div.).*

44.

Modulus of Elasticity.

1,740,000 (average of 40 tests by U. S. Forestry Div.).*

1,470,000.

Modulus of Rupture.

10,800 (average of 40 tests by U. S. Forestry Div.).*

14,800.

Remarks.

Yellow inner bark affords yellow dye.

* See page 6.

Live Oak. { *Quercus virginiana* Mill.
 { *Quercus virens* Ait.

Nomenclature. (Sudworth.)

Live Oak (Va., N. C., S. C., Chêne Vert (La.).
Ga., Fla., Miss., Ala.,
Tex., La., Calif.).

Locality.

Southern States—coast from Virginia to Florida, westward to Texas and Lower California, southern Mexico, Central America, and Cuba. Best in south Atlantic States.

Features of Tree.

Fifty to sixty feet high, diameter three to six feet. General resemblance to apple-tree. Evergreen foliage.

Color, Appearance, or Grain of Wood.

Heartwood light brown or yellow, sapwood nearly white, close-grained, compact structure, pronounced medullary ray, annual layers often hardly distinguishable.

Structural Qualities of Wood.

Heavy, strong, tough, hard, difficult to work, splits easily. Receives high polish, very durable.

Representative Uses of Wood.

Ship-building.

Weight of Seasoned Wood in Pounds per Cubic Foot.

59.

Modulus of Elasticity.

1,600,000.

Modulus of Rupture.

14,000.

Remarks.

Trunk and branches furnish small straight pieces, but principally knees, crooked or compass timbers. Virens refers to evergreen foliage. Splits so easily that it is better fastened with bolts or trenails than spikes. Now scarce, grows rapidly.

California Live Oak. *Quercus agrifolia* Nee.

Nomenclature. (Sudworth.)

Coast Live Oak (Cal.).

Encena (Cal.).

California Live Oak (Cal.).

Evergreen Oak (Cal.).

Locality.

California.

Features of Tree.

Forty to seventy-five and occasionally more feet in height, three to six feet in diameter. Evergreen foliage, leaves spiked like those of holly. Shape resembles that of apple tree.

Color, Appearance, or Grain of Wood.

Heartwood creamy white, but darkens on exposure. Compact structure, annual layers hardly distinguishable.

Structural Qualities of Wood.

Heavy, hard, but brittle.

Representative Uses of Wood.

Fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

51.

Modulus of Elasticity.

1,350,000.

Modulus of Rupture.

13,200.

Remarks.

Agrifolia is from the Latin *acer*, sharp, and *folium*, leaf, alluding to the spinous toothed leaves.

Live Oak. *Quercus chrysolepis* Liebm.

Nomenclature. (Sudworth.)

Live Oak (Cal., Oreg.).	Canyon Oak, Iron Oak, Maul
Canyon Live Oak, Black Live	Oak, Valparaiso Oak (Cal.).
Oak, Golden-cup Oak	
(Cal.).	

Locality.

West of Rocky Mountains, canyons, and high elevations.

Features of Tree.

Fifty to eighty feet in height, three to six feet in diameter.
Often low shrub. Impressive appearance. Evergreen foliage.

Color, Appearance, or Grain of Wood.

Heartwood light brown, sapwood lighter, small pores in wide bands parallel to conspicuous medullary rays. Close-grained.

Structural Qualities of Wood.

Hard, heavy, strong, tough, difficult to work.

Representative Uses of Wood.

Implements, wagons, tool-handles.

Weight of Seasoned Wood in Pounds per Cubic Foot.

52.

Modulus of Elasticity.

1,700,000.

Modulus of Rupture.

18,000.

Remarks.

Said to be the most valuable of the California oaks. Grows at elevations of 2000 to 5000 feet. Highland Oak (*Quercus wislizeni*) is an evergreen and a Pacific Coast variety.

English Oak. *Quercus robur* var. *pedunculata*.

Nomenclature.

English Oak. British Oak. Common Oak.

Locality.

Widespread throughout northern and central Europe.

Features of Tree.

Seventy to one hundred feet in height, eight to ten feet in diameter. Crooked branches, stalkless leaves, long-stalked acorns.

Color, Appearance, or Grain of Wood.

Heartwood light brown, darker spots frequent, sapwood lighter. Compact structure.

Structural Qualities of Wood.

Hard, tough, strong, durable, difficult to work, liable to warp in seasoning.

Representative Uses of Wood.

Ship-building, beams, cabinet-work, formerly carpentry.

Weight of Seasoned Wood in Pounds per Cubic Foot.

51 (Laslett).

Modulus of Elasticity.

1,170,000 (Thurston).

Modulus of Rupture.

10,000 (Thurston).

Remarks.

The English, Chestnut, Durmast, or Red Oak, *Q. robur* var. *sessiliflora*, distinguished by long leaf stalks and short acorn stalks, affords practically similar but lower-rated wood. The two varieties supply the British Oak of commerce. Dantzic, Rigi, and some other European oaks take names from port of shipment. *Rubrus* is red, but *robur* is a noun meaning strength; the adjective *robustus* means "oaken" or vigorous.



PLATE 6. WHITE ASH (*Fraxinus americana*).



ASH.

(*Fraxinus*.)

Ash is widely distributed over the temperate regions of the northern hemisphere, and occurs in the tropics, on the island of Cuba. The tree has occupied a position second only to that of oak. Our Teutonic forefathers relied upon its wood for boats and weapons. Their ancient faith connects it with the creation of the original man. It is often associated with oak in country proverbs.* Europeans regard the trees for ornamental purposes, but Americans value them for wood.

Ash and oak woods resemble one another in that there are bands of open pores in both woods, but the pith-rays of the ash are thinner and scarcely discernible. Ash is coarser, less attractive, easier to work, tough, elastic, and somewhat lighter than oak. It seasons well, but does not last when exposed to the weather. Lumbermen separate the woods into white and black ash, the former including the lighter-colored and more desirable pieces. This commercial division is also a botanical one in the North, where the only species of any note are the white ash and black ash (*F. americana* and *F. nigra*). The Southern green ash (*F. lanceolata*) is usually classed as white ash. The trees that grow up after the cutting of the virgin forest afford tougher, more pliable, but not necessarily stronger pieces, known as "second-growth" ash. Although not relied upon for out-of-door construction, ash is one of the most important of the cheaper cabinet woods and is used in stairs, furniture, and similar works.



WHITE ASH (*Fraxinus americana*).

* A tradition, old in Pliny's time, is that serpents avoid ash trees; another is that ash is particularly liable to be struck by lightning. (Keeler.)

One half of the thirty known species of the genus *Fraxinus* inhabit North America.

The name ash is also applied to several species of the genus *Pyrus* or *Sorbus*, to which the apple, pear, quince, and some other trees belong. "Mountain Ash" is either *Pyrus americana* or *Pyrus sambucifolia*. Both species, with their bright red berries, are to be classed as shrubs rather than trees; their light, soft, weak, close-grained woods having no economic importance, save perhaps for fuel. The series is partially as follows:

<i>Pyrus malus</i> (Common apple).	<i>Pyrus americana</i> (Mountain ash).
<i>Pyrus coronaria</i> (American crab-apple).	<i>Pyrus sambucifolia</i> (Mountain ash).
<i>Pyrus communis</i> (Common pear).	<i>Pyrus aucuparia</i> (Rowan tree, European
<i>Pyrus vulgaris</i> (Common quince).	Mountain ash).

The Toothache Trees, *Xanthoxylum americana* and *Xanthoxylum clava-herculis* (Linn.), are known as ash and prickly ash. The gopher wood, *Cladrastis tinctoria*, is yellow ash. These woods are not important.

White Ash. *Fraxinus americana* Linn.

Nomenclature. (Sudworth.)

White Ash (local and common name). Cane Ash (Ala., Miss., La.). American Ash (Ia.).

Ash (Ark., Ia., Wis., Ill., Mo., Minn.).

Locality.

Nova Scotia to Florida, westward intermittently to Minnesota and Texas. Greatest development in the Ohio River basin.

Features of Tree.

Forty-five to ninety feet in height, occasionally higher. Three to four feet in diameter. Usually smooth leaves, have whitish under surfaces. Gray furrowed bark, long-winged seed.

Color, Appearance, or Grain of Wood.

Heartwood reddish brown, usually mottled; sapwood much lighter or nearly white. Coarse-grained, compact structure. Layers clearly marked by large open ducts. Medullary rays obscure.

Structural Qualities of Wood.

Heavy, hard, strong, elastic, becoming brittle with age, not durable in contact with soil.

Representative Uses of Wood.

Agricultural implements, carriages, handles, oars, interior and cheap cabinet-work.

Weight of Seasoned Wood in Pounds per Cubic Foot.

39 (U. S. Forestry Div.)*

40.

Modulus of Elasticity.

1,640,000 (average of 87 tests by U. S. Forestry Div.)*

1,440,000.

Modulus of Rupture.

10,800 (average of 87 tests by U. S. Forestry Div.)*

12,200.

Remarks.

Economically valuable. Rapid growers, preferring low, rather moist soil. Not apt to form in forests, but found mingled with other varieties. Large trees sometimes have large heart-cracks.

* See page 6.

Red Ash. { *Fraxinus pennsylvanica* Marsh.
 { *Fraxinus pubescens* Lam.

Nomenclature. (Sudworth.)

Red Ash (local and common name).	Brown Ash (Mo.).
River Ash (R. I., Ont.).	Black Ash (N. J.).
	Ash (Nebr.).

Locality.

New Brunswick to Florida, westward intermittently to Dakota and Alabama. Best developed in North Atlantic States.

Features of Tree.

A small tree, rarely over forty-five feet high, one and one-half feet in diameter. Downy-covered young twigs and leaves.

Color, Appearance, or Grain of Wood.

Heartwood rich brown, sapwood light brown streaked with yellow, coarse-grained compact structure.

Structural Qualities of Wood.

Heavy, hard, strong, brittle.

Representative Uses of Wood.

Agricultural implements, handles, boats, oars, paper-pulp.

Weight of Seasoned Wood in Pounds per Cubic Foot.

38.

Modulus of Elasticity.

1,154,000.

Modulus of Rupture.

12,300.

Remarks.

Grows on borders of streams and swamps in low ground. Often confused with and substituted for the more valuable white ash. Pubescens is in allusion to the downy covering of the new twigs (those of white ash usually smooth). Pennsylvanica refers to locality in which it is well developed.

Blue Ash. *Fraxinus quadrangulata Michx.*

Nomenclature. (Sudworth.)

Blue Ash (Mich., Ill., Ky., Mo., Ala.).

Locality.

Central States, Mississippi Valley, Michigan, and southward, cultivated in Pennsylvania. Best in low Wabash Valley.

Features of Tree.

Fifty to seventy-five feet in height, occasionally higher, one to two feet in diameter. Slender. Blue properties in inner bark, smooth square twigs.

Color, Appearance, or Grain of Wood.

Heartwood light yellow, streaked with brown, sapwood lighter, close-grained, compact structure satiny.

Structural Qualities of Wood.

Hard, heavy, brittle, not strong, most durable of ash woods.

Representative Uses of Wood.

Largely used in floorings, carriage-building, pitchfork- and other tool-handles.

Weight of Seasoned Wood in Pounds per Cubic Foot.

44.

Modulus of Elasticity.

1, 100, 000.

Modulus of Rupture.

11, 500.

Remarks.

Has no superior among ash woods. Blue Ash pitchfork-handles are very fine. Prefers limestone formations. Inner bark colors water blue, whence name.

Black Ash. { *Fraxinus nigra* Marsh.
 { *Fraxinus sambucifolia* Lam.

Nomenclature. (Sudworth.)

Black Ash (local and common name).	Swamp Ash (Vt., R. I., N. Y.).
Water Ash (W. Va., Tenn., Ind.).	Brown Ash (N. H., Tenn.). Hoop Ash (Vt., N. Y., Del., Ohio, Ill., Ind.).

Locality.

Northern and Northeastern States—Newfoundland to Virginia, westward intermittently to Manitoba and Arkansas.

Features of Tree.

Seventy to eighty feet in height, one to one and one-half feet in diameter. Leaves resemble those of Elder. A thin tree. Excrescences or knobs frequent on trunk. Dark, almost black, winter buds.

Color, Appearance, or Grain of Wood.

Heartwood dark brown, sapwood light brown, often nearly white, coarse-grained, compact structure, medullary rays numerous and thin.

Structural Qualities of Wood.

Separates easily in layers, rather soft and heavy, tough, elastic, not strong or durable when exposed.

Representative Uses of Wood.

Largely used for interior finish, fencing, barrel-hoops, cabinet-making, splint baskets, chair-bottoms.

Weight of Seasoned Wood in Pounds per Cubic Foot.

39.

Modulus of Elasticity.

1,230,000.

Modulus of Rupture.

11,400.

Remarks.

Excrescences known as burls; their distorted grain causes them to be prized for veneers. The most northerly of ash-trees; one of the most slender of trees.

Green Ash.

{ *Fraxinus lanceolata* Borkh.
{ *Fraxinus viridis* Michx. f.

Nomenclature. (Sudworth.)

Green Ash (local and common name). Ash (Ark. Iowa).
Swamp Ash (Fla., Ala., Tex.).
Blue Ash (Ark., Iowa). Water Ash (Iowa).
White Ash (Kans., Neb.).

Locality.

East of Rocky Mountains. Vermont and northern Florida intermittently to Utah and Arizona.

Features of Tree.

Forty to fifty feet in height, one to two feet in diameter. Bright green upper and lower surfaces of smooth leaves.

Color, Appearance, or Grain of Wood.

Heartwood brownish, sapwood lighter, rather coarse-grained, compact structure.

Structural Qualities.

Hard, heavy, strong, brittle.

Representative Uses.

Similar to those of White Ash.

Weight of Seasoned Wood in Pounds per Cubic Foot.

39 (U. S. Forestry Div.)*
44.

Modulus of Elasticity.

2,050,000 (average of 10 tests by U. S. Forestry Div.)*
1,280,000.

Modulus of Rupture.

11,600 (average of 10 tests by U. S. Forestry Div.)*
12,700.

Remarks.

Sometimes considered a variety of Red Ash.

* See page 6.

Oregon Ash. *Fraxinus Oregona Nutt.*

Nomenclature.

Oregon Ash (Calif., Wash., Oregon).

Locality.

Pacific coast, Washington to California. Best developed in bottom lands, southwestern Oregon.

Features of Tree.

Fifty to occasionally seventy-five feet in height, one to one and one-half feet in diameter. Dark grayish-brown, bark exfoliates in thin scales.

Color, Appearance, or Grain of Wood.

Heartwood brown, sapwood lighter, coarse-grained, compact structure, numerous thin medullary rays.

Structural Qualities of Wood.

Rather light, hard, not strong.

Representative Uses of Wood.

Manufacture of furniture, carriage-frames, cooperage, and fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

35.

Modulus of Elasticity.

1,200,000.

Modulus of Rupture.

9400.

Remarks.

One of the valuable deciduous trees of the Pacific coast. Thrives only on moist soils and in moist climates.

PLATE 7. ELM (*Ulmus americana*).



ELM.

(*Ulmus*.)

The different species of elm are distributed over the cold and temperate portions of the northern hemisphere, save western United States and Canada. A high degree of perfection is attained in eastern North America, where trees are greatly prized for their form and appearance.

The foliage of the elm is concentrated at the top, and the absence of lower branches causes it to be a good tree to plant near houses or along streets. Much of the wood is tough, fibrous, durable, strong, hard, heavy, and, because it is so often cross-grained, difficult to split and work. The large pores of the spring wood arranged in one or several rows mark the annual deposit, while the minute pores of the summer wood arranged in concentric wavy lines are so peculiar as to distinguish this wood from



ELM (*Ulmus americana*).

all others. The tall, straight trunks afford pieces of considerable size. Elm piles sustain constant and severe shocks for long intervals. The grain arrangement of elm is often very beautiful, so that it is increasingly used for decoration. It is more commonly employed in the construction of cars, wagons, boats, agricultural implements, machinery, and furniture.

The shape of the trees is so marked as to cause them to be easily noted. Fifteen or sixteen species have been recognized. Five are known to exist in the eastern American forests, and all of them furnish good wood of commercial importance. *Ulmus* was the ancient name of the elm.

White Elm. *Ulmus americana* Linn.

Nomenclature. (Sudworth.)

White Elm (local and common name).

Water Elm (Miss., Tex., Ark., Mo., Ill., Ia., Mich., Minn., Neb.).

Elm (Mass., R. I., Conn., N. J., Pa., N. C., S. C., Ia., Wis.).

American Elm (Vt., Mass., R. I., N. Y., Del., Pa., N. C., Miss., Tex., Ill., Ohio, Kans., Neb., Mich., Minn.).

Locality.

East of Rocky Mountains, Newfoundland to Florida, westward intermittently to Dakota, Nebraska, and Texas.

Features of Tree.

Ninety to one hundred feet in height, three to seven feet in diameter. Characteristic and beautiful form, smooth buds; leaves, smaller than those of Slippery-elm, are rough only when rubbed one way.

Color, Appearance, or Grain of Wood.

Heartwood light brown, sapwood yellowish white, rather coarse-grained, annual rings clearly marked.

Structural Qualities of Wood.

Strong, tough, fibrous, difficult to split.

Representative Uses of Wood.

Flooring, wheel-stock, cooperage, ship-building, flumes, piles.

Weight of Seasoned Wood in Pounds per Cubic Foot.

34 (U. S. Forestry Division.)*

40.

Modulus of Elasticity.

1,540,000 (average of 18 tests by U. S. Forestry Div.)*

1,060,000.

Modulus of Rupture.

10,300 (average of 18 tests by U. S. Forestry Div.)*

12,100.

Remarks.

The concentration of foliage at top, together with the form of the tree, renders it valuable in landscape work. It does not cause dense shade. Elm and silver-maple trees are among the first to show life in spring. Discarded brownish scales then cover ground in vicinity.

* See page 6.

Cork Elm. *Ulmus racemosa* Thomas.

Nomenclature. (Sudworth.)

Cork Elm (local and common name).	Rock Elm (R. I., W. Va., Ky., Mo., Ill., Wis., Ia., Mich., Nebr.).
Hickory Elm (Mo., Ill., Ind., Ia.).	White Elm (Ont.). Cliff Elm (Wis.).

Locality.

Quebec and Vermont, westward intermittently to Nebraska and Tennessee. Best developed in southern Ontario and Michigan.

Features of Tree.

Seventy to ninety feet in height, two to three feet in diameter. Thick, corky, irregular projections give bark a shaggy appearance and mark the species.

Color, Appearance, or Grain of Wood.

Heartwood light brown, often tinged with red; sapwood yellowish or greenish white. Compact structure, fibres interlaced.

Structural Qualities of Wood.

Heavy, hard, very strong, tough, difficult to split, susceptible of a beautiful polish, elastic.

Representative Uses of Wood.

Heavy agricultural implements, wheel-stocks, railway ties, sills, bridge-timbers, axe-helves, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

45.

Modulus of Elasticity.

2,550,000.

Modulus of Rupture.

15,100.

Remarks.

Cork Elm is the best of the elm woods.

Slippery Elm, Red Elm. $\left\{ \begin{array}{l} \textit{Ulmus pubescens Wall.} \\ \textit{Ulmus fulva Michx.} \end{array} \right.$

Nomenclature. (Sudworth.)

Slippery Elm, Red Elm (local and common name). Redwooded Elm (Tenn.).
Moose Elm (occasional).

Rock Elm (Tenn.).

Locality.

Ontario and Florida, westward intermittently to Nebraska and Texas. Best developed in Western States.

Features of Tree.

Forty-five to sixty feet in height, one to two feet in diameter. Characteristic shape, mucilaginous inner bark. Buds hairy. Leaves, larger than American Elm, are rough when rubbed either way.

Color, Appearance, or Grain of Wood.

Heartwood dark brown or red, sapwood lighter, compact structure, annual layers marked by rows of large open ducts. Heartwood greatly preponderates.

Structural Qualities of Wood.

Heavy, hard, strong, and durable in contact with soil.

Representative Uses of Wood.

Largely used for fence-posts, rails, railway ties, sills, sleigh-runners, and wheel-stocks. Mucilaginous bark, employed in medicine.

Weight of Seasoned Wood in Pounds per Cubic Foot.

43.

Modulus of Elasticity.

1,300,000.

Modulus of Rupture.

12,300.

Remarks.

Mucilaginous inner bark renders this species unmistakable. This bark is used in medicine.

Wing Elm, Winged Elm. *Ulmus alata Michx.*

Nomenclature.

Wing Elm, Winged Elm (local and common names).	Mountain Elm, Red Elm (Fla., Ark.).
Wahoo, Whahoo (W. Va., N. C., S. C., La., Tex., Ky., Mo.).	Elm, Witch Elm (W. Va.). Water Elm (Ala.). Small-leaved Elm (N. C.).
Cork Elm, Corky Elm (Fla., S. C., Tex.).	Wahoo Elm (Mo.).

Locality.

Southern United States, Virginia and Florida westward intermittently to southern Illinois and Texas.

Features of Tree.

Forty feet or more in height, one to two feet in diameter. Corky "wings" on branches.

Color, Appearance, or Grain of Wood.

Color brownish, sapwood lighter, close-grained, compact structure.

Structural Qualities of Wood.

Hard, heavy, tough.

Weight of Seasoned Wood in Pounds per Cubic Foot.

46.

Modulus of Elasticity.

740,000.

Modulus of Rupture.

10,200.

Remarks.

MAPLE.

(*Acer.*)

The maples grow on all of the continents of the northern hemisphere. Nearly one half of the known species belong in China, Japan, and the Orient. The principal European species (*Acer pseudo-platanus*) is the European scycamore.* The hard or sugar maple (*Acer saccharum*) is one of the principal deciduous trees of North America.

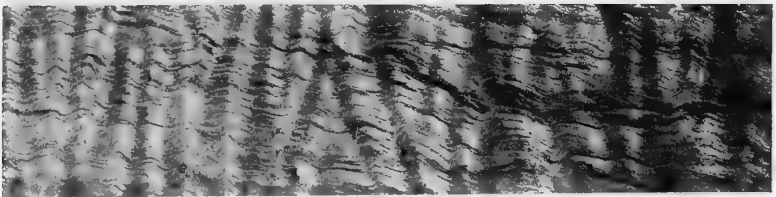
Maple wood † is characterized by its appearance and by its fine compact texture. The first quality is so marked that selected pieces take rank among the most beautiful of cabinet woods; the last is so pronounced as to fit it for carvings and even for type. "Birdseye," "blister," and "curly" maples are not from different species, but are the results of fibre distortions, possible in some form in any tree of any species, but peculiarly liable to occur in the maple; birdseye and blister effects for the most part in the hard maples, curly effects in the hard, but generally in the softer, species. The distortions do not occur in all trees, and it is seldom possible to tell whether the woods are thus figured until after the trees have been cut. Maple wood shrinks moderately, stands well in protected places, is strong, tough, but not durable when exposed. Pores are not arranged in circles, but are scattered irregularly throughout the layers. Maple is used for ceiling, flooring, panelling, car and ship construction, shoe-lasts, shoe-pegs, furniture, school supplies, implements, and machinery. Sugar is principally, although not exclusively, present in the sap of the sugar maple.‡ The softer species are sometimes

* See Sycamore, page 65.

† These notes apply to the American product.

‡ Vermont, New York, and Michigan produce the larger portion of the about fifty million pounds of sugar and three million gallons of syrup annually manufactured in the United States. Third Annual Report of the Fisheries, Game, and Forestry Commissioners, New York, 1897, p. 308.

PLATE 8. SUGAR MAPLE (*Acer saccharum*).

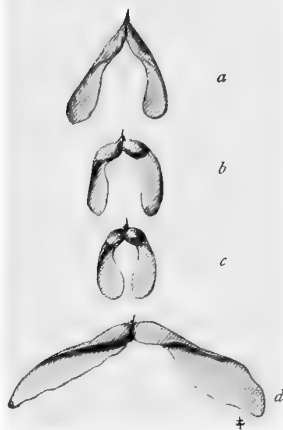


"Curly" Maple Wood (*dissection*).

tapped, and sugar is also present in the sap of other trees, such as the butternut and birch. A sugar maple will, on an average, produce about twenty-five gallons of sap, containing a total of about six pounds of sugar, in a season.

The Boxelder (*Acer negundo*) is a true maple, remarkable in that it is widely distributed from Canada to Mexico and from the Atlantic to the Rocky Mountains, on low bottom lands, and at elevations of five thousand and six thousand feet.* The trees are beautiful and, like other maples are valued for ornamental purposes. The soft, light wood is not particularly noted, although occasionally used for woodenware, interior finish, and paper-pulp. Small quantities of sugar are present in the sap of this tree.

The maples may be told by their leaves of characteristic shape, but chiefly by their two-seeded fruit or "keys," the two wings of which spread differently in different species. The leaves of some species change in autumn from green to red and other brilliant colors. Those of other species change to yellow without trace of red. Sixty to seventy species have been distinguished, nine of which occur in North America.



a, Box Elder. *b*, Hard or Sugar Maple. *c*, Soft or Red Maple. *d*, Soft or Silver Maple.

* Sargent.

Sugar Maple, Hard Maple. { *Acer saccharum* Marsh.
 { *Acer saccharinum* Wang.

Nomenclature. (Sudworth.)

Sugar Maple, Hard Maple (local and common names).	Rock Maple (Me., Vt., N. H., Conn., Mass., R. I., N. Y., Tenn., Ill., Mich., Ia., Kans., Wis., Minn.).
Black Maple (Fla., Ky., N. C.).	
Sugar Tree (frequent).	

Locality.

Best development Maine to Minnesota; range extends southward to Florida and Texas.

Features of Tree.

Seventy to one hundred feet and more in height, one and one-half to four feet in diameter. The fruit or "maple-key" with wings less than right angles ripen in early autumn; one seed-cavity is usually empty. Foliage turns to brilliant reds and other colors later. Large impressive tree.

Color, Appearance, or Grain of Wood.

Heartwood brownish, sapwood lighter, close-grained, compact structure, occasional "curly," "blister," or "birdseye" effects.

Structural Qualities of Wood.

Tough, heavy, hard, strong, susceptible of good polish, wears evenly, not durable when exposed.

Representative Uses of Wood.

Furniture, shoe-lasts, piano-actions, wooden type for showbills, pegs, interior finish, flooring, ship-keels, vehicles, fuel, veneers, rails, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

43.

Modulus of Elasticity.

2,070,000.

Modulus of Rupture.

16,300.

Remarks.

Birdseye, blister, and to a less extent curly and landscape effects pronounced in this species. Saccharum refers to sugar manufactured from the sap. Hard maple is because of hardness of wood.

Silver Maple, Soft Maple. $\left\{ \begin{array}{l} \textit{Acer saccharinum Linn.} \\ \textit{Acer dasycarpum Ehr.} \end{array} \right.$

Nomenclature. (Sudworth.)

Silver Maple, Soft Maple (local and common names).

Swamp Maple (W. Va., Md.).

Water Maple (Pa., W. Va.).

River Maple (Me., N. H.,

R. I., W. Va., Minn.).

White Maple (Me., Vt., R. I.,

N. Y., N. J., Pa., W. Va.,

N. C., S. C., Ga., Fla.,

Ala., Miss., La., Ky., Mo.,

Ill., Ind., Kans., Nebr.,

Minn.).

Locality.

New Brunswick to Florida, westward intermittently to Dakota and Indian Territory. Best development in lower Ohio River basin.

Features of Tree.

Forty to ninety feet in height, occasionally higher. Three to five feet in diameter. Fine shape, sometimes suggests elm. Fruit or "maple-key" with long, stiff, more than right-angled wings ripens in early summer. Leaves whitish beneath, turn showing yellow, but little or no red, in autumn.

Color, Appearance, or Grain of Wood.

Heartwood reddish brown, sapwood ivory-white, fine grain, compact structure. Fibres sometimes twisted, waved, or curly.

Structural Qualities of Wood.

Light, brittle, easily worked, moderately strong; receives high polish. Not durable when exposed.

Representative Uses of Wood.

Woodenware, turned work, interior decoration, flooring, fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

32.

Modulus of Elasticity.

1,570,000.

Modulus of Rupture.

14,400.

Remarks.

Waved, spiral, or curly figure pronounced in this species, very real resemblance to lights and shadows on planed surfaces. Small quantities of sugar present in sap, occasionally utilized.

Red Maple, Swamp Maple. *Acer rubrum* Linn.

Nomenclature. (Sudworth.)

Red Maple, Swamp Maple Water Maple (Miss., La., Tex.,
(local and common names). Ky., Mo.).

Soft Maple (Vt., Mass., N. Y., White Maple (Me., N. H.).

Va., Miss., Mo., Kans., Red Flower (N. Y.).

Neb., Minn.).

Locality.

New Brunswick and Florida, westward intermittently to Dakota
and Texas. Wide range.

Features of Tree.

Sixty to eighty feet and more in height, two and one-half to
four feet in diameter. Red twigs and flowers in early spring.

Color, Appearance, or Grain of Wood.

Heartwood brown tinged with red, sapwood lighter, close-
grained, compact structure. Red blossoms, twigs, and stems.

Leaves turn scarlet in autumn.

Structural Qualities of Wood.

Easily worked, heavy, hard, not strong, elastic, qualities
between those of silver and sugar maple.

Representative Uses of Wood.

Largely used in cabinet-making, turnery, woodenware, gun-
stocks, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

38.

Modulus of Elasticity.

1,340,000.

Modulus of Rupture.

15,000.

Remarks.

Occasionally shows "curly" figure. Trees are occasionally
tapped and small quantities of sugar are obtained from the
sap.

Oregon Maple. *Acer macrophyllum Pursh.*

Nomenclature. (Sudworth.)

Oregon Maple (Oreg., Wash.).	Broad-leaved Maple (Central
White Maple (Oreg., Wash.).	Calif., Willamette Valley,
Maple (Calif.).	Oreg.).

Locality.

Alaska to California. Best in rich bottom lands of southern Oregon.

Features of Tree.

Seventy to one hundred feet in height, three to five feet in diameter. Beautiful appearance.

Color, Appearance, or Grain of Wood.

Reddish brown, sapwood whitish, close-grained, compact structure, occasionally figured.

Structural Qualities.

Light, hard, strong; receives polish.

Representative Uses of Wood.

Locally used for tool-handles, turned work, and furniture.

Weight of Seasoned Wood in Pounds per Cubic Foot.

30.

Modulus of Elasticity.

1, 100,000.

Modulus of Rupture.

9720.

Remarks.

Ornamental tree has been introduced into Europe. Said to be one of the most valuable Pacific coast broadleaf woods.

Boxelder, Ash-leaved Maple. { *Acer negundo* Linn.
 { *Negundo aceroides* Moench.

Nomenclature. (Sudworth.)

Boxelder, Ash-leaved Maple (local and common name).	Stinking Ash (S. C.). Negundo Maple (Ill.).
Red River Maple, Water Ash (Dak.).	Three-leaved Maple (Fla.). Black Ash (Tenn.).
Cut-leaved Maple (Colo.).	Sugar Ash (Fla.).

Locality.

Atlantic Ocean westward intermittently to Rocky Mountains, Mexico.

Features of Tree.

Forty to seventy feet in height, one and one-half to three feet in diameter. Wings to keys are straight or incurved. Leave sparingly and coarsely toothed, show yellow but little or no red in autumn.

Color, Appearance, or Grain of Wood.

Thin heartwood, cream-white; sapwood similar; close-grained, compact structure.

Structural Qualities of Wood.

Light, not strong, soft.

Representative Uses of Wood.

Woodenware, cooperage, etc., paper-pulp (largely), occasionally interior finish.

Weight of Seasoned Wood in Pounds per Cubic Foot.

26.

Modulus of Elasticity.

82,000.

Modulus of Rupture.

7500.

Remarks.

A rapid grower. Withstands severe climatic changes. A good tree to plant in naturally treeless sections. Sugar is sometimes obtained from the sap of this species. The "Boxelder" is a true maple.

PLATE 9. WALNUT (*Juglans*).



Black Walnut Tree (*Juglans nigra*).
Black, White, and English Walnuts.

Black Walnut Trunk (*Juglans nigra*)
Black Walnut Wood (*Juglans nigra*).

WALNUT.

(*Juglans*.)

The English or Royal Walnut (*Juglans regia*), a native of Persia, was the only available species of this genus until the introduction of the nearly similar Black Walnut of North America.* As oak gave way first to soft woods for construction, so it gave way first to walnut for cabinet purposes. The wood soon became very fashionable, and exorbitant prices were paid for it. Walnut was extremely popular in the United States until about 1880, when oak began to resume its place as the popular cabinet wood. The nuts of the English or Persian walnut are better than those of the American species, but the wood of the latter is superior.

The use of walnut wood for gun-stocks began in Europe, the demands early becoming so great that, until the general peace following the battle of Waterloo, the greater part of the French product was diverted for that purpose, while prices rose in England so that six hundred pounds sterling is reported to have been paid for a single tree. In spite of the innumerable woods that have since been introduced, this one is yet regarded as best for gun-stocks.† Walnut is a firm, hard, chocolate-colored wood, with pores not arranged in rings but scattered somewhat irregularly. The sombre, although rich, color has been objected to for some positions. Large excrescences or "burrs" are common on foreign trees, particularly those near the Black Sea and in Italy. The grain in such growths is beautifully irregular, and the wood, known as "burl," is prized for veneers. Trees are very scarce, and walnut is now seldom seen save in cabinet work or gun-stocks. The related White Walnut or Butternut (*Juglans cinerea*) affords a less-prized and

* About the middle of the seventeenth century.

† France used twelve thousand trees in 1806. (Stevenson's "Trees of Commerce," p. 77.)

lighter-tinted wood. The nuts of the walnuts are a source of profit.

Black walnut trees seldom form forests by themselves, but occur generally in mixed growth. They grow quickly, but the heartwood for which the tree is valued begins to form only when the tree is at a considerable age, so that a number of years must elapse before a tree can produce wood of the desired quality. Trees one hundred years old furnish the best quality of wood.

Walnut trees may be known by their nuts, the husks or pods of which adhere unbroken, instead of loosening, completely divide into four sections, as with the hickories. *Juglans* is from *Jovis*, signifying Jove's, and *glans*, signifying acorn. This nut, not the fruit of the oak, was the acorn of the ancients.*

* The ancients considered the shade of the walnut as harmful to all life. It is certain some vegetation is affected, probably by properties in fallen leaves.

Black Walnut.*Juglans nigra* Linn.

Nomenclature. (Sudworth.)

Black Walnut (local and common name).

Walnut (N. Y., Del., W. Va., Fla., Ky., Mo., Ohio, Ind., Ia.).

Locality.

Ontario and Florida, westward intermittently to Nebraska and Texas.

Features of Tree.

Ninety to one hundred and twenty-five feet in height, three to eight feet in diameter. A tall handsome tree with rough brownish, almost black, bark. Large, rough-shelled nuts.

Color, Appearance, or Grain of Wood.

Heartwood dark, rich, chocolate-brown. Thin sapwood much lighter, rather coarse-grained.

Structural Qualities of Wood.

Heavy, hard, strong, easily worked, durable, susceptible to high polish.

Representative Uses of Wood.

Cabinet-making, gun-stocks, also formerly furniture and decoration.

Weight of Seasoned Wood in Pounds per Cubic Foot.

38.

Modulus of Elasticity.

1,550,000.

Modulus of Rupture.

12,100.

Remarks.

The English, Royal, or Persian Walnut (*Juglans regia*) affords nearly similar wood. Widely distributed over Europe. Italian trees furnish best, French next, and English least desirable, paler and coarser wood. Occasional trees in Eastern United States, as New York; very plentiful in California.

Butternut, White Walnut. *Juglans cinerea* Linn.

Nomenclature.

Butternut,	White Walnut	Walnut (Minn.).
(local and common names).		White Mahogany.
Oil Nut (Me., N. H., S. C.).		

Locality.

New Brunswick to Georgia, westward to Dakota and Arkansas.
Best in Ohio River basin.

Features of Tree.

Medium size, sometimes seventy-five feet or over in height, two to four feet in diameter. Branches widespread; large-sized oblong edible nuts.

Color, Appearance, or Grain of Wood.

Heartwood light gray-brown, darkening with exposure; sapwood nearly white, coarse-grained compact structure, attractive.

Structural Qualities of Wood.

Light, soft, not strong, easily worked. Susceptible of high polish.

Representative Uses of Wood.

Interior finish, cabinet-work. Inner bark furnishes yellow dye.

Weight of Seasoned Wood in Pounds per Cubic Foot.

25.

Modulus of Elasticity.

1,150,000.

Modulus of Rupture.

8400.

Remarks.

The sap contains sugar and is occasionally mixed with maple-sap in the manufacturing of "maple" sugar.

PLATE 10. HICKORY (*Ilicoria ovata*).



HICKORY.

(*Hicoria* or *Carya*.)

The Hickories occur only in the eastern part of North America. They produce woods in which the qualities of toughness, elasticity, and resilience are unusually pronounced, and since these qualities are greatest in the sapwood, hickories are peculiar in that the sapwood is more valuable than the heart. Second-growth wood is much prized, since, being younger, it contains more of the pliable sapwood.*

Hickory is not durable when exposed and is more or less subject to attack by boring-insects. It is used for implements, machinery, carriages, and the like; hickory axe-helves have no superiors. The nuts of the shagbark or white hickory are a source of considerable profit. The pecan (*Hicoria pecan*) affords wood so inferior as to be little used in construction, although it makes an excellent fuel. Pecans are planted in many of the Southern States because of the nuts, for which a considerable demand exists.

The Hickories are known by their nuts, the husks or pods of which loosen completely from the nut in four pieces, instead of adhering unbroken as in the case of the walnuts. The nine species are American trees, eight of them being natives of the United States. *Carya* was the Greek name of the common walnut. Hickory is said to be derived from the Indian *powcohicora*, a liquor once obtained from the nuts of the hickory.

* See Second-growth Ash.

Shagbark Hickory, Shellbark Hickory. $\left\{ \begin{array}{l} \textit{Hicoria ovata Mill.} \\ \textit{Carya alba Nutt.} \end{array} \right.$

Nomenclature. (Sudworth.)

Shellbark or Shellbark Hickory (local and common name).	Hickory (Vt., Ohio). Upland Hickory (Ill.).
Scalybark Hickory (W. Va., S. C., Ala.).	White Hickory (Ia., Ark.). Walnut (Vt., N. Y.).
Shellbark (R. I., N. Y., Pa., N. C.).	Sweet Walnut (Vt.). Shagbark Walnut (Vt.).
Shagbark (R. I., Ohio).	

Locality.

Maine to Florida, westward intermittently to Minnesota and Texas. Wide range, best in Ohio valley.

Features of Tree.

Seventy-five to ninety feet in height, occasionally higher; two and one-half to three feet in diameter. Shaggy bark, thin-shelled edible nuts.

Color, Appearance, or Grain of Wood.

Heartwood light brown, sapwood ivory- or cream-colored. Close-grained, compact structure. Annual rings clearly marked. Medullary rays numerous but thin.

Structural Qualities of Wood.

Very heavy, very hard, strong, exceptionally tough and flexible, not durable when exposed.

Representative Uses of Wood.

Largely used for agricultural implements, wheels, and runners, axe-handles, baskets, fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

51 (U. S. Forestry Div.).*

52.

Modulus of Elasticity.

2,390,000 (average of 137 tests by U. S. Forestry Div.).*

1,900,000.

Modulus of Rupture.

16,000 (average of 137 tests by U. S. Forestry Div.).*

17,000.

Remarks.

The nuts form an important article of commerce. "Shagbark" refers to the shaggy appearance of the bark.

* See page 6.

Pignut (Hickory). { *Hicoria glabra* Mill.
 { *Carya porcina* Nutt.

Nomenclature. (Sudworth.)

Pignut (local and common name).	Bitternut (Ark., Ill., Ia., Wis.).
Black Hickory (Miss., La., Ark., Mo., Ind., Ia.).	White Hickory (N. H., Ia.).
Brown Hickory (Del., Miss., Tex., Tenn., Minn.).	Broom Hickory (Mo.).
	Hardshell (W. Va.).
	Red Hickory (Del.).
	Switchbud Hickory (Ala.).

Locality.

Ontario to Florida, westward intermittently to southern Nebraska and eastern Texas.

Features of Tree.

Seventy-five to one hundred feet in height, occasionally higher; Two to four feet in diameter. Rather smooth bark. Large thick-shelled nuts, kernels often astringent or bitter.

Color, Appearance, or Grain of Wood.

Heartwood light and dark brown, thick sapwood, lighter, nearly white. Close-grained.

Structural Qualities of Wood.

Heavy, hard, flexible, tough, strong.

Representative Uses of Wood.

Similar to those of shagbark hickory.

Weight of Seasoned Wood in Pounds per Cubic Foot.

56 (U. S. Forestry Div.).*
51.

Modulus of Elasticity.

2,730,000 (average of 30 tests by U. S. Forestry Div.).*
1,460,000.

Modulus of Rupture.

18,700 (average of 30 tests by U. S. Forestry Div.).*
14,800.

Remarks.

Nuts are devoured by pigs, whence the name *porcina*.

* See page 6.

Mocker Nut (Hickory). { *Hicoria alba* Linn.
 { *Carya tomentosa* Nutt.

Nomenclature. (Sudworth.)

Mocker Nut, Whiteheart Hickory (local and common names).	Hickory (Ala., Tex., Pa., S. C., Neb.).
Bullnut (N. Y., Fla., Miss., Tex., Mo., Ohio., Ill., Minn.).	Big-bud, Red Hickory (Fla.).
Black Hickory (Tex., Miss., La., Mo.).	Common Hickory (N. C.).
	White Hickory (Pa., S. C.).
	Hickory Nut (Ky., W. Va.).
	Hog Nut (Del.).
	Hard bark Hickory (Ill.).

Locality.

Ontario to Florida, westward intermittently to Missouri and Texas. Wide range.

Features of Tree.

Seventy-five to one hundred feet in height, two and one-half to three and one-half feet in diameter. A tall slender tree with rough, but not shaggy, bark. Thick shell, edible nut.

Color, Appearance, or Grain of Wood.

Heartwood rich dark brown, thick sapwood nearly white, close-grained.

Structural Qualities of Wood.

Very heavy, hard, tough, strong, and flexible.

Representative Uses of Wood.

Similar to those of shellbark hickory.

Weight of Seasoned Wood in Pounds per Cubic Foot.

53 (U. S. Forestry Div.).*
 51.

Modulus of Elasticity.

2,320,000 (average of 75 tests by U. S. Forestry Div.).*
 1,630,000.

Modulus of Rupture.

15,200 (average of 75 tests by U. S. Forestry Div.).*
 16,000.

Remarks.

The most generally distributed species of the genus in the South. Mocker nut or moker nut is said (Britton) to be from a Dutch word meaning hammer, or else (Keeler) from disappointing quality of nuts.

* See page 6.

Pecan, (Hickory). $\left\{ \begin{array}{l} \textit{Hicoria pecan Marsh.} \\ \textit{Carya oliviformis Nutt.} \end{array} \right.$

Nomenclature. (Sudworth.)

Pecan (local and common name).

Pecan Nut, Pecan-tree, Pecanier (La.).

Locality.

Valley of Mississippi, southward to Louisiana, Texas, and Mexico.

Features of Tree.

Ninety to one hundred feet in height, sometimes higher. Two and one-half to five feet in diameter. A tall tree, smooth-shelled oblong edible nuts.

Color, Appearance, or Grain of Wood.

Heartwood light brown, tinged with red, sapwood lighter brown. Close-grained and compact, medullary rays numerous but thin.

Structural Qualities of Wood.

Heavy, hard, not strong, brittle.

Representative Uses of Wood.

Fuel, seldom used in construction.

Weight of Seasoned Wood in Pounds per Cubic Foot.

49 (U. S. Forestry Div.).*

44.

Modulus of Elasticity.

2,530,000 (average of 37 tests by U. S. Forestry Div.).*

940,000.

Modulus of Rupture.

15,300 (average of 37 tests by U. S. Forestry Div.).*

8,200.

Remarks.

Grows on borders of streams in low rich soil. Largest and most important tree of western Texas. The sweet edible nuts form an important article of commerce.

* See page 6.

CHESTNUT, CHINQUAPIN.

(*Castanea.*)

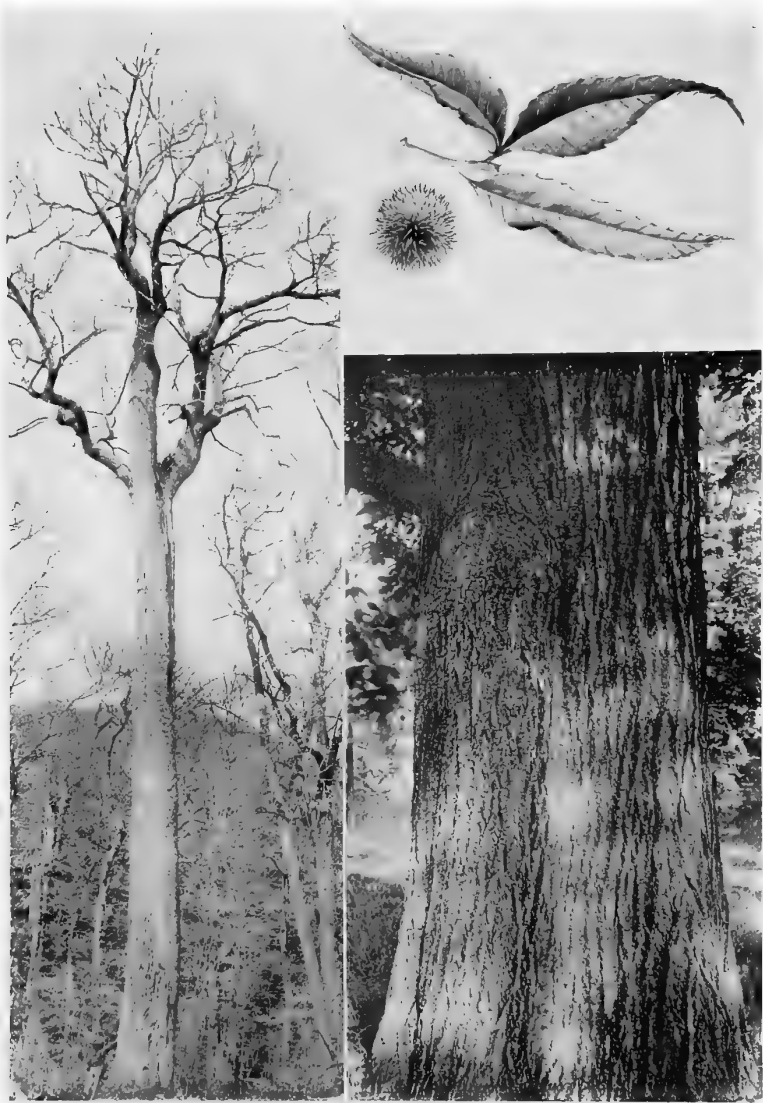
The chestnut is found in the temperature regions of central and southern Europe, northern Africa, China, Japan, and eastern North America. The wood is valued in construction, and the much-prized nuts are regarded as a food rather than a confection. European chestnut wood was once high in favor, although examination of structures in which it was supposed to have been used indicates that in some instances oak had been mistaken for it and had been employed in its place.

The North American chestnut affords a weak, brittle, but easily worked and very durable wood, such as is admirably adapted for beams, ties, and sills, where lightness and durability rather than much transverse strength are required. Trees in Europe have attained to great size and age. Micheaux mentions one thirty feet in circumference six feet from the ground and said to have been standing for a thousand years. The famous Mt. Etna chestnut * is reported to have measured two hundred and four feet in circumference. Large trunks are apt to be hollow, affording brittle, useless wood. The botanical relation between the American and European chestnuts is not distinct. Some consider the former a distinct species, others a variety only. The name "Chinquapin" applies to two distinct botanical species, one, the *Castanea pumila*, closely related to the common chestnut; the other, *Castanopsis chrysophylla*, belonging to the same family (*Cupuliferæ*), but to quite another genus. Both afford woods resembling, but heavier than, chestnut.

The chestnut may be known by its large prickly burr,

* "Castagno di cento cavalli," so called from having sheltered 100 mounted cavaliers, measured by Brydon in 1770. It had the appearance of five distinct trees, but was probably one trunk. (G. B. Emerson, "Trees and Shrubs of Massachusetts," Vol. I, page 192.)

PLATE 11. CHESTNUT (*Castanea dentata*).



(Courtesy A. C. Geological Survey.)



containing from one to three thin-shelled, triangular, wedge-shaped nuts. Both chinquapins have prickly burrs containing one, or sometimes two, sweet edible nuts. Three of the four known species of the genus *Castanea* grow in North America, one the common chestnut (*Castanea vulgaris*); another the Chinquapin (*Castanea pumila*); the third a plant never attaining to the size of a tree. The Chinquapin (*Castanopsis chrysa-phylla*) is the only North American representative of a genus including twenty-five species. Keeler says that *Castanea* is from a town of that name in Thessaly, or from another town of that name in Pontus.

Chestnut. $\left\{ \begin{array}{l} \textit{Castanea dentata (Marsh) Borkh.} \\ \textit{Castanea vesca var. americana Michx.} \\ \textit{Castanea vulgaris var. americana A. de C.} \end{array} \right.$

Nomenclature.

Chestnut (local and common name).

Locality.

New England, New York to Georgia, Alabama, Mississippi. Kentucky, Missouri, Michigan. Best on western slope of Alleghany Mountains.

Features of Tree.

Seventy-five to one hundred feet in height, five to twelve feet in diameter. Fine characteristic shape, not easily distinguished from Red Oak in winter. Blossoms in midsummer. Prickly burrs contain three thin-shelled nuts.

Color, Appearance, or Grain of Wood.

Heartwood brown, sapwood lighter, coarse-grained.

Structural Qualities of Wood.

Light, soft, not strong, liable to check and warp in drying. Easily split. Very durable in exposed positions.

Representative Uses of Wood.

Cabinet-making, railway ties, posts, fencing, sills.

Weight of Seasoned Wood in Pounds per Cubic Foot.

28.

Modulus of Elasticity.

1,200,000.

Modulus of Rupture.

9800.

Remarks.

The nuts of the foreign species (*C. vesca*) as well as those of the domestic species are much prized. The former are larger and the latter sweeter. One of the latest trees to blossom.

Chinquapin. *Castanea pumila* (Linn.) Mill.

Nomenclature. (Sudworth.)

Chinquapin (Del., N. J., Pa., Va., W. Va., N. C., S. C., Ga., Ala., Fla., Miss., La., Tex., Ark., Ohio, Ky., Mo., Mich.).

Locality.

Pennsylvania to Florida, Mississippi, Louisiana, Texas, Arkansas, Ohio, Kentucky, Missouri, Michigan.

Features of Tree.

A small tree, sometimes forty-five feet in height, one to two feet or over in diameter. Sometimes reduced to low shrub. Small prickly burr with single small chestnut-colored nut.

Color, Appearance, or Grain of Wood.

Heartwood dark brown, sapwood hardly distinguishable. Coarse-grained, annual layers marked by rows of open ducts.

Structural Qualities of Wood.

Rather heavy, hard, strong. Durable in exposed positions. Liable to check in drying.

Representative Uses of Wood.

Posts, rails, railway ties, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

36.

Modulus of Elasticity.

1,620,000.

Modulus of Rupture.

14,000.

Remarks.

The Chinquapin *Castanopsis chrysophylla*, is a tree with characteristics between oak and chestnut. Its wood is nearly similar to that of the Chinquapin *Castanea pumila*, and is sometimes used for implements.

BEECH.**IRONWOOD.***(Fagus.) (Carpinus, Ostrya, etc.)*

Beech is well known on the eastern continent. The common beech (*Fagus atropunicea*) is the only American representative. Eastern species

BEECH (*Fagus atropunicea*).

have figured in literature since the time of Virgil. The northern nations early wrote upon thin tablets of beechwood, and *boc*, *boč*, and *buche*, the northern names for beech, finally gave origin to the word book.* American Indians

believed that the beech was proof against lightning.

Beechwood is hard, heavy, strong, not durable when exposed, and somewhat subject to attack by insects. European engineers employ it to a considerable extent in construction, but it is seldom used in America save for indoor finish, furniture, handles, flooring, and the like. The small edible nuts, known as beech-mast, are pressed abroad for a fixed oil, resembling and used in place of that from the olive. They are seldom gathered in this country, but are devoured by animals. Beech-trees have smooth, light-colored bark, and are very attractive in their winter appearance. They may be recognized earlier in the season by their small prickly burrs, each containing two triangular, sharp-edged nuts. There are fifteen or more species known to belong to this genus. *Fagus* is from *phago*, to eat, and refers to the nut.

The name Ironwood has been applied to Blue Beech (*Carpinus caroliniana*), to the Hornbeam (*Ostrya virginiana*), and to at least eight other North American species affording unusually hard and heavy woods, such as are used for handles

**Liber*, the Latin for book, is from *liber*, the inner bark of a tree, while *papyrus*, the Latin for paper, is from an Egyptian reed of that name. The words "book," "library," and "paper" are thus drawn from trees and plants.

† Keeler notes experiments made to prove resistance on part of beechwood.

PLATE 12. BEECH (*Fagus*).



and implements.* Trunks of trees affording these woods are generally small and the weight of the woods is so great as to prevent their use in construction.

* *Prosopis juliflora*, *Olneya tesota*, *Gujacum sanctum*, *Cliftonia monophylla*, *Cyrilla racemiflora*, *Exothea paniculata*, *Bumelia tenax*, *Bumelia lycioides*. (Sudworth.)

Beech. { *Fagus atropunicea* (Marsh.) Sudworth.
 } *Fagus ferruginea* Ait.

Nomenclature. (Sudworth.)

Beech (local and common name). White Beech (Me., Ohio., Mich.).

Red Beech (Me., Vt., Ky., Ohio.). Ridge Beech (Ark.).

Locality.

Nova Scotia to Florida, westward intermittently to Wisconsin and Texas.

Features of Tree.

Sixty to eighty feet, occasionally higher; two to four feet in diameter. Small rough burr contains two thin-shelled nuts.

Color, Appearance, or Grain of Wood.

Heartwood reddish, variable shades, sapwood white. Rather close-grained, conspicuous medullary rays.

Structural Qualities of Wood.

Hard, strong, tough, not durable when exposed. Takes fine polish. Liable to check during seasoning.

Representative Uses of Wood.

Shoe-lasts, plane-stocks, ship-building, handles, and fuel. Carpentry (abroad), wagon-making, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot. .

42.

Modulus of Elasticity.

1,720,000.

Modulus of Rupture.

16,300.

Remarks.

The nuts are seldom gathered in the United States, nor is the wood there often utilized in carpentry. This is sometimes divided commercially into Red and White Beech, according to color of wood. Such division has no botanical basis.

Ironwood, Blue Beech. *Carpinus caroliniana* Walt.

Nomenclature. (Sudworth.)

Ironwood, Blue Beech (local and common name).	Hornbeam (Me., N. H., Mass., R. I., Conn., N. Y., N. J., Pa., Del., N. C., S. C., Ala., Tex., Ky., Ill., Kans., Minn.).
Water Beech (R. I., N. Y., Pa., Del., W. Va., Ohio, Ill., Ind., Mich., Minn., Nebr., Kans.).	

Locality.

Quebec to Florida, westward intermittently to Nebraska and Texas.

Features of Tree.

Thirty to fifty feet in height. Six inches to occasionally two feet in diameter. A small tree, dark bluish-gray; bark resembles that of beech save in color.

Color, Appearance, or Grain of Wood.

Heartwood light brown, thick sapwood nearly white, close-grained.

Structural Qualities of Wood.

Very hard, tough, strong, heavy, very stiff, inclined to check during seasoning, not durable when exposed.

Representative Uses of Wood.

Levers, tool-handles, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

45.

Modulus of Elasticity.

1,630,000.

Modulus of Rupture.

16,300.

Remarks.

Prized by wheelwrights in Europe. Resemblance of bluish bark to light-gray bark of beech gave rise to name.

Ironwood, Hop Hornbeam. *Ostrya virginina* Willd.

Nomenclature. (Sudworth.)

Ironwood, Hop Hornbeam (local and common names).	Hornbeam (R. I., N. Y., Fla., S. C., La.).
Leverwood (Vt., Mass., R. I., N. Y., Pa., Kans.).	Hardhack (Vt.).

Locality.

Nova Scotia to Florida, westward intermittently to Dakota and Texas.

Features of Tree.

Thirty to forty feet in height, one foot or less in diameter.
The bark exhibits long vertical rows of small squares. Small fruit resembles hops. Leaves resemble those of birch.

Color, Appearance, or Grain of Wood.

Heartwood reddish brown, sometimes white, sapwood lighter or white. Close-grained, compact structure.

Structural Qualities of Wood.

Very strong, hard, heavy, tough, durable when exposed.

Representative Uses of Wood.

Posts, levers, tool-handles, axe-helves, mill-cogs, wedges.

Weight of Seasoned Wood in Pounds per Cubic Foot.

51.

Modulus of Elasticity.

1,950,000.

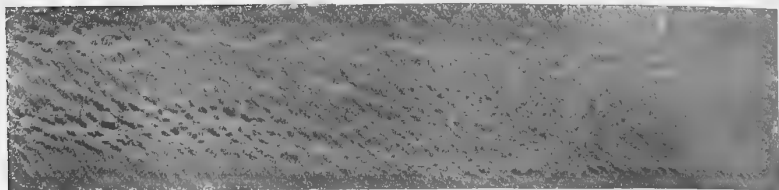
Modulus of Rupture.

16,000.

Remarks.

Trees over twelve inches in diameter are often hollow.

PLATE 13. SYCAMORE (*Platanus occidentalis*).



SYCAMORE.

(*Platanus*.)

The name Sycamore applies to a maple (*Acer pseudo-platanus*) in Europe, to a fig-tree (*Ficus sycomorus*) in the Orient,* and to the buttonball or plane tree (*Platanus*) in North America. Of the plane trees (*Platanus*) the common or Oriental plane (*Platanus orientalis*) is a native of Europe; the plane, buttonball, or sycamore tree (*Platanus occidentalis*) is a native and common tree in eastern North America; and the California plane, buttonball, or sycamore (*Platanus racemosa*) is a native of western North America.

The sycamore stands for curiosity, because of its Biblical association with Zaccheus. Many European sycamores were planted by religious persons during the middle ages because of the belief that they were the trees thus referred to in the Bible.

The woods afforded by the American sycamores have unusually complicated, cross-grained, but beautiful structures, difficult to work, but standing well and valued for cabinet work and small articles. American trees are often very large.

American buttonball or sycamore trees are distinguished by rough balls which remain hanging on long stems throughout the winter. The bark also is shed to an unusual extent; flakes of the outer cover drop away, exposing smooth inner surfaces so white as to appear as if painted. Six or seven species are included in the genus; three occur in North America. *Platanus* is from *platus*, signifying broad, and refers to the shape of the leaves.



SYCAMORE (*Platanus occidentalis*).

* Brockhaus, *Konversations-Lexicon* (B. 15, p. 536).

Sycamore.
 Buttonwood.
 Buttonball-tree. } *Platanus occidentalis* Linn.

Nomenclature. (Sudworth.)

Sycamore, Buttonwood, Buttonball Tree (local and common names).	Plane Tree (R. I., Del., S. C., Kans., Nebr., Ia.).
Buttonball (R. I., N. Y., Pa., Fla.).	Water Beech (Del.). Platane cotonier, Bois puant (La.).

Locality.

Maine to Florida, westward intermittently to Nebraska and Texas. Best in bottom lands of Ohio and Mississippi River basins.

Features of Tree.

Ninety to over one hundred feet in height, six to sometimes twelve feet in diameter. Inner bark exposed in white patches. Large rough balls or fruit.

Color, Appearance, or Grain of Wood.

Heartwood reddish brown, sapwood lighter, close-grained, compact structures, satiny conspicuous medullary rays. Attractive when quartered.

Structural Qualities of Wood.

Heavy, hard, difficult to work, not strong, stands well when not exposed.

Representative Uses of Wood.

Tobacco-boxes, ox-yokes, butcher-blocks, cabinet-work.

Weight of Seasoned Wood in Pounds per Cubic Foot.

35.

Modulus of Elasticity.

1,220,000.

Modulus of Rupture.

9000.

Remarks.

Some specimens rank among the largest of American deciduous trees. These are usually hollow. The remarkably rigid bark does not stretch to accommodate the growth and is thus discarded to an unusual degree.

California Sycamore. *Platanus racemosa* Nutt.

Nomenclature.

Sycamore, Buttonwood, Buttonball Tree, Buttonball (California).

Locality.

California.

Features of Tree.

Seventy-five to one hundred feet in height, occasionally higher; three to four feet in diameter. The bark exfoliates in irregular patches.

Color, Appearance, or Grain of Wood.

Heartwood light reddish brown, sapwood lighter, close-grained, compact structure, medullary rays numerous and conspicuous. Beautiful when quartered.

Structural Qualities of Wood.

Brittle, very difficult to split and to season. Qualities similar to those of *P. occidentalis*.

Representative Uses of Wood.

Decoration, furniture, similar to *P. occidentalis*.

Weight of Seasoned Wood in Pounds per Cubic Foot.

30.

Modulus of Elasticity.

800,000.

Modulus of Rupture.

7900.

Remarks.

Hough mentions* a tree twenty-nine feet seven inches in circumference.

* "American Woods," Part 6, p. 36.

BIRCH.

(*Betula.*)

The birches grow in Europe, Asia, and North America, their ranges on the latter continent extending far into the north.* Their history is remote and probably began with attention to the bark rather than to the wood.

Birch-bark is smooth, pliable, water-tight, and by reason of its resinous oils so durable that it often remains intact long after the wood inside of fallen trees has disappeared. It is separable into thin layers and was early employed as a writing material.† Houses have been covered by it and it has been used for cordage, utensils, "damp courses," and even rude clothing. The American Indians employed it for canoes, tents, troughs, and buckets. The wood is hard, heavy, strong, fine-grained, and beautiful. It shrinks in seasoning, works easily, stands well when not exposed. It is used for spools, woodenware, and other small articles, as well as for interior finish and cabinet work. Figured birch is one of the most beautiful of American cabinet woods.‡ Birch is often stained so as to imitate cherry and mahogany; the best imitations of the latter wood are of birch. Birch is commercially divided, according to the quantity of heartwood present, into white birch and red birch. The wood is "white" when the amount is small, and as heartwood increases with age the same tree might at one time afford white and at another red wood.

Birch trees may be known by their more or less laminated bark with its peculiar long horizontal lenticles or dashes. The

* Birch forms large forests in the North.

† Pliny and Plutarch agree that the famous books of Numa Pompilius, written 700 years before Christ, were upon birch-bark. (Keeler.)

‡ The banquet-hall of the famous Auditorium Hotel in Chicago is finished in birch. (Kidder.)

PLATE 14. BIRCH (*Betula*).



Yellow Birch Tree (*Betula lutea*).
Yellow Birch Foliage (*Betula lutea*).

White Birch Bark (*Betula populifolia*),
Birch Wood.

leaves of the several birches differ but little, but the decided colors exhibited by their barks give names and serve to distinguish the species. Nine of the twenty-four known species of birch occur in North America; six are trees and the others low shrubs. *Betula* is said to be derived from bitumen.

White Birch. *Betula populifolia* Marsh.

Nomenclature. (Sudworth.)

White Birch (local and com- Oldfield Birch, Poverty Birch
mon name). (Me.).Gray Birch (Me., R. I., Poplar-leaved Birch, Small
Mass.). White Birch (Vt.).

Locality.

Atlantic coast, Canada to Delaware.

Features of Tree.

Twenty to forty feet in height, about one foot in diameter.

Durable, laminated, smooth, white bark on large branches
and on trunk, save near ground; is not very easily detached
from tree. Tremulous leaves.

Color, Grain, or Appearance of Wood.

Heartwood light brown, sapwood lighter, close-grained.

Structural Qualities of Wood.

Soft, light, not strong or durable.

Representative Uses of Wood.

Clothes-pins, shoe-pegs, tooth-picks, paper-pulp.

Weight of Seasoned Wood in Pounds per Cubic Foot.

35.

Modulus of Elasticity.

1,036,000.

Modulus of Rupture.

11,000.

Remarks.

The white bark is distinct from that of the paper birch in that
it does not cover the whole trunk and in that it remains more
perfectly intact.

Paper Birch, White Birch. *Betula papyrifera Marsh.*

Nomenclature. (Sudworth.)

Paper Birch, White Birch	Boleau (Quebec).
(local and common names).	Canoe Birch (Me., Vt., N. H.,
Silver Birch (Minn.).	R. I., Mass., N. Y., Pa.,
Large White Birch (Vt.).	Wis., Mich., Minn.).

Locality.

Northern United States, northward into Canada, valley of the Yukon in Alaska.

Features of Tree.

Fifty to seventy feet in height, one and one-half to two and one-half feet in diameter. Smooth white exterior bark on large limbs and trunks away from ground. Brown or orange inner surfaces of bark. Splits freely into thin paper-like layers.

Color, Grain, or Appearance of Wood.

Heartwood brown tinged with red, sapwood nearly white. Very close-grained, compact structure.

Structural Qualities of Wood.

Strong, hard, tough, not durable.

Representative Uses of Wood.

Spools, shoe-last, pegs, paper-pulp, fuel, bark used in canoes.

Weight of Seasoned Wood in Pounds per Cubic Foot.

37.

Modulus of Elasticity.

1,850,000.

Modulus of Rupture.

• 15,000.

Remarks.

Starch is said to be manufactured from inner bark by Northern Indians. Reaches higher latitude than any American deciduous tree. Forms forests. The name White Birch is because of the color of the bark.

Red Birch.*Betula nigra* Linn.

Nomenclature. (Sudworth.)

Red Birch (local and common name).	Ala., Miss., Tex., Mo., Ill., Wis., Ohio).
Black Birch (Fla., Tenn., Tex.).	Birch (N. C., S. C., Miss., La.).
River Birch (Mass., R. I., N. J., Del., Pa., W. Va.,	Water Birch (W. Va., Kans.). Blue Birch (Ark.).

Locality.

Massachusetts to Florida, westward intermittently to Minnesota and Texas. Best development in south Atlantic and lower Mississippi valley regions.

Features of Tree.

Thirty to eighty feet in height, one to three feet in diameter, sometimes larger. Dark red brown scaly bark on trunk. Red to silvery-white bark on branches. Bark separates in thin paper-like scales curling outward.

Color, Appearance, or Grain of Wood.

Heartwood light brown, sapwood yellowish white. Close-grained, compact structure.

Structural Qualities of Wood.

Light, rather hard and strong.

Representative Uses of Wood.

Furniture, woodenware, shoe-lasts, ox-yokes. **Inferior cask-hoops** from branches.

Weight of Seasoned Wood in Pounds per Cubic Foot.

35.

Modulus of Elasticity.

1,580,000.

Modulus of Rupture.

13,100.

Remarks.

Dark brown bark, whence name Red Birch. Prefers moist bottoms, whence name River Birch.

Yellow Birch. *Betula lutea Michx. f.*

Nomenclature. (Sudworth.)

Yellow Birch (local and com- mon name).	Swamp Birch (Minn.). Silver Birch (N. H.).
Gray Birch (Vt., R. I., Pa., Mich., Minn.).	Merisier, Merisier Rouge (Quebec).

Locality.

Newfoundland to North Carolina, westward intermittently to Minneosta and Texas. Best developed north of the Great Lakes.

Features of Tree.

Sixty to eighty feet or more in height, two to four feet in diameter. A medium-sized tree. Bark on trunk silvery gray to silvery yellow, branches green to lustrous or dull brown. Bark exfoliates, causing a rough, ragged appearance.

Color, Appearance, or Grain of Wood.

Heartwood light reddish brown, sapwood nearly white, close-grained, compact structure, satiny.

Structural Qualities of Wood.

Heavy, very strong, and hard, tough, susceptible of high polish. Qualities suggest those of maple. Not durable when exposed.

Representative Uses of Wood.

Furniture, buttons, tassel-moulds, pill-boxes, spools, and wheel-hubs.

Weight of Seasoned Wood in Pounds per Cubic Foot.

40.

Modulus of Elasticity.

2,290,000.

Modulus of Rupture.

17,700.

Remarks.

Occasional trees have thin outer bark ruptured, and exhibit inner bark of almost metallic yellow. *Lutea*, signifying yellow, alludes to color of bark. Inner bark has pungent, pleasant flavor.

Sweet Birch, Cherry Birch. *Betula lenta* Linn.

Nomenclature. (Sudworth.)

Sweet Birch, Cherry Birch (many localities).	Mahogany Birch (N. C., S. C.).
Black Birch (N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Pa., W. Va., Ga., Ill., Ind., Mich., Ohio).	River Birch (Minn.). Mountain Mahogany (S. C.).

Locality.

Newfoundland intermittently to Illinois, southward intermittently along Alleghanies to Kentucky, Tennessee, and Florida.

Features of Tree.

Fifty to eighty feet in height, three to four feet in diameter, dark reddish-brown bark, resembling that of cherry; does not separate into layers as paper-birch. Leaves, bark, and twigs sweet, spicy, and aromatic.

Color, Appearance, or Grain of Wood.

Heartwood dark brown tinged with red, sapwood light brown or yellow, close-grained, compact structure.

Structural Qualities of Wood.

Heavy, very strong, hard, receives stains and high satin-like polish.

Representative Uses of Wood.

Woodenware, furniture, ship-building (Canada), fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

47.

Modulus of Elasticity.

2,010,000.

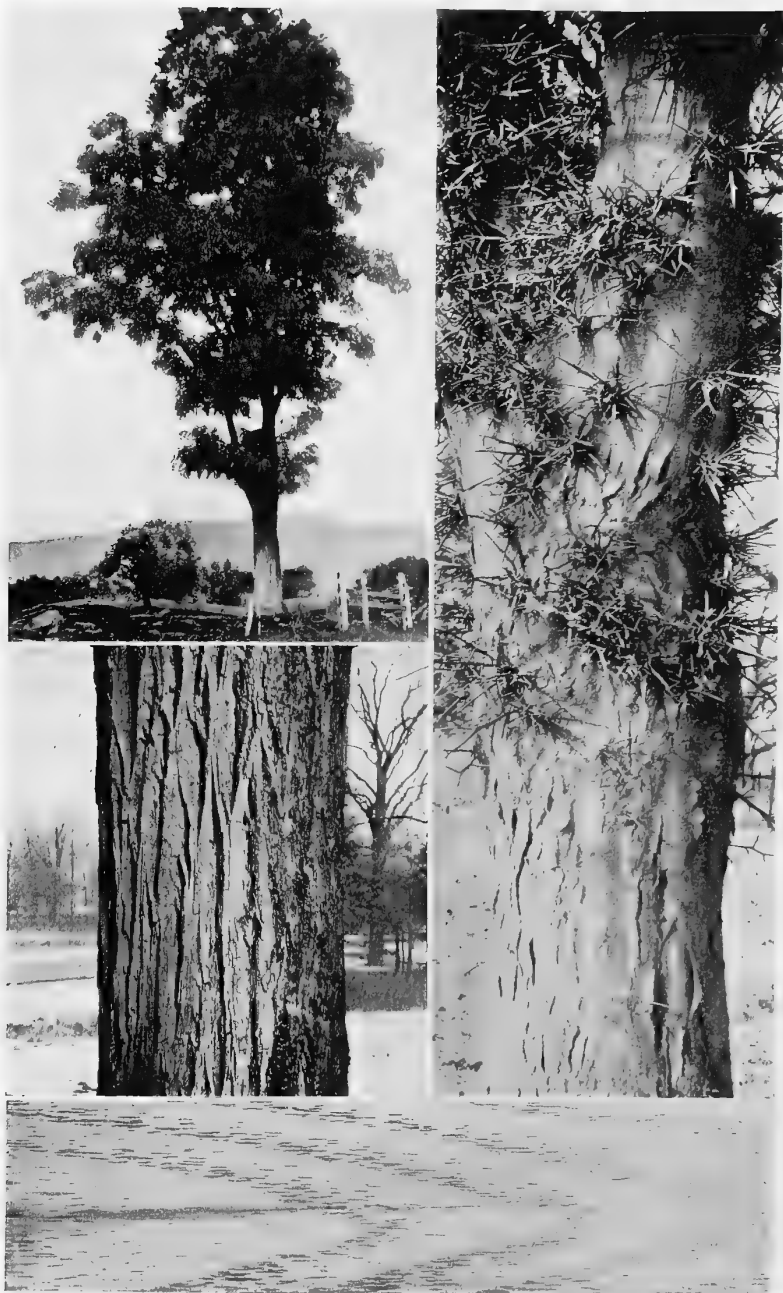
Modulus of Rupture.

17,000.

Remarks.

A common tree in Northern States. Wood often stained so as to resemble cherry and mahogany. Essences suggest wintergreen, contain much salicylic acid, and are used in medicine. The name "cherry" is because bark resembles that of cherry. "Sweet" is because of essences.

PLATE 15. LOCUST (*Robinia, Gleditsia*).



Black Locust Tree and Bark (*Robinia pseudacacia*.)

Honey Locust (*Gleditsia triacanthos*).

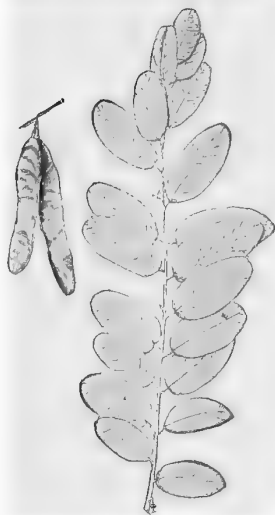
Locust Wood.

LOCUST, MESQUITE.

(*Robinia*, *Gleditsia*, *Prosopis*.)

The name Locust applies to species of three distinct genera, all of which belong to the family Leguminosæ. The black locust (*Robinia pseudacacia*), the honey locust (*Gleditsia triacanthos*), and the Mesquite or honey locust (*Prosopis juliflora*) are principal representatives of their respective kinds. The first-named genus is North American, the other two have species on both continents.

Black locust wood is tough, durable, unequalled for torsional strength and resilience, and is in every way in the first rank of American woods. It is fitted not only for exposed constructions, but for finer articles; hubs, pins, bolts, and trenails having no superiors. Trees develop rapidly when young, heart wood forming as early as the third year. Later growth and ultimate commercial value in the United States are much affected by insect borers, which practically limit the usefulness of the species. The black locust may be known by its clusters of large pea-blossom-shaped flowers, its bean-shaped pods, three to six inches in length, and by the prickles on the bark. The genus has



BLACK LOCUST (*Robinia pseudacacia*).

six species, four of which are natives of the United States.* *Robinia* is from Robin, the name of an early French botanist.

* Three of the four United States species are trees; the other species of this genus grow in Mexico. No one is approximately as important or well known as the Black Locust.

The black locust has been extensively introduced into Europe, both for ornamentation and for wood.*

The wood of the honey locust resembles that of the black locust, but is seldom used or appreciated save for fencing and similarly unimportant purposes. Trees grow rapidly and are not subject to the attacks of insects, so that they frequently attain to normal proportions. The flowers are much smaller than those of the black locust, but the pods are several times as long (twelve to eighteen inches). These often curl in drying and are thus rolled to some distance by the wind. Thorns or spines are present on some individuals and are often from three to six inches in length. The foliage resembles but is more delicate than that of the black locust. There is at least one other American species. *Gleditsia* is from Gleditsch, the name of a botanist.

Mesquite, also called honey locust, affords wood that is hard, heavy, and almost indestructible in exposed positions. The tree grows in the desert where vegetation would often seem to be impossible. The roots are developed to great size by their search for water, and are gathered and burned in the absence of other fuel. The trunks are small, but afford posts and ties. There are pods filled with rich edible pulp. Sixteen or more species belong to this genus, *Prosopis*, of which one other, the screw-pod mesquite (*Prosopis odorata*), is found in the United States.

* Black Locust was introduced into Europe early in the seventeenth century, being first cultivated by the son of Jean Robin, for whom the genus is named. Few American species have received such attention abroad.

Locust, Black Locust, Yellow Locust. *Robinia pseudacacia* Linn.

Nomenclature. (Sudworth.)

Locust, Black Locust, Yellow Locust (local and common names).	Red Locust, Green Locust (Tenn.).
False Acacia (S. C., Ala., Tex., Minn.).	Honey Locust (Minn.).
Pea-flower Locust, Post Locust (Md.).	White Locust (R. I., N. Y., Tenn.).
	Acacia (La.).

Locality.

Southern Alleghany region, widely cultivated in United States east of Rocky Mountains.

Features of Tree.

Fifty to seventy feet in height, two to three feet or over in diameter. Leaves curl or close at night. Long spikes or briars on young branches.

Color, Appearance, or Grain of Wood.

Heartwood brownish, thin sapwood, light-greenish yellow. Close-grained and compact. Annual layers clearly marked.

Structural Qualities of Wood.

Heavy, very hard, strong, and durable under extreme conditions of wet and dry.

Representative Uses of Wood.

Long wooden bolts or pins called treenails. Posts, ties, construction, turnery, ship-ribs, ornamentations, fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

45.

Modulus of Elasticity.

1,830,000.

Modulus of Rupture.

18,100.

Remarks.

Often a low shrub. Extensively planted, particularly in West, but subject to attack by borers. One of the most valuable of American timber trees. Heartwood is formed very early in this species. Pseudacacia means false acacia or imitation of acacia.

Honey Locust. *Gleditsia triacanthos* Linn.

Nomenclature. (Sudworth.)

Honey Locust (local and common name). Honey or Honeyshucks (R. I., N. J., Va., Fla., Iowa).

Thorn or Thorny Locust Tree or Acacia (N. Y., N. J., Ind., Tenn., La.). Honeyshucks Locust (Ky.). Sweet Locust (S. C., La., Kans., Nebr.).

Three-thorned Acacia (Mass., R. I., La., Tex., Neb., Mich.). Piquant Amourette (La.). Confederate Pintree (Fla.). Locust (Nebr.).

Black Locust (Miss., Tex., Ark., Kans., Neb.).

Locality.

Pennsylvania to Florida, westward intermittently to Nebraska and Texas. Best in lower Ohio River basin.

Features of Tree.

Seventy to ninety feet or more in height, two to four feet in diameter. Frequent long thorns.* Light thin foliage. Brown pods contain sweet pulp.

Color, Appearance, or Grain of Wood.

Heartwood bright brown or red, sapwood yellowish, annual layers strongly marked, coarse-grained, medullary rays conspicuous.

Structural Qualities of Wood.

Heavy, hard, strong, very durable in contact with soil.

Representative Uses of Wood.

Fence-posts, rails, wagon-hubs, rough construction, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

42.

Modulus of Elasticity.

1,540,000.

Modulus of Rupture.

13,100.

Remarks.

Widely cultivated for landscape effect. Young trees used for forming hedges.

* Thorns plentiful on some individuals, but absent on others.

Mesquite. *Prosopis juliflora* (Swartz) de C.

Nomenclature. (Sudworth.)

Mesquite (Tex., N. M., Ariz., Cal.). Honey Pod or Honey Locust (Tex., N. M.).

Algaroba (Tex., N. M., Ariz., Cal.). Ironwood (Tex.).

Locality.

Texas, west to San Bernardino Mountains, California. Also Colorado, Utah, and Nevada and northern Mexico.

Features of Tree.

Forty to fifty feet in height, one to two feet in diameter. Sometimes low shrub. Roots often very large. Pods with sweet pulp.

Color, Appearance, or Grain of Wood.

Heartwood rich dark brown, often red. Sapwood clear yellow. Close-grained, compact structure, distinct medullary rays.

Structural Qualities of Wood.

Weak, difficult to work, heavy, hard, very durable.

Representative Uses of Wood.

Posts, fencing, ties, house-beams, fuel, charcoal.

Weight of Seasoned Wood in Pounds per Cubic Foot.

47.

Modulus of Elasticity.

820,000.

Modulus of Rupture.

6800.

Remarks.

A locally important tree. Trees sometimes stunted by fires have numerous roots. Large roots used for fuel.

WHITEWOOD OR TULIP-TREE WOOD, POPLAR OR COTTONWOOD,
(*Liriodendron*.) (*Populus*.)

CUCUMBER-TREE WOOD, BASSWOOD.
(*Magnolia*.) (*Tilia*.)

These trees are not related, but are all noted for woods with soft, fine qualities, such as fit them for carvings, woodenware, and paper-pulp. No one of the woods is durable when exposed, and all are used for boxes because they nail without splitting. The names are commercially interchangeable.

The whitewood or tulip tree (*Liriodendron tulipifera*) is a native of America and an acclimated tree in Europe. It is the sole surviving species of its genus. The wood is soft, stiff,



WHITEWOOD (*Liriodendron tulipifera*).

clean, fine, straight-grained, and obtainable in large-sized pieces. Much whitewood is made into lumber, the wood standing among those of the broadleaf series as white pine does among the conifers. Whitewood is particularly suitable for carvings. In spite of its name it is largely greenish yellow. It is often divided commercially, according to color, into

“white poplar” and “yellow poplar.” Trunks often attain to a very large size. Matthews mentions a specimen* thirty-three feet in circumference. The species may be known by its large tulip-shaped flower. *Liriodendron* is from two Greek words meaning lily and tree.

The poplars, sometimes called cottonwoods because of their seeds covered with a cotton-like down, are represented on both continents. The wood was made into shields by the

*F. Schuyler Matthews, “Familiar Trees” (Appleton, 1901), p. 39.

PLATE 16. WHITEWOOD OR TULIP TREE (*Liriodendron tulipifera*).



ancients, because it was light and tough and would indent without breaking. The wood is often substituted for white-wood, but is less desirable, although valuable as a basis for paper-pulp. The trees may be known by the long drooping catkins that appear early in the spring before the leaves, and that are followed by white downy seeds that soon escape to whiten the surrounding ground. The poplars are noted for foliage more or less constantly in agitation. This peculiarity, so pronounced in the aspen (*Populus tremuloides*), is due to the very long petioles or leaf-stems. The cottonwoods abound in many otherwise arid regions of American Western deserts.

The cucumber trees are of the magnolia family and grow in many of the Eastern States. The wood resembles and is probably often mistaken for whitewood, for which it is a fair substitute. The trees may be known by their fruit, which resembles vegetable cucumbers. Magnolia is from Magnol, a botanist of the seventeenth century.

Basswood is a name applied to trees known in Europe and America as limes, lime trees, lind, linden, tiel, tiel trees, bass, and basswood trees. The trees and their wood were early esteemed, the first for their shade and appearance, and the last for their working qualities, which resemble, but are inferior to, whitewood.* The trees are characterized by their dense foliage and clusters of small cream-colored fragrant flowers, so attractive to bees as to have originated the further name bee-tree. *Tilia* arises from the ancient name for these trees.

* The carvings of Gibbons, a famous English artist, are said to have been made entirely of linden, no other available wood being so even-grained and free from knots. (Keeler.)

Tulip Tree, Whitewood, Yellow Poplar. *Liriodendron tulipifera* Linn.

Nomenclature. (Sudworth.)

Tulip Tree, Whitewood, Yellow Poplar (local and common names).

Poplar (R. I., Del., N. C., S. C., Fla., Ohio).

Tulip Poplar (Del., Pa., S. C., Ill.).

Hickory Poplar (Va., W. Va., N. C.).

Blue Poplar (Del., W. Va.).

Popple (R. I.).

Cucumber Tree (N. Y.).

Canoe-wood (Tenn.).

Locality.

New England to Florida, westward intermittently to Michigan and Mississippi.

Features of Tree.

Ninety to one hundred and fifty feet in height, six to twelve feet in diameter. Tulip-shaped flowers in spring. Greenish cones dry and remain after leaves have fallen.

Color, Appearance, or Grain of Wood.

Heartwood light yellow or greenish brown, thin sapwood, nearly white. Close, straight-grained, compact structure, free from knots.

Structural Qualities of Wood.

Light, soft, moderately strong, brittle, easily worked, durable. Hard to split, shrinks little, resembles white pine, stands well.

Representative Uses of Wood.

Lumber, interior finish, shingles, boat-building, pumps, woodenware, shelves, the bottoms of drawers.

Weight of Seasoned Wood in Pounds per Cubic Foot.

26.

Modulus of Elasticity.

1,300,000.

Modulus of Rupture.

9300.

Remarks.

Very large trees formerly common. Indians hollowed logs into boats. "Some large enough to carry twenty or thirty persons" (Hough), whence name canoe-wood. *Tulipifera*, signifying turbans and to bear, refers to flowers. One of the largest as well as most useful of American deciduous trees.

Poplar, Largetooth Aspen. *Populus grandidentata Michx.*

Nomenclature. (Sudworth.)

Poplar, Largetooth Aspen (local and common names).	White Poplar (Mass.). Popple (Me.).
Largetooth Poplar (N. C.).	Large American Aspen (Ala.).
Large Poplar (Tenn.).	

Locality.

Nova Scotia and Delaware, westward intermittently to Minnesota, Alleghany Mountains to Kentucky and Tennessee.

Features of Tree.

Sixty to eighty feet high, two feet or more in diameter. Irregular points or teeth on margins of leaves. Smooth gray bark.

Color, Appearance, or Grain of Wood.

Heartwood brownish, sapwood nearly white, close-grained, compact structure.

Structural Qualities of Wood.

Soft, light, weak.

Representative Uses of Wood.

Paper-pulp and occasionally woodenware.

Weight of Seasoned Wood in Pounds per Cubic Foot.

28.

Modulus of Elasticity.

1,360,000.

Modulus of Rupture.

10,200.

Remarks.

The several "poplars" are much prized for paper-pulp. The quaking aspen (*P. tremuloides*) has long leaf-stalks flattened vertically to the leaf-surface, so that leaves tremble in slight winds.

Cottonwood. { *Populus deltoides* Marsh.
 { *Populus monilifera* Ait.

Nomenclature. (Sudworth.)

Cottonwood (local and common name).	Big Cottonwood (Miss., Neb.). Whitewood (Ia.).
Carolina Poplar (Pa., Miss., La., N. M., Ind., Ohio).	Cotton Tree (N. Y.). Necklace Poplar (Tex., Col.).
Yellow Cottonwood (Ark., Ia., Neb.).	Broadleaved Cottonwood (Colo.).

Locality.

Canada to Florida, westward intermittently to Rocky Mountains.

Features of Tree.

Seventy-five to one hundred feet in height, four to five feet in diameter, occasionally much larger. Long catkins distribute cotton-like fibres.

Color, Appearance, or Grain of Wood.

Thin heartwood, dark brown, sapwood nearly white, close-grained, compact structure.

Structural Qualities of Wood.

Light, soft, weak, liable to warp, difficult to season.

Representative Uses of Wood.

Greatly valued in manufacture of paper-pulp, also packing-boxes, fence-boards, fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

24.

Modulus of Elasticity.

1,400,000.

Modulus of Rupture.

10,900.

Remarks.

Monilifera is from the Latin *monolinum*, a necklace, and *fero*, to bear, and refers to the long necklace or catkin.

Black Cottonwood. *Populus trichocarpa* Torr. and Gr.

Nomenclature. (Sudworth.)

Black Cottonwood (Oreg., Cal.). Cottonwood (Oreg., Cal.).

Balsam Cottonwood, Balm (Oreg.). Balm Cottonwood (Cal.).

Locality.

Pacific coast region, Alaska to California.

Features of Tree.

A large tree sometimes one hundred and fifty feet in height and four to six feet in diameter.

Color, Appearance, or Grain of Wood.

Heartwood light dull brown, sapwood nearly white, compact structure.

Structural Qualities of Wood.

Light, soft, weak.

Representative Uses of Wood.

Staves, woodenware (local).

Weight of Seasoned Wood in Pounds per Cubic Foot.

23.

Modulus of Elasticity.

1,580,000.

Modulus of Rupture.

8400.

Remarks.

Largest deciduous tree of Puget Sound district (Sargent).

Cucumber Tree. *Magnolia acuminata* Linn.

Nomenclature. (Sudworth.)

Cucumber Tree (R. I., Mass., N. Y., Pa., N. C., S. C., Ala., Miss., La., Ark., Ky., W. Va., Ohio, Ind., Ill.),
 Mountain Magnolia (Miss., Ky.),
 Black Lin, Cucumber (W. Va.),
 Magnolia (Ark.).

Locality.

New York to Illinois, southward through Kentucky and Tennessee to Gulf (intermittently).

Features of Tree.

Fifty to occasionally one hundred feet in height, two to four feet in diameter. A large, handsome, symmetrical tree, with cones resembling cucumbers.

Color, Appearance, or Grain of Wood.

Heartwood brownish yellow, sapwood nearly white, close-grained, compact structure. Satiny, thin medullary rays.

Structural Qualities of Wood.

Light, soft, not strong, durable. Qualities similar to white-wood.

Representative Uses of Wood.

Cabinet-making, cheap furniture, flooring, pump-logs, troughs, crates, packing-boxes. Used similarly to *L. tulipifera*.

Weight of Seasoned Wood in Pounds per Cubic Foot.

29.

Modulus of Elasticity.

1,310,000.

Modulus of Rupture.

9500.

Remarks.

Wood resembles and is often sold for tulip-tree wood.

Basswood, Linn, Linden. *Tilia americana* Linn.

Nomenclature. (Sudworth.)

Basswood, Linn, Linden,	Whitewood (Vt., W. Va., Ark.,
American Linden (local	Minn.).
and common names).	Yellow Basswood, Lein (Ind.).
Limetree (R. I., N. C., S. C.,	Beetree (Vt., W. Va., Wis.).
Ala., Minn., La., Ill.).	White Lind (W. Va.).
Black or Smooth-leaved Lime-	Wickup (Mass.).
tree (Tenn.).	

Locality.

New Brunswick to Georgia, westward intermittently to Nebraska and Texas. Wide range.

Features of Tree.

Sixty to ninety feet in height, two to four feet in diameter, occasionally larger. Large smooth leaves.

Color, Appearance, or Grain of Wood.

Heartwood light or reddish brown, thick sapwood nearly similar, very straight and close-grained, compact structure.

Structural Qualities of Wood.

Light, soft, easily worked, tough, not strong nor durable.

Representative Uses of Wood.

Sides and backs of drawers, bodies of carriages, woodenware, paper-pulp.

Weight of Seasoned Wood in Pounds per Cubic Foot.

28.

Modulus of Elasticity.

1,190,000.

Modulus of Rupture.

8300.

Remarks.

Basswood refers to the inner bark or "bast," sometimes utilized for cordage. The flowers attract bees, whence the name beebtree. White Basswood, (*Tilia heterophylla*,) is not distinguished commercially.

WILLOW.

(*Salix*.)

The willows are very widely distributed over both continents, and their history extends back over a very considerable period. Pliny states that Britons used to make voyages in boats of willow. The willow mentioned in the Bible was the *Salix babylónica*, or weeping willow, later acclimated in this country.

The principal experience with the tough, light, workable, elastic wood has been in Europe. The ancients used it for shields, because it was one of the woods that would indent without breaking. Lazlett states that it is used for cart-linings because it will not splinter when struck by stones. It has been used for lap-boards, cricket-bats, keels, paddles, and water-wheels. It resists heat and friction and is therefore used for lining friction-brakes. Willow charcoal ignites readily and is highly esteemed in the manufacture of the finer kinds of gunpowder. The bark is used in tanning. The little branches have long been associated with baskets and woven work. American trees are seldom cut up into lumber, but are valued for shade and appearance, and are often planted along the banks of streams to prevent erosion.

Willows grow very rapidly and have a characteristic and attractive appearance. They usually prefer low moist places. There are so many hybrids and peculiar species as to render classification in all cases difficult.* Black willow is the native species, oftenest attaining to tree size in North America. The White, Crack, Bedford, and Goat Willows (*Salix alba*, *S. fragilis*, *S. russeliana*, and *S. caprea*) are said to afford good wood. *Salix* is said to be from the Celtic *sal*, meaning near, and *lis*, water. Salicylic acid is abundantly present in the bark of some species.

* About 140 species and varieties of the willow family have been enumerated.

PLATE 17. BLACK WILLOW (*Salix nigra*).



Black Willow.*Salix nigra Marsh.*

Nomenclature. (Sudworth.)

Black Willow (local and common name).

Willow (N. Y., Pa., N. C., S. C., Miss., Tex., Cal., Ky., Mo., Neb.).

Swamp Willow (N. C., S. C.).

Locality.

New Brunswick to Florida, westward intermittently to Dakota, Arizona, and California, Mexico.

Features of Tree.

Forty to fifty feet in height, two to four feet in diameter. Long narrow leaf, characteristic appearance.

Color, Appearance, or Grain of Wood.

Heartwood brown, sapwood nearly white, close-grained.

Structural Qualities of Wood.

Soft, light, weak, checks badly in drying, readily worked. Dents without splitting.

Representative Uses of Wood.

Lap-boards, basket-making, fuel, charcoal.

Weight of Seasoned Wood in Pounds per Cubic Foot.

27.

Modulus of Elasticity.

550,000.

Modulus of Rupture.

6000.

Remarks.

Prefers borders of rivers and bottom lands. Many varieties of willow grow in the United States. No one is used to any extent in construction.

CATALPA.

(*Catalpa*.)

Many kinds of wood that were formerly plentiful are now much less so. Attention is being turned to trees that give best results under artificial conditions. Catalpa, formerly but little known, now bids fair to become of some importance in this connection.

The catalpa grows rapidly and produces a coarse, brittle, weak, but durable and desirable, lumber, well fitted to meet the requirements of railways and other branches of construction where the annual consumption is the largest. Fifty thousand catalpa trees have recently been planted by a Western railway at a cost of one cent apiece. Catalpas at Hutchison, Kansas, were large enough to cut for posts at the end of six years.* A sample tie recently removed from a Western railway was found to be perfect after fifteen years of service. Mr. John Brown† mentions specimens sixteen inches in diameter seventeen years after planting. The species *Catalpa speciosa* is said to be much the more desirable in that it is hardy and reaches a tall upright form.

The catalpa may be known by its showy flowers, suggesting those of the horse chestnut. These are succeeded by long pods filled with many-winged seeds and often used by children as cigars.

* U. S. Dept. of Agriculture, Div. of Forestry, Bulletins 27 and 37.

† *The Forester*, October, 1900, and November, 1902.

Kansas Agricultural College Experiment Station, Bulletin 108.

PLATE 18. CATALPA (*Catalpa*).



Catalpa, Hardy Catalpa. *Catalpa speciosa* Warder.

Nomenclature. (Sudworth.)

Catalpa (R. I., N. Y., La., Ill., Ind., Mo., Wis., Ia., Neb., Minn.).	Western Catalpa (Pa., Ohio, Kans., Neb., Ill.).
Hardy Catalpa (Ill., Ia., Kan., Mich.).	Cigar Tree (Mo., Ia.). Indian Bean, Shawneewood (Ind.). Bois Puant (La.).

Locality.

Central Mississippi valley, naturalized in many localities.

Features of Tree.

Forty to sixty feet or more in height, three to six feet in diameter; well-formed trunks. Large, white, faintly mottled flower, long pod or bean.

Color, Appearance, or Grain of Wood.

Thick heartwood brown, thin sapwood lighter, nearly white, coarse-grained, compact structure, annual layers clearly marked.

Structural Qualities of Wood.

Light, soft, not strong, durable in contact with soil.

Representative Uses of Wood.

Railway ties, fence-posts, rails, adapted for cabinet-work and interior finish.

Weight of Seasoned Wood in Pounds per Cubic Foot.

25.

Modulus of Elasticity.

1,160,000.

Modulus of Rupture.

9000.

Remarks.

Hardier and better formed trunks than afforded by *C. catalpa*. A rapid grower; sprouts vigorously from stumps. A valuable tree, promising to become better known. Foliage subject to attack by insects.

* John P. Brown (*The Forester*, October, 1900).

Catalpa. { *Catalpa Catalpa* (Linn.) Karst.
 { *Catalpa bignonioides* Walt.

Nomenclature. (Sudworth.)

Catalpa (local and common name).	Indian Bean (Mass., R. I., N. Y., N. J., Pa., N. C., Ill.).
Indian Cigar Tree (Pa.).	Catawba, Catawba Tree (Del., W. Va., Ala., Fla., Kans.).
Smoking Bean (R. I.).	Bean Tree (N. J., Del., Pa., Va., W. Va., Mo., Ill., Wis., La., Neb.).
Cigar Tree (R. I., N. J., Pa., W. Va., Mo., Ill., Wis., Ia.).	

Locality.

Naturalized in many localities east of Rocky Mountains.

Features of Tree.

Thirty to fifty feet in height, one to two or more feet in diameter. Trunks not well formed. A low, wide tree, large heart-shaped leaves, characteristic flower. Long slender pod or bean.

Color, Appearance, or Grain of Wood.

Thick heartwood is light pink brown; thin sapwood is nearly white. Coarse-grained, compact.

Structural Qualities of Wood.

Light, soft, not strong, durable in contact with soil.

Representative Uses of Wood.

Fence-posts, railway ties, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

27.

Modulus of Elasticity.

960,000.

Modulus of Rupture.

8300.

Remarks.

Grows rapidly. Pods remain on tree after leaves fall. Sometimes used as cigars by children. Wood is less desirable than *C. speciosa*.

PLATE 19. SASSAFRAS (*Sassafras officinale*).



SASSAFRAS. MULBERRY.

(*Sassafras.*) (*Morus.*)

The sassafras was one of the first American trees to be described in Europe,* where many fictitious properties were early credited to its aromatic essences. The wood is not distinguished by unusual qualities, but trees are cut for lumber as encountered with other and more valuable species in the forest. The mucilaginous leaves are of three separate shapes. Some have lobes on both sides of the central surface, others have one lobe at one side so as to resemble mittens, while yet others on the same branch have simple oval shapes. The dark-blue berries on bright-red stems are so eagerly devoured by birds as to be seldom seen. The characteristic flavor is most pronounced in the bark of the root.

The Red, White, and Black Mulberries are named from the color of their fruits. The former, which is the American species, has wood resembling that of the sassafras, only in that it is not distinguished by unusual qualities. Its leaves, like that of the sassafras, are of several shapes on the same tree. The very sweet fruit resembles blackberries in form. The leaves used in silkworm-culture are from the Russian mulberry, a cross between the white mulberry and black mulberry (*M. alba* and *M. nigra*).†

* Monardes, a Spanish writer, described the sassafras about half a century after the landing of Columbus.

† Annual Report Chief U. S. Forestry Division, 1887; also Bulletins on Silk, published by U. S. Dept. Agriculture.

Sassafras. { *Sassafras officinale* Nees and Eberm.
 { *Sassafras sassafras* (Linn.) Karst.

Nomenclature. (Sudworth.)

Sassafras (local and common name). Sassafac, Sassafras (W. Va., Del.).

Saxifrax, Sasifrax Tree (Fla., Tenn.). Gumbo file (La., negro).

Locality.

Vermont to Florida, westward intermittently to Michigan and Texas.

Features of Tree.

Thirty to fifty feet in height, one to three feet in diameter, sometimes larger, often low shrub, characteristic odor and leaves.

Color, Appearance, or Grain of Wood.

Thick heartwood, delicate brown, thin sapwood yellowish white, coarse-grained, annual rings clearly marked.

Structural Qualities of Wood.

Light, soft, not strong, brittle, checks in drying, very durable in contact with soil. Slightly aromatic.

Representative Uses of Wood.

Pails, buckets, ox-yokes, fence-posts, and rails.

Weight of Seasoned Wood in Pounds per Cubic Foot.

31.

Modulus of Elasticity.

730,000.

Modulus of Rupture.

8500.

Remarks.

Leaves and shoots mucilaginous. Bark of root rich in highly aromatic essences. Sassafras often forms thickets.

Red Mulberry, Mulberry. *Morus rubra* Linn.

Nomenclature. (Sudworth.)

Red Mulberry, Mulberry (local and common name). Virginia Mulberry Tree (Tenn.).
Murier Sauvage (La.).

Black Mulberry (N. J., Pa., W. Va.).

Locality.

Massachusetts to Florida, westward intermittently to Nebraska and Texas. Best in lower Ohio and Mississippi River basins.

Features of Tree.

Fifty to sixty feet in height, two and one half to three feet in diameter. Sweet edible fruit. Dark brown broken bark, smooth gray branches.

Color, Appearance, or Grain of Wood.

Thick heartwood, light orange yellow, thin sapwood whitish, coarse-grained, compact structure, annual layers clearly marked.

Structural Qualities of Wood.

Light, soft, not strong, very durable in contact with soil, receives good polish.

Representative Uses of Wood.

Local ship-building, agricultural implements, fencing, cooperage.

Weight of Seasoned Wood in Pounds per Cubic Foot.

36.

Modulus of Elasticity.

11,700,000.

Modulus of Rupture.

11,000.

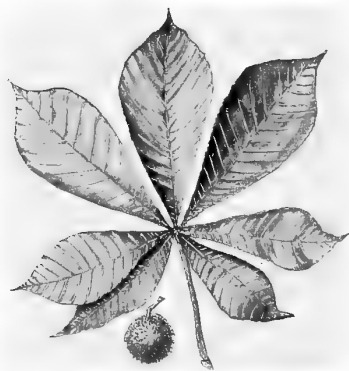
Remarks.

An ornamental tree. The leaves of this species are not adapted to silkworm culture.

BUCKEYE. HORSE CHESTNUT.

(*Æsculus*.)

The buckeye and horse chestnut are species of the same genus. The common horse chestnut (*Æsculus hippocastanum*) was once thought to have been a native of Asia, but it is now quite certain that it originated on the mountains of northern Greece. Trees have been cultivated in Europe for at least three centuries and are now extensively grown over



Horse Chestnut (*Æsculus hippocastanum*).

the United States. The name buckeye is generally applied to such species as are natives of North America.

The woods resemble one another in that they are soft, straight-grained, easily worked, and decay rapidly when exposed. They are employed to some extent in woodenware, artificial limbs, and paper-making. The trees may be known by their round prickly pods, containing smooth chestnut-colored bitter nuts. The leaves of the buckeye are arranged in groups of five, while those of the horse chestnut are in groups of seven. The horse chestnut produces showy spotted flowers. There are thirteen species of this genus, eight of which are North American. The name "horse chestnut" may refer ironically to the coarse nuts, or may arise from the fact that they are occasionally eaten by cattle, or from a horse-shoe marking seen on young twigs. *Hippocastanum* is from *hippos*, a horse, and *castanea*, a chestnut. The name buckeye refers to the appearance of the brown nut through the paler husk partly separated when ripe, suggesting the eye of the common deer.

PLATE 20. HORSE CHESTNUT (*Aesculus hippocastanum*).



Ohio Buckeye, Fetid Buckeye. *Æsculus glabra Willd.*

Nomenclature. (Sudworth.)

Buckeye, Ohio Buckeye (local and common names).	Stinking Buckeye (Ala., Ark.). American Horse Chestnut (Pa.).
Fetid Buckeye (W. Va.).	

Locality.

Ohio River basin to Alabama, portions of Iowa, Kansas, and Indian Territory.

Features of Tree.

Twenty-five to forty-five feet in height. One to one and one-half feet in diameter. Yellowish-white flower, succeeded by round prickly pod or fruit.

Color, Appearance, or Grain of Wood.

Heartwood white, sapwood a little darker, close-grained, frequent dark lines of decay.

Structural Qualities of Wood.

Weak, light, soft, hard to split.

Representative Uses of Wood.

Artificial limbs, woodenware, paper-pulp, rarely lumber.

Weight of Seasoned Wood in Pounds per Cubic Foot.

28.

Modulus of Elasticity.

910,000.

Modulus of Rupture.

7000.

Remarks.

The nearly similar horse chestnut (*A. hippocastanum*) is forty to fifty feet or more in height and two to four feet in diameter. The light, weak wood is seldom used. The name horse may be applied to the coarse nuts ironically, or may refer to their occasional use by cattle, or a horseshoe marking seen on young twigs.

Buckeye, Sweet Buckeye. { *Æsculus octandra* Marsh.
 { *Æsculus flava* Ait.

Nomenclature. (Sudworth.)

Buckeye (N. C., S. C., Ala., Miss., La., Tex., Ky.).	Yellow Buckeye (S. C., Ala.).
Sweet Buckeye (W. Va., Miss., Tex., Mo., Ind.).	Large Buckeye, Big Buckeye (Tex., Tenn.).

Locality.

Alleghany Mountains, Pennsylvania to Georgia, westward inter-
 mittently to Iowa and Texas.

Features of Tree.

Forty to seventy feet in height, one to three feet in diameter,
 sometimes low shrub. Large mahogany-colored seed.

Color, Appearance, and Grain of Wood.

Heartwood, creamy white, sapwood similar, compact structure,
 close-grained, difficult to split.

Representative Uses of Wood.

Similar to those of Ohio Buckeye (*A. glabra*).

Weight of Seasoned Wood in Pounds per Cubic Foot.

26.64.

Modulus of Elasticity.

Modulus of Rupture.

Remarks.

PLATE 21. SWEET GUM (*Liquidambar styraciflua*).



GUM.

(*Liquidambar*, *Nyssa*.)

This name is applied to two unrelated American trees—the Sweet or Red Gum (*Liquidambar styraciflua*), a member of the witch-hazel family, and the Sour or Black Gum (*Nyssa sylvatica*), which is one of the dogwoods.

The woods afforded by these two trees are also distinct from one another, although both are referred to by the one name, gum. The softer Sweet Gum figures in carpentry. Selected pieces so resemble black walnut as to be cut into veneers and made up into furniture. Sour Gum is harder, it splits with difficulty, and is fitted for small work and implements, such as wagon-hubs and tool-handles. Both woods are close- and often cross-grained, besides being strong, heavy, tough, and difficult to season.

The Sweet Gum tree is characterized by rough, round balls, resembling those of the sycamore, by pointed star-like leaves, suggesting those of the sugar maple, and by corky ridges on the bark of younger branches. These latter cause the bark to resemble alligator-skin and give rise to the name alligator-wood. *Liquidambar* refers to gums excreted by the tree and sometimes used in medicine.



SWEET GUM (*Liquidambar styraciflua*).

The Sour Gum bears ovoid bluish-black sour drupes, or fruit containing single roughened seeds. The thick oval leaves are dark green above and dull or hairy below. The foliage of both species becomes brilliant in autumn.

Sweet Gum. *Liquidambar styraciflua* Linn.

Nomenclature. (Sudworth.)

Sweet Gum (local and common name).	Red Gum (Va., Ala., Miss., Tex., La.).
Liquidambar (R. I., N. Y., Del., N. J., Pa., La., Tex., Ohio, Ill.).	Gum, Gum Tree (Va., S. C., La.).
	Alligatorwood, Blisted (N. J.).

Locality.

Connecticut to Florida, westward intermittently to Illinois and Texas, Mexico. Greatest development in basin of Mississippi River.

Features of Tree.

Eighty to one hundred feet or more in height, three to five feet in diameter. Tall straight trunk, corky ridges frequent on branches. Star-shaped leaves turn to brilliant scarlet in autumn, round balls on long stems.

Color, Appearance, or Grain of Wood.

Heartwood rich brown suggesting black walnut, sapwood nearly white, close-grained, compact structure.

Structural Qualities of Wood.

Heavy, rather soft, strong, stiff, not durable when exposed, † shrinks and warps badly in seasoning, receives high polish.

Representative Uses of Wood.

Veneers, cabinet-work, substitute for black walnut, shingles, clapboards, paving-blocks, wooden plates.

Weight of Seasoned Wood in Pounds per Cubic Foot.

37 (U. S. Forestry Div.)*
36.

Modulus of Elasticity.

1,700,000 (average of 118 tests by U. S. Forestry Div.)*
1,220,000.

Modulus of Rupture.

9500 (average of 118 tests by U. S. Forestry Div.)*
9200.

Remarks.

Wood sometimes commercially known as satin walnut and sometimes as star-leaved gum. Large specimens often have hollow butts.

* See page 6.

† E. C. Woodward, C. E. Division Engineer Texas & Pacific Ry. reports "gum" ties good after 5 years' service. They hold spikes well.

Sour Gum, Black Gum, Tupelo. *Nyssa sylvatica* Marsh.

Nomenclature. (Sudworth.)

Sour Gum, Black Gum, Tu- pelo (local and common names).	Wild Pear Tree, Yellow Gum Tree (Tenn.). Gum (Md.).
Pepperidge (Vt., Mass., R. I., N. Y., N. J., S. C., Tenn., Mich., Ohio, Ontario).	Stinkwood (W. Va.). Tupelo Gum (Fla.).

Locality.

Maine to Florida, westward intermittently to Michigan and Texas.

Features of Tree.

Forty-five to one hundred feet high, one and six inches to occasionally four feet in diameter. Ovoid, bluish-black, sour fruit, with seed. Horizontal branches, short spur-like lateral branchlets.

Color, Appearance, or Grain of Wood.

Heartwood light brown or yellow, often nearly white, sapwood hardly distinguishable, fine grain.

Structural Qualities of Wood.

Heavy, not hard, fibres interlaced, therefore hard to work, strong, tough, checks unless carefully seasoned, not durable in contact with soil.

Representative Uses of Wood.

Wagon-hubs, rollers, ox-yokes, bowls, and woodenware.

Weight of Seasoned Wood in Pounds per Cubic Foot.

39.

Modulus of Elasticity.

1,160,000.

Modulus of Rupture.

11,800.

Remarks.

Limited usefulness because difficult to work. Larger specimen in South. Large trees often hollow at butts and sometimes higher.

Cotton Gum, Tupelo Gum, Large Tupelo. *Nyssa aquatica* Linn.

Nomenclature. (Sudworth.)

Cotton Gum, Tupelo Gum,	Tupelo, Swamp Tupelo (N. C.,
Large Tupelo (local and	S. C., La.).
common names).	Olivetree, Wild Olivetree
Sour Gum (Ark., Mo.).	(Miss., La.).

Locality.

Virginia and Kentucky, southward.

Features of Tree.

Sixty to eighty feet high, two to three feet in diameter. Blue oblong fruit one inch or more in length.

Color, Appearance, or Grain of Wood.

Heartwood light brown, often nearly white, sapwood nearly the same.

Structural Qualities of Wood.

Light, not strong, soft, compact, difficult to work.

Representative Uses of Wood.

Turnery, woodenware, roots used as net-floats instead of corks.

Weight of Seasoned Wood in Pounds per Cubic Foot.

32.

Modulus of Elasticity.

730,000.

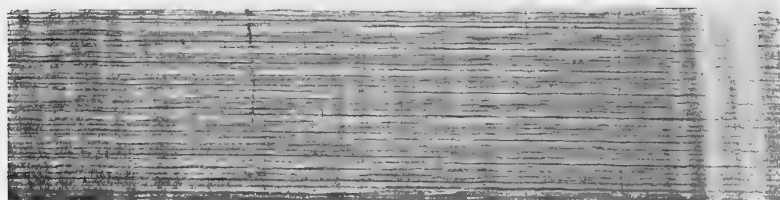
Modulus of Rupture.

9300.

Remarks.

Butts of large trees are usually hollow. Parts above are usually sound.

PLATE 22. HOLLY, BOXWOOD, LIGNUMVITÆ (*Ilex*, *Buxus*, etc.).



Box Tree (*Buxus sempervirens*).

Holly Foliage (*Ilex opaca*).

Lignumvitæ Foliage (*G. sanctum*).

Dogwood Foliage (*Cornus florida*).

Dogwood Bark (*Cornus florida*).

Dogwood Wood.

Lignumvitæ Wood.

HOLLY.*(Ilex.)***BOXWOOD.***(Buxus, Cornus, etc.)***LIGNUM VITÆ.***(Guajacum.)*

The woods afforded by these trees are all demanded in small and very perfect pieces to fill needs for which no others appear to be perfectly fitted. The holly (*Ilex*) grows in Europe and America, where the brilliant evergreen foliage and red berries have long been associated with the Christmas season. The name holly is probably a subversion of "Holy." * The true boxwood (*Buxus sempervirens*) attains to some size in Europe and Asia, but remains a small shrub in America, where it is seldom if ever cut for wood, but is placed as a decoration along the borders of walks and gardens. The wood called "boxwood" in America is not therefore derived from the "box." The *Lignumvitæ* grow in Florida, the West Indies, and on the northern coast of South America.

Holly-wood is noted for its fine, even grain, but chiefly for its smooth, ivory-white color, fitting it for the white of inlaid work, for carvings and other decorations where white color and fine qualities are required. The principal European source is the *Ilex aquifolium*, while in America it is the *Ilex opaca*. Boxwood is, as stated, the name applied to several woods, all noted for their fine compact structure, rendering them suitable for very fine carvings such as are required in wood-engraving. The Eastern product as cut from the true box is so highly prized as to be sold by the pound. American boxwood is chiefly derived from the Flowering Dogwood, the Mexican Persimmon, and the Rose Bay. In Australia several species of *Eucalyptus* are said to be used. *Lignumvitæ* is noted for great strength and hardness. Layers of fibres alternately cross one another so that the wood may be said to crumble rather than split. It has no superior for implements that must be

* "The German name Christdorn, the Danish name Christorn, and the Swedish name Christstorn seem to justify this conjecture." (Keeler, quoting Loudon.)

fine, true, and strong, such as the sheaves of pulleys and handles of tools. The supply is obtained from two species (*Guajacum sanctum* and *Guajacum officinale*).

Holly may be known by its foliage and berries. Box (*Buxus*) has small, smooth, ovate, dark, evergreen leaves joining the stem so as to be opposite one another. The Dogwood is known by its flowers; the *Lignum-vitæ* is a low gnarled tree.

Holly, American Holly. *Ilex opaca Ait.*

Nomenclature. (Sudworth.)

Holly, American Holly (local White Holly (Va.),
and common names).

Locality.

Massachusetts to Florida, westward intermittently to Indiana
and Texas.

Features of Tree.

Occasionally fifty feet in height and three feet in diameter, frequently much smaller, particularly in North. Foliage is evergreen. Bright red berries remain until spring.

Color, Appearance, or Grain of Wood.

Heartwood cream-white, darkening or spotting on exposure. Sapwood similar or lighter. Very close-grained, compact structure.

Structural Qualities of Wood.

Tough, moderately hard and heavy, easily worked.

Representative Uses of Wood.

Inlaid work, carvings, scrollwork, turnery, moderately for furniture and decoration.

Weight of Seasoned Wood in Pounds per Cubic Foot.

36.

Modulus of Elasticity.

910,000.

Modulus of Rupture.

9700.

Remarks.

The wood resembles ivory.

Dogwood, Flowering Dogwood. *Cornus florida* Linn.

Nomenclature. (Sudworth.)

Dogwood, Flowering Dogwood (local and common names).	False Box-dogwood (Ky.). New England Boxwood (Tenn.).
Boxwood (Conn., R. I., N. Y., Miss., Mich., Ky., Ind., Ont.).	Cornel, Flowering Cornel (Tex., R. I.).

Locality.

New England to Florida, westward intermittently to Minnesota and Texas, Sierra Madra Mountains, Mexico.

Features of Tree.

Twenty-five to thirty-five feet in height, one foot or more in diameter. Often low shrub, large white flowers precede foliage, red berry in fall. Rough blackish bark.

Color, Appearance, or Grain of Wood.

Heartwood rich brown, changing to green and red. Sapwood lighter, close-grained.

Structural Qualities of Wood.

Heavy, strong, tough, hard, receives high polish.

Representative Uses of Wood.

Wood-carving, engraving, bearings of machinery, turnery.

Weight of Seasoned Wood in Pounds per Cubic Foot.

50.

Modulus of Elasticity.

1,160,000.

Modulus of Rupture.

12,800.

Remarks.

The Mexican or Black Persimmon and the Great Laurel (*Rhododendron maximum*) afford substitutes. Yellowwood (*Schaeferia frutescens*) is also known as boxwood. The names Dogwood and Poison Dogwood are often applied to the sumach. *Cornus* signifies horn and refers to hardness of wood.

Lignumvitæ.*Guajacum sanctum.*

Nomenclature. (Sudworth.)

Lignumvitæ (Fla.). Ironwood (Fla.).

Locality.

Semitropical Florida, Bahamas, San Domingo, Cuba, Puerto Rico.

Features of Tree.

Twenty-five feet high, one foot in diameter, a low gnarled tree.

Color, Appearance, or Grain of Wood.

Heartwood rich yellow-brown in younger specimens and almost black in older ones. Sapwood light yellow. Close-grained, compact structure.

Structural Qualities of Wood.

Very heavy and exceedingly hard, strong, hard to work, brittle.

Lubricated by water.

Representative Uses of Wood.

Sheaves of ship-blocks, rollers, pulleys, tool-handles. Bearings for journals rotating in water.

Weight of Seasoned Wood in Pounds per Cubic Foot.

71.

Modulus of Elasticity.

1,220,000.

Modulus of Rupture.

11,100.

Remarks.

Two other species, *Guajacum officinale* and *Guajacum arborium*, afford similar woods not commercially distinguished from the above.

LAUREL.

(*Magnolia*, *Rhododendron*, *Arbutus*, etc.)

The name Laurel applies locally or botanically to a number of American plants, several of which attain to the dignity of trees.

The Big Laurel or Magnolia (*M. grandiflora*) is an ornamental tree of the highest rank, extensively planted in parks and gardens of American cities as far north as Washington, and also grown in Europe. The wood is suitable for interior finish and is also used for fuel. The California Laurel (*Umbellularia californica*) and the Madroña or Madroña Laurel (*Arbutus menziesii*) are Pacific coast species of beautiful appearance, the strong, heavy, hard woods of which are of economic importance. Professor Sargent considers* that the former is the most valuable interior or cabinet wood produced by the forests of the Pacific coast. The wood of the Madroña has little or no place in construction, but its charcoal is used in the manufacture of gunpowder. The wood of the Great Laurel or Rose Bay (*Rhododendron maximum*) has been used as boxwood. The gnarled roots of the Mountain Laurel or calico bush (*Kalmia latifolia*) are used for rustic hanging-baskets, seats, and the like.

All of the kinds here noted have evergreen foliage.

* Page 69, "Catalogue Jesup Collection," Sargent.

California Laurel, Mountain Laurel. *Umbellularia californica Nutt.*

Nomenclature. (Sudworth.)

California Laurel, Mountain
Laurel (Cal., Nev.).California Bay Tree, Spice
Tree (Cal., Nev., Oreg.).Laurel, Bay-tree, Oreodaphne
(Cal.).Myrtle-tree, Cajeput, Cali-
fornia Olive (Oreg.).
Californian Sassafras.

Locality.

California and Oregon.

Features of Tree.

Seventy-five to one hundred feet in height, three to five feet in
diameter. Evergreen foliage, beautiful appearance.

Color, Appearance, or Grain of Wood.

Heartwood light rich brown, sapwood lighter brown. Close-
grained, compact structure.

Structural Qualities of Wood.

Heavy, hard, strong, receives beautiful polish.

Representative Uses of Wood.

Ship-building, cabinet-work, cleats, crosstrees.

Weight of Seasoned Wood in Pounds per Cubic Foot.

40.

Modulus of Elasticity.

1,510,000.

Modulus of Rupture.

11,400.

Remarks.

A valuable Pacific coast cabinet wood.

Madroña, Madroña Laurel. *Arbutus menziesii* Pursh.

Nomenclature. (Sudworth.)

Madroña, Madroña Laurel Madrone-tree, Manzanita
(Cal., Oreg.). (Oreg., Cal.).

Laurel, Laurelwood, Madrone. Madrove (Cal.).

Locality.

Pacific coast from British Columbia to southern California.

Features of Tree.

Fifty to seventy-five feet in height, occasionally higher. Two to four feet in diameter. Straight well-formed trunk. Ever-green foliage. A shrub in the South.

Color, Appearance, or Grain of Wood.

Thick heartwood reddish, thin sapwood slightly pink. Close-grained; numerous and conspicuous medullary rays

Structural Qualities of Wood.

Heavy, hard, strong, checks badly in seasoning.

Representative Uses of Wood.

Largely for gunpowder, charcoal, also furniture.

Weight of Seasoned Wood in Pounds per Cubic Foot.

43.

Modulus of Elasticity.

1,190,000.

Modulus of Rupture.

12,000.

Remarks.

A beautiful ornamental tree.

PLATE 23. PERSIMMON, OSAGE ORANGE, CHERRY
(*Diospyros*), (*Maclura*), (*Prunus*).



Osage Orange Trunk (*M. aurantiaca*). Wild Black Cherry Trunk (*P. serotina*).
Cherry Wood.

Osage Orange Wood.
Persimmon Wood.

PERSIMMON.	OSAGE ORANGE.	CHERRY.
(<i>Diospyros.</i>)	(<i>Maclura.</i>)	(<i>Prunus.</i>)

The Persimmon (*Diospyros virginiana*) grows in many of the central and southern United States and affords a hard, tough wood, resembling fine-grain hickory, that is used for implements and other small work. The plum-like fruit is remarkably astringent when green, but is sweet, rich, and palatable when ripe. The persimmon is a member of the ebony family (*Ebenaceæ*), and the extremely close-grained heartwood is almost black. The ebony of commerce is derived from tropical species of this genus.

The Osage Orange or Bois D'Arc (*Maclura aurantiaca*) is found in the Gulf and neighboring States, and has been cultivated in the North. The wood is unusually hard and strong, and is of a yellow color, which, however, darkens with age. It is in many ways a unique and serviceable product, widely utilized locally in the South, but almost unknown in the North, and nowhere sufficiently appreciated. The aborigines made bows and arrows of it, whence the name Bois D'Arc. The tree affords a useless fruit somewhat resembling the common orange in appearance.

The widely distributed Wild Cherry or Wild Black Cherry (*Prunus serotina*) supplies the cherry wood of commerce. This wood is strong, hard, fine-grained, red-colored, and one of the most popular decorative woods of the American forests. Sweet or Cherry Birch (*Betula lenta*) is often stained so as to imitate it, while it of itself is stained so as to resemble mahogany. The wood of the cultivated cherry is not used in the United States. The wild cherry bears purplish-black fruit somewhat larger than peas, sweetly bitter when ripe. The bark is also bitter. It should be noted of these woods that the thin heart of the persimmon is black, that of the Bois d'Arc is yellow, and that of the cherry is red. Each receives a high polish.

Persimmon. *Diospyros virginiana* Linn.

Nomenclature. (Sudworth.)

Persimmon (local and com- Simmon, Possumwood (Fla.),
mon name). Plaqueminiér (La.).

Date Plum (N. J., Tenn.).

Locality.

Connecticut to Florida, westward intermittently to Missouri and Texas.

Features of Tree.

Occasionally seventy feet in height, one to two feet in diameter. Soft plum-like fruit, astringent when green, sweet when ripe.

Color, Appearance, or Grain of Wood.

Heartwood dark-brown or black, sapwood light-brown, often with darker spots. Very thin heartwood. Very close-grained, compact structure. Medullary rays conspicuous. Resembles hickory.

Structural Qualities of Wood.

Hard, heavy, strong.

Representative Uses of Wood.

Plane-stocks, shoe-lasts, etc. Prized for shuttles.

Weight of Seasoned Wood in Pounds per Cubic Foot.

49.

Modulus of Elasticity.

1,110,000.

Modulus of Rupture.

12,400.

Remarks.

The astringency of unripe fruit is due to tannic acid. The dried and roasted seeds have been used for coffee.* Heartwood is not greatly developed in trees under one hundred years of age.

* U. S. Dispensatory.

Osage Orange. { *Maclura aurantiaca* Nutt.
 { *Toxylon pomiferum* Raf.

Nomenclature. (Sudworth.)

Osage Orange (local and common name).	Hedge, Hedge-plant, Osage (Ill., Ia., Neb.).
Bois D'Arc (La., Tex., Mo.).	Mock Orange (La.).
Bodark, Bodock (Kans.).	Bow-wood (Ala.).
Yellow-wood, Osage Apple Tree (Tenn.).	

Locality.

Southern Arkansas, Indian Territory, and Texas. Cultivated elsewhere, as in Massachusetts, Pennsylvania, and Michigan.

Features of Tree.

Twenty to fifty feet in height, rarely beyond one and one-half feet in diameter. Fruit resembles orange. Long thorns.

Color, Appearance, or Grain of Wood.

Heartwood bright orange, turns brown on exposure. Sapwood light yellow, close-grained, annual rings clearly marked.

Structural Qualities of Wood.

Hard, heavy, very strong, flexible, durable in contact with soil. Receives beautiful polish. Shrinks in seasoning.

Representative Uses of Wood.

Fence-posts, piles, telegraph poles, railway ties, paving-blocks, occasionally indoor decoration.

Weight of Seasoned Wood in Pounds per Cubic Foot.

48.

Modulus of Elasticity.

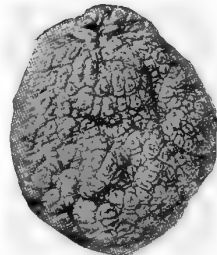
1,300,000.

Modulus of Rupture.

16,000.

Remarks.

Indians used wood for bows, thus the name Bois D'Arc, corrupted into Bow Dark or Bodark. A valuable wood not enough appreciated. Often planted as hedges. The fruit is useless.



OSAGE ORANGE.

Wild Black Cherry, Wild Cherry. *Prunus serotina Ehrh.*

Nomenclature. (Sudworth.)

Wild Black Cherry, Wild
Cherry (local and common
names).Black Cherry (Me., N. H.,
Vt., R. I., N. Y., Miss.,
Ky., Mich., Wis., Ind.,
Neb.).Rum Cherry (N. H., Mass.,
R. I., Miss., Neb.).

Whiskey Cherry (Minn.).

Choke Cherry (Mo., Wis.,
Ia.).

Locality.

Eastern to Central United States.

Features of Tree.

Forty to eighty feet in height. Two to three or more feet in
diameter. Bitter bark, pea-sized fruit.

Color, Appearance, or Grain of Wood.

Heartwood reddish brown, sapwood yellow, fine straight grain,
compact structure.

Structural Qualities of Wood.

Light, hard, strong, easily worked.

Representative Uses of Wood.

Cabinet-work, interior finish.

Weight of Seasoned Wood in Pounds per Cubic Foot.

36.

Modulus of Elasticity.

1,200,000.

Modulus of Rupture.

11,700.

Remarks.

The bitter bark contains medicinal properties
valued in bronchitis and other troubles.
The fruit, agreeable when ripe, is also
used in medicines and cordials.WILD BLACK CHERRY
(*Prunus serotina*).

PLATE 24. TEAK AND GREENHEART (*Tectona*, *Nectandra*, etc.).



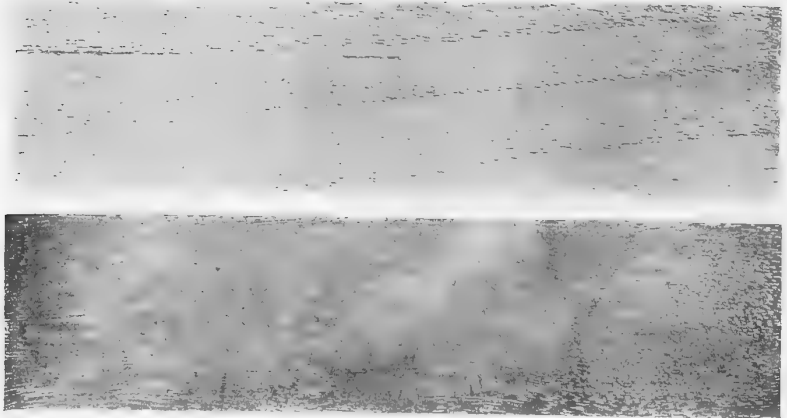
Greenheart (*Nectandra rodiali*).



Teak (*Tectona grandis*).



Teak Tree.



Teakwood,
Greenheart.

TEAK.**GREENHEART.***(Tectona.)**(Nectandra.)*

There are two Teaks; the principal one (*Tectona grandis*), a native of Asia, has been called the "Oak" of the Indian forests, the other (*Oldfieldia africana*) is an African tree.* The Greenheart (*Nectandra rodiali*) is of the laurel family and grows in South America. The woods, although foreign, are of such nature as to have widely established reputations, and each has at some time been used in construction.

Teak suggests oak, save that it is lighter and has a more uniform structure. It is very durable, and an oily secretion repels insects and preserves iron fastenings. During the supremacy of wooden vessels it was regarded as one of the best ship-building woods in existence. The grain fits it for carvings, and it is now known in North America chiefly because of this fact. Indian teak is the wood usually referred to.

Greenheart was early placed among the first class of ship-building woods by Lloyd's Register, and is yet taken to Europe to some extent for dock- and ship-building and for implements, but is seldom found and but little known in the United States. It is strong, hard, durable, and extremely heavy, the latter quality being so pronounced as to limit its field of usefulness.

* It was long supposed that African teak was supplied by the species *Swietenia senegalensis*. It is now known that the source is *Oldfieldia africana*, of the family Euphorbiaceæ. It is not impossible that wood passing as teak may be derived from yet other species.

Teak.*Tectona grandis.*

Nomenclature.

Teak.	Teek.
Indian Oak.	Sagwan.

Locality.

India, Burma, Siam, Ceylon.

Features of Tree.

Eighty to one hundred feet in height, three to four feet in diameter, sometimes larger. Straight trunk, large drooping deciduous leaves.

Color, Appearance, or Grain of Wood.

Variable, brownish-yellow, straight, even-grained.

Structural Qualities of Wood.

Moderately hard, strong, easily worked, stands well, oily, fragrant, resists termites, preserves iron.

Representative Uses of Wood.

Furniture, ship-building, timbers, backing for armor-plates.

Weight of Seasoned Wood in Pounds per Cubic Foot.

50 (Laslett).

Modulus of Elasticity.

1,338,000 (Laslett).
2,100,000 (Thurston).

Modulus of Rupture.

15,000 (Thurston).

Remarks.

The oil is thought to preserve iron and repel termites. Burma, Malabar, Rangoon, and other teaks take names from districts producing them. The distinct African teak (*Oldfieldia africana*) affords wood sometimes marketed as African mahogany and sometimes as African oak. (Forestry methods, see "Burma Teak Forests," Sir Dietrich Brandis, "Garden and Forest," Vol. IX, "Forestry and Irrigation," Vol. IX, No. 3, p. 139.)

Greenheart. *Nectandra rodiali.*

Nomenclature.

Greenheart (local and common name).

Locality.

British Guiana and adjacent portions of South America and the West Indies.

Features of Tree.

Twenty-five to sometimes seventy feet in height, two to four feet in diameter. A straight tree.

Color, Appearance, or Grain of Wood.

Heartwood dark green to chestnut or nearly black, sapwood similar. Clean, straight, compact structure, free from knots. Numerous pores, annual layers hardly distinguishable.

Structural Qualities of Wood.

Exceptionally heavy, strong, and durable, tough, hard, elastic, receives high polish, breaks suddenly.

Representative Uses of Wood.

Ship-keels, frames, rollers, turnery, also beams, planks, and piles (Europe). In America tops of fishing-rods and very occasionally veneers.

Weight of Seasoned Wood in Pounds per Cubic Foot.

72 (Lazlett).

Modulus of Elasticity.

1,090,000 (Lazlett).

Modulus of Rupture.

10,000 (Thurston).

Remarks.

Excessive weight unfits it for many purposes. Placed in first class of ship-building woods by Lloyd's Register. Formerly supposed to repel teredo. Generally exported through Demerara to England.

MAHOGANY.

(*Swietenia, Khaya, Soyimida, Cedrela, etc.*)

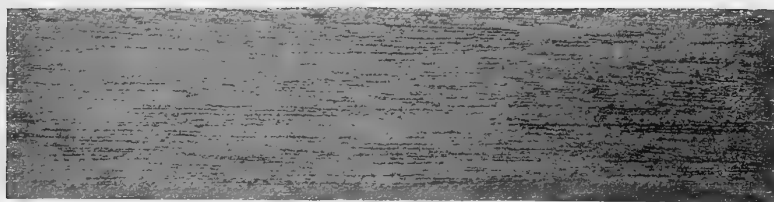
There are three principal mahogany trees: the Central American or true mahogany (*Swietenia mahogani*), the African mahogany (*Khaya senegalensis*), and the Indian mahogany (*Soyimida febrifuga*). There are also minor species called mahoganies.* American mahogany was originally divided by dealers into Spanish and Honduras wood, the former from the then Spanish-American possessions. A considerable supply now comes from Mexico, taking name from port of shipment; as, Frontera, Laguna, Santa Ana, Tecolutla, Minatitlan, and Tonalá, desirability being much in the order named. The African field is the latest and probably most important, very large quantities of its wood being distributed through English markets.

Mahogany, placed among the second class of ship-building woods by Lloyd's Register, was once used to some extent in place of oak in naval architecture, but is now so greatly valued for decoration as to be employed for little else, save occasionally the hulls of small pleasure craft. The decorative value is due to a combination of beauty, working qualities, and durability. Beauty is influenced by both grain and warm red color. The latter is generally light, and although it subsequently darkens, in most cases, to a characteristic and rich reddish-brown, is usually induced immediately by stains. The grain is not only beautiful of itself, but is such as to receive those stains and finishing processes thus demanded. Different localities produce woods varying in tint and grain. Individual

* Mahogany and mountain mahogany are names applied in the United States to *Rhus integrifolia*, a native of Lower California and the coast islands, and to the following species of the Rocky Mountain Region (Idaho to Arizona):

<i>Cercocarpus ledifolius</i> ,	Used for fuel.
<i>Cercocarpus parvifolius</i> ,	Used for fuel.
<i>Cercocarpus breviflorus</i> ,	Heavy, hard, not common.

PLATE 25. MAHOGANY (*Swietenia mahagoni*).



Two Specimens of Wood.

trees also differ in desirability. No two are alike. Beautiful grain effects are often obtained in "crotches" or junctions between trunk and branch, and such pieces bring high prices. Mahogany is generally used as a veneer. Layers are glued either to some central piece or "core" or else to one another. The layers are arranged so as to cross one another's grain, and results are usually thought to be more desirable than those obtained from solid wood. Few woods glue better, and few shrink or distort less when in place.

"Spanish Cedar" (*Cedrela odorata*) is a broadleaf wood, and not a conifer as is usually supposed. It is nearly related to, and usually found and cut with, true mahogany. Lindley* divides *Cedrelecæ* into two sub-orders: *Swietenia*, including the true mahoganies, and *Cedrelæ*, with nine genera and twenty-five species distributed over tropical Asia and America.

Prima vera or white mahogany belongs to *Bignoniaceæ*, which also includes the catalpas.

* John Lindley, *Treasury of Botany*, p. 243, Part I; also see Gifford, "Forestry and Irrigation," Vol. VIII, No. 4, p. 174; also Correspondence Messrs. Wm. E. Uptegrove & Brother, New York City

Mahogany. *Swietenia mahogani Jacq.*

Nomenclature.

Mahogany (local and common name).	Honduras Mahogany (Honduras).
Spanish Mahogany (Cuba, San Domingo, West Indies).	Baywood, Madeira, Redwood.
Mexican Mahogany (Frontera, Laguna, Santa Anna, and other Mexican ports).	

Locality.

Florida Keys, Bahamas, West Indies, Mexico, Central America, Peru.

Features of Tree.

Florida specimens forty-five feet in height and two or more feet in diameter. Foreign trees larger.

Color, Appearance, or Grain of Wood.

Light, rich reddish brown. Thin sapwood yellow. Smooth, fine uniform texture, inconspicuous rings, conspicuous pores, sometimes filled with white substance.

Structural Qualities of Wood.

Strong, brittle, durable, holds glue, takes stains and high polish, small distortion in seasoning, stands well.

Representative Uses of Wood.

Cabinet-work, veneers; formerly ship-building.

Weight of Seasoned Wood in Pounds per Cubic Foot.

45.

Modulus of Elasticity.

1,510,000.

Modulus of Rupture.

14,000.

Remarks.

Desirability varies with locality. Spanish mahogany ranks first, and harder Mexican woods next. Mahogany is usually stained. African mahogany is now successfully rivaling the American product.

White Mahogany. *Prima vera.* *Tabebuia Donnell-Smithii* (Rose).

Nomenclature.

White Mahogany, *Prima vera* (local and common names).

Locality.

Mexico and Central America.

Features of Tree.

Fifty to seventy-five feet in height, two to four feet in diameter.

Tall, slender, a beautiful tree. Numerous golden-yellow flowers precede the leaves.

Color, Appearance, or Grain of Wood.

Cream-white. Beautiful, fine grain, resembles mahogany.

Structural Qualities of Wood.

Works and stands well.

Representative Uses of Wood.

Cabinet-work, fine furniture, veneers.

Weight of Seasoned Wood in Pounds per Cubic Foot.

Modulus of Elasticity.

Modulus of Rupture.

Remarks.

Many twelve-foot logs imported through San Francisco and west. Higher-priced than Red Mahogany. Named after discoverer. The wood of the Butternut or White Walnut is sometimes sold as White Mahogany.

See Botanical Gazette, Vol. XVII, 1892, p. 418; Contribution U. S. National Herbarium, p. 346, Vol. I, No. 9, U. S. Dept. Agriculture, Division of Botany.

Spanish Cedar, Mexican Cedar. *Cedrela odorata* Linn.

Nomenclature.

Spanish Cedar, Mexican Cedar, Cuban Cedar (local and common names).

Locality.

Mexico, Cuba, West Indies.

Features of Tree.

Fifty to eighty feet in height, two to five feet in diameter. Pale-yellow flowers. Pods resemble pecan-nuts. Tree suggests English walnut (*J. regia*).

Color, Appearance, or Grain of Wood.

Brownish red, straight, even, compact grain.

Structural Qualities of Wood.

Soft, fragrant, porous, durable. Resembles cedar woods derived from coniferous trees (page 167); also resembles mahogany.

Representative Uses of Wood.

Cigar-boxes, boats, fine cabinet-work. May be used in place of mahogany. The figured Australian Red Cedar (*C. australis*) is locally used for furniture, joinery, carriages, ceilings, door-frames, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

Modulus of Elasticity.

Modulus of Rupture.

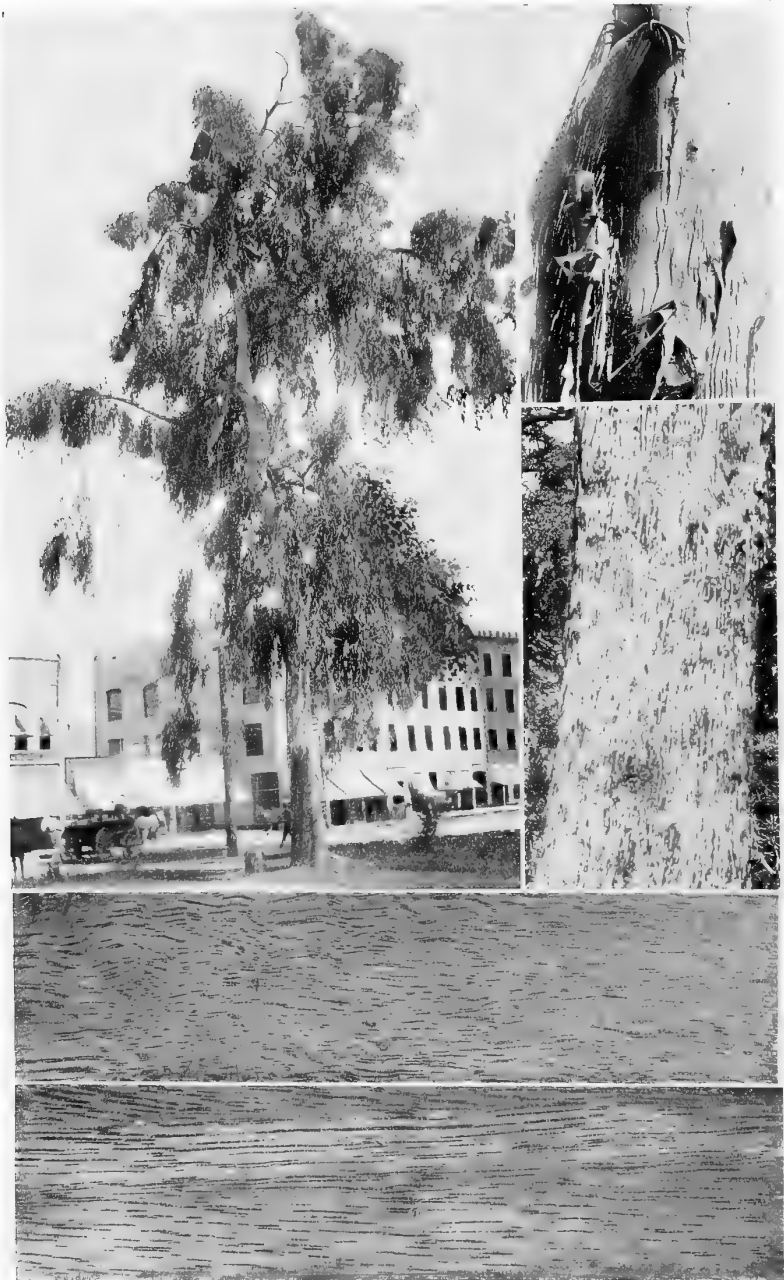
Remarks.

Used for cigar-boxes, because its porous structure assists cigars to season, and its odor improves their flavor. The Cuban supply is practically exhausted. Mexico is now the chief American source. Trees grow rapidly.

The Toon Cedar (*Cedrela toona* Roxburgh) of the Orient is the same as the Red Cedar (*Cedrela australis* F. v. M.) of Australia. The Cedar (*Cedrela odorata* Blanco) is thought to be distinct Philippine species.

"Forestry and Irrigation," p. 173, Vol. VIII, No. 4; Writings Dr. Gifford; Correspondence Wm. E. Uptegrove & Brother, and others.

PLATE 26. EUCALYPTUS (*Eucalyptus*).



Blue Gum Tree, (*E. globulus*) California. Blue Gum Bark (*E. globulus*) California.
Jarrah Trunk, (*E. marginata*) Australia.
Jarrah Wood (*E. marginata*).
Karri Wood (*E. diversicolor*).

EUCALYPTUS.

(*Eucalyptus*.)

These trees, locally known as Stringy-barks, Iron-barks, and Gum-trees, are natives of Australia and the neighboring islands. Some of the nearly four hundred species have been widely transplanted, although none have thus far succeeded in this country outside of Florida and California.* The Blue Gum (*E. globulus*) is the species commonly referred to when Eucalyptus is mentioned in North America.

The Eucalypts are noted for their great size, rapid growth, tough, durable wood, and alleged effect upon health. Size is illustrated by the species *Eucalyptus amygdalina*, specimens of which have reached a height of four hundred and eighty feet and are thus the tallest, although not the largest, trees known to man. Growth is shown by specimens of the *Eucalyptus gunnii*, which have grown in excess of two feet a month during the first year.† The working qualities of Jarrah, Karri, and Tuart woods (*E. marginata*, *E. diversicolor*, and *E. gomphocephala*) are such as to cause them to take high rank in local construction. The first two have been preferred beyond all other species for paving the streets of London and of Paris. Some improvement in health is said to have followed the introduction of the Blue Gum (*Eucalyptus globulus*) in malarial districts, such as those around Rome. It is not certain whether these results are due to the presence of essences in the foliage, although medicinal properties are ascribed to them and they are used in the preparation of listerine and similar compounds, or

* First introduced in 1856; 1,000,000 specimens thought to be in California, 1874. A. Kinney, U. S. Forestry Bulletin No. 11.

† *Eucalyptus globulus* is said to have grown in California at the rate of two feet a month during the first year.

Works of Baron von Müller; Report J. Ednie-Brown, Forest Commissioner, Western Australia; Correspondence M. Francis Chapman, Esq., London; The Forester, Jan. 1900; Abbot Kinney, U. S. Forestry Bulletin No. 11.

whether they are due to the fact that the leaves evaporate unusual quantities of water drawn by the roots from the soil.*

The trees are characterized by leathery evergreen foliage of many shades, such as blue, gray, and green. The leaves of young and old trees differ widely in some species. Those of young blue gums are bright blue, oval, and stalkless, while leaves of older trees have stems, are dark green and sickle-shaped. The characteristic odor is the only point in common between the foliage of the old and young of this species. There are, as stated, nearly four hundred species.

* The writer has seen long rows of California blue gums cut down because they "dried the soil." The general form of a blue gum tree suggests that of large black Locust.

McClatchie, U. S. Forestry Bulletin No. 35.

Jarrah. *Eucalyptus marginata.*

Nomenclature.

Jarrah (local and common name).

Mahogany Gum (Australia).

Locality.

Western coast of Australia.

Features of Tree.

Ninety to one hundred or more feet in height, two to five feet in diameter. Fifty or more feet to lowest branch. Dull, sombre appearance. Branches concentrated at top.

Color, Appearance, or Grain of Wood.

Reddish, resembles mahogany, also Kauri wood.

Structural Qualities of Wood.

Heavy, non-absorbent, somewhat oily, durable in contact with the soil, receives good polish. Characteristic odor, wears thin evenly, not easily inflammable. Said to repel teredo and termite.

Representative Uses of Wood.

Marine work, exposed positions, ship-building, bridge timbers, street-paving (London and Paris).

Weight of Seasoned Wood in Pounds per Cubic Foot.

65 (Ednie-Brown).*

Modulus of Elasticity.

2,080,000 (Ednie-Brown).*

Modulus of Rupture.

8900 (Ednie-Brown).*

Remarks.

Chief timber tree of southwestern Australia. Preferred by Australian ship-builders. Often confused with Karri. † Specimens forty years old two feet in diameter. Müller calls it the least inflammable of woods. Marginata refers to thick-edged leaves.

* Report Forests Western Australia, Presented to Parliament, 1896.

† The Melbourne Argus, December 31, 1892, states that the woods may be distinguished by the fact that the ashes of Jarrah are white and those of Karri black. Specimens of Jarrah wood seen by the writer were dark, suggesting black walnut, those of Karri were red, resembling mahogany.

Karri. *Eucalyptus diversicolor.*

Nomenclature.

Karri (many localities). White Gum (Australia).

Locality.

Australia, New Zealand.

Features of Tree.

Two to three hundred and fifty feet in height, four to eighteen feet in diameter. A straight graceful tree, lower branches often one hundred and fifty feet from ground. Smooth yellow white bark.

Color, Appearance, or Grain of Wood.

Reddish brown, fibres interlaced, compact structure.

Structural Qualities of Wood.

Hard, heavy, tough and elastic, non-absorbent, durable, difficult to work, wears evenly, characteristic odor.

Representative Uses of Wood.

Construction, railway ties, piles, marine work, pavements (London and Paris).

Weight of Seasoned Wood in Pounds per Cubic Foot.

63 (Ednie-Brown).*

Modulus of Elasticity.

2,890,000 (Ednie-Brown).*

Modulus of Rupture.

8000 (Ednie-Brown).*

Remarks.

Once named *Eucalyptus colossea* because of great size. Rich in essential oils. Grows rapidly, one specimen thirty-five years old, having reached a height of one hundred and thirty-five feet. Distinct from Kauri Pine (*D. australis*) of New Zealand. *Diversicolor* refers to leaves the upper and lower sides of which differ in color.

* Report Forests Western Australia, Presented to Parliament, 1896.

Tuart. *Eucalyptus gomphocephala.*

Nomenclature.

Tuart (local and common name).	Tooart (Australia). White Gum (Australia).
Tewart (Australia).	

Locality.

Australia.

Features of Tree.

One hundred to one hundred and fifty feet in height, four to six feet in diameter. Lower branches forty or more feet from ground. Bright, cheerful appearance, straight trunk, gray-white bark.

Color, Appearance, or Grain of Wood.

Heartwood light yellow, compact appearance, fibres interlaced.

Structural Qualities of Wood.

Very hard, heavy, strong, tough, rigid, durable, seasons well. Difficult to split or work.

Representative Uses of Wood.

Keels, buffers, stern-posts, frames, wheel-hubs, shafts.

Weight of Seasoned Wood in Pounds per Cubic Foot.

67 (Ednie-Brown).*

Modulus of Elasticity.

2,300,000 (Ednie-Brown).*

Modulus of Rupture.

9300 (Ednie-Brown).*

Remarks.

Highly prized locally. One of the strongest of woods. Gomphocephala refers to peculiarities in lid of calyx-tube.

* Report on Forests Western Australia, Presented to Parliament, 1896.

Blue Gum, Fever Tree. *Eucalyptus globulus.*

Nomenclature.

Blue Gum (local and common name).	Fever Tree (Australia). Balluck (Australia).
-----------------------------------	---

Locality.

Native of Australia acclimated in southern California and elsewhere throughout the world.

Features of Tree.

Two hundred to sometimes three hundred or more feet in height. Three to six feet in diameter. Loose, shaggy, exfoliating bark.* Leaves sometimes twelve inches in length. Color varies with age. Characteristic odor.

Color, Appearance, or Grain of Wood.

Straw color. Sapwood lighter. Indistinct annual rings. Fibres interlaced.

Structural Qualities of Wood.

Hard, heavy, durable, difficult to split.

Representative Uses of Wood.

Rollers, paving-blocks, ship-building, fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

43 to 69 (Mueller).
57 to 69 (Lazlett).

Modulus of Elasticity.

Modulus of Rupture.

Remarks.

The *Eucalyptus* of California. The species planted in malarial districts. Sanitary powers due to evaporation from large leaves or presence of essential oils, which are thought to have medicinal qualities. Grows very rapidly.

* The bark is variable. Some trees of nearly 1 foot diameter have smooth green bark resembling that on young willow saplings; most others have the shaggy bark, while from some this has dropped away, exposing a smooth grayish interior suggesting that of the sycamore.

PLATE 27. PINE (*Pinus*).



White Pine Foliage (*P. strobus*).
White Pine Tree (*P. strobus*).
(Courtesy N. C. Geol. Survey.)

Hard Pine Trunk (*P. palustris*).
(Photograph by Edward J. Davison.)

Hard Pine Wood (*P. palustris*).
Soft or Sugar Pine Wood (*P. lambertiana*)

NEEDLELEAF WOODS.

The trees affording these woods cover large areas in the natural forests of the Northern Hemisphere. They exist, but to an unimportant extent, in the South. Cedar, larch, and cypress figure in ancient history, but woods generally were not employed until recent times.* Pine, spruce, hemlock, and other so-called soft woods are of this group.

Needle-leaved woods are characterized by uniform fibre-conditions, presence of resins, and lighter weights. The vertical structure consists of simple, similar, elongated tubes or cells, tapering and finally closing at their ends, known as tracheids. These are arranged with more or less regularity, and woods are correspondingly easy to work. Pith-rays are scarcely visible, and sections do not show pores. Cavities known as resin-ducts, and which are not real vessels but rather simple intercellular spaces, secrete resins so important in making these woods durable and elastic. Trees afford large, straight pieces. Woods are used in carpentry and heavy constructions. The total requirement greatly exceeds that for hard woods.

The resinous, usually evergreen, leaves and the cones are sufficient to identify these trees. Needleleaf, softwood, conifer, and evergreen trees are the same.

* See Oak, pages 11 *et seq.* The woods have always been important in the United States.

PINE.

(*Pinus.*)

These trees were not regarded seriously until about the latter half of the eighteenth century. Their woods are now the principal ones in carpentry and construction, and are more used than any others. They are to the soft woods what the oaks are to the hard woods, and they stand at present with reference to all woods much as iron does to all metals. Pine is prized because of a combination of strength, elasticity, light weight, working qualities, and availability, such as fits it for those constructions requiring the largest quantities of wood.

The pines have smooth, straight, solid trunks, usually destitute of branches for many feet from the ground. There are needle-shaped, more or less cylindrical, evergreen leaves from one to many inches in length, gathered in clusters of two, three, or five, their number and the fact that they are thus clustered being important bases of classification. There are also cones of woody overlapping scales. They reproduce with difficulty,* and mature so slowly that ultimate survival of modern conditions must probably be as cultivated trees.

Thirty-nine of the seventy known species of pine are found in the United States. These with their woods are separated into two groups known as *hard* and *soft* pines. The Dantzic or Northern pine (*Pinus silvestris*) is the principal European species.

* The roots of most species die with cutting of trees. There is no power of producing new shoots. (The pitch pine (*Pinus rigida*) is an exception to this rule.) Seeds also have short-lived vitality. Trees are easily raised from fresh seeds.

SOFT PINE.

Soft pine is soft, clean, light, uniform, easily worked, not strong, free from knots and resins, and obtainable in large and perfect pieces. The wood is whitish and the yearly rings are not pronounced. The supply is divided, as obtained from the white pine on the one hand, and from the sugar-pine and all other species on the other.

White pine (*Pinus strobus*) grows in the north, central, and eastern United States and was formerly the important tree of North America. It emphasized the forest industries of Maine and of Michigan, and methods connected with harvesting it have influenced logging practices in many fields. It was long the only softwood seriously considered by Northern lumbermen. Thirty per cent of the sawn timber and lumber used in this country in 1899 was drawn from this species.* White pine is diminishing so rapidly as to be already practically unobtainable in many places.

The Sugar Pine (*Pinus lambertiana*) of the Western States is a tree growing at high elevations and is so large as to take rank with the redwoods and other of the world's greatest trees. Some material is derived from the Western white pine (*Pinus flexilis*) and one or more minor species. Sugar pine resembles, but is not as desirable as, white pine. The sweetish exudations from this tree are sometimes used in medicine.

* Roth, U. S. Forestry Bul. No. 22, p. 73.

"White Pine Timber Supplies." U. S. S. Doc. 55-1, Vol. IV.

HARD PINE.

Hard pine differs from soft pine in that it is hard, resinous, heavy, harder to work, and very strong. It also is obtainable in large pieces. The orange-yellow wood is more or less figured. The annual deposits are pronounced and are separated into two sharply divided rings. The supply is chiefly derived from the longleaf, shortleaf, Cuban, and loblolly pines of the South Atlantic States.

The longleaf pine (*Pinus palustris*) is distinctly the most important of its group. The wood is ideal for heavy constructions. Beams, docks, trestles, and frames of cars are formed of it. The trees afford the greater bulk of turpentine, tar, and resin, or "naval stores," produced in this country.* Cuban, shortleaf, and loblolly pine woods (*P. heterophylla*, *P. echinata*, and *P. taeda*) are nearly similar. Longleaf and Cuban pines are seldom separated, while shortleaf and loblolly pines are also mixed. Longleaf pine usually affords finer structure and more heartwood than Cuban pine. Strength and weight averages of both woods are in excess of those of shortleaf and loblolly pines. No method of invariably telling these four woods apart has as yet been determined. (Roth.) Any or all of them are practically liable to be delivered in response to a demand for Southern pine. Johnson considers shortleaf pine as good as longleaf pine of equal weight, and suggests environment as a means of identification.

Palustris, signifying "swampy," is misleading, since long leaf pine prefers dry, sandy soil and tracts known as "pine barrens." *Mitis* refers to the soft, delicate foliage of shortleaf pine. *Taeda* signifies "torch." The trees may be told by differences in their leaves and cones.

* Manufacture of tar, pitch, etc. (See Report Chief U. S. Div. Forestry, 1892, p. 356; also U. S. Forestry Bulletin No. 13.)

Names.	Leaves.		Cones.	
	Number in Cluster.	Length.	Diameter (open).	Length.
Longleaf (<i>P. palustris</i>).	3	10 to 15 in.	4 to 5 in.	6 to 10 in.
Cuban (<i>P. heterophylla</i>).	2 or 3	8 to 12 "	3 to 5 "	4 to 7 "
Shortleaf (<i>P. echinata</i>).	2 or 3	2 to 5 "	1 to 2 "	2 "
Loblolly (<i>P. taeda</i>).	3	5 to 10 "	2 to 3 "	3 to 4 "

A confusion exists in the naming of the pines. American white pine is known as yellow or Weymouth pine in Europe, and all American hard pines are there often known as pitch pines. The European, Dantzic, or Northern pine has also many names, principally depending on port of shipment. Georgia, Southern, Yellow, Hard, and even Pitch pine, are interchangeable names in this country. The species *palustris* has thirty local names.

White Pine. *Pinus strobus* Linn.

Nomenclature. (Sudworth.)

White Pine (local and com- mon name).	Soft Pine (Pa.).
Weymouth Pine (Mass., S. C.).	Northern Pine (N. C.).
	Spruce Pine (Tenn.).
	Pumpkin Pine.

Locality.

North-central and northeastern United States, northward into Canada, southward to Illinois, and along the Alleghanies into Georgia, intermittently.

Features of Tree.

Seventy-five to one hundred and fifty feet in height. Three to six feet in diameter, sometimes larger. Erect impressive form. Tufts of five soft, slender, evergreen leaves in long sheath. Cones four to six inches long, one inch thick, slightly curved.

Color, Appearance, or Grain of Wood.

Heartwood cream-white, sapwood nearly white. Close, straight grain. Compact structure. Comparatively free from knots and resin.

Structural Qualities of Wood.

Soft, uniform, seasons well, easy to work, nails without splitting, fairly durable. Lightest and weakest of eastern United States pines. Shrinks less than other pines.

Representative Uses of Wood.

Carpentry, construction, matches, spars, boxes, numerous uses.

Weight of Seasoned Wood in Pounds per Cubic Foot.

24 (U. S. Forestry Div.).*

24.

Modulus of Elasticity.

1,390,000 (average of 130 tests by U. S. Forestry Div.).*

1,210,000.

Modulus of Rupture.

7900 (average of 120 tests by U. S. Forestry Div.).*

8900.

Remarks.

Formerly the chief lumber tree of the United States. The supply is rapidly diminishing.

* See page 6.

"The White Pine." Spaulding. U. S. Forestry Bul. No. 22.

"White Pine" a Study. Mr. Gifford Pinchot. (Century Co.)

"White Pine Timber Supplies." U. S. Doc. 40 Senate, 55-1, Vol. IV.

White Pine.*Pinus flexilis* James.

Nomenclature. (Sudworth.)

White Pine (Cal., Nev., Utah,
Col., N. M.).

Bull Pine (Col.).

Western and Rocky Mountain

Pine (Utah, Mont.).

White Pine (Cal.).

Locality.

Rocky Mountains, Montana to Mexico.

Features of Tree.

Forty to fifty feet in height, one to three feet in diameter.

Tufts of five rather short, rigid leaves in sheaths.

Color, Appearance, or Grain of Wood.

Heartwood light, clear yellow, turning red from exposure.

Sapwood nearly white. Close-grained, compact structure,
numerous and conspicuous medullary rays.

Structural Qualities of Wood.

Light, soft.

Representative Uses of Wood.

Construction.

Weight of Seasoned Wood in Pounds per Cubic Foot.

27.

Modulus of Elasticity.

960,000.

Modulus of Rupture.

8800.

Remarks.

This tree forms mountain forests of considerable extent. Valued
locally.

Sugar Pine. *Pinus lambertiana* Dougl.

Nomenclature. (Sudworth.)

Sugar Pine (local and com- mon name).	Little or Great Sugar Pine. Gigantic Pine.
Big Pine, Shade Pine (Cal.).	White Pine.

Locality.

Oregon and California. Best at high altitudes (above 4000 feet), central and northern California.

Features of Tree.

One hundred to occasionally three hundred feet in height, fifteen to sometimes twenty feet in diameter. Cones ten to eighteen inches in length, edible seeds. Sweetish exudations. A great tree.

Color, Appearance, or Grain of Wood.

Heartwood pinkish brown, sapwood cream-white. Coarse, straight-grained, compact structure.

Structural Qualities of Wood.

Light, soft, easily worked, resembles white pine (*Pinus strobus*).

Representative Uses of Wood.

Carpentry, interior finish, doors, blinds, sashes, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

22.

Modulus of Elasticity.

1,120,000.

Modulus of Rupture.

8400.

Remarks.

Grows at as high elevations as five thousand feet or more above tide-water. Forms extensive forests with Balsam Fir (*Abies concolor*).

White Pine.*Pinus monticola* Dougl.

Nomenclature. (Sudworth.)

White Pine (Cal., Nev., Oreg.). Little Sugar Pine, Soft Pine (Cal.).

Mountain Pine, Finger Cone Pine (Cal.). Western White Pine. Mountain Weymouth Pine.

Locality.

Montana, Idaho, Pacific States, and British Columbia.

Features of Tree.

Eighty to one hundred feet in height. Two to three feet in diameter, sometimes larger. Foliage resembles, but is denser than, white pine. Long smooth cones.

Color, Appearance, or Grain of Wood.

Heartwood light brown or red, sapwood nearly white. Straight-grained, compact, suggests white pine (*Pinus strobus*).

Structural Qualities of Wood.

Light, soft, not strong.

Representative Uses of Wood.

Lumber.

Weight of Seasoned Wood in Pounds per Cubic Foot.

24.

Modulus of Elasticity.

1,350,000.

Modulus of Rupture.

8600.

Remarks.

Found at elevations of seven thousand to ten thousand feet. Common and locally used in northern Idaho.

Georgia Pine, Hard Pine, Yellow Pine, Longleaf Pine.*Pinus palustris* Mill.

Nomenclature. (Sudworth.)

Turpentine Pine.	Florida Pine.
Rosemary Pine.	Florida Longleaved Pine.
N. Carolina Pitch Pine.	Southern Pitch Pine.
Southern Pine.	Southern Hard Pine.
Longleaved Yellow Pine.	Southern Heart Pine.
Longleaved Pitch Pine.	Southern Yellow Pine.
Long Straw Pine.	Georgia Pitch Pine.
Pitch Pine.	Georgia Longleaved Pine.
Fat Pine.	Georgia Heart Pine.
Heart Pine.	Georgia Yellow Pine.
Brown Pine.	Texas Yellow Pine.
Florida Yellow Pine.	Texas Longleaved Pine.

Locality.

South Atlantic and Gulf States, Virginia to Alabama, intermittently.

Features of Tree.

Fifty to ninety feet or more in height, one to three feet in diameter. Tufts of three leaves, ten to fifteen inches long, in long sheath.

Color, Appearance, or Grain of Wood.

Heartwood orange, sapwood lighter. Coarse-grained, compact structure, conspicuous medullary rays.

Structural Qualities of Wood.

Hard, heavy, tough, strong, elastic, durable, resinous.

Representative Uses of Wood.

Heavy constructions, ship-building, cars, docks, beams, ties, flooring, house-trim, many uses.

Weight of Seasoned Wood in Pounds per Cubic Foot.

38 (U. S. Division of Forestry).*

43.

Modulus of Elasticity.

2,070,000 (average of 1230 tests by U. S. Forestry Div.).*

2,110,000.

Modulus of Rupture.

12,600 (average of 1160 tests by U. S. Forestry Div.).*

16,300.

Remarks.

Finer and has less sapwood than Cuban pine. One of the best woods for car-building. Principal lumber tree of the South-east.

* See page 6.

"Southern Pine." U. S. Forestry Circular No. 12. (Dr. B. E. Fernow, Chief.)

"Timber Pines of Southern States." U. S. Forestry Bul. No. 13. (Dr. B. E. Fernow, Chief.)

Cuban Pine. *Pinus heterophylla* Sudw.

Nomenclature. (Sudworth.)

Cuban Pine, Slash Pine (local and common names).	Swamp Pine (Fla., Miss.). Bastard Pine, Meadow Pine, Spruce Pine.
Pitch Pine, She Pine, She Pitch Pine (Ga., Fla.).	

Locality.

Coast region, South Carolina to Florida and Louisiana.

Features of Tree.

Fifty to eighty feet in height, one to two feet in diameter.

Color, Appearance, or Grain of Wood.

Resembles longleaf pine.

Representative Uses of Wood.

Similar to those of longleaf pine, from which it is seldom separated.

Weight of Seasoned Wood in Pounds per Cubic Foot.

39 (U. S. Forestry Div.).*

Modulus of Elasticity.

2,370,000 (average of 410 tests by U. S. Div. of Forestry).*

Modulus of Rupture.

13,600 (average of 410 tests by U. S. Div. of Forestry).*

Remarks.

Resembles and is marked longleaf pine (*Pinus palustris*).

* See page 6.

"Southern Pine." U. S. Forestry Circular No. 12. (Dr. B. E. Fernow, Chief.)

"Timber Pines of Southern States." U. S. Forestry Bul. No. 13. (Dr. B. E. Fernow, Chief.)

Shortleaf Pine, Yellow Pine. { *Pinus echinata* Mill.
 { *Pinus mitis* Michx.

Nomenclature. (Sudworth.)

Common Yellow Pine, Hard Pine.	Rosemary Pine (N. C.). Virginia Yellow Pine.
Spruce Pine (Del., Miss., Ark.).	North Carolina Yellow Pine. North Carolina Pine.
Bull Pine (Va.).	Carolina Pine.
Shortshat Pine (Del.).	Slash Pine.
Pitch Pine (Mo.).	Old Field Pine.
Poor Pine (Fla.).	
Shortleaved Yellow Pine (N. C.).	

Locality.

Connecticut to Florida, westward intermittently to Kansas and Texas.

Features of Tree.

Sixty to sometimes ninety feet in height, two to sometimes four feet in diameter. A large erect tree; small cones have minute weak prickles. Leaves usually in twos from long sheaths.

Color, Appearance, or Grain of Wood.

Resembles longleaf pine.

Structural Qualities of Wood.

Variable, usually hard, tough, strong, durable, resinous, lighter than longleaf pine.

Representative Uses of Wood.

Lumber, construction, similar to longleaf pine.

Weight of Seasoned Wood in Pounds per Cubic Foot.

32 (U. S. Forestry Div.).*

30.

Modulus of Elasticity.

1,680,000 (average of 330 tests by U. S. Forestry Div.).*

1,950,000.

Modulus of Rupture.

10,100 (average of 330 tests by U. S. Forestry Div.).*

14,700.

Remarks.

Affords considerable pitch and turpentine, and is the principal species of Northern Arkansas, Kansas, and Missouri.

* See page 6.

"Southern Pine." Mohr U. S. Forestry Circular No. 12.

"Timber Pines of Southern States." U. S. Forestry Bul. No. 13. (Dr. B. E. Fernow, Chief.)

Loblolly Pine.*Pinus taeda* Linn.

Nomenclature. (Sudworth.)

Old Field Pine.	Sap Pine.
Torch Pine.	Meadow Pine.
Rosemary Pine.	Cornstalk Pine (Va.).
Slash Pine.	Black Pine.
Longshat Pine.	Foxtail Pine.
Longshucks.	Indian Pine.
Black Slash Pine.	Spruce Pine.
Frankincense Pine.	Bastard Pine.
Shortleaf Pine.	Yellow Pine.
Bull Pine.	Swamp Pine.
Virginia Pine.	Longstraw Pine.

Locality.

Delaware to Florida and westward intermittently to Texas.

Features of Tree.

Fifty to one hundred feet or more in height, two to sometimes four feet in thickness. Leaves in twos and threes. Scales or cones have short straight spines. A large tree.

Color, Appearance, or Grain of Wood.

Resembles longleaf pine.

Structural Qualities of Wood.

Resembles longleaf pine.

Representative Uses of Wood.

Resembles longleaf pine.

Weight of Seasoned Wood in Pounds per Cubic Foot.

33 (U. S. Forestry Div.).*

33.

Modulus of Elasticity.

2,050,000 (average of 660 tests by U. S. Forestry Div.).*

1,600,000.

Modulus of Rupture.

11,300 (average of 650 tests by U. S. Forestry Div.).*

12,500.

Remarks.

Grows naturally on deforested land, whence the name of Old Field Pine.

* See page 6. .

"Southern Pine." U. S. Forestry Circular No. 12. (Dr. B. E. Fernow, Chief.)

"Timber Pines of Southern States." U. S. Forestry Bul. No. 13. (Dr. B. E. Fernow, Chief.)

Bull Pine, Yellow Pine, Western Yellow Pine.*Pinus ponderosa* Laws.

Nomenclature. (Sudworth.)

Big Pine.	Heavy-wooded Pine.
Longleaved Pine.	Western Pitch Pine.
Red Pine.	Heavy Pine (Calif.).
Pitch Pine.	Foothills Yellow Pine.
Southern Yellow Pine.	Montana Black Pine.

Locality.

Rocky Mountains, westward intermittently to Pacific Ocean.

Features of Tree.

One hundred to sometimes three hundred feet in height, six to sometimes twelve feet in diameter. Thick, deeply furrowed bark. Leaves in tufts of threes.

Color, Appearance, or Grain of Wood.

Thin heartwood is light red, sapwood nearly white. Rather coarse grain, compact structure.

Structural Qualities of Wood.

Variable, heavy, hard, strong, brittle, not durable.

Representative Uses of Wood.

Lumber, railway ties, mine timbers, fuel, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

29.

Modulus of Elasticity.

1,260,000.

Modulus of Rupture.

10,200.

Remarks.

Ponderosa, signifying "heavy," refers to great size.

Norway Pine, Red Pine. *Pinus resinosa* Ait.

Nomenclature. (Sudworth.)

Norway Pine, Red Pine (local and common names). Hard Pine (Wis.).
Canadian Red Pine (Eng.).

Locality.

Southern Canada, northern United States from Maine to Minnesota, Pennsylvania.

Features of Tree.

Sixty to ninety feet in height, one to three feet in diameter. Reddish blossoms and bark on branchlets. Leaves in twos from long sheaths. A tall, straight tree.

Color, Appearance, or Grain of Wood.

Thin heartwood light red, sapwood yellow to white. Numerous pronounced medullary rays.

Structural Qualities of Wood.

Light, hard, elastic, not durable, resinous.

Representative Uses of Wood.

Piles, telegraph poles, masts, flooring, and wainscoting.

Weight of Seasoned Wood in Pounds per Cubic Foot.

31 (U. S. Forestry Div.).*
30.

Modulus of Elasticity.

1,620,000 (average of 100 tests by U. S. Forestry Division).*
1,600,000.

Modulus of Rupture.

9,100 (average of 95 tests by U. S. Forestry Div.).*
12,500.

Remarks.

Sometimes commercially handled with white pine. Unimportant as regards turpentine and resin, in spite of specific name, which signifies resinous. Long sheaths enable children to make chains of leaves.

* See page 6.

Pitch Pine. *Pinus rigida* Mill.

Nomenclature. (Sudworth.)

Pitch Pine (local and common name).	Yellow Pine (Pa.). Black Pine (N. C.).
Longleaved Pine, Longschat Pine (Del.).	Black Norway Pine. Rigid Pine, Sap Pine.
Hard Pine (Mass.).	

Locality.

Atlantic coast, Canada to Georgia, Kentucky.

Features of Tree.

Forty to sometimes eighty feet in height, one to sometimes three feet in diameter. Rigid flattened leaves in threes from short sheaths.

Color, Appearance, or Grain of Wood.

Heartwood light brown or red, thick sapwood yellow to nearly white. Coarse conspicuous grain, compact structure, very resinous.

Structural Qualities of Wood.

Light, soft, not strong, brittle.

Representative Uses of Wood.

Coarse lumber, fuel, charcoal.

Weight of Seasoned Wood in Pounds per Cubic Foot.

32.

Modulus of Elasticity.

820,000.

Modulus of Rupture.

10,500.

Remarks.

Rigida refers to rigid leaves. The name "Pitch Pine" is sometimes applied to all of the Southern pines. The name is yet more widely applied in foreign markets. Sometimes called Fat Pine.

Northern Pine, Scotch Pine, Dantzic Pine. *Pinus sylvestris* Linn.

Nomenclature.

Dantzic Fir (from place of shipment).	Stettin Fir (from place of shipment).
Rigi Fir (from place of shipment).	Swedish Fir.
Memel Fir (from place of shipment).	Scots or Scottish Fir.
	Northern Fir.
	Redwood, Yellowwood.
	Deal (Local).

Locality.

Widespread in Europe, as Scotland, Germany, and Russia; also Asia. Naturalized in United States.

Features of Tree.

Fifty to one hundred feet in height, two to five feet in diameter; sometimes larger.

Color, Appearance, or Grain of Wood.

Heartwood reddish white to yellowish white, sapwood similar. Even straight grain (varies with locality).

Structural Qualities of Wood.

Moderately light, hard, tough, and elastic, easily worked (varies with locality).

Representative Uses of Wood.

Carpentry, construction, planks, beams, masts, heavy timber.

Weight of Seasoned Wood in Pounds per Cubic Foot.

34 (Lazlett *) (varies with locality).

Modulus of Elasticity.

1,680,000 (Lazlett) (varies with locality).
1,800,000 (Thurston).

Modulus of Rupture.

7000 (Thurston) (varies with locality).

Remarks.

Principal soft wood of Europe. Widely distributed; local peculiarities once thought to denote different species. Fields tributary to Dantzic and Rigi afford best wood. Wood "equal to Dantzic Fir" sometimes specified.

* Table CLXVII, p. 418.

KAURI PINE.

(*Dammara.*)

This New Zealand tree affords one of the best substitutes for northern pine. Although not true pine, it belongs to the same family as the pine and other conifers. The light, strong, durable, elastic wood is obtainable in large-sized pieces suitable for masts.

The species is universally noted for its resin, which possesses the quality of uniting more perfectly than others with linseed oil.* Kauri gum is thus one of the most valuable constituents of good varnish.† The best gum occurs as a fossil, and is collected by digging over areas known to be fruitful but from which trees have long since disappeared. The pieces, varying in size from small pebbles to lumps as large as eggs, are scraped and otherwise cleansed by natives in the fields.‡

* It unites with linseed oil at lower temperatures than other gums of its kind.

† Fossil Kauri gum has sold for one thousand to fifteen hundred dollars per ton.

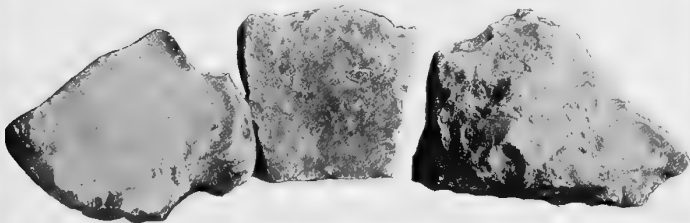
‡ One mass of two hundred and twenty pounds has been reported (R. Ingham Clark, F.R.G.S.: "Notes on Fossil Resins," published by C. Letts & Co., London).

Correspondence Professor Alvah H. Sabin, New York City; Messrs. Pratt & Lambert, New York City.

PLATE 28. KAURI PINE (*Dammara australis*).



From R. Ingham Clark, by courtesy of Messrs. Pratt & Lambest.



Fragments of Gum one-quarter natural size. "Fossil gum" at right and centre.

Kauri Pine.*Dammara australis.*

Nomenclature.

Kauri Pine (local and gen- eral).	Cowdie Pine (New Zealand and many localities).
--------------------------------------	---

Locality.

New Zealand.

Features of Tree.

Ninety to one hundred feet in height, three to four feet in diameter, occasional specimens much larger. Small leaves resembling those of box. A tall handsome tree.

Color, Appearance, or Grain of Wood.

Heartwood straw-colored, fine, close, straight grain.

Structural Qualities of Wood.

Moderately hard, light, elastic, strong, seasons well, works readily, receives high polish.

Representative Uses of Wood.

Carpentry, masts.

Weight of Seasoned Wood in Pounds per Cubic Foot.

33 (Lazlett *) (varies with locality).

Modulus of Elasticity.

1,810,000 (Lazlett).

Modulus of Rupture.

Remarks.

The species is widely known by reason of its gum.

* Table CLXXI, p. 426.

SPRUCE.

(*Picea.*)

The spruces form forests in Europe and North America. The black spruce (*P. nigra*) and the white spruce (*P. alba*) predominate in eastern United States, while the white spruce (*P. engelmanni*) is important in the West. The Norway spruce, or white fir (*P. excelsa*), is the chief European species. American trees prefer Northern ranges characterized by short summers and long winters.

The soft, light, clean woods resemble and are probably the best substitute for soft pine. They are apt to warp and twist in seasoning and so are not good for posts and trusses. Spruce is the principal wood in New England for studding and floor-joists. The product is divided commercially and according to appearance, but irrespective of species, into white and black spruce. These terms depend sometimes, at least, on the wide and narrow rings of the black spruce (*P. nigra*). It should be remembered that spruce and fir woods are often confused with one another, and that there are trees, as the Douglas spruce and Kauri pine or spruce, that are called, but are not, true spruces. European spruce is often locally known as white deal.

Spruce trees have single, sharp-pointed, short leaves, pointing everywhere, and keeled above and below so as to appear four-sided; the cones hang down. Spruce may be distinguished from the pines, firs, and hemlocks by the fact that pine leaves are longer and in clusters, that hemlock leaves are flat, blunt, and two-ranked, and that fir cones point upward. The genus *picea* has twelve species, five of which are North American. The resins of the black and red spruce are used as confections.

PLATE 29. BLACK SPRUCE (*Picea nigra*).



[Faint, illegible text, likely bleed-through from the reverse side of the page.]

The following table sets forth the primary distinctions between the spruces and the pines, firs, and hemlocks:

Names.	Arrangement of Leaves.	Shape of Leaves.	Cones.
Pines (<i>Pinus</i>)....	In tufts or clusters.	Comparatively long.	Hang down, 1 to 6 inches long.
Spruce (<i>Picea</i>)....	Single, scattered, point in all directions.	Short, sharp ends, keeled above and below. Somewhat four-sided.	
Fir (<i>Abies</i>).....	Single, scattered, appear somewhat as in two ranks.	Short, blunt ends, flat.	Stand erect, 2 to 4 inches long.
Hemlock (<i>Tsuga</i>)..	Single, scattered, appear as in two ranks.	Short, blunt ends, flat.	Hang down, $\frac{3}{4}$ to 1 inch long.

Black Spruce. { *Picea nigra* Link.
 { *Picea mariana* Mill.

Nomenclature. (Sudworth.)

Spruce (Vt.), Yew Pine, Spruce	White Spruce (W. Va.).
Pine (W. Va.).	He Balsam (Del., N. C.).
Double Spruce (Me., Vt., Minn.).	Water Spruce (Me.).
Blue Spruce (Wis.).	

Locality.

Pennsylvania to Minnesota, Alleghany Mountains to North Carolina. Best in Canada.

Features of Tree.

Forty to eighty feet in height, one to two feet in diameter. Conical shape with straight trunk. Dark foliage. Cones remain for several years, being thus distinct from white spruce.

Color, Appearance, or Grain of Wood.

Heartwood reddish, nearly white; sapwood lighter. Straight grain, compact structure.

Structural Qualities of Wood.

Light, soft, not strong, elastic, resonant.

Representative Uses of Wood.

Lumber, flooring, carpentry, ship-building, piles, posts, railway ties, paddles, oars, "sounding-boards," paper-pulp.

Weight of Seasoned Wood in Pounds per Cubic Foot.

28.

Modulus of Elasticity.

1,560,000.

Modulus of Rupture.

10,600.

Remarks.

A substitute for soft pine. Resin is used as a confection.

It is often difficult to distinguish between black and white spruce trees. The foliage of the former is darker as a whole, and there are differences in shape and persistence of cones. The names double spruce and single spruce are without evident foundation. Woods exhibit similar qualities and are classed together by lumbermen. Red Spruce (*Picea rubens*) resembles, and is sometimes considered a variety of, black spruce.

White Spruce.	{ <i>Picea alba</i> Link. { <i>Picea canadensis</i> Mill.	
Nomenclature. (Sudworth.)		
Single Spruce (Me., Vt., Minn.).	Skunk Spruce (Wis., New Eng.).	
Bog Spruce, Cat Spruce (N. Eng.).	Spruce, Double Spruce (Vt.). Pine (Hudson Bay).	

Locality.

Northern United States, Canada to Labrador and Alaska.

Features of Tree.

Fifty to one hundred feet in height, one to two feet in diameter, occasionally larger. Compact, symmetrical, conical shape. Foliage lighter than black spruce. Cones fall sooner than those of black spruce. Whitish resin.

Color, Appearance, or Grain of Wood.

Heartwood light yellow, sapwood similar. Straight-grained, numerous prominent medullary rays. Compact structure.

Structural Qualities of Wood.

Light, soft, not strong (similar to Black Spruce).

Representative Uses of Wood.

Lumber, flooring, carpentry, etc. (similar to Black Spruce).

Weight of Seasoned Wood in Pounds per Cubic Foot.

25.

Modulus of Elasticity.

1,450,000.

Modulus of Rupture.

10,600.

Remarks.

Notable as resident of high latitudes. Chief tree of arctic forests. Wood, used similarly to black spruce, is substituted for white pine.

White Spruce. *Picea engelmanni* Engelm.

Nomenclature. (Sudworth.)

White Spruce (Ore., Col., Utah, Idaho). White Pine (Idaho), Mountain Spruce (Mont.).

Balsam, Engelmann's Spruce (Utah).

Locality.

Rocky Mountain region, Montana to Mexico, Washington, Oregon, and British Columbia (high elevations).

Features of Tree.

Frequently seventy-five to one hundred feet in height and sometimes higher, two to three feet in diameter, sometimes low shrub.

Color, Appearance, or Grain of Wood.

Heartwood pale reddish yellow, sapwood similar. Close, straight grain, compact structure, conspicuous medullary rays.

Structural Qualities of Wood.

Light, soft, not strong.

Representative Uses of Wood.

Lumber, charcoal, fuel. Bark rich in tannin, sometimes used for tanning.

Weight of Seasoned Wood in Pounds per Cubic Foot.

21.

Modulus of Elasticity.

1,140,000.

Modulus of Rupture.

8100.

Remarks.

Notable as resident of high altitudes, extensive forests occurring at eight to ten thousand feet above sea-level. A valuable tree of the central and southern Rocky Mountain region.

Sitka Spruce. *Picea sitchensis* Trautv. and Mayer.

Nomenclature. (Sudworth.)

Sitka Spruce (local and common name).

Menzies Spruce.

Western Spruce.

Tideland Spruce (Cal., Oreg., Wash.).

Great Tideland Spruce.

Locality.

Pacific coast region, Alaska to central California. Extends inland about fifty miles; prefers low elevations.

Features of Tree.

One hundred and fifty feet or more in height, three feet or more in diameter. Flat-pointed pyramidal needles, oval cylindrical cones, thick scaly reddish-brown bark.

Color, Appearance, or Grain of Wood.

Heartwood light reddish brown, sapwood nearly white. Coarse-grained, satiny.

Structural Qualities of Wood.

Light, soft, not strong.

Representative Uses of Wood.

Construction, interior finish, fencing, boat-building, cooperage.

Weight of Seasoned Wood in Pounds per Cubic Foot.

2626.

Modulus of Elasticity.

Modulus of Rupture.

10,400.

Remarks.

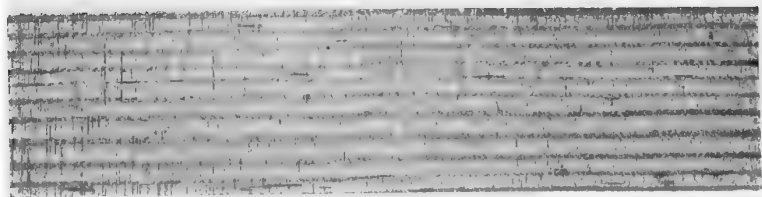
A giant among spruces. Forms an extensive coast-belt forest.

DOUGLAS SPRUCE.

(*Pseudotsuga.*)

The Douglas or Red Pine, Spruce, or Fir, of the Pacific coast is neither true pine, spruce, nor fir, but a sort of bastard hemlock. The name "pseudotsuga" is from *pseudo*, or false, and *tsuga*, or hemlock. The trees are among the greatest known. The wood resembles larch or hard pine in properties, appearance, and applications. Trees have been successfully planted in the Adirondacks. The species was earlier classed as *Pinus taxifolia* and as *Abies taxifolia*.

PLATE 30. DOUGLAS SPRUCE (*Pseudotsuga taxifolia*).



Douglas Spruce, Douglas Fir. } *Pseudotsuga taxifolia* Lam.
 } *Pseudotsuga Douglasii* Carr.

Nomenclature. (Sudworth.)

Oregon Pine (Cal., Wash., Oreg.).	Douglas Tree, Cork-barked Douglas Spruce.
Red Fir, Yellow Fir (Oreg., Wash., Idaho, Utah, Mont., Col.).	Spruce, Fir (Mont.). Red Pine (Utah, Idaho, Col.). Puget Sound Pine (Wash.).

Locality.

Pacific coast region, Mexico to British Columbia. Best in western Oregon and Washington.

Features of Tree.

One hundred and seventy-five to sometimes three hundred feet in height, three to five and sometimes ten feet in diameter. Older bark rough-gray, often looking as though braided.

Color, Appearance, or Grain of Wood.

Heartwood light red to yellow, sapwood nearly white.

Structural Qualities of Wood.

Variable, usually hard, strong, difficult to work, durable.

Representative Uses of Wood.

Heavy construction, dimension timbers, railway ties, piles, fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

32 (U. S. Forestry Div.).*

36 (average of 20 specimens by Soulé).†

32.

Modulus of Elasticity.

1,680,000 (average of 41 tests by U. S. Forestry Div.).*

1,862,000 (average of 21 specimens by Soulé).†

1,824,000.

Modulus of Rupture.

7,900 (average of 41 tests by U. S. Forestry Div.).*

9,334 (average of 21 specimens by Soulé).†

12,500.

Remarks.

Used similarly to hard pine. Lumbermen divide into red and yellow woods, the former dark and coarse, the latter fine, lighter, and more desirable. These distinctions probably due to age. One of the world's greatest trees.

* See page 6.

† Professor Frank Soulé, University of California. Trans. Am. Inst. M. E., p. 552, Vol. XXIX.

FIR.

(*Abies.*)

Several of the fir-trees of the western United States attain to very great size. The silver fir (*Abies grandis*) and the white fir (*Abies concolor*) supply much wood in the section in which they grow. The balsam fir (*Abies balsamea*) of the Eastern States is of some commercial importance.

Fir wood resembles spruce in appearance and in structural qualities. It may be told from spruce as well as from pine and larch by the fact that fir has no resin-ducts. The balsam fir is distinguishable by clear liquid resin which appears in blisters in the bark. The coarse, weak wood is cleaner than the bark would indicate. Spruce and fir woods are often confused in the United States, while pine, spruce, and fir are similarly confounded in Europe.



BALSAM FIR (*Abies balsamea*).

Fir trees have flat, scattered, evergreen leaves, and cones that stand erect (see footnote under spruce).

Balsam Fir, Common Balsam Fir. *Abies balsamea* Mill.

Nomenclature. (Sudworth.)

Balsam (Vt., N. H., N. Y.).	Blister Pine, Fir Pine (W. Va.).
Fir Tree (Vt.).	
Balm of Gilead (Del.).	Single Spruce, Silver Pine (Hudson Bay).
Canada Balsam (N. C.).	
Balm of Gilead Fir (N. Y., Pa.).	

Locality.

Minnesota to Virginia, northward intermittently into Canada.

Features of Tree.

Fifty to seventy feet in height, one to two feet in diameter. Sometimes low shrub. Blisters in smooth bark contain thick balsam. Erect cones.

Color, Appearance, or Grain of Wood.

Heartwood white to brownish, sapwood lighter. Coarse-grained, compact structure, satiny.

Structural Qualities of Wood.

Soft, light, not durable or strong, resinous, easily split.

Representative Uses of Wood.

Occasionally used as inferior lumber.

Weight of Seasoned Wood in Pounds per Cubic Foot.

23.

Modulus of Elasticity.

1,160,000.

Modulus of Rupture.

7300.

Remarks.

Scattered throughout Northern pineries. Cut when of sufficient size and sold with pine or spruce. Cultivated in gardens. Exudations known as Canada Balsam used in medicine. The poplar (*P. balsamifera*) is also called Balm of Gilead.

Great Silver Fir, White Fir. *Abies grandis* Lindl.

Nomenclature. (Sudworth.)

Silver Fir (Mont., Idaho).

Yellow Fir (Mont., Idaho).

Oregon White Fir, Western

Lowland Fir.

White Fir (Cal.).

Locality.

Vancouver region, northwestern United States. Best in west Washington and Oregon.

Features of Tree.

Two hundred to sometimes three hundred feet in height, two to five feet in diameter. Leaves deep green above, silvery below, usually curved. A handsome tree.

Color, Appearance, or Grain of Wood.

Heartwood light brown, sapwood lighter. Coarse-grained, compact structure.

Structural Qualities of Wood.

Light, soft, not strong.

Representative Uses of Wood.

Lumber, interior finish, packing-cases, cooperage.

Weight of Seasoned Wood in Pounds per Cubic Foot.

22.

Modulus of Elasticity.

1,360,000.

Modulus of Rupture.

7000.

Remarks.

Forms important part of local mountain forests and furnishes much lumber locally.

White Fir, Balsam Fir. '*Abies concolor* Parry.

Nomenclature. (Sudworth).

Silver Fir, Balsam (Cal.).

White Balsam (Utah).

California White Fir (Cal.).

Balsam Tree (Idaho).

Black Gum, Bastard Pine
(Utah).Colorado White Fir, Concolor
White Fir.

Locality.

Rocky Mountains and coast ranges, high elevations.

Features of Tree.

Seventy to one hundred and fifty feet in height, three to five feet in diameter. Pale green or silvery foliage. Bark blisters filled with clear pitch.

Color, Appearance, or Grain of Wood.

Heartwood light brown to nearly white, sapwood same or darker. Coarse-grained, compact structure.

Structural Qualities of Wood.

Light, soft, not strong, without odor.

Representative Uses of Wood.

Butter-tubs, packing-boxes, lumber.

Weight of Seasoned Wood in Pounds per Cubic Foot.

22.

Modulus of Elasticity.

1,290,000.

Modulus of Rupture.

9900.

Remarks.

Not always distinguished from the species *Abies grandis*.

Red Fir.*Abies magnifica* Murr.

Nomenclature. (Sudworth.)

California Red Fir, California	Magnificent Fir, Golden Fir
Red-bark Fir (Cal.).	(Cal.).
	Shasta Fir (Cal.).

Locality.

California, vicinity of Mount Shasta.

Features of Tree.

One hundred to two hundred and fifty feet in height, six to ten feet in diameter. Large erect cones. Beautiful form.

Color, Appearance, or Grain of Wood.

Heartwood reddish, sapwood distinguishable. Rather close-grained, compact structure.

Structural Qualities of Wood.

Light, soft, not strong, durable when exposed, liable to injury in seasoning.

Representative Uses of Wood.

Construction, sills, lumber, fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

29.

Modulus of Elasticity.

940,000.

Modulus of Rupture.

9900.

Remarks.

Magnifica or magnificent refers to appearance and size of tree.

Red Fir, Noble Fir. *Abies nobilis* Lindl.

Nomenclature. (Sudworth.)

Noble Silver Fir, Noble Red Fir. Bigtree, Feather-cone, Red Fir (Cal.).

Larch (Oreg.).

Locality.

Northwestern United States. Cultivated in East.

Features of Tree.

One to two hundred feet in height, six to nine feet in diameter. Leaves curved. Large, beautiful tree.

Color, Appearance, or Grain of Wood.

Heartwood reddish brown, sapwood darker. Rather close-grained, compact structure.

Structural Qualities of Wood.

Light, hard, strong, elastic.

Representative Uses of Wood.

Fitted for house-trimmings.

Weight of Seasoned Wood in Pounds per Cubic Foot.

28.

Modulus of Elasticity.

1,800,000.

Modulus of Rupture.

22,200.

Remarks.

Grows at high elevations (3000 and 4000 feet). With other fir forms extensive forests. Sold as larch.

HEMLOCK.

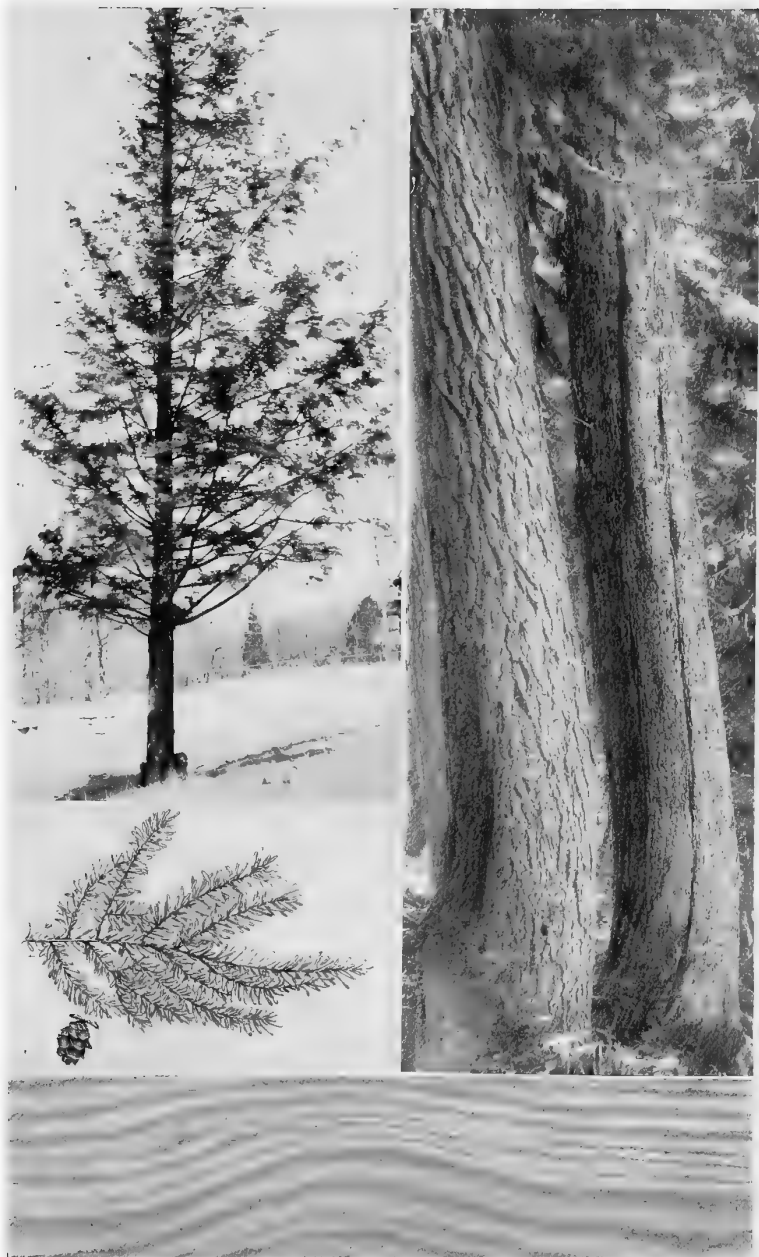
(*Tsuga.*)

The hemlocks are distributed over northern United States from Maine to Michigan, in the Rocky Mountains, and on the Pacific coast. They generally mingle with broad-leaved and other needle-leaved species, but occasionally form pure forests by themselves.

The wood is coarse, often crossed-grained, perishable, brittle, liable to wind-shakes, hard to work, and apt to warp and splinter. It holds nails firmly and is used for coarse lumber, dimension pieces, paper-pulp, and latterly for cheap finish. It should not be relied upon to receive shocks. The bark is used in tanning.

Hemlock trees may be known by their blunt, flat, evergreen leaves, appearing two-ranked and whitened beneath (see footnote under Spruce). Red inner bark.

PLATE 31. HEMLOCK (*Tsuga*).



Hemlock Tree (*Tsuga canadensis*).

Hemlock Foliage (*Tsuga canadensis*).

Hemlock Wood (*Tsuga canadensis*).

Western Hemlock Tree (*T. heterophylla*)
* (6500 feet above sea-level.)

Hemlock. *Tsuga canadensis.*

Nomenclature. (Sudworth.)

Hemlock (local and common name). N. Y., Pa., N. J., W. Va., N. C., S. C.).

Spruce (Pa., W. Va.). Spruce Pine (Pa., Del., Va.,

Hemlock Spruce (Vt., R. I., N. C., Ga.).

Locality.

Eastern and central Canada, southward to North Carolina and Tennessee.

Features of Tree.

Sixty to eighty or more feet in height, two or three feet in diameter. Short leaves, green above and white beneath. Straight trunk, beautiful appearance.

Color, Appearance, or Grain of Wood.

Heartwood reddish brown, sapwood distinguishable. Coarse, pronounced, usually crooked grain.

Structural Qualities of Wood.

Light, soft, not strong or durable, brittle, difficult to work, retains nails firmly, splintery.

Representative Uses of Wood.

Coarse lumber, joists, rafters, plank walks, laths, railway ties.

Weight of Seasoned Wood in Pounds per Cubic Foot.

26.

Modulus of Elasticity.

1,270,000.

Modulus of Rupture.

10,400.

Remarks.

Canadensis refers to Canada, the locality where tree excels.

The Southern or Carolina Hemlock (*T. caroliniana*) resembles Hemlock. The Western Hemlock (*T. heterophylla*, Alaska to California) attains height of 180 feet, diameter of 9 feet, and is said to afford heavier and better wood. This tree is known by the following names (Sudworth):

Western Hemlock,	Hemlock Spruce	Prince Albert's Fir,	Western Hemlock
(Cal.).		Fir,	California Hemlock Spruce

Hemlock (Oreg., Idaho, Wash.).	(England).
--------------------------------	------------

Alaska Pine (Northwestern Lumberman).

“The Western Hemlock.” Allen, U. S. Forestry Bureau Bulletin No. 33.

LARCHE. TAMARACK.

(*Larix.*)

Larch was well known in the older time, and was prized in Europe and the Orient. The two principal American species are also called tamarack and hackmatack. The Eastern larch or tamarack (*L. americana*) prefers peculiar low, wet areas known as tamarack swamps. The Western tree (*L. occidentalis*) resembles the European species and prefers dry places.

Larch wood has always been regarded as very durable. It is noted by Pliny and other ancient authors.* Vitruvius mentions a bridge that, having burned, was replaced by one of larch, because that wood would not burn as readily.† The foundation-piles of Venice are said to be of larch.‡ It should be remembered that the identities of ancient woods are not always beyond question. American larch resembles, if it does not equal, true foreign wood. The trees are tall and straight, but so slender as to be seldom cut into lumber, almost the entire supply being demanded for posts, ties, and poles. The exceedingly durable wood resembles spruce in structure, and hard pine in weight and appearance.

Larch trees are marked by the fact that their foliage is deciduous. The little leaves, gathered in tufts or bundles, are of a bright pea-green when fresh in the springtime. The appearance of tamarack trees when divested of foliage in the winter is very gloomy.

* Pliny, XVI, 43-49 and XVI, 30.

† Vitruvius, II, 9.

‡ Encyclopædia Britannica, Vol. XIV, p. 310.

PLATE 32. LARCH (*Larix*).



Larch Trees in Winter.

Tamarack, Larch. $\left\{ \begin{array}{l} \textit{Larix americana Michx.} \\ \textit{Larix laricina (Du Roi) Koch.} \end{array} \right.$

Nomenclature. (Sudworth.)

Tamarack, Larch, American Larch (local and common names). Black Larch, Red Larch (Minn., Mich.). Juniper (Me., Canada).

Hackmatack (Me., N. H., Mass., R. I., Del., Ill., Mich.)

Locality.

Northern United States and southern Canada, east from Great Lakes.

Features of Tree.

Seventy to ninety feet high, one to three feet in diameter. Short pea-green deciduous leaves in tufts. A slender tree, winter aspect gloomy.

Color, Appearance, or Grain of Wood.

Heartwood light brown, sapwood nearly white. Coarse conspicuous grain, compact structure, annual layers pronounced.

Structural Qualities of Wood.

Heavy, hard, very strong, durable, resembles spruce.

Representative Uses of Wood.

Railway ties, fence-posts, sills, ship timbers, telegraph poles, flagstaves, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

38.

Modulus of Elasticity.

1,790,000.

Modulus of Rupture.

12,800.

Remarks.

Practically all (tall thin) trunks required for railway ties, posts, masts, etc. Seldom cut into lumber in consequence. Grows in light swamps often extensive and known as tamarack swamp. (Trans. Am. Inst. Mining Engineers, Vol. XXIX, page 157.)

Tamarack Larch. *Larix occidentalis.*

Nomenclature. (Sudworth.)

Tamarack, Larch (local and common names).	Western Larch, Great Western Larch, Red American Larch.
Hackmatack (Idaho, Wash.).	Western Tamarack (Cal.).

Locality.

Washington and Oregon, intermittently to Montana.

Features of Tree.

Ninety to one hundred and twenty-five feet high, two and one-half to four feet in diameter. A large tree.

Color, Appearance, or Grain of Wood.

Heartwood light red, thin sapwood lighter. Coarse-grained, compact structure, annual rings pronounced.

Structural Qualities of Wood.

Hard, heavy, strong, durable.

Representative Uses of Wood.

Posts, railway ties, fuel, limited quantity of lumber, similar to *L. americana*.

Weight of Seasoned Wood in Pounds per Cubic Foot.

46.

Modulus of Elasticity.

2,300,000.

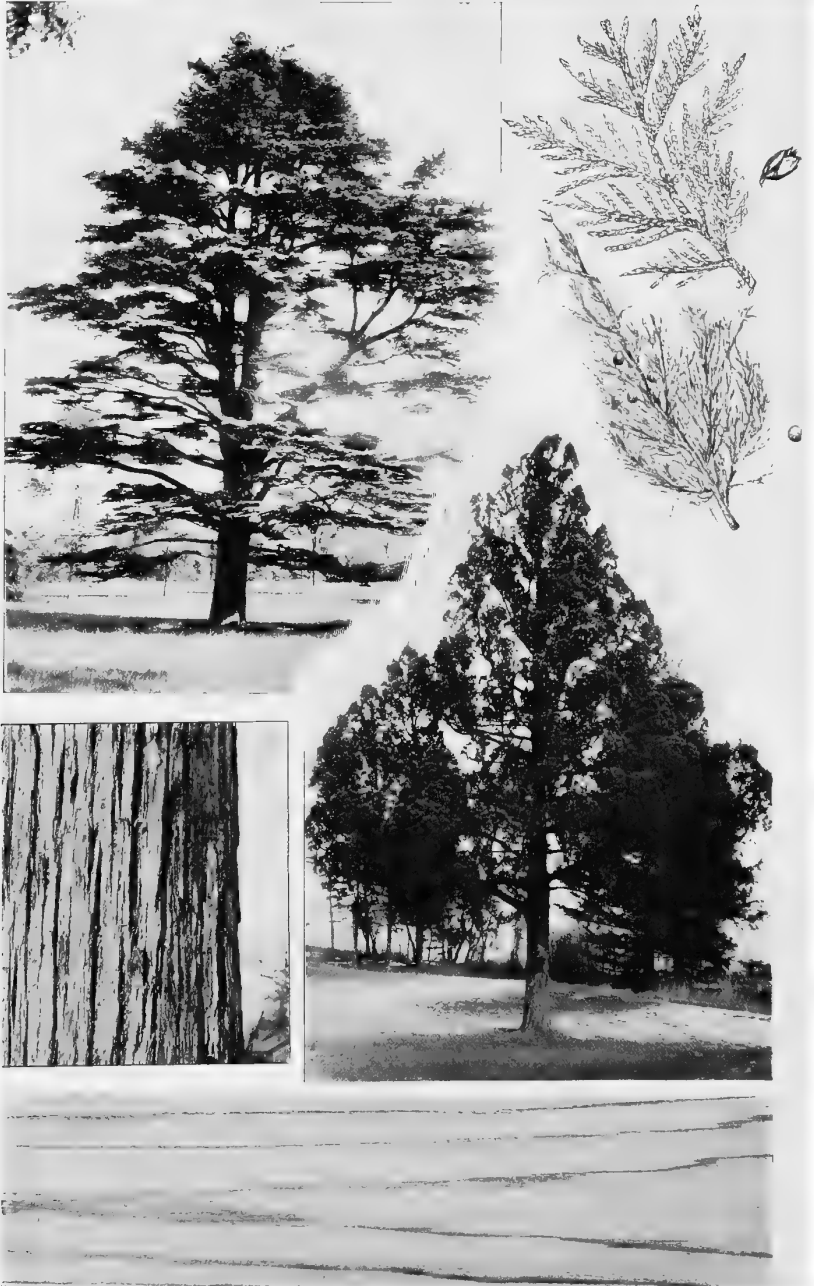
Modulus of Rupture.

17,400.

Remarks.

A valuable tree of the Columbian basin. Differs from *L. americana* in that it grows on dry ground, often at high elevations.

PLATE 33. CEDAR (*Cedrus*, *Thuja*, etc.).



Cedar of Lebanon (*Cedrus libani*).
Red Cedar Bark (*Juniperus virginiana*).
White Cedar Wood (*Thuja occidentalis*).

Foliage of White Cedar (*T. occidentalis*).
Foliage of Red Cedar (*J. virginiana*).
Tree of Red Cedar (*J. virginiana*).

CEDAR.

(*Cedrus*, *Thuya*, *Chamaecyparis*, *Libocedrus*, *Juniperus*.)

Cedar was a name first applied to the true or Lebanon cedars (*Cedrus*) of the Eastern continent, but later to certain Arborvitæ (*Thuya*), Junipers (*Juniperus*), and Cypresses (*Chamaecyparis*), and other trees (see "Spanish Cedar," page 122) from which durable, fine-grained, more or less fragrant woods, known as cedar, are obtained. Cedar was highly prized by the ancients, who employed it in costly constructions, such as the temples of Solomon and of Diana at Ephesus.* † Woods known as cedar are divided into so-called Red and White Cedars.

Red Cedar is very fine-grained, soft, light, durable, fragrant, and of a pinkish-red color. Much wood is derived from the Red Cedars, *Juniperus virginiana*, *Juniperus scopulorum*, and *Juniperus barbadensis*, of the Eastern, Western, and Southern States respectively. Although seen in construction, red cedar is chiefly used in chests, closets, lead-pencils, and cigar-boxes. One hundred and twenty-five thousand trees (125,000) ‡ are annually required for lead-pencils alone. The waste is often converted into shavings and used instead of camphor to protect woolens. The demand is greater than the supply. Trees are easily grown on almost any soil. Trees and wood are subject to fungus diseases which apparently cease after trees have been felled; the wood is then durable.§

White Cedar is best defined as all cedar that is not "red

* It is probable that the ancients also used the word Cedar somewhat generally.

† Pliny, 16, 213 and 16, 216.

‡ Notes on Red Cedar, Mohr. Bul. 31, U. S. Division Forestry (Gifford Pinchot, Forester).

§ Several of the fungoid parasites cause swellings known as "cedar apples." The branches usually die. Professor von Schrenk recognizes two diseases of the wood, white rot (*Polyporus juniperus* Schrenk) and red rot (*Polyporus carneus*). (Bulletin No. 21, Division Vegetable Physiology and Pathology, U. S. Dept. Agriculture.)

cedar," and is obtained from several valuable trees.* The arborvitæ (*T. occidentalis*) vary in size from large bushes used in hedging and ornamentation to small-sized trees gathered for wood. They are most vigorous on cold, wet areas known as cedar swamps.† The giant arborvitæ (*T. gigantea*), noted for its great girth, and the yellow and Lawson Cypresses, are important Pacific coast species. The incense cedar, while much subject to fungus trouble, is also prized.‡ White cedar wood is durable, plentiful, and employed in exposed positions as ties and shingles.

Arborvitæ (*Thuja*) have very small overlapping leaves that form flat rods or fan-like sprays. The cones are oblong, less than one-half inch in length, and all of their six or eight scales separate or open when ripe. The cypresses (*Chamæcyparis*) exhibit similar foliage, but their tiny cones are simple, roughened, close, or solid globules. The Junipers (*Juniperus*) often, but not always, bear bluish-black berries powdered with a whitish-blue bloom. The true cedars (*Cedrus*) differ from the others in that they have simple needle leaves, an inch, more or less, in length, together with cones erect and several inches in length. The Deodar or cedar of India is of this genus. The principal American red and white cedars are as follows:

Red Cedar.	White Cedar.
Red Cedar (<i>Juniperus virginiana</i>).	Arborvitæ (<i>Thuja occidentalis</i>).
Red Cedar (<i>Juniperus scopulorum</i>).	Canoe Cedar (<i>Thuja gigantea</i>).
Red Cedar (<i>Juniperus barbadensis</i>).	White Cedar (<i>Chamæcyparis thyoides</i>).
	Port Orford Cedar (<i>Chamæcyparis lawsoniana</i>).
	Yellow Cedar (<i>Chamæcyparis nutkaensis</i>).
	Incense Cedar (<i>Libodectrus decurrens</i>).

Spanish Cedar. (See page 99.)

* Heartwood often light grayish brown.

† Trunks of considerable size often grow surrounding, but apart from, such swamps. Vigorous lower branches impede progress through swamps, which are often as thick as to resemble immense cultivated hedges. (Trans. Am. Inst. M. E., Vol XXIX, p. 157.)

‡ Von Schrenk, Contribution No. 14, Shaw School of Botany, St. Louis.

Red Cedar. *Juniperus virginiana* Linn.

Nomenclature. (Sudworth.)

Red Cedar (local and common name).

Cedar (Conn., Pa., N. J., S. C., Ky., Ill., Ia., Ohio).

Pencil Cedar, Cendre (La.).

Savin (Mass., R. I., N. Y., Pa., Minn.).

Juniper, Red Juniper, Juniper Bush (local).

Locality.

Atlantic coast, Canada to Florida, westward intermittently to Mississippi River in the North, and Colorado River in the South.

Features of Tree.

Fifty to eighty feet in height, two to three feet in diameter. Sometimes low shrubs. Dark-green foliage, loose ragged outer bark.

Color, Appearance, or Grain of Wood.

Heartwood dull red, thin sapwood nearly white. Close, even grain, compact structure, annual layers easily distinguishable.

Structural Qualities of Wood.

Light, soft, weak, brittle, easily worked, durable, fragrant.

Representative Uses of Wood.

Ties, sills, posts, interior finish, pencil-cases, chests, cigar-boxes.

Weight of Seasoned Wood in Pounds per Cubic Foot.

30.

Modulus of Elasticity.

950,000.

Modulus of Rupture.

10,500.

Remarks.

Fragrance of wood utilized as insecticide. The Western Red Cedar (*J. scopulorum*) and the Southern Red Cedar (*J. barbadensis*) afford similar wood.

Juniper.*Juniperus occidentalis* Hook.

Nomenclature. (Sudworth.)

Juniper (Oreg., Cal., Col., Utah, Nev., Mont., Idaho, N. M.).	ern Cedar (Idaho, Col., Mont.).
Cedar, Yellow Cedar, West-	Western Red Cedar, Western Juniper (local).

Locality.

California, Washington, and Oregon.

Features of Tree.

Twenty-five to fifty feet in height, two to four feet in diameter, often smaller. Long straight trunk in West.

Color, Appearance, or Grain of Wood.

Heartwood reddish-brown, sapwood nearly white. Very close-grained, compact structure.

Structural Qualities of Wood.

Light, soft, durable, receives high polish.

Representative Uses of Wood.

Fencing, railway ties, posts, and fuel.

Weight of Seasoned Wood in Pounds per Cubic Foot.

35.

Modulus of Elasticity.

Modulus of Rupture.

Remarks.

Rarely found below an altitude of 6000 feet. Fruit said to be eaten by Indians.

White Cedar, Arborvitæ. *Thuja occidentalis* Linn.

Nomenclature. (Sudworth.)

White Cedar, Arborvitæ (local Atlantic Red Cedar (Cal.)
and common names). Vitæ (Del.).

Cedar (Me., Vt., N. Y.).

Locality.

Northern States eastward from Manitoba and Michigan. Northward, also occasionally southward, as in mountain region of North Carolina and eastern Tennessee.

Features of Tree.

Thirty to sixty feet high; one to three feet or more in diameter, often smaller. Bruised leaves emit characteristic pungent odor, rapidly tapering trunk.

Color, Appearance, or Grain of Wood.

Heartwood light brown, darkening with exposure, thin sapwood, nearly white. Even, rather fine grain, compact structure.

Structural Qualities of Wood.

Soft, light, weak, brittle, durable, inflammable. Permits spikes to work loose.

Representative Uses of Wood.

Railway ties, telegraph poles, posts, fencing, shingles, and boats.

Weight of Seasoned Wood in Pounds per Cubic Foot.

19.

Modulus of Elasticity.

750,000.

Modulus of Rupture.

7200.

Remarks.

Trunks so shaped as to be seldom sawn for lumber. Often used for telegraph or other poles, or else thin upper ends are used for posts, and lower section flattened into ties.

Canoe Cedar, Arborvitæ, Giant Arborvitæ. { *Thuja plicata* Don.
 { *Thuja gigantea* Nutt.

Nomenclature. (Sudworth.)

Canoe Cedar, Giant Arborvitæ (local and common names).	Cedar, Giant Cedar, Western Cedar (Oreg., Cal.).
Red Cedar, Giant Red Cedar, Pacific Red Cedar (Wash., Oreg., Cal., Idaho).	Shinglewood (Idaho).

Locality.

Coast region, California to Alaska, Idaho to Montana.

Features of Tree.

One hundred to two hundred feet in height, two to eleven feet in diameter. Four-sided leaves closely overlapping in sprays.

Color, Appearance, or Grain of Wood.

Heartwood dull reddish brown, thin sapwood nearly white. Coarse-grained, compact structure, annual layers distinct.

Structural Qualities of Wood.

Soft, weak, light, brittle, easily worked, very durable.

Representative Uses of Wood.

Shingles, fencing, cooperage, interior finish, canoes (coast Indians).

Weight of Seasoned Wood in Pounds per Cubic Foot.

23.

Modulus of Elasticity.

1,460,000.

Modulus of Rupture.

10,600.

Remarks.

Large trees are often hollow at the bottom.

White Cedar. *Chamaecyparis thyoides* L.

Nomenclature. (Sudworth.)

White Cedar (local and com- Post Cedar, Swamp Cedar (Del.),
mon name). Juniper (Ala., N. C., Va.).

Locality.

Maine to Florida, Gulf coast to Mississippi, best in Virginia and North Carolina.

Features of Tree.

Sixty to eighty feet in height, three to four feet in diameter. Shaggy rugged bark. A graceful tree.

Color, Appearance, or Grain of Wood.

Heartwood pinkish to darker brown, sapwood lighter. Close-grained, compact structure, conspicuous layers.

Structural Qualities of Wood.

Very light, soft, not strong, extremely durable in exposed positions, fragrant, easily worked.

Representative Uses of Wood.

Boats, railway ties, fencing, poles, posts, shingles.

Weight of Seasoned Wood in Pounds per Cubic Foot.

23 (U. S. Forestry Div.).

20.

Modulus of Elasticity.

910,000 (average of 87 tests by U. S. Forestry Div.).

570,000.

Modulus of Rupture.

6310 (average of 87 tests by U. S. Forestry Div.).

6400.

Remarks.

Grows chiefly in swamps. "White cedar posts" last many years.

Thyoides is from *Thuya* meaning *arborvitæ* and *eidōs*, the Greek for "resemblance."

Port Orford Cedar, Lawson Cypress.*Chamæcyparis lawsoniana* Murr.

Nomenclature. (Sudworth.)

White Cedar, Oregon Cedar Ginger Pine (Cal.).
(Oreg., Cal.).

Locality.

Pacific coast, California and Oregon.

Features of Tree.

One hundred to sometimes two hundred feet in height, four to twelve (?) feet in diameter. Leaves overlapping in sprays, very small cones one-fourth inch in diameter.

Color, Appearance, or Grain of Wood.

Heartwood yellowish white, sapwood similar. Very close-grained.

Structural Qualities of Wood.

Light, hard, strong, durable, easily worked, fragrant, resinous.

Representative Uses of Wood.

Lumber, flooring, interior finish, ties, posts, matches, ship-building.

Weight of Seasoned Wood in Pounds per Cubic Foot.

28.

Modulus of Elasticity.

1,730,000.

Modulus of Rupture.

12,600.

Remarks.

Resin employed as insecticide.

Yellow Cedar, Yellow Cypress, } { *Chamæcypris nootkatensis*
 Sitka Cypress. } { (*Lamb*) *Spach.*
 } { *Chamæcypris nutkaënsis* *Spach.*

Nomenclature. (Sudworth.)

Nootka Cypress, Nootka Alaska Cypress, Alaska
 Sound Cypress (local). Ground Cypress (local).

Locality.

Oregon to Alaska.

Features of Tree.

One hundred feet or more in height, three to five feet or more in diameter. Sharp-pointed, overlapping leaves, small globose cones.

Color, Appearance, or Grain of Wood.

Heartwood clear light yellow, thin sapwood nearly white. Close-grained, compact structure.

Structural Qualities of Wood.

Light, not strong, brittle, hard, durable in contact with soil, easily worked, receives high polish, fragrant.

Representative Uses of Wood.

Ship-building, furniture, interior finish.

Weight of Seasoned Wood in Pounds per Cubic Foot.

29.

Modulus of Elasticity.

1,460,000.

Modulus of Rupture.

11,000.

Remarks.

Valuable Alaska timber tree. Commercially not distinguished from Pacific *Arborvitæ*.

Incense Cedar, White Cedar. *Libocedrus decurrens* Torr.

Nomenclature. (Sudworth.)

Post Cedar,	California Post	California	White	Cedar
	Cedar (local).		(local).	
Bastard Cedar,	Red Cedar,	Juniper	(Nevada).	

Locality.

California and Oregon.

Features of Tree.

Ninety to one hundred and twenty-five feet in height, occasionally higher, three to six feet in diameter.

Color, Appearance, or Grain of Wood.

Heartwood brownish, sapwood lighter. Close-grained, compact structure. Heartwood often pitted. Fragrant.

Structural Qualities of Wood.

Light, brittle, soft, durable.

Representative Uses of Wood.

Flumes, shingles, interior finish.

Weight of Seasoned Wood in Pounds per Cubic Foot.

25.

Modulus of Elasticity.

1,200,000.

Modulus of Rupture.

960,000.

Remarks.

Subject to attack by fungus, causing the large oval pits in the heartwood. Disease ceases upon the felling of trees. (von Schrenk Contribution No. 14 Shaw School Botany, St. Louis.)

PLATE 34. CYPRESS (*Cupressus*, *Taxodium*).



Monterey Cypress (*Cupressus macrocarpa*).
(Courtesy Doubleday, Page & Co.)

Cypress (*Taxodium distichum*).
(Photograph by Edward J. Davison.)

"Peggy" Cypress Wood.

CYPRESS.

(*Cupressus and Taxodium.*)

The name cypress has been chiefly applied to trees of the genera *Chamæcyparis*, *Cupressus*, and *Taxodium*. Most species of the genus *Chamæcyparis* are now called cedars (see page 167). The *Cupressus*, while true cypresses and important in Europe, have no significance in America. The single species of the genus *Taxodium* is not a cypress, but supplies the "cypress" wood of American commerce. It is perhaps best to confine the name cypress to the true cypress (*Cupressus*) and to the commercial cypress (*Taxodium*).

The true cypress (*Cupressus*) was once important in the East, and is thought by some to have given the gopher wood of which the Ark was built.* Pliny mentions cypress doors good after four hundred years, and a statue good after six hundred years. Herodotus and other ancient authors † speak of it. Authorities in the middle ages thought that it would never decay. The cypress gates of the early St. Peter's, removed after one thousand years of service, were found to be in perfect condition. ‡ Cypress was much prized for mummy-cases. Living trees long figured as funeral emblems, and are yet planted over graves in Italy and Turkey.§ The common or evergreen cypress is the chief European species. The eight or nine American representatives are of little note save as they are sometimes used for hedges and ornamentation. The Monterey and Gowan cypresses (*Cupressus macrocarpa* and *Cupressus goveniana*) are thus employed. There are small evergreen scale-like leaves.

* Funk & Wagnalls' Standard Dictionary, quoting Horace Smith, "Gayeties and Gravities," Chapter VII, p. 57.

† Pliny 16, 214 and 16, 215; Herodotus 4, 16; Virgil, Georgics, 2, 443.

‡ Encyclopædia Britannica, B. 6, p. 745.

§ Brockhaus, Konversations-Lexikon, B. 4, p. 654.

The American or Bald Cypress (*Taxodium distichum*) is a tree of considerable importance. It grows in the South Atlantic and Gulf States, on submerged lands or in deep swamps where unusual logging methods are necessitated. The seasoned wood resembles white cedar in that it is soft, light, and very durable. It has been called by many names. Pieces



BALD CYPRESS (*Taxodium distichum*).

were once called black or white cypress according as they sank or floated. All dark pieces are now called black cypress. The tinted woods of some localities are called red or yellow cypress. The name bald cypress was caused by the leafless appearance of the trees in winter. The living trees are subject to a peculiar fungous disease, causing numerous cavities in the wood. These so resemble perforations made by small pegs that the wood is termed "peggy." The trouble ceases as the trees are cut, and the wood is then as durable as that from perfect trees. About one third of the standing supply is thus affected.* The roots frequently project upward above the surface in what are known as cypress knees. The single species of this genus may easily be recognized by its deciduous foliage; the little leaves are separated and are not in tufts as with the tamaracks.

* U. S. Forestry Circular No. 19 (Dr. B. E. Fernow, Chief).

Cypress, Bald Cypress. *Taxodium distichum* Rich.

Nomenclature. (Sudworth.)

White Cypress (N. C., S. C., Fla., Miss.).	Swamp Cypress (La.).
Black Cypress (N. C., S. C., Ala., Tex.).	Deciduous Cypress (Del., Ill., Tex.).
Red Cypress (Ga., Miss., La., Tex.).	Southern Cypress (Ala.).

Locality.

South Atlantic and Gulf States, Maryland through Florida to Texas, Mississippi Valley from southern Illinois to the Gulf. Occasional in North, as New York. Forms forests in swamps and barrens.*

Features of Tree.

Seventy to one hundred and fifty feet in height, four to ten feet in diameter. Knees on roots often hollow in old age. Flat deciduous leaves.

Color, Appearance, or Grain of Wood.

Heartwood brownish, sapwood nearly white. Close, straight grain. Frequently pitted by disease.

Structural Qualities of Wood.

Light, soft, not strong, durable. Green wood often very heavy.

Representative Uses of Wood.

Carpentry, construction, cooperage, railway ties.

Weight of Seasoned Wood in Pounds per Cubic Foot.

29 (U. S. Forestry Div.). †

28.

Modulus of Elasticity.

1,290,000 (average of 655 tests by U. S. Forestry Div.). †

1,460,000.

Modulus of Rupture.

7900 (average of 655 tests by U. S. Forestry Div.). †

9600.

Remarks.

Wood commercially divided into "white" and "black" cypress because of differences in age and environment. Fungus disease pits much wood, but stops with felling of trees. ‡

* See Trans. Am. Inst. M. E., Vol. XXIX, page 157.

† See page 6.

‡ Von Schrenk, Contribution No. 14, Shaw School Botany, St. Louis; also U. S. Forestry Circular No. 19.

REDWOOD.

(*Sequoia*.)

These trees grow only in California. There are two species: the common redwood (*S. sempervirens*), noted for its lumber, and the big or mammoth tree (*S. washingtoniana*), so remarkable for its great size. Geological evidence indicates that the genus was once represented by many species on both hemispheres, but that all disappeared during the glacial period save the two here noted.

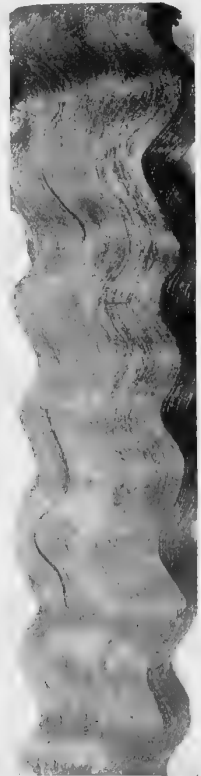
The common redwood is a large and perfect tree and supplies a wood suggesting good red cedar. This soft, light, clean, reddish-brown, durable wood works and stands well, is not easily inflamed, and is obtainable in large-sized pieces for use in large constructions. Coffins and shingles are made of it, also large quantities of wooden water-pipe employed for irrigation purposes. The average wood is seen in cheaper forms of indoor finish, while occasional pieces, in which the grain is distorted, are classed as curly redwood and used for costlier decorations.

Big or Mammoth trees have been measured up to three hundred and twenty feet in height and thirty-five feet in diameter (Sargent). They are thus the largest of American trees and the most massive, although not the tallest, of all trees. Specimens twenty-five feet in diameter have been estimated as thirty-six hundred years old, and it is thought that under favorable conditions trees can survive for five thousand years, or even longer. The oldest trees are sound throughout. The almost incombustible bark is nearly two feet in thickness; the wood is brittle, but otherwise resembles ordinary redwood. It should be noted that large exceptional trees are all known, and that most of them have names such as the "Pride of the Forest," the "Grizzly Giant," and the "U. S. Grant." These, with younger trees, are grouped in

PLATE 35. REDWOOD (*Sequoia*).



Redwood Foliage (*Sequoia sempervirens*).



Giant Redwood Tree (*S. washingtoniana*). (Courtesy Doubleday, Page & Co.)

"Curly" Redwood Wood (*dissection*).

the Mariposa, Calaveras, and other groves. Many sawmills are unfortunately engaged on the trees of this species.

Redwood trees may be known by their size, locality, and fine, dull, evergreen foliage. The name Sequoia is that of an Indian chief.

References : "The Big Trees of California," U. S. Forestry Division Bulletin No. 28. Also Mr. Jas. Horsburgh, Jr., Southern Pacific Railway.

Redwood. *Sequoia sempervirens* Endl.

Nomenclature. (Sudworth.)

Redwood (local and common name). Sequoia, California Redwood, Coast Redwood (local).

Locality.

Central and North Pacific coast region.

Features of Tree.

Two hundred to three hundred feet in height, sometimes higher, six to eight and sometimes twenty feet in diameter. Straight, symmetrical trunk. Low branches rare.

Color, Appearance, or Grain of Wood.

Thick heartwood red, changing to reddish brown when seasoned; Thin sapwood nearly white. Coarse, straight grain, compact structure, very thick bark.

Structural Qualities of Wood.

Light, not strong, soft, very durable, not resinous, easily worked. Does not burn easily, receives polish.

Representative Uses of Wood.

Timber, shingles, flumes, fence-posts, coffins, railway ties, water-pipes, interior decoration. Bark made into souvenirs.

Weight of Seasoned Wood in Pounds per Cubic Foot.

26 (census figure, see page 6).

Modulus of Elasticity.

790,000 (average of 8 Humboldt specimens). †
1,140,000 (average of 7 Humboldt specimens). †
960,000 (census figure, see page 6).

Modulus of Rupture.

4920 (average of 9 Humboldt specimens). †
7138 (average of 7 Mendocino specimens). †
8400 (census figure, see page 6).

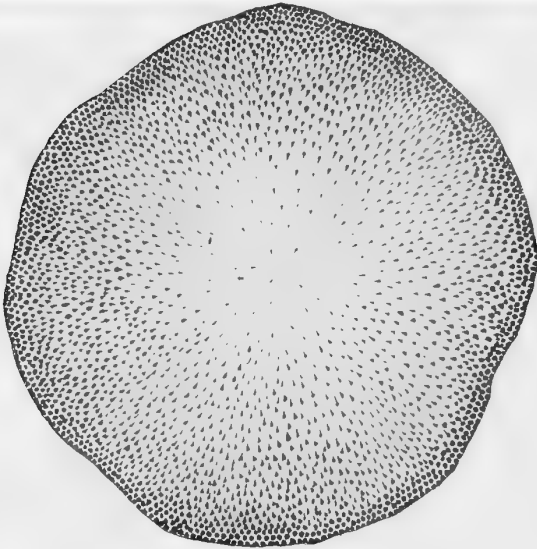
Remarks.

Pacific coast chief construction wood. Curled or distorted grain adds value for cabinet purposes.

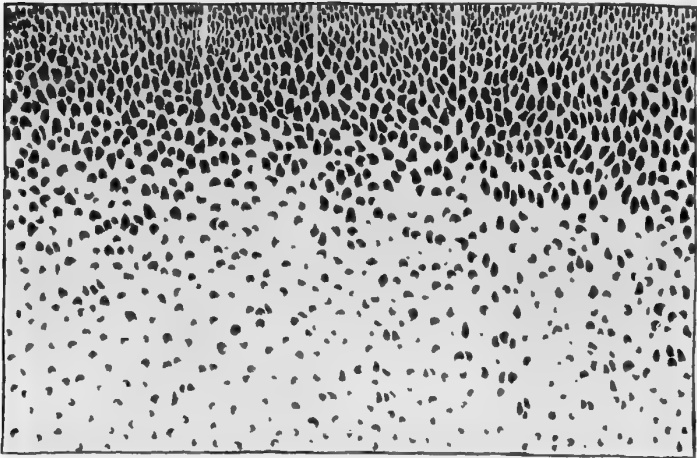
The Big or Mammoth Tree or Giant Redwood (*S. washingtoniana* Sudworth and *S. gigantea*) is the largest tree known. The wood resembling that of *S. sempervirens* is used locally, see U. S. Forestry Bul. No. 28.

† Professor Frank Soulé, Trans. Am. Inst. M. E., California Meeting, 1899. There are several trees of this species near New York City.

PLATE 36. ENDOGENOUS STRUCTURE IN WOOD.



A section through a Palm Tree.



A cross-section of Palm wood. (Natural size.)

ENDOGENOUS TREES.

(*Monocotyledons.*)

Endogenous trees are those that increase from within. Their elemental parts are similar to those of exogenous trees but the arrangement of such parts differs in that the newer fibres of the Endogen intermingle with the old, pass through a pith-like tissue, and cause cross-surfaces to appear as dotted, whereas the new material of the Exogen is deposited altogether and upon the outside of the old, their sections exhibiting rings or layers. The Palms, Yuccas, Cornstalks, and Bamboos are of the endogens. Bark is unusual on trees of the series.

Endogenous woods are hardest and most compact at circumferences. The stems of palm trees are solid, but those of some of the grasses, particularly those that grow quickly, are hollow.* The tube or canal, when existing, is due to sluggishness on the part of the central pith, which, developing more slowly than the outer tissues, finally ruptures and disappears at the center. There are also more or less permanent joints or knots,† such as are made familiar by the canes and bamboos. The stems of Endogenous plants are seldom cut up into lumber, but are used in segments, or else entire, as for troughs or piles.‡ The use of Palm wood must be more or less

* The Bamboo, which is a grass, is hollow, while the cornstalk, which is also a grass, is not.

† The knots of endogens correspond to the nodes of exogens. Spaces between the nodes, known as internodes, mark the annual lengthening. Knots are places whence leaves have emerged.

‡ Palm in marine work appears to repel the teredoe. This is probably because of the porous character of the wood. See "Marine Wood Borers," Trans. Am. Soc. C. E., Vol. XL, pages 195 and 204.

limited to the neighborhoods in which such trees flourish, but it is probable that the Bamboo can be much more generally employed.

The Endogens include numerous families and many thousand species.* The grasses, including wheat, rye, and Indian corn at the North and sugar-cane and bamboo at the South, belong to this group. Most Endogens are herbs; comparatively few furnish material for structural purposes. The Palms, including the palmetto, rattans, cane palms, and others, the Yucca, including the Joshua tree, Spanish bayonet, and others, and the Bamboos, representatives of the grasses, are thus useful. Endogens are also known as Monocotyledons.

* Bastin ("College Botany," p. 379) divides into about fifty natural orders distributed among seven divisions. Warming ("Systematic Botany," pp. 277, 278) divides into seven families corresponding with Bastin's seven divisions. A. Gray divides into twenty-one orders or families. Coulter ("Plants," p. 237) divides into forty families, including twenty thousand species.

PLATE 37. PALM (*Palmaceæ*)



Cabbage Palmetto.
(Courtesy N. C. Geological Survey.)

Washington Palm (untrimmed).
(Messrs. Doubleday, Page & Co.)

Washington Palm
(trimmed).
(Los Angeles Chamber Commerce.)

PALM.

PALMACEÆ.

This is one of the largest and most important orders of plants known to man. The one thousand* or more known species are distributed over the tropical and semitropical regions of the entire world. Only a few species, including the palmettos of the Gulf States and the fan palms of California, are native in the United States.

Palms have tall, columnar trunks without branches, but with crowns of large leaves at their summits. Their forms and proportions are often magnificent. The wood is soft, light, more or less porous, difficult to work, and not strong. The shapes of trunks sometimes cause them to be locally prized for piles, while the porous qualities of the wood are such as to repel teredo † There are many by-products, as fruit, nuts, oil, etc. The rattan or cane palms of India and the Malayan Islands sometimes grow to a height of two hundred feet and are imported into Europe and America for chair-bottoms and the like.

Sudworth ‡ enumerates the following as attaining to the dignity of trees in the United States:

Cabbage Palmetto (<i>Sabal palmetto</i>).	Sargent Palm (<i>Pseudophoenix sargentii</i>).
Silvertop Palmetto (<i>Thrinax microcarpa</i>).	Fanleaf Palm (<i>Washingtonia filifera</i>).
Silktop Palmetto (<i>Thrinax parviflora</i>).	Royal Palm (<i>Oreodora regia</i>).
Mexican palmetto (<i>Sabal mexicana</i>).	

* Coulter, "Plants," p. 241.

† "Marine Wood Borers," Snow Trans. Am. Soc. C. E., Vol. XL, pp. 195 and 204.

‡ "Check List," U. S. Forestry Bul. No. 17.

Cabbage Palmetto. *Sabal palmetto* Walt.

Nomenclature. (Sudworth.)

Cabbage Palmetto, Palmetto	Cabbage Tree (Miss., Fla.).
(N. C., S. C.).	Tree Palmetto (La.).

Locality.

Southern Atlantic and Gulf coast, United States (intermittently).

Features of Tree.

Medium size, thirty to forty feet in height, one to two and one-half feet in diameter.

Color, Appearance, or Grain of Wood.

Light-brown tint. Characteristic coarse fibre arrangement.

Structural Qualities of Wood.

Light, soft, difficult to work; durable in marine work; repels teredo.

Representative Uses of Wood.

Piles, wharf-work, etc.

Weight of Seasoned Wood in Pounds per Cubic Foot.

27.

Modulus of Elasticity.

Modulus of Rupture.

Remarks.

Scrubbing-brush "bristles" are made in considerable quantities in Florida from the sheath of young leaves. The inner part of young plants is edible. It is said (N. Y. *Evening Post*, April 20, 1901) that paper is being manufactured from the leaves of the Palmetto.

Washington Palm. } *Washingtonia filifera* Wendl.
Fanleaf Palm. } *Neowashingtonia filamentosa* Wendl.

Nomenclature. (Sudworth.)

Fanleaf Palm, Washington	California Fan Palm, Arizona
Palm, Desert Palm (Cal.).	Palm, Wild Date (Cal.).

Locality.

California.

Features of Tree.

Thirty to sixty feet in height, one and one-half to three feet in diameter. Fan-shaped leaves rising yet farther in tuft from summit; edible fruit.

Color, Appearance, or Grain of Wood.

Light greenish yellow to dark red, conspicuous grain.

Structural Qualities of Wood.

Soft, light, shrinks in seasoning, difficult to work.

Representative Uses of Wood.

Ornamental purposes.

Weight of Seasoned Wood in Pounds per Cubic Foot.

32.

Modulus of Elasticity.

Modulus of Rupture.

Remarks.

The largest of the United States Palms. Much used for landscape effects in California.

YUCCA.

(*Yucca*.)

The eighteen species constituting this genus are all American. Twelve of them are found in the southern and western United States, and eight of these are mentioned by Sudworth* as arborescent. Several of the *Yuccas* are cultivated because of their beautiful lily-like flowers. The Tree *Yucca* or Joshua-tree affords wood.

This last named species produces a short stout trunk, peculiar in that it is covered by thick bark. The soft, spongy wood is sometimes sawn into lumber, made into souvenirs and lately into artificial limbs. An attempt to manufacture it into paper-pulp† is said to have failed because of high cost made necessary by the remote position of the industry. Hough notes‡ that trees are sometimes attacked by borers that impregnate the walls of their tunnels with hardening antiseptic solutions, causing such parts to remain after the disappearance of the others. And that these parts are described as "petrified wood," and are prized for fuel since they burn with "little smoke and great heat."

The eight species noted by Sudworth are as follows:

<i>Yucca arborescens</i> (Joshua tree).	<i>Yucca aloifolia</i> (Aloe-leaf <i>Yucca</i>).
<i>Yucca treculeana</i> (Spanish Bayonet).	<i>Yucca macrocarpa</i> (Broadfruit <i>Yucca</i>).
<i>Yucca gloriosa</i> (Spanish Dagger).	<i>Yucca brevifolia</i> (Schott <i>Yucca</i>).
<i>Yucca mohavensis</i> (Mohave <i>Yucca</i>).	<i>Yucca constricta</i> .

* "Check List," U. S. Forestry Bul. No. 17.

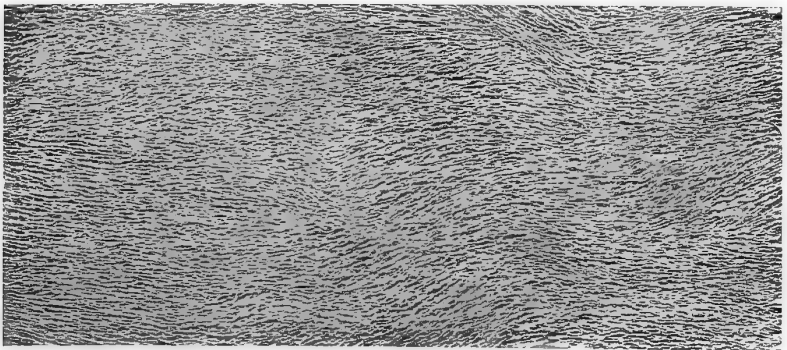
† South of Mohave Desert in California about twenty years ago.

‡ American Woods, Part VII, p. 57.

PLATE 38. YUCCA (*Yucca arborescens*).



By courtesy of Messrs. Doubleday, Page & Co. Photograph by Conway.



Wood of Yucca.

Joshua-tree, *Yucca*. { *Yucca arborescens* Torr.
 { *Yucca brevifolia* Engelm.

Nomenclature. (Sudworth.)

Joshua-tree, The Joshua, Yucca Cactus (Cal.).
 Yucca, Yucca Tree (Utah,
 Ariz., N. M., Cal.).

Locality.

Central and lower Rocky Mountain region.

Features of Tree.

Twenty-five to forty feet in height, six inches to two feet in diameter.

Thick outer cover or bark.*

Color, Appearance, or Grain of Wood.

Light brown to white, porous grain.

Structural Qualities of Wood.

Light, soft, spongy, flexible in thin sheets.

Representative Uses of Wood.

Paper-pulp, souvenirs, boxes, book covers, and other small articles.

Weight of Seasoned Wood in Pounds per Cubic Foot.

23.

Modulus of Elasticity.

Modulus of Rupture.

Remarks.

Bark is unusual in the case of endogenous trees. *Arborescens* refers to fact that *it* is a tree.

* See paragraph Bark, Endogenous Trees, page 55.

BAMBOO.

(*Bambusæ.*)

The bamboos are giant members of a group (grasses *), the other individuals of which, while widely distributed, valued, and very numerous, are for the most part insignificant as to bulk, height, and structural characteristics. The canes and bamboos are exceptions in that they form what may well be called forests, and produce woods used in construction. The Bamboos (*Bambusæ*), including about twenty genera and two hundred species,† are distributed unevenly over the tropical zone.

The bamboo plant with its numerous stalks and delicate foliage resembles a plume of giant ostrich feathers. The stems attain heights of seventy feet and diameters of four and six inches (see Fig. 3 plate). Knots or joints are at first close together, but are later one or two feet apart. Growth is surprisingly rapid. A Philippine specimen, which when measured was eighteen inches high and four inches in diameter, grew two feet in three days.‡ Florida stalks have reached heights of seventy-two feet in a single season.§ The plants are apt to take complete possession of the ground on which they grow. Those who use bamboo value it highly. It is employed entire or else split into segments. Some can be

* Grasses, "one of the largest and probably one of the most useful groups of plants. . . . If grass-like sedges be associated, . . . there are about 6000 species, representing nearly one third of the Monocotyledons." (Coulter, "Plants," pp. 240-241.) The various pasture-grasses, cereals, and sugar-canes are here included. Bamboos and canes are distinct in that they afford structural materials.

† B. E. Fernow notes (p. 29, Forestry Bulletin No. 11): "In addition to the genus bambusa, the genera *Arundinaria*, *Arundo*, *Dendrocalamus*, and *Guadua* are the most important." All of tribe *Bambusæ*.

‡ Frederic H. Sawyer, Memb. Inst. C. E., "Inhabitants of the Philippines," Chas. Scribner's Sons, 1900 (p. 5).

§ Page 29, U. S. Forestry Bulletin No. 11.

PLATE 39. BAMBOO (*Bambusa*).



Bamboo Grove, Philippines.

By the courtesy of the Manila P.O. Forestry Bureau.



Bamboo Grove, China.

Bamboo sections, $5\frac{1}{2}$ inches diameter.

opened and flattened into rough boards, splitting everywhere but holding together.* For vessels it is cut off with reference to the partitions. The subject is thus summarized by Dr. Martin:† “The Chinese make masts of it for their small junks, and twist it into cables for their larger ones. They weave it into matting for floors, and make it into rafters for roofs. They sit at table on bamboo chairs, eat shoots of bamboo with bamboo chop-sticks. The musician blows a bamboo flute, and the watchman beats a bamboo rattle. Criminals are confined in a bamboo cage and beaten with bamboo rods. Paper is made of bamboo fibre, and pencils of a joint of bamboo in which is inserted a tuft of goat’s hair.”

The manipulation of this valuable material is not yet understood in America. Prof. Johnson notes‡ that the wood of “bamboo is just twice as strong as the strongest wood in cross-bending, weight for weight, when the wood is taken in specimens, with a square and solid cross-section.” Dr. Fernow considers the bamboo worthy of extensive trial throughout the Gulf region.§

* Prof. Isaac F. Holton, “New Granada,” Harper Bros., New York, 1857 (p. 109).

† “Cycle of Cathay,” Fleming H. Revell Co., 1899 (p. 172).

‡ Materials of Construction, 1897, p. 689.

§ Henry G. Hubbard, U. S. Forestry Bulletin No. 11, A. B. Mitford.

“The Bamboo Garden,” Macmillan, 1896. Kurz, “Bamboo and its Uses,” Calcutta, 1876.

“Bamboo as substitute for Wood,” Fernow, p. 203, 6th Annual Report.

Bamboo.*Bambusa vulgaris.*

Nomenclature.

Bamboo local and common name.

Locality.

Florida (acclimated).

Features of Tree.

Seventy-five feet in height, four to six inches in diameter.

Delicate branches and leaves. Greenish glazed jointed stem, extensive roots.

Color, Appearance, or Grain of Wood.

Yellowish brown, conspicuously fibrous, moderately thin walls, central canal broken by joints.

Structural Qualities of Wood.

Light, elastic, works easily.

Representative Uses of Wood.

Posts, poles, utensils, troughs, pipes, roofing, paper.

Weight of Seasoned Wood in Pounds per Cubic Foot.

Variable.

Modulus of Elasticity.

2,380,000 (Johnson's "Materials of Construction," p. 689).

Modulus of Rupture.

27,400 (Johnson's "Materials of Construction," p. 689).

Remarks.

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