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Tropical Timbers of the World

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The photo on the cover was obtained from the tropical rain forest in Sarawak, Malaysia. Most canopy trees are dipterocarp species for producing nice timber. We have been monitoring their dynamics from the view point of forest conservation and canopy biology.
From Dr. Tomoaki Iche of Kochi University, Japan.

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Requests for copies of illustrations contained in this handbook should be directed to the Forest Products Laboratory, USDA Forest Service, P.0. Box 5130, Madison, WI 53705.

Foreword

Few days go by at the Forest Products Laboratory without questions from around the world about properties and uses of tropical woods. Interspersed with the queries about such U.S. species as Douglas-fir and white oak are requests about arariba from Brazil, sipo from Ivory Coast, or kapur from Malaya.

Such questions come logically to the Forest Products Laboratory, because it is the official wood identification arm of the Federal government. In the more than 70 years the laboratory has been answering such questions, research concentration has been primarily on determining properties and uses for U.S. species. But as lumber imports from the tropics are increasing, so are questions about foreign woods. As international trade increases, people need more Information on exotic species, their properties, and what woods can be substituted for those no longer available.

To answer these questions, information has to be gleaned from publications by other scientists around the world. The average person who needs technical data does not have access to the hundreds of rare publications that contain the information. Even if such documentation were pulled together from a variety of sources, the seeker might discover the information was given in several languages and often based on nonuniform test methods, descriptions, or measurements. How can one compare and choose?

To fill this need, Martin Chudnoff has compiled information on the better known tropical species, put the data on a common basis, and assembled it in a brief, useful form. To accomplish this, he drew on his training as a forester and wood technologist and his many years of forest products research in tropical and subtropical areas of the world.

This volume is the product of his dedicated work.

Max A. Davidson
Forest Products Laboratory, retired

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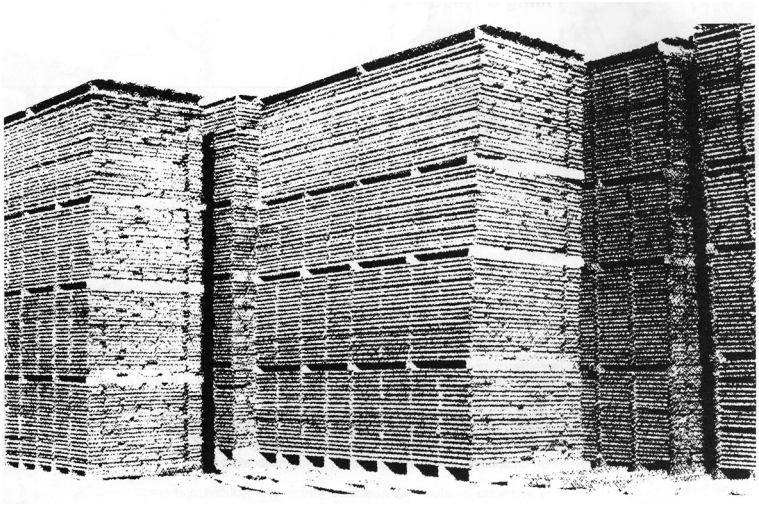
Introduction



M 150 272-17

Hartwood lumber being air-dried at a large industrial complex in South America. The lumber will be further dried in a kiln before it is processed for export markets.

Filling a Need

Over the past two decades U.S. lumber imports from the tropics have increased fourfold. Plywood trade, mostly from Asian sources, has soared fortyfold and now equals our domestic production. Log imports, though, have decreased drastically from about 100 million board feet (log scale) in the 1950‘s to 30 million currently. Much of the world timber trade now is in the form of processed material. A wide array of tropical wood species and species groupings are now available to U.S. processors. Many are already well known on the European markets. This surge in supplies from overseas includes softwoods, hardwoods, decorative species, and utility woods.

An extensive body of foreign literature describes the properties of tropical woods, but much of this literature is not readily available to interested users. In this country the Forest Products Laboratory has issued “Information Leaflets” or “Forest Wood Series” reports on some species of importance, but few are in print. The most recent comprehensive document, “properties of Imported Tropical Woods,” (*3*) contained a description of about 100 tropical genera.

Because of the ever-increasing demand for reference material, we have prepared this more extensive data source. Parts I–Tropical America, II–Africa, and III–Southeast Asia and Oceania contain concise descriptions of tree and timber characteristics for about 370 tropical species or generic groupings. The actual number of botanical entities, however, is many more. Almost all the information was compiled from world literature. This required an extensive search of abstracts and then an amassing of a rather formidable documentation. Focus has been on species already highly favored in international trade.

The worldwide literature was translated, interpreted, reduced, and synthesized. Only a small part of the information presented in this volume is based on research conducted by the USDA Forest Service.

Species are listed alphabetically by scientific name and are grouped according to regional origin–Tropical America, Africa, and Southeast Asia and Oceania. Each of these parts supplies condensed information about particular species or species grouping. Technical data and descriptive information presented here follow the format used by R. H. Farmer (*2*)

Part IV classifies the physical and mechanical property data from parts I, II, and III into groupings that permit comparisons even though methods of testing may have been quite different. A guide to several major use categories is also included. All data are presented in table form that allows rapid scanning or easy transfer to card sorts or input to a computer retrieval system. A summary reference sheet attached to the table can be used to decode physical and mechanical properties classified in table IV-I.

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Modern logging equipment, including portable high lead rigging, is now in use throughout the tropics where tree size and species concentrations are economically favorable.

Five appendixes supply additional Information. Appendix A is a partial list of forest products references, almost all of which were used in this compilation. They are divided into those with worldwide coverage and those specific to Tropical America, Africa, and Southeast Asia.

Appendix B is a list of generic synonyms. If a particular species or species grouping cannot be found in the text, this list of name changes should be checked.

Appendix C may be helpful where more than one genus makes up a trade grouping. For example, the name *Neesia* may be known, but the data are filed under *Durio* and *Neesia*.

Appendix D furnishes Information on the derivation of comparable toughness values given in table IV–1.

Appendix E offers tables that can be used to assemble the dry kiln schedules suggested for the various timbers.

If only the trade name of a wood is known, the Index of trade names can be used to obtain cross references to scientific names and entry to the species descriptions. For a listing of the thousands of common names used in the producing countries, see the catalog prepared by Boutlje (*1*).

Scientific Names

Species information is arranged alphabetically by generic name within the three main tropical regions. Where more than one species is described within a genus, the material is presented alphabetically according to specific name or group trade name. Where two or more species in a genus make up a commercial grouping, the composite is designated by spp. (e.g., *Peltogyne* spp).

We have attempted to use currently accepted nomenclature, but well-known synonyms are also given (e.g., *Ochroma pyramidale* syn. *Ochroma lagopus* or *Nauclea diderrichii* syn. *Sarcocephalus diderrichii).* Some commercial timber groupings may include more than one genus (e.g., the wood marketed as Resak includes *Cotylelobium* spp. and *Vatica* spp.*).*

Many genera are native to more than one region (e.g., *Podocarpus, Pterocarpus, Terminalia),* but *Ceiba pentandra, Symphonia globulifera, Andira inermis* and *Rhizophora mangle* are the only species listed that are indigenous to two or more regions. However, many species from one region have been introduced into the other two, either as ornamentals or for the production of such products as timber, tannin, latex, gums, and resins. Para rubber tree, *Hevea brasiliensis, is* native to Brazil but is most extensively cultivated in Africa and Asia. Teak, *Tectona grandis, is* a favored plantation species in tropical America and West Africa but is native to Southeast Asia. The information on these and other exotics is arranged in their region of origin.

To further complete botanical affinities, family names are also given. Plants developing woody tissue are classified in about 250 families. Species and species groupings in this compilation can be placed in some 70 families. The largest number, by far, belongs to the Leguminosae, followed by Meliaceae, Lauraceae, and Moraceae. Nineteen species or species grouping of the 4 gymnosperm or softwood families of Araucariaceae, Cupressaceae, Pinaceae, and Podocarpaceae are also included.

Trade and Other Common Names

The scientific name is followed by one or more trade names. These come into use after years of marketing on national and international levels. Sometimes the trade name is merely a repetition of the generic name (e.g., afzelia, albizzia, alstonia). Often when there is a superficial similarity to a Temperate Zone timber, but no botanical affinity, names such as Queensland-maple and silky-oak are used. Honduras mahogany, is a trade name for *Swietenia macrophylla* because shipments, at first, were mostly centered in Honduras. Yet the name applies to timber now harvested from Mexico southward to eastern Bolivia. The name mahogany, with a geographical modifier, also refers to species of *Khaya* from Africa and to botanically unrelated species of *Shorea* from the Philippines.

A few other common names, mostly of local use only, are also given. Some woods may have dozens of such names, changing from country to country and from district to district within countries. All of the trade names, but only a few of the common names, are indexed in this volume.

Distribution

Information on growth ranges and site preferences is given. Gregarious species are also noted. Most of the species or species groups described here are found growing between the Tropic of Cancer and Tropic of Capricorn, some 50° of latitude. Included are a few species growing outside of the tropical belt (e.g., *Nothofagus* spp. and *Fitzroya cupressoides* native to Chile and Argentina and some eucalypts from Australia).

Most of the species described are available to world markets only in rather small volumes. To obtain larger supplies for a particular end use, it may be necessary to accumulate timbers having similar characteristics from several botanical groupings. Even those species growing in pure Stands over large areas may be limited in supply. For example, Parana-pine forests have been heavily cut over in Brazil, and the area is being restocked mainly with exotics. *Virola* spp., once abundant for plywood production in the Guianas, must now be imported from other regions to meet their veneer needs. Okoume, a highly favored plywood species on the European market, is no longer available from the First Zone (mostly coastal) of Gabon. Because of this transient characteristic of the resource, we have not attempted to indicate current or future availability of the species listed.

Distribution within the tropics is highly variable. Some species are found in coastal tidelands (red

mangrove, *Rhizophora mangle),* swamp forests (ramin, *Gonystylus bancanus* or banak, *Virola* spp.*),* on low coastal plains, and along riverbanks (cativo, *Prioria copaifera* or mora, *Mora excelsa).* Others are established on low-temperature, high-mountain sites (roble, *Quercus* spp. or Benquet pine, *Pinus insularis).* All of the above species occur in rather pure forest stands, but this is not typical of the tropical forest as a whole. Where there are no special atmospheric, geological, topographic, or edaphic conditions, individuals of the most common species found in lowland tropical forests are widely dispersed, seldom making up 10 percent of the volume, and often much less.

The Tree

Tree form and size are emphasized under this heading. Some specialty woods are milled from very small stems (e.g., African blackwood, *Dalbergia melanoxylon* and West Indian satinwood, *Zanthoxylum flavum).* Other timbers come from trees that soar to heights of 150 to 200 feet and have log diameters of 8 feet and more (e.g., okoume, *Aucoumea klaineana* or kapur, *Dryobalanops* spp.*).* Trunks of many species have buttresses that may reach heights of 15 to 25 feet (e.g., obeche, *Triplochiton scleroxylon* or mora, *Mora* spp.*).*

The Wood

General Characteristics: This section stresses the appearance of wood of individual species and species groupings. Heartwood colorations, unusual changes on exposure to light or air, and differentiation, if any, from sapwood are described. Woods with high luster or golden cast due to the way light is reflected are noted. If anatomical elements are large and irregular, the wood is described as having coarse and uneven texture. If these same features are small and evenly distributed, the texture is fine and uniform. Grain defines the arrangement or alinement of wood tissue-straight, spiral, or interlocked. Interlocked grain is most common in tropical timbers and is due to an alternating right- and left-hand spiraling of the grain. If quartersawn, this produces a ribbon or roey figure. Other grain irregularities, enhanced by various sawing or slicing techniques, can develop other kinds of figure (e.g., curly, feather, fiddleback, etc.). Distinctive scents and tastes are also noted. Silica percentages, if significant, are given. The literature suggests that there is little blunting of cutting tools unless silica accumulations are above 0.5 percent.

Almost all woods have constituents that are allergenic or toxic to someone, including our native white pine and paper birch. Most people, though, are unaffected by most woods. Dust generated in woodworking may irritate skin and mucous membranes and even cause nosebleeds and respiratory disorders. Timbers that are particularly toxic are noted. Woods with gummy, oily, or resinous exudates are also indicated.

Weight: Specific gravity or density may be related to important wood attributes such as mechanical strength, shrinkage, paper-forming properties, and cutting forces required in machining. Often in assessing the use potential of a species, specific gravity receives first attention.

Basic specific gravity is the ratio of wood density to the density of water at 4° C and is calculated from the ovendry weight and volume in the green condition. This may range from less than 0.1 for balsa, *Ochroma pyramidale* to about 1.1 for lignumvitae, *Guaiacum* spp. Density calculated from weight and volume when air dry, usually at a moisture content of 12 percent, is also given. This may range from about 10 to 80 pounds per cubic foot (pcf) for commercial species.

Mechanical Properties: It must be emphasized that the mechanical properties presented here by species are taken from the world literature. Sampling and testing procedures have varied considerably. Values are given so that comparisons between species can be made as well as selection for targeted end uses. However, the data reported may not be acceptable to regulatory bodies as a basis for assigning design properties. Such interests are beyond the scope and intent of this document.

Sources from which the strength data were obtained are listed in the Literature Cited sections at the end of each geographical part.

Data are given for strength tests in the green and dry condition. These include bending strength (modulus of rupture), stiffness in bending (modulus of elasticity), compression parallel to the grain (maximum crushing strength), Janka side hardness, and toughness (based on either the Amsler or the FPL-Madison type machines).

Most test results reported here are based on the ASTM D 143 procedures using either 2-inch or 1-inch specimens, British Standard No. 373 using 2-centimeter material, or Norme Francaise B51-007, B51-008, and other standards in this series, also a 2-centimeter standard. In the French data, modulus of rupture was calculated using beam depth to the 10/6 power instead of the square of the depth used to obtain U.S. and British bending strength values. The data based on French standards were adjusted to be comparable in this presentation. There are other differences in testing methods. At the Instituto de Pesquisas Tecnologicas, São Paulo, bending strength is based on beams 2 by 2 by 30 centimeters, center-loaded over a 24-centimeter span. Modulus of elasticity, though, is calculated from test beams 6 by 6 by 100 centimeters, center-loaded over an 84-centimeter span.

Drying and Shrinkage: Note is made of the response of individual woods to air-drying and kiln-drying and whether or not there is degrade due to checking, warp or collapse.

Percent shrinkage values (volumetric, radial, tangential) from the green to ovendry condition or green to air-dry condition are given. Movement ratings indicate dimensional stability in service and are based on the sum of percent radial and percent tangential dimension changes corresponding to a change in exposure from 90 to 60 percent relative humidity. Ratings used are:

Small	Under 3.0 percent
Medium	3.0 to 4.5 percent
Large	Over 4.5 percent

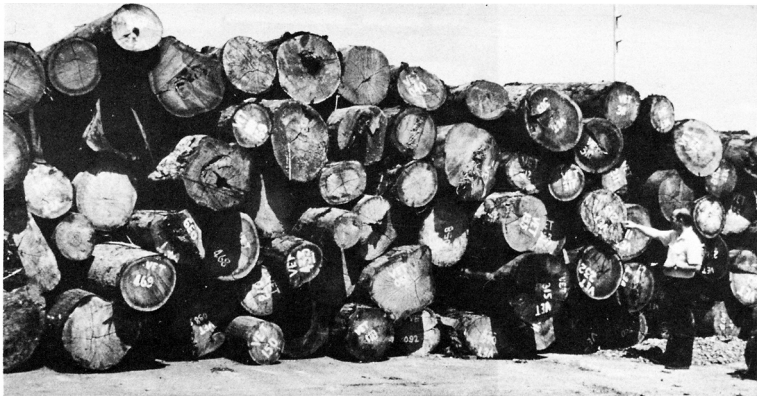
Appendix E presents a series of tables that can be assembled into kiln schedules where these are suggested for particular species or species groupings. If no kiln schedules are found in the literature, none are recommended.

M 150 273-6

Highly perishable cuangare (*Dialyanthera* spp.) and banak (*Virola* spp.) logs harvested from coastal lowlands in southwest Colombia are ready for pond storage

Working Properties: Much of the information given on working properties of individual species is highly subjective. Described are ease of working with hand and machine tools, tendencies to torn or chipped grain, smoothness of finish cut, dulling of cutters, and ease of veneering. Nailing, screwing, or gluing characteristics may be included as well as steambending properties if well suited for this purpose. If working the wood is reputed to cause skin or mucous membrane irritations, this is mentioned again.
Durability: Resistance of the wood to attack by decay fungi, insects, and marine borers is described. Ratings are based on laboratory assays, field stake tests, or performance under actual use conditions.

M 150 273-11



If natural durability is good and turnover is frequent, logs can be held in "dry" storage until processed.

Heartwood decay resistance classifications are based on ground contact and are:

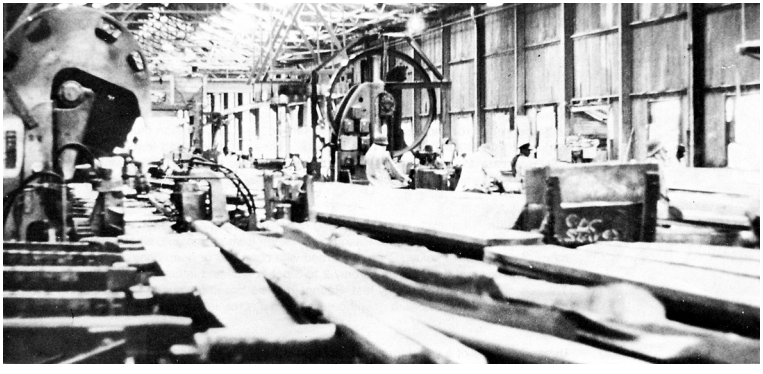
Classification (2)	Approximate service life
	Years
Very durable	More than 25
Durable	15-25
Moderately durable	10-15
Nondurable	5-10
Perishable	Less than 5

Sapwood of all species will rate perishable. If not in ground contact and kept dry, all woods could be free of rot and have an extended service life. Consideration must also be given to vulnerability to attack by Lyctus beetles, subterranean and dry-wood termites, and other insects. If data are available, resistance to such attack is reported here. Weathering characteristics and performance under particular kinds of chemical exposure may also be noted.
Preservation: Treatability of sapwood and heartwood using either open tank or pressurevacuum processes is described. Ratings may range from permeable, where 15 to 20 pcf and more of preservative solutions are absorbed with complete or deep chemical penetration to extremely resistant if absorption is only 2 to 3 pcf or less and lateral penetration is superficial. There is no standard treatability test. Ratings may be based on laboratory trials using a wide range of specimen sizes, with or without end coatings, or actual commercial treating plant experience.
Uses: Suitability of a wood for particular applications may be based on indigenous uses in underdeveloped regions or perhaps long experience in export trade but with little or no experience

on U.S. markets. As an example, Jongkong, *Dactylocladus stenostachys*, is treated with oil and used for shingles in Sarawak. This wood may not be marketable elsewhere for the same purpose. Demand exists overseas for woods particularly suitable for produce boxes, which are rarely used in the U.S. economy. Nevertheless, the lists of uses indicate the properties and working characteristics of the wood and may suggest applications still not realized. Often trees formerly classified as uneconomic or weed species are now in high demand an world markets. Use categories, then, should not be considered restrictive.

M 150 272-11

Sash gang saws are used in Surinam for log breakdown. About 30 species are classified as available in quantity from the region, yet only 3 species make up 90 percent of the lumber exports.



M 150 273-8

In Guyana band mills are preferred for log breakdown and resaw.

If a tree is noted for the yield of products other than wood (gums, latex, fiber, tannins, nuts and fruits, etc.), this is also indicated.

Additional Reading

The species descriptions are based on a compilation of world literature. Presentations are rather concise to fit the format used. Material for a few species is based on only one or two sources; more often dozens were used. Usually three or four references are cited and listed at the end of each regional section.

Several thousand documents, many of them long out of print, were consulted to develop this data base. For those with an interest to read further, a few comprehensive references are given in appendix A.

Literature Cited–Introduction

1. Boutlje, J. B. 1980. Encyclopedia of world timbers: Names and technical literature. Swedish For. Prod. Res. Lab. STFI–meddelande Serie Anr 611. Stockholm.
2. Farmer, R. H. (Editor). 1972. Handbook of hardwoods. H. M. Stationery Office, London.
3. Kukachka, B. F. 1970. Properties of imported tropical woods. USDA Forest Service Res. Pap. FPL-125. Forest Product Laboratory, Madison, Wis.

Part I–Tropical American Species[1]

M 150 272-12

Planalto forest south of Santarém in the Rio Curuá-Una region, Brazil. About 60 percent of the volume is in species considerably denser than U.S. commercial woods (basic specific gravity over 0.70).

[1] Numbered references listed under Mechanical Properties and Additional Reading for each species appear in Literature Cited–Tropical American Species, beginning on p. 172.

Tree and Wood Characteristics

Alexa imperatricis
Haiari

Family: Leguminosae
Other Common Names: Haiariballi (Guyana).
Distribution: Found in the Venezuelan Guiana, Guyana, Surinam, and the Brazilian Amazon region. Often dominant on the light-colored sands of the northwest and upper Mozaruni district and the Pakaraima Mountains in Guyana.

The Tree

Unbuttressed, well formed, with small oval crowns. Grows to 36 in. in diameter and 100 ft high on favorable sites, but are usually 20 to 24 in. in diameter and less than 100 ft high. The bole is cylindrical and often 70 ft long.

The Wood

General Characteristics: Heartwood brownish yellow but occasionally somewhat darker; not sharply differentiated from the light yellow to grayish-yellow sapwood, 3 to 4 in. wide. Luster is medium to low; generally straight grained; rather coarse textured; odorless and tasteless when dry.
Weight: Basic specific gravity (ovendry weight/green volume) reported to be 0.46 to 0.55 in Guyana; 0.41 in the Venezuelan Guiana. Air-dry density about 32 pcf.
Mechanical Properties: (1-in. standard)

Moisture content	Bending strength	Modules of elasticity	Maximum crushing strength
	Psi	*1,000 psi*	*Psi*
12% *(24)*	10,590	1,580	5,620

Janka side hardness is 690 lb and the Forest Products Laboratory toughness is 118 in.-lb (5/8-in. specimen).
Drying and Shrinkage: Lumber has a marked tendency to collapse during seasoning. Close piling for air-drying and the use of high humidities and low temperatures during the early stages of kiln-drying are suggested. Veneers are slow to dry. Jet-drying of 1/16-in. veneer at 285° F resulted in buckling, collapse, and splitting. Kiln schedule T2-C2 is suggested for 4/4 stock and T2-C1 for 8/4. Shrinkage green to ovendry: radial 4.0%; tangential 8.5%; volumetric 11.7%. Movement of seasoned wood is classified as large.
Working Properties: Haiari is reported to work easily and finish satisfactorily. Nail withdrawal resistance is higher than would be expected from its density. Rotary cutting trials of 1/16-in. veneer gave smooth surfaces and uniform thickness; rough cutting occurred in 1/8-in. veneer. Reported to have rather unfavorable gluing properties when made into plywood.
Durability: Reported to be highly resistant to decay, but freshly cut logs are very susceptible to damage by pin-hole borers.
Preservation: Both sapwood and heartwood very easy to treat. Absorptions over *9 pcf* with uniform penetration obtainable by hot and cold bath as well as pressure-vacuum systems.
Uses: Haiari is suitable for interior construction, boxes, crating, general construction, plywood, and other uses requiring an easily worked wood of moderate strength.

Additional Reading

(24), (46), (60)

Summary Reference Sheet for Decoding Table IV-1

Color	
Code	Color
1	Whitish, pale brown, pale yellow, straw
2	Dark brown
3	Pink or red tints, including red brown
4	Other colors (black, purple, bright yellow, etc.)

Density	
Code	Density
	Pcf
1	<20
2	20-30
3	30-40
4	40-50
5	50-60
6	>60

Movement	
Code	Movement
	Percent
1	Small, under 3.0
2	Medium, 3.0-4.5
3	Large – over 4.5

Mechanical Properties (12 percent moisture content)					
Code	Bending strength (2-in. specimen)	Stiffness (2-in. specimen)	Crushing strength (2-in. specimen)	Toughness (FPL 2-centimeter)	Hardness, Janka side
	Psi	*1,000 psi*	*Psi*	*In.-lb*	*Lb*
1	<7,000	< 1,000	< 5,000	< 180	< 500
2	7,000-9,500	1,000-1,400	5,000-6,000	180-270	500-800
3	9,500-12,000	1,400-1,800	6,000-7,000	270-360	800-1,100
4	12,000-14,500	1,800-2,200	7,000-8,000	360-450	1,100-1,400
5	14,500-17,000	2,200-2,600	8,000-9,000	450-540	1,400-1,700
6	17,000-19,500	2,600-3,000	9,000-10,000	540-630	1,700-2,000
7	> 19,500	> 3,000	> 10,000	> 630	> 2,000

Shrinkage				
	Radial		Tangential	
Code	Green to ovendry	Green to airdry	Green to ovendry	Green to airdry
	Percent			
1	<3.0	<2.0	< 5.0	< 3.0
2	3.0-4.0	2.0-2.5	5.0-6.5	3.0-4.0
3	4.0-5.0	2.5-3.0	6.5-8.0	4.0-5.0
4	5.0-6.0	3.0-3.5	8.0-9.5	5.0-6.0
5	>6.0	> 3.5	> 9.5	> 6.0

Hartwood Durability	
Code	Classification
1	Very durable
2	Durable
3	Moderately
4	Nondurable
5	Perishable

Hartwood Treatability	
Code	Classification
1	Permeable
2	Moderately resistant
3	Resistent
4	Extremely resistant

Table *IV-1.–Coded physical and mechanical properties of various timbers of the world, compared to eight sample U.S. species*

Name					Mechanical properties						Other properties			
											Shrinkage			
Scientific	Commercial	Geographic region	Color	Densitiy	Bending strength	Stiffness	Crushing strength	Tough-ness	Hardness	Move-ment	Rad.	Tan.	Durability (heartwood)	Treatability (heartwood)
Eight U.S. species for comparison														
Acer saccharum	Sugar maple	USA	3	4	5	4	4	4	5	2	3	5	4	2
Carya ovata	Shagbark hickory	USA	1, 3	4	7	4	6	7	-[1]	-	5	5	4	2
Liriodendron tulipifera	Yellow-poplar	USA	1, 4	2-3	3	3	2	2	2	-	3	4	4	3
Pinus strobus [2]	Eastern white pine	USA	1, 3	2	2	2	1	1	1	1	1	2	3	3-4
Pinus taeda [2]	Loblolly pine	USA	3	3	4	3	4	2	2	-	3	3	2-3	3-4
Pseudotsuga menziesii [2]	Douglas-fir	USA	3	3	4	4	4	3	2	1	3	3	3	4
Quercus alba	White oak	USA	1	4	5	3	4	4	4	2	4	5	2	4
Quercus rubra	Northern red oak	USA	1, 3	4	4	4	3	4	4	-	3	4	4	2
Tropical Timbers of the World														
Acacia melanoxylon	Aust. blackwood	AS	1, 2	4	4-5	4-5	5	3	4	2	2	4	3	4
Acacia mollissima	Black wattle	AS	1	4	5	5	5	-	6	3	-	-	5	2
Adina cordifolia	Haldu	AS	1, 3	4	4	2	3-5	2	4	3	2	3	3-4	-
Afzelia spp.	Afzelia	AF	3	5	5-6	3-4	6-7	-	6	1	1	1	1	4
Agathis spp.[2]	Kaun	AS	1, 3	3	3-4	3-4	2-3	-	2-3	-	3	2	3-4	1
Albizia lebbek	Kokko	AS	2	3	4-5	4	4-7	3	4-5	-	1	2	3	4
Albizia falcataria	Batai	AS	1, 3	2	2	2	1	2	1	1	2	2	5	3
Albizia spp.	Albizzia	AF	1, 2, 3	3-4	2-4	2-3	3	-	2-4	1	1	1	3	4
Alexa imperatricis	Haiari	AM	1	3-4	3	3	2	2	2	3	3	4	1	1
Alstonia congensis and *A. boonei*	Alstonia	AF	1	2	1-2	1-2	1-2	1	1	-	2	2	5	1
Alstonia spp.	Pulai	AS	1	2	2	2	1	4	1	-	2	2	5	1
Amburana cearensis	Amburana	AM	1	3-4	3-4	2	3	2	2	-	1	1-2	3	-
Amoora spp.	Amoora	AS	3	3-5	-	-	4	3	3	-	-	-	3	-
Anacardium excelsum	Espave	AM	1	3	2	2	1	1	1	-	1	2	3-5	3
Anadenanthera macrocarpa	Curupay	AM	3	6	7	5	7	7	7	2	3	3	1	4
Andira inermis	Angelin	AM	3	4-5	6-7	5-6	6	-	5	-	3	5	3	4
Androstachys johnsonii	Mecrusse	AF	3	5	6	-	6	-	7	-	4	2	1	4
Aniba spp.	Louro	AM	1	4	6	5	7	3	5	-	3	3	1	4
Aningeria spp.	Aningeria	AF	1, 3	3	2-5	2-3	2-4	3	2-4	-	2	3	5	1
Anisoptera spp.	Mersawa	AS	1	3-4	4-6	3-5	4-5	6	3	2	3	4	3	4
Antnocephalus chinensis	Cadam	AS	1	2	3	2	2-3	3	2	1	1	2	5	1
Antiaris spp.	Antiaris	AF	1	2	2	1-2	1-2	1	1	1	2	3	5	1
Apeiba spp.	Duru	AM	1	1-2	1	1	1	-	1	-	1	2	5	1
Araucaria angustifolia [2]	Parana-pine	AM	1, 3	3	4	3	3-4	2	2	2	2	3	5	2
Araucaria spp.[2]	Hoop-pine	AS	1, 3	3	3-4	3-4	2-4	2-4	2	1	2	2	5	1
Artocarpus spp.	Keldang	AS	1, 2	3-5	4	2-3	3-5	4	4	-	1	2	1-5	3
Aspidosperma spp.	Aracanga	AM	1, 3	5-6	7	6-7	7	3-5	6-7	-	4	4	1-3	2
Aspidosperma spp.	Peroba rosa	AM	1, 2	4	4	3	4	3	6	-	2	2	3	4
Astronium graveolens	Concalo alves	AM	3	5	5-6	4-5	7	2	7	-	3	3	1	4
Aucoumea klaineana	Okoume	AF	3	2	3	2	2	-	1	-	3	2	5	3
Autranella congolensis	Mukulungu	AF	3	5	7	5	7	4-6	-	3	4	3	1	4
Azadirachta spp.	Neem	AS	3	4	3-4	2	3-4	-	5	1	2	3	2-4	4
Bagassa guianensis	Bagasse	AM	1	5	7	5	7	3	6	-	4	3	1	4
Baikiaea insgnis	Nkobakoba	AF	1	5	6	6	6	-	6	2	2	3	4	3
Baikiaea plurijuga	Rhodesian-teak	AF	3	5	4	2	6	-	7	1	1	1	1	4
Baillonella toxisperma	Moabi	AF	3	5	7	5	7	3-7	-	1	4	3	1	4
Balanocarpus spp.	Chengal	AS	2	5	7	6	7	-	7	-	-	-	1	4
Balfourodendron riedelianum	Pau marfim	AM	1	4-5	6	-	5	7	-	-	3	4	4	3
Beilschmiedia tawa	Tawa	AS	1	4	5	4	5	-	5	-	-	-	4	1
Berlinia spp.	Berlinia	AF	3	4	4-5	2-4	4	2	4	2	3	4	3	3
Bertholletia excelsa	Brazil-nut tree	AM	1	4	5	3	3	2	4	-	2	4	1-2	4
Bischofia javanica	Bishopwood	AS	3	3-5	5	3	4-5	2	4	-	3	5	2-5	3
Bombacopsis quinata	Pochote	AM	3	3	3-4	3	2-3	2	2	-	2	2	1-2	4
Bombax spp.	Bombax	AF	1, 3	2-3	1-3	1-2	1-2	1	1	1	3	4	5	2-4
Bowdichia spp.	Sucupira	AM	3	5	6	-	7	6	-	-	4	3	1	-
Brachylaena hutchinsii	Muhuhu	AF	1, 4	5	5	3	6	-	7	1	2	2	1	4
Brachystegia spiciformis	Mtundu	AF	1, 3	5	6	4	6	-	6	2	3	3	4	4
Brachystegia spp.	Okwen	AF	1, 2	3-4	3-4	2-3	2-4	-	3-5	2	2	2	3	4
Brosimum spp. (Alicastrum group)	Capomo	AM	1	4-6	3	4	5	-	4-5	-	4	4	5	-
Brosimum spp. (Utile group)	Cow tree	AM	1	2-3	4	5	5	-	3	-	2	3	5	-
Buchenavia capitata	Yellow sanders	AM	1	4	4	3	4	2	4	-	1	2	3	4
Bucida buceras	Jucaro	AM	1, 4	6	-	-	-	-	-	-	3	3	2	3
Bucklandia populna	Pipli	AS	3	3	3-5	2-4	2-5	-	4	-	-	-	4-5	-
Bulnesla arborea	Verawood	AM	4	6	-	-	-	-	-	-	-	-	1	4
Burkea africana	Burkea	AF	2-3	4-6	-	-	-	-	-	1	1	1	1	4

Table *IV-2.–Uses for various tropical timbers of the world, compared to eight U.S. species*

Name	Uses																	
	Construction																	
	Heavy	Light	Marine Use	Crossties	Joinery/ milwork	Flooring	Shakes/ shingles	Recon-stituted Products [1]	Plywood	Decorative veneers	Furniture/ cabinet-work	Turnery	Carvings	Musical instru-ments	Tool handles	Vats/tanks	Coop-erage	Boxes/ crates	Specialty items
Eight U.S. species for comparison																		
Acer saccharum				x		x		x		x	x			x				x	x
Carya ovata				x		x					x				x				x
Liriodendron tulipifera					x			x	x		x			x				x	x
Pinus strobus [1]		x			x			x			x					x		x	x
Pinus taeda [2]	x	x	x	x	x	x		x	x							x	x	x	
Pseudotsuga menziesii [2]	x	x	x	x	x	x		x	x							x	x		
Quercus alba				x	x	x		x		x	x						x		x
Quercus rubra				x	x	x		x		x	x								
Tropical Timbers of the World																			
Acacia melanoxylon					x					x	x	x		x			x		x
Acacia mollissima						x		x											
Adina cordifolia					x	x					x	x							x
Afzelia spp.	x		x		x	x					x					x			
Agathis spp.[2]					x		x			x	x					x			x
Albizia lebbek					x	x				x	x								
Albizia falcataria								x	x		x							x	
Albizia spp.					x	x					x								
Alexa imperatricis		x							x									x	
Alstonia congensis and *A. boonei*		x			x				x		x							x	
Alstonia spp.					x				x		x		x					x	
Amburana cearensis		x								x	x								
Amoora spp.		x			x	x			x		x	x							
Anacardium excelsum		x						x	x		x							x	
Anadenanthera macrocarpa	x		x	x		x						x			x				
Andira inermis	x			x		x				x	x	x							
Androstachys johnsonii	x				x		x						x						
Aniba spp.	x				x						x	x							
Aningeria spp.					x				x		x								
Anisoptera spp.		x			x	x			x		x								
Antnocephalus chinensis		x			x			x	x		x							x	
Antiaris spp.		x			x				x		x							x	
Apeiba spp.																			x
Araucaria angustifolia [2]		x			x			x	x		x								
Araucaria spp. [2]		x			x	x		x	x		x							x	
Artocarpus spp.	x				x	x					x	x		x					
Aspidosperma spp. *Aracanga*	x			x	x	x					x	x							
Aspidosperma spp. *Peroba rosa*		x			x	x				x	x	x	x						
Astronium graveolens	x										x	x	x						x
Aucoumea klaineana		x			x			x	x		x								
Autranella congolensis	x				x	x					x	x				x			
Azadirachta spp.					x				x		x		x						
Bagassa guianensis	x	x									x								
Baikiaea insgnis	x					x					x								
Baikiaea plurijuga						x													
Baillonella toxisperma					x	x				x	x	x	x						
Balanocarpus spp.	x			x		x										x	x		
Balfourodendron riedelianum						x					x	x			x				
Beilschmiedia tawa					x	x			x		x	x					x		
Berlinia spp.	x									x	x								
Bertholletia excelsa		x		x		x					x					x			
Bischofia javanica		x				x		x			x								
Bombacopsis quinata		x			x			x	x		x								
Bombax spp.									x		x							x	
Bowdichia spp.	x			x															
Brachylaena hutchinsii						x						x	x						
Brachystegia spiciformis		x				x					x								
Brachystegia spp.		x			x	x				x									
Brosimum spp. (Alicastrum group)		x				x					x								
Brosimum spp. (Utile group)		x			x			x	x		x								
Buchenavia capitata						x				x	x	x				x			
Bucida buceras				x		x													
Bucklandia populna					x						x							x	
Bulnesla arborea				x															x
Burkea africana				x	x	x					x								

Name		Geographic	Color	Densitiy	Mechanical properties						Other properties			
					Bending	Stiffness	Crushing	Tough-	Hardness	Move-	Shrinkage		Durability	Treatability
Scientific	Commercial	region			strength		strength	ness		ment	Rad.	Tan.	(heartwood)	(heartwood)
Bursera simaruba	Gumbo-limbo	AM	1	1-2	1	1-2	1	-	1	-	1	1	5	1
Byrsonima spp.	Serrette	AM	3	4	5-6	4	6	2	5	-	3	4	4	2
Cabralea cangerana	Cangerana	AM	3	4	4	-	4	2	-	-	2	3	1	-
Caesalpinia spp.	Partridgewood	AM	3, 4	6	-	-	-	-	-	-	-	-	1	4
Callitris glauca [2]	White cypress-pine	AS	1	4	3	2	4	1-2	4	-	2	1	1	-
Calophyllum brasiliense	Santa maria	AM	3	3	5	4	3-5	3	4	2	3	3	2-3	4
Calophyllum spp.	Bintangor	AS	3	3-4	4	3	4-5	2	5	-	2	2	4	3
Calycophyllum candidissimum	Degame	AM	1	5	7	5	6	5	6	-	3	4	4	-
Campnosperma panamensis	Sajo	AM	1	2	2	3	2	-	1	-	-	-	5	1
Canangium odoratum	Cananga	AS	1, 3	2	1	2	1	2	1	-	2	3	5	-
Canarium schweinfurthii	African canarium	AF	3	2-3	2-3	2	1-2	1	2	2	3	3	5	4
Canarium spp.	Kedondong	AS	1, 3	2-3	-	-	-	3	-	-	4	3	5	4
Carapa guianensis	Crabwood	AM	3	4	5	4-5	4-5	2	4	1	2	3	2-4	4
Carapa procera	African crabwood	AF	3	4	-	-	-	-	-	1-2	-	-	3	4
Cariniana pyriformis	Albarco	AM	3	3	3-4	3	3	3	3	1	1	2	2	4
Caryocar spp.	Piquia	AM	1	5	6	4	5	3	6	-	4	4	1	-
Casearia batiscombei	Muirungi	AF	1, 3	3-4	3	3	3	-	2	-	1	3	5	1
Cassipourea malosana	Pillarwood	AF	1	4	5-6	3	5-6	-	4-5	2	4	5	5	4
Castanopsis spp.	Berangan	AS	1, 2	4	3	2	2	-	-	-	-	-	5	3
Casuarina spp.	Casuarina	AS	3	6	7	4-7	7	2	7	-	5	5	5	3
Catostemma spp.	Baromalli	AM	1, 3	3-4	3-5	4-6	3-5	3	2	3	4	5	5	1
Cecropia peltata	Trumpet-wood	AM	1	2	1-2	2	1	1	1	-	1	2	5	2
Cedrela spp.	Spanish-cedar	AM	3	2-4	3	3	2-3	2	2	1	3	2	3	4
Cedrela spp.	Toon	AS	3	3	3	2-3	2-3	2	2-3	-	2	2	3	2
Cedrelinga catenaeformis	Cedro-rana	AM	1, 3	3	-	-	-	-	-	-	-	-	3	-
Ceiba pentandra	Ceiba	AM, AF	1, 3	1-2	1	1	1	1	1	1	1	2	5	1
Celtis spp.	African celtis	AF	1	4	3-7	4-5	2-7	-	5	2	4	5	5	2
Centrolobium spp.	Araruba	AM	1, 3	4-5	5-6	5	4-6	4	3	-	1	2	1	3
Cephalosphaera usambarensis	Mtambara	AF	3	3	4	5	3	-	2	3	4	5	5	2
Chlorophora excelsa	Iroko	AF	1, 2	4	3-4	3	3-5	2-3	4	1	1	1	1	4
Chirorophora tinctoria	Fustic	AM	1	5	7	4	7	4	7	-	2	2	1	4
Chloroxylon swietenia	East Indian satinwood	AS	1	6	5	4	7	-	7	-	4	3	1	-
Chukrasia tabularis	Chickrassy	AS	1, 3	4	2	3	3	-	4	1	2	2	4	4
Cinnamomum spp.	Cinnamon wood	AS	1, 3	2-3	3	-	2	1	-	2	-	-	2-4	-
Clarisima racemosa	Oiticica amarela	AM	1	4	3-6	5	6	3	4-5	1	1	2	2-4	3
Chlatrotropis spp.	Aromata	AM	2, 3	6	7	7	7	-	7	-	3	3	3	-
Combretodendron macrocarpum	Essia	AF	3	5	5-6	3-5	4-7	3	7	3	4	5	2-3	4
Copaifera spp.	Copaiba	AM	3	3-4	3-7	6	2-7	4	6	-	3	4	1-4	3-4
Cordia millenii	West African cordia	AF	1, 3	2	2	2	1	1	2	1	2	1	3	3
Cordia spp.	Cordia	AS	1, 2, 4	3-4	-	-	-	-	-	-	1	2	2-5	-
Cordia spp. (Alliodora group)	Freijo	AM	1	3	3-4	3-4	2-4	2-3	3	1	2	3	2-3	3
Cordia spp. (Gerascanthus group)	Canalete	AM	3	4-6	5-6	3	3	5	7	1	3	3	1	-
Cordyla africana	Cordyla	AF	1	5	3	3	5	-	5	2	5	4	1	4
Cotylelobium spp.	Resak	AS	3	4-6	5-7	5	4-5	5	5	-	3	4	1-2	3
Couma macrocarpa	Cow tree	AM	1, 3	3	5	-	4-5	-	3	-	2	2	5	-
Couratari spp.	Mahot	AM	1, 3	3	4-6	3-4	4-5	2	3	-	3	3	2-4	1
Cratoxylon arborescens	Geronggang	AS	3	2-3	1	2	1	-	1	-	3	3	5	1
Croton megalocarpus	Musine	AF	1, 2	4	4	-	4	-	4	3	-	-	5	1
Cryptocarya spp.	Rose-maple	AS	3	3-5	4-7	3-6	3-7	2-3	5-7	-	3	3	2-4	-
Cupressus lusitanica [2]	Mexican cypress	AM	1, 3	3	3-4	2	2	-	1	-	-	-	2-4	3-4
Cybistax donell-smithii	Primavera	AM	1	2	3	2	2	1	2	1	2	2	2-4	-
Cylicodiscus gabunensis	Okan	AF	3	6	6-7	5-6	7	6	7	-	4	4	1	4
Cynodendron spp.	Caimito	AM	1, 2, 3	5-6	6-7	7	7	2	-	-	5	4	4	3
Cynometra alexandri	Muhimbi	AF	3	5	7	4-5	7	-	7	2	3	3	2	-
Cynometra spp.	Kekatong	AS	3	6	6-7	5-6	6	-	7	-	3	3	5	2
Dacrydium spp. [2]	Rimu	AS	1, 3	3	2-3	2	2	-	2	-	4	5	5	3
Dacryodes excelsa	Gommier	AM	3	3-4	4	3	4	-	3	-	3	2	4	4
Dacryodes spp.	Adjouaba	AF	3	4-5	5-6	4-6	4-6	1-6	-	-	5	4	4	3
Dactyloklados stenostachys	Jongkong	AS	3	3	2-4	3	1-4	1	2	-	2	3	5	-
Dalbergia latifolia	Indian rosewood	AS	4	5	5	2-3	6	-	7	1	1	2	1	-
Dalbergia melanoxylon	African blackwood	AF	4	6	7	7	7	6	-	1	-	-	1	-
Dalbergia nigra	Brazilian rosewood	AM	4	4-5	6	4	6	-	7	-	1	1	1	-
Dalbergia retusa	Cocobolo	AM	4	6	-	-	-	-	-	1	-	-	1	-
Dalbergia stevensonii	Honduras rosewood	AM	4	5-6	-	-	-	-	-	1	-	-	1	-
Daniellia ogea	Ogea	AF	3	3	2-3	2-3	2	1	2	2	2	4	5	2-3
Dendropanax arboreus	Angelica tree	AM	1	3	2-3	3	1	-	2	-	4	4	5	1
Dialium dinklagei	Eyoum	AF	3, 4	5-6	4-7	4-6	6-7	2-7	-	-	3	3	1	4
Dialium guianense	Jutahy	AM	3	6	7	6	7	-	7	-	4	4	1	4
Dialium spp.	Keranji	AS	3, 4	6	7	6-7	7	7	7	-	5	5	3	3

Name	Uses																		
	Construction																		
	Heavy	Light	Marine Use	Crossties	Joinery/ milwork	Flooring	Shakes/ shingles	Recon- stituted Products [1]	Plywood	Decorative veneers	Furniture/ cabinet- work	Turnery	Carvings	Musical instru- ments	Tool handles	Vats/tanks	Coop- erage	Boxes/ crates	Specialty items
Bursera simaruba		x							x									x	
Byrsonima spp.						x			x		x	x							
Cabralea cangerana		x			x						x		x						
Caesalpinia spp.	x											x							
Callitris glauca [2]		x			x	x				x	x								
Calophyllum brasiliense		x				x					x								
Calophyllum spp.		x				x					x								
Calycophyllum candidissimum												x			x				x
Campnosperma panamensis					x			x	x		x							x	x
Canangium odoratum												x						x	x
Canarium schweinfurthii					x	x			x	x	x								
Canarium spp.		x			x				x		x							x	
Carapa guianensis					x		x		x	x	x	x							
Carapa procera					x	x					x								
Cariniana pyriformis		x				x			x		x	x							
Caryocar spp.	x		x			x					x								
Casearia batiscombei					x						x							x	
Cassipourea malosana						x						x							
Castanopsis spp.		x					x				x								
Casuarina spp.	x	x																	
Catostemma spp.		x						x	x								x	x	
Cecropia peltata								x	x									x	
Cedrela spp. Spanish-cedar					x				x	x	x			x					x
Cedrela spp. Toon					x					x	x			x					
Cedrelinga catenaeformis		x									x								
Ceiba pentandra		x			x			x	x		x							x	
Celtis spp.		x				x			x	x									
Centrolobium spp.	x			x		x				x	x	x					x		
Cephalosphaera usambarensis		x			x				x		x							x	
Chlorophora excelsa			x	x	x	x					x								
Chirorophora tinctoria	x			x		x					x	x			x	x			
Chloroxylon swietenia					x					x	x	x							x
Chukrasia tabularis										x	x	x	x				x		
Cinnamomum spp.								.			x								x
Clarisima racemosa		x				x					x								
Chlatrotropis spp.	x					x					x								
Combretodendron macrocarpum	x									x									
Copaifera spp.		x			x			x			x	x							
Cordia millenii					x						x								
Cordia spp.											x	x	x	x					
Cordia spp. (Alliodora group)		x			x	x				x	x						x		
Cordia spp. (Gerascanthus group)						x				x	x	x							x
Cordyla africana	x			x															
Cotylelobium spp.	x			x	x	x					x	x							
Couma macrocarpa		x			x			x	x		x							x	
Couratari spp.		x		x					x		x							x	
Cratoxylon arborescens		x					x	x	x		x								
Croton megalocarpus		x				x													
Cryptocarya spp.		x			x	x				x	x								
Cupressus lusitanica [2]		x									x								
Cybistax donell-smithii					x					x	x								
Cylicodiscus gabunensis	x		x	x		x													
Cynodendron spp.		x									x	x							
Cynometra alexandri	x		x	x		x													
Cynometra spp.		x		x															
Dacrydium spp. [2]		x	x		x	x				x	x							x	
Dacryodes excelsa		x								x	x								
Dacryodes spp.					x	x				x	x								
Dactyloladus stenostachys		x			x		x			x	x								
Dalbergia latifolia										x	x	x		x					x
Dalbergia melanoxylon												x	x	x					x
Dalbergia nigra										x	x	x		x					x
Dalbergia retusa												x		x					x
Dalbergia stevensonii										x		x		x					x
Daniellia ogea					x				x	x	x							x	
Dendropanax arboreus		x			x			x	x		x							x	
Dialium dinklagei				x		x						x							
Dialium guianense	x			x		x						x							
Dialium spp.	x					x									x				x

Name		Geographic	Color	Densitiy	Mechanical properties						Other properties			
					Bending	Stiffness	Crushing	Tough-	Hardness	Move-	Shrinkage		Durability	Treatability
Scientific	Commercial	region			strength		strength	ness		ment	Rad.	Tan.	(heartwood)	(heartwood)
Dialyanthera spp.	Cuangare	AM	3	2	2-3	3-4	1	-	1	-	3	4	5	2
Dicorynia guianensis	Basralocus	AM	3	4-5	6	4	5	3	4	1	3	4	1-2	4
Didelotia brevipaniculata	Sapo	AF	1	4	4	2-4	4	4	-	-	2	4	3	3
Didymopanax morototoni	Morototo	AM	1	2-3	3-4	4-5	3	1	2-3	-	4	4	5	3
Dillenia spp.	Simpoh	AS	3	3-5	4-5	3	2-5	2	3-5	-	2	2	4	2-3
Dipspyros spp.	African ebony	AF	4	6	7	6	5-7	4	7	-	5	5	1	4
Diospyros spp.	East Indian ebony	AS	4	4-5	3-6	3-4	2-6	5	6	-	4	4	1	-
Diplotropis purpurea	Sucupira	AM	1	5	7	6-7	7	4	7	-	3	3	1-3	3
Dipterocarpus spp.	Keruing	AS	2, 3	4	5-7	4-5	5-7	3	5	2-3	5	5	3	2
Dipteryx odorata	Tonka	AM	1	6	7	7	7	5	7	-	3	3	1	3
Distemonanthus benthamianus	Ayan	AF	1	4	5-6	3	5-6	3	4	1	2	2	3	3
Dracontomelum spp.	Paldao	AS	1, 3	3-4	3-5	3-4	3-4	7	3-4	-	2	3	4	-
Dryobalanops spp.	Kapur	AS	3	4	5	4-6	5-6	-	4	2	3	5	3	4
Duabanga spp.	Magas	AS	1, 3	2	1-2	2	1	-	1-2	1	1	1	5	2
Durio spp.	Durian	AS	3	3-4	2-3	2-3	1-2	-	2	-	3	3	4	1
Dyera costulata	Jelutong	AS	1	2	2	2	1	-	1	1	1	2	5	1
Ekebergra rueppelliana	Ekebergia	AF	1	3	2	-	1	-	3	2	1	3	5	1
Endiandra palmerstonii	Orientalwood	AS	1, 2, 3	4	-	-	-	-	-	-	3	4	4	-
Endospermum spp.	Gubas	AS	1	2	-	-	-	-	-	-	2	2	5	1
Entendrophragma angolense	Gedunohor	AF	3	3	3	2-3	3-4	2	3	1	3	3	3	4
Entandrophragma candollei	Kosipo	AF	1, 3	4	3-4	4	4-5	3	-	2	5	4	3	3
Entandrophragma cylindricum	Sapele	AF	3	4	5	4	5	3	5	2	3	3	3	3
Entandrophragma utile	Utile	AF	3	4	4	3	4-5	2	4	2	3	2	3	4
Enterolobium cyclocarpum	Guanacaste	AM	1, 3	2	1	1	1	-	2	1	1	2	2	-
Enterolobium schomburgkii	Timbauba	AM	1	6	6-7	6-7	7	5	7	-	2	4	1	4
Eperua spp.	Wallaba	AM	3	5	6	5	7	-	7	-	2	3	1	4
Erythrophleum ivorense	Missanda	AF	3	5	4-7	3-6	4-7	3	7	1	4	4	1	4
Erythroxylum manii	Landa	AF	3	3	4	-	4	4	-	-	-	-	3	3
Eschweilera spp.	Manbarklak	AM	1, 3	7	4-7	3-7	3-7	4-7	4-7	-	4	5	1	4
Eucalyptus deglupta	Deglupta	AS	3	2-4	3	3	2	1	1	-	2	3	4	-
Eucalyptus diversicolor	Karri	AS	3	5	6	6	7	4	7	3	5	5	2	4
Eucalyptus globulus	Bluegum	AS	1	5-6	5-7	5-6	6-7	4-5	5-7	3	5	5	3	3
Eucalyptus marginata	Jarrah	AS	3	5	5	4	5	2-3	6	2	5	5	1	4
Eucryphia cordifolia	Ulmo	AM	3	3	3	3	3	-	-	-	3	4	5	1
Eugenia spp.	Kelat	AS	1, 3	4-5	4-5	4-5	4-5	2-3	3-5	-	3	3	3	4
Eusideroxylon zwageri	Belian	AS	2, 3, 4	6	7	6	7	-	7	-	3	3	1	4
Euxylophora paraensis	Pau amarello	AM	4	5	5	4	6	-	6	-	4	3	4	-
Fagara macrophylla	East African satinwood	AF	1, 4	4-6	5-7	4	5-7	-	-	-	-	-	4	3
Fagaropsis angolensis	Mafu	AF	2, 4	4	5	4	5	-	4	2	2	2	3	4
Fagraea spp.	Tembusu	AS	1	5-6	6-7	7	6-7	4	7	-	1	1	1	4
Fitzroya cupressoides [2]	Alerce	AM	3	2	2	2	2	-	2	-	2	2	2	-
Flindersia spp.	Queensland-maple	AS	1	3	3-4	3	3-4	1	2	-	4	4	4	-
Gambeya africana	Longui	AF	3, 4	4	6	4-5	6-7	3	-	-	4	4	5	1
Garcinia spp.	Kandis	AS	3	5-6	-	-	-	-	-	-	2	4	1-4	-
Genipa americana	Jagua	AM	1, 3	4	4-5	3	3-4	3	5	-	3	4	5	1
Gluta spp.	Rengas	AS	3	4	3-5	3-4	5	-	5-7	-	1	2	3	3
Gmelina arborea	Gmelina	AS	1, 3	3	2	1-2	1	-	2	1	1	1	3-4	3
Gonioma kamassi	Kamassi	AF	1	5	7	5	7	-	7	-	-	-	2	4
Gonystylus spp.	Ramin	AS	1	4	6	4	5-7	3	4	3	3	4	5	1
Gossweilerodendron balsamiferum	Agba	AF	1, 3	2-3	2-3	1-2	1-3	1	2	1	1	1	2	3
Glossypiospermum praecox	West Indian boxwood	AM	1	5	-	-	-	-	-	-	-	-	5	-
Goupia glabra	Kopie	AM	3	5	5	4-5	5-7	2	6	-	3	3	3	4
Grevillea robusta	Silky-oak	AS	1	3	2-4	2	2	1	3	-	2	3	3	1
Guaiacum spp.	Lignumvitae	AM	4	6	-	-	7	3	7	-	-	-	1	4
Guarea cedrata	Guarea	AF	3	3	4-5	3	4-5	3	3	1	2	2	2-3	4
Guarea spp.	Cramantee	AM	3	3-4	3-5	3	3-4	2	3-4	1	2	3	2	4
Guibourtia arnoldiana	Mutenye	AF	1, 3	4	7	5-7	7	3-7	-	2	4	4	3	3
Guibourtia ehie	Ovangkol	AF	1, 2	5	5-6	5-6	5	5	-	-	4	5	3	3
Guibourtia spp.	Bubinga	AF	3	5	6-7	5-7	6-7	3-7	-	-	5	5	3	3
Helicostylis tomentosa	Leche perra	AM	2	5	7	6	7	5	7	-	4	4	5	4
Heritiera spp.	Mengkulang	AS	3	4	5	4	5	-	4	1	1	2	5	2
Hevea brasiliensis	Para rubbertree	AM	3	3	-	-	-	-	-	-	1	2	5	2
Hibiscus elatus	Blue mahoe	AM	4	4	-	-	-	-	-	-	-	-	1	-
Holopyxidium jarena	Jarana	AM	3	5-6	7	6	7	7	7	-	5	4	1	-
Homalium spp.	African homalium	AF	1	5	6	5-6	5-6	2	7	-	5	5	3	2
Homalium spp.	Burma lancewood	AS	1, 3	5	5-6	5	3-7	-	6-7	-	1	1	2-3	3
Hopea spp.	Thingan	AS	1	4	5	4-5	5	-	3-4	1	2	2	2	4
Humiria balsamifera	Tauroniro	AM	1, 3	5	6	5	5	2	5	-	5	5	1-2	-
Hura crepitans	Hura	AM	1	2	2	1-2	1	1	1	2	1	1	5	1

Name	Uses																		
	Construction																		
	Heavy	Light	Marine Use	Crossties	Joinery/ milwork	Flooring	Shakes/ shingles	Recon-stituted Products [1]	Plywood	Decorative veneers	Furniture/ cabinet-work	Turnery	Carvings	Musical instru-ments	Tool handles	Vats/tanks	Coop-erage	Boxes/ crates	Specialty items
Dialyanthera spp.	x				x			x	x		x								
Dicorynia guianensis	x		x	x		x													
Didelotia brevipaniculata					x			x	x	x	x								
Didymopanax morototoni		x						x	x									x	x
Dillenia spp.				x	x				x		x								
Dipspyros spp. African ebony												x	x	x					x
Diospyros spp. E. Indian ebony												x	x	x					x
Diplotropis purpurea	x			x		x					x	x							
Dipterocarpus spp.		x		x		x			x										
Dipteryx odorata	x			x		x						x			x				x
Distemonanthus benthamianus					x	x				x	x								
Dracontomelum spp.					x	x				x	x								x
Dryobalanops spp.	x				x	x			x		x								
Duabanga spp.					x				x		x								
Durio spp.		x							x		x								
Dyera costulata													x						x
Ekebergra rueppelliana					x				x	x	x								
Endiandra palmerstonii					x	x				x	x								
Endospermum spp.					x				x		x		x					x	x
Entendrophragma angolense					x				x	x	x								
Entandrophragma candollei					x	x			x	x	x								
Entandrophragma cylindricum					x	x			x	x	x								
Entandrophragma utile					x				x	x	x								
Enterolobium cyclocarpum					x					x	x								
Enterolobium schomburgkii	x			x							x				x				
Eperua spp.	x			x		x										x			
Erythrophleum ivorense	x		x	x		x													
Erythroxylum manii		x			x				x		x								
Eschweilera spp.	x		x	x		x						x							
Eucalyptus deglupta		x			x			x			x								
Eucalyptus diversicolor	x					x													
Eucalyptus globulus		x				x		x	x										
Eucalyptus marginata	x		x	x		x													
Eucryphia cordifolia		x		x		x					x								
Eugenia spp.		x		x		x					x								
Eusideroxylon zwageri	x		x			x	x				x				x				x
Euxylophora paraensis						x					x								x
Fagara macrophylla						x				x	x	x							
Fagaropsis angolensis					x					x	x	x							
Fagraea spp.	x			x		x						x	x						x
Fitzroya cupressoides [2]		x					x				x			x		x			x
Flindersia spp.					x					x	x			x					x
Gambeya africana		x			x	x			x		x								
Garcinia spp.						x						x							x
Genipa americana						x			x		x	x							
Gluta spp.					x					x	x	x							x
Gmelina arborea								x	x		x		x						x
Gonioma kamassi												x							x
Gonystylus spp.					x	x			x		x	x							x
Gossweilerodendron balsamiferum		x			x	x			x		x								
Glossypiospermum praecox										x		x	x						x
Goupia glabra	x				x	x					x								
Grevillea robusta		x			x	x				x	x	x							
Guaiacum spp.												x							x
Guarea cedrata					x	x				x	x	x							
Guarea spp.					x				x	x	x	x							
Guibourtia arnoldiana						x				x	x	x							
Guibourtia ehie						x				x	x	x							
Guibourtia spp.										x	x	x							
Helicostylis tomentosa	x					x					x	x							
Heritiera spp.					x	x			x	x	x								
Hevea brasiliensis		x						x											
Hibiscus elatus		x		x	x						x								
Holopyxidium jarena	x			x											x				
Homalium spp. *African homalium*	x			x		x													
Homalium spp. Burma lancewood		x				x					x	x							
Hopea spp.		x		x	x	x					x	x							
Humiria balsamifera	x					x				x	x								
Hura crepitans					x			x	x		x							x	

Name					Mechanical properties						Other properties			
		Geographic	Color	Densitiy	Bending	Stiffness	Crushing	Tough-	Hardness	Move-	Shrinkage		Durability	Treatability
Scientific	Commercial	region			strength		strength	ness		ment	Rad.	Tan.	(heartwood)	(heartwood)
Hyeronima alchorneoides	Suradan	AM	3	4-5	5-6	5	5-6	3	6	-	4	5	1-3	2
Hymenaea courbaril	Courbaril	AM	3	5-6	6-7	4-7	6-7	4	7	-	3	4	1	4
Hymenolobium excelsum	Para-angelim	AM	1	4	4-6	4	5	4	6	-	3	3	1-2	2
Intsia bijuga	Merbau	AS	3	5	5-7	5-6	5-7	3-4	5-6	1	1	1	3	4
Irvingia gabonensis	Oba	AF	1	5	7	6	7	4	-	-	5	5	2	4
Iryanthera spp.	Kirikawa	AM	1, 2, 3	2-4	4-5	4-6	3-6	2	3	-	4	4	3-4	-
Isoberlinia scheffleri	Mbarika	AF	3	4-5	5	4	5	-	5	2	3	4	4	3
Jacaranda copaia	Copaia	AM	1	2	2-3	2-4	1	1	1	-	3	3	5	1
Juglans spp.	Nogal	AM	4	3	2	2	2	-	-	-	1	2	-	4
Julbernardia globiflora	Muwa	AF	3	5-6	7	5	7	-	7	2	3	2	2	4
Juniperus procera [2]	African pencil cedar	AF	3	3	3	2	2	-	2	-	2	2	2	4
Khaya grandifoliola	African mahogany	AF	3	4	4	3	4	2-3	4	1	3	3	3	4
Khaya ivorensis	African mahogany	AF	3	3	3	2-3	3	2	3	1	2	2	3	4
Klainedoxa gabonensis	Eveuss	AF	2	6	7	7	7	6	-	-	5	5	1	3
Koompassia malaccensis	Kempas	AS	3	5	6	6	6	-	6	1	4	3	3	1
Koordersiodendron pinnatum	Ranggu	AS	3	5	7	5	7	-	6	1	4	5	3-4	4
Lagerstroemia spp.	Pyinma	AS	3	4	4	3	4-5	3	3	-	3	3	3	4
Lecythis spp.	Sapucaia	AM	3	4-6	4-7	4-7	7	6-7	7	-	4	3	1	4
Licania spp.	Marishballi	AM	1, 2	5-6	7	5-7	7	4	7	-	5	5	4	3
Licaria spp.	Kaneelhart	AM	1, 3	5-6	7	7	7	5	7	-	4	3	1	-
Litsea spp.	Medang	AS	4	3	2-4	3-4	2-4	2	2	-	2	3	2-5	3
Lonchocarpus spp.	Black cabbage-bark	AM	1, 3	4-5	6-7	6-7	4-7	6	7	2	2	4	2-4	3
Lophira alata	Ekki	AF	3, 4	6	7	6-7	7	7	7	2	5	5	1	4
Lophopetalum spp.	Perupok	AS	1, 3	3	2-3	2	2	2	-	-	2	2	5	4
Lovoa trichilioides	African-walnut	AF	1	3	3	3	3	3	2	1	2	3	3	4
Luehea spp.	Estribeiro	AM	1, 3	3	3-4	4	3	4	3	-	2	3	5	1
Lysiloma spp.	Sabicu	AM	1, 4	4	4	4	-	5	4	-	1	3	1	-
Machaerium spp.	Caviuna	AM	4	5	5	-	4	4-5	-	-	1	3	1	-
Machilus spp.	Machilus	AS	1, 3	3	2	2	1	-	2	-	1	2	3	-
Maesopsis eminii	Musizi	AF	1, 4	3	2-3	2-3	2-3	-	2	1	2	2	5	1
Magnolia spp.	Magnolia	AM	4	3-4	3-4	3-4	4	2	3	-	2	3	1-2	3
Mammea africana	Oboto	AF	3	4-5	6-7	5	6-7	1-4	-	3	5	5	2	3
Mangifera spp.	Mango	AS	1, 2, 3	3-4	4-5	3-4	3-4	4	3	1	1	1	4	2
Manilkara bidentata	Bulletwood	AM	3	6	7	7	7	5	7	-	5	4	1	4
Mansonia altissima	Mansonia	AF	1, 4	3-4	4-5	3	3-5	2-5	4	2	3	3	1	4
Maytenus spp.	Carne d'anta	AM	3	4-5	6	5	7	2	7	-	3	4	4	1
Melaleuca quinquenervia	Broad-leaved tea-tree	AS	3	4-5	-	-	-	4	-	-	3	4	2	-
Melia azedarach	Persian lilac	AS	3	3	5	2	4	5	-	-	4	4	2	-
Mesua ferrea	Gangaw	AS	3	6	7	6	7	4	7	-	4	4	2	-
Metrosideros collina	Ohia	AS	3	5	6	5	5	4	7	3	5	5	4	3
Michelia spp.	Champaca	AS	1	3	2-3	2-3	2-3	-	2	-	2	2	3	-
Microberlinia brazzavilensis	Zebrano	AF	1, 4	5	5-7	5	5-7	7	-	-	5	5	2	4
Micropholis spp.	Grumixava	AM	1	4-5	4-7	7	3-6	2	5	-	4	4	3	-
Millettia spp.	Panga panga	AF	2, 4	5	5-7	4-6	6-7	4-7	5	1	2	2	1	4
Mitragyna ciliata	Abura	AF	1, 3	3	3	2-3	2-3	1	2	1	3	4	4	2
Monopetalanthus heitzii	Adoung	AF	3	3	4	2	3	3	-	-	3	3	3	3
Mora excelsa	More	AM	3	5-6	7	6	7	4	7	-	5	5	1-2	3
Morus mesozygia	Difou	AF	1	5	7	5	7	3	-	1	2	2	4	4
Musanga cecropioides	African corkwood	AF	1	1-2	1-2	1-2	1	1	-	-	1	3	5	3
Myristica spp.	Darah darah	AS	1, 3	3-4	-	-	3	-	3	-	3	3	5	1
Myroxylon balsamum	Balsamo	AM	3	5-6	6-7	5	6-7	5	7	-	2	2	1	4
Nauclea diderrichie	Opepe	AF	1	4	4-5	4	5-6	3	5	1	3	4	1	2
Nectandra spp.	Canelo	AM	4	3-4	3-5	3	3-5	2	3	-	2	2	2-4	4
Nesogordonia papaverifa	Danta	AF	3	4-5	6	3-4	6	5	7	2	4	4	2	4
Nothofagus spp.	Rauli Coigue	AM	3	3	3-5	3-4	3-5	-	3	1	2	3	2-4	2
Nothofagus spp.	Tasmanian-myrtle	AS	3	3-4	3-5	3-4	2-5	2-3	4	-	2	2	2-4	3
Ochroma pyramidale	Balsa	AM	1, 3	1	1	1	1	-	1	1	2	3	5	3
Ocotea rodiaei	Demerara greenheart	AM	4	6	7	7	7	-	7	2	5	5	1	4
Ocotea rubra	Determa	AM	3	4	3-4	4	2-3	1-2	2	-	2	3	1-2	4
Ocotea usambarensis	East African camphorwood	AF	1	3	3-4	3	3-4	-	3	1	2	2	1	4
Octomeles sumatrana	Binuang	AS	1, 3	2	2	1-2	1-2	1	1	1	4	5	5	2
Odyendea spp.	Onzang	AF	1	2	1	1	1	1	-	-	2	2	5	2
Olea hochstetteri	East African olive	AF	4	5	7	6	7	-	7	3	5	5	3-4	2
Ongokea gore	Angueuk	AF	1	5	4-7	3-5	5-7	1-2	-	-	3	5	2	3
Ormosia spp.	Baracara	AM	1, 3	3-5	4-6	3-5	3-6	3	3-5	-	2	3	5	2
Oxandra lanceolata	West Indian lancewood	AM	1	6	7	6	-	-	-	-	5	5	4	-
Oxystigma oxyphyllum	Tchitola	AF	3	4	4-5	3	4	2	4	1	4	5	2-4	1
Palaquium spp.	Nyatoh	AS	1, 4	3-4	3-4	3-4	1-4	-	3-4	-	3	3	4	4
Parashorea spp.	White seraya	AS	1, 3	3	3-4	3-4	3-4	3	2-3	1	1	3	3-4	4

Name	Uses																		
	Construction																		
	Heavy	Light	Marine Use	Crossties	Joinery/ milwork	Flooring	Shakes/ shingles	Recon- stituted Products [1]	Plywood	Decorative veneers	Furniture/ cabinet- work	Turnery	Carvings	Musical instru- ments	Tool handles	Vats/tanks	Coop- erage	Boxes/ crates	Specialty items
Hyeronima alchorneoides	x		x	x	x	x				x	x	x							
Hymenaea courbaril				x		x					x	x			x				x
Hymenolobium excelsum	x										x	x							
Intsia bijuga					x	x					x	x		x					x
Irvingia gabonensis	x			x															
Iryanthera spp.		x			x			x	x		x	x						x	
Isoberlinia scheffleri	x					x													
Jacaranda copaia		x					x	x			x							x	x
Juglans spp.										x	x								
Julbernardia globiflora	x			x															
Juniperus procera [2]					x		x				x					x			x
Khaya grandifoliola					x	x				x	x								
Khaya ivorensis					x				x	x	x								
Klainedoxa gabonensis	x			x		x									x				
Koompassia malaccensis	x			x		x			x										
Koordersiodendron pinnatum					x	x					x	x							
Lagerstroemia spp.		x			x	x					x								
Lecythis spp.	x			x		x						x			x				
Licania spp.	x		x	x															
Licaria spp.	x					x					x	x							
Litsea spp.		x			x				x		x		x						
Lonchocarpus spp.	x			x		x					x								
Lophira alata	x		x	x		x													
Lophopetalum spp.		x			x				x		x								
Lovoa trichilioides					x					x	x								x
Luehea spp.		x			x	x		x	x		x							x	
Lysiloma spp.		x			x	x				x	x								x
Machaerium spp.										x	x	x							x
Machilus spp.		x			x				x		x		x	x					
Maesopsis eminii		x			x				x									x	
Magnolia spp.		x			x				x		x	x							
Mammea africana					x						x								x
Mangifera spp.					x	x			x		x	x							
Manilkara bidentata	x			x		x					x	x			x				x
Mansonia altissima					x					x	x	x							
Maytenus spp.		x									x	x							
Melaleuca quinquenervia				x							x		x						x
Melia azedarach										x	x	x							x
Mesua ferrea	x			x															
Metrosideros collina						x													x
Michelia spp.		x			x				x		x	x	x						
Microberlinia brazzavilensis										x		x			x				x
Micropholis spp.		x			x	x				x	x								
Millettia spp.		x			x	x				x									x
Mitragyna ciliata					x	x			x		x		x						
Monopetalanthus heitzii		x							x		x							x	
Mora excelsa	x			x		x													
Morus mesozygia					x	x				x		x							
Musanga cecropioides								x											x
Myristica spp.		x			x						x								
Myroxylon balsamum				x	x	x					x	x							
Nauclea diderrichie	x	x	x	x		x					x								
Nectandra spp.					x	x			x		x								
Nesogordonia papaverifa	x	x			x	x					x	x			x				x
Nothofagus spp. Rauli, Coigue					x	x					x						x		
Nothofagus spp. Tasmanian-myrtle					x	x		x	x		x	x	x					x	x
Ochroma pyramidale																			x
Ocotea rodiaei	x		x			x						x							x
Ocotea rubra	x	x			x	x			x		x	x				x	x		
Ocotea usambarensis					x	x				x	x								
Octomeles sumatrana		x					x		x		x								
Odyendea spp.								x	x									x	
Olea hochstetteri						x				x	x	x							
Ongokea gore					x	x						x							
Ormosia spp.		x									x								
Oxandra lanceolata												x			x				x
Oxystigma oxyphyllum					x					x	x								
Palaquium spp.					x				x		x								
Parashorea spp.		x			x				x		x								

Name		Geographic	Color	Densitiy	Mechanical properties						Other properties			
					Bending	Stiffness	Crushing	Tough-	Hardness	Move-	Shrinkage		Durability	Treatability
Scientific	Commercial	region			strength		strength	ness		ment	Rad.	Tan.	(heartwood)	(heartwood)
Paratecoma peroba	White peroba	AM	3, 4	4	5	3	3-5	5	5	-	2	3	1	3
Parinari excelsa	Sougue	AF	3	4-5	5-7	4-5	6-7	3	6	3	5	5	4	3
Parinari spp.	Burada	AM	1, 3	5	6-7	6	6-7	3	6	-	4	5	3-5	1
Peltogyne spp.	Purpleheart	AM	4	5-6	6-7	5-7	7	3-7	6-7	1	2	2	1	4
Pentace spp.	Thitka	AS	1, 3	4	4	3	3-4	-	3-4	-	2	2	-	3
Pentacme spp.	White lauan	AS	1, 3	3-5	3-6	3	3-6	2	2	-	3	3	2-4	2
Pericopsis elata	Afrormosia	AF	1, 2	4	3-6	3-4	5-6	2	5	1	2	2	1	4
Persea spp.	Lingue	AM	3	3-4	3-4	3	3	3	3	-	3	4	4	3
Phoebe porosa	Imbuia	AM	2, 4	4	4	3	3	2	3	-	1	2	2	-
Phyllostylon brasiliensis	San Domingo-boxwood	AM	1	5	-	-	-	-	-	-	-	-	-	-
Pinus caribaea [2]	Caribbean pine	AM	1, 3	2-5	2-5	1-5	4-5	5	4	-	5	3	3	2
Pinus insularis [2]	Benguet pine	AS	1, 3	3	3-5	3-4	3-4	2	1-2	-	3	3	5	2
Pinus merkusii [2]	Merkus pine	AS	1	4	6	5	5	2	2	-	-	-	4	-
Pinus oocarpa [2]	Ocote pine	AM	3	4	5	5	4	2	3	-	3	3	3	3
Pines patula [2]	Patula pine	AM	1	3	4	2-4	2-4	-	-	-	3	3	5	1
Piptadenia pittieri	Carbonero	AM	1, 3	4	5-7	4-5	5-6	-	5	-	3	3	4	2
Piptadeniastrum africanum	Dahoma	AF	1	4	5	4	4-5	4	5	2	2	4	2	3
Piratinera guianensis	Letterwood	AM	3, 4	6	-	-	-	-	-	-	-	-	1	-
Pithecellobium saman	Saman	AM	2, 4	3	2	2	2	1	3	-	1	1	1-2	-
Planchonia spp.	Putat paya	AS	3, 4	4	4-5	3-4	4	2-3	4	2	5	5	4	4
Platymiscium spp.	Trebol	AM	3, 4	5-6	5-7	6-7	5-7	3	6-7	-	1	1	1	4
Podocarpus spp. [2]	Podocarp	AM	1	2-4	2-5	2-4	1-3	1	2	1	1	2	3-5	1
Podocarpus spp. [2]	Totara	AS	1, 3	2-3	2-3	2-3	2-4	1	1-3	-	2	2	2-4	3
Podocarpus spp. [2]	Podo	AF	1	3	3	2	3	-	3	1	1	2	5	1
Poga oleosa	Ovoga	AF	3	2	2	2	2	1-2	-	-	1	3	5	-
Pometia spp.	Kasai	AS	3	4	4-5	3-4	4-5	2	4-6	-	4	3	3	2
Poulsenia armata	Mastate	AM	1	2	1	1	-	-	1	-	2	3	5	-
Prado sia spp.	Chupon	AM	1, 3	5	6	5	4	4	6	-	3	5	2	-
Prioria copaifera	Cativo	AM	1, 2	2-3	2	2	1	1	2	-	1	2	4	1
Protium spp.	Kurokai	AM	1, 3	3-4	3-5	3-4	3-5	3	2-4	-	3	3	5	3
Pseudosamanea guachapele	Guachapele	AM	1	4	3	2	3	2	3	-	1	1	1-2	4
Pseudosindora palustris	Sepetir	AS	2, 3	4	4-6	4	3-5	-	4-5	1	2	3	4	4
Pterocarpus angolensis	Muninga	AF	1, 2, 3	3-4	4	2	4	-	5	1	1	1	2-3	3
Pterocarpus dalbergioides	Andaman padauk	AS	3	4	5	3	6	-	5	-	2	1	1	2
Pterocarpus indicus	Narra	AS	1, 3	3-4	4	3	4-5	2-4	3-4	1	1	1	1	-
Pterocarpus macrocarpus	Burma padauk	AS	3	5	7	4	7	-	7	-	2	2	1	4
Pterocarpus soyauxii	African padauk	AF	3-4	4-5	4-6	3-4	4-5	2-4	-	1	2	2	1	3
Pterocarpus spp.	Sangre	AM	1	2-4	2-5	2-4	2-4	4	1-4	-	2	3	5	1
Pterogyne nitens	Amendoim	AM	3	5	5	-	4	5	-	-	2	2	3	-
Pterygota spp.	Pterygota	AF	1	3-4	3-5	3-5	3-5	3-4	3	2	4	5	4	2
Pycnanthus angolensis	Ilomba	AF	1, 3	3	3	2	2	2	-	-	3	4	5	1
Pygeum africanum	Mueri	AF	3	4	5	3	5	-	6	-	-	-	5	3
Qualea spp	Mandioquera	AM	3	3-4	5-6	5-6	4-7	3	3-6	-	3	4	3	1-2
Quercus spp.	Roble	AM	1, 3	4-6	5-7	6	-	-	5-7	-	5	5	2	4
Rheedia spp.	Pacun	AM	1, 3	5	6	-	5	6	-	3	3	5	2-4	2
Rhizophora mangle	Mangle Colorado	AM	3	6	7	6-7	7	-	7	-	4	5	2	4
Riconodendron heudelotii	Erimado	AF	1	1	1	1	1	1	-	-	1	1	5	1
Santalum album	Sandalwood	AS	1, 2, 3	5	5	-	4	-	5	-	-	-	1	-
Sapium spp.	Lechero	AM	1	3	3	3-4	2-3	1	2	-	2	3	5	1
Schima spp.	Needlewood	AS	3	4	4	4	4	-	4	-	3	4	4	3
Schinopsis spp,	Quebracho	AM	3	6	4-7	4	5	-	-	-	-	-	1	-
Sclerolobium spp	Djedoe	AM	2, 3	3	3-4	3-4	2-3	3	2	-	3	4	2-4	3
Scorodocarpus borneensis	Kulim	AS	3	5	5	4	5	-	4	-	3	4	3	3
Scottellia coriacea	Odoko	AF	1	4	5	4	5	-	3	2	1	2	5	1
Scyphocephallum ochocoa	Sorro	AF	3	3	3	2-4	1-3	1	-	-	2	1	5	2
Shorea spp.	Balau group	AS	3	5	6-7	5	6	5	5	2	5	5	4	4
Shorea spp.	Dark red meranti group	AS	2, 3	4	3-4	3	2-4	4	2-3	1	2	3	3	3
Shorea spp.	Light red meranti group	AS,	1, 2, 3	2-3	3-4	3-4	2-3	2	2	1	3	4	4	3-4
Shorea spp.	White meranti group	AS	1	3-4	4	3	3	-	3-4	-	2	3	4	2-4
Shorea spp.	Yellow meranti group	AS	1	3	4	3	4	-	-	1	2	4	4	4
Sickingia spp.	Arariba	AM	2	3-4	4	-	3	2	-	-	1	4	3	1
Simarouba amara	Simarouba	AM	1	2	2	2	1	1	1	-	1	2	5	1
Sonneratia spp.	Perepat	AS	1, 2	3-4	3	2	3	-	-	-	1	2	3	-
Spondias mombin	Jobo	AM	1	2	2	2	1-3	1	1-2	-	1	1	5	1
Staudtia stipitata	Niove	AF	1, 3	5	7	5	7	2-4	-	1	4	3	1	4
Sterculia apetala	Chicha	AM	1, 3	2	1-2	1	1	1	1-2	-	2	4	5	1-2
Sterculia oblonga	Yellow sterculia	AF	1	4	5	4	6	4	4	2	3	5	4	4
Sterculia pruriens	Sterculia	AM	1	3	3	3-4	3-5	2	2-3	3	3	5	5	2
Sterculia rhinopetala	Brown sterculia	AF	3	4	7	4	6	4	6	3	5	5	3	4

Name	Uses																		
	Construction																		
	Heavy	Light	Marine Use	Crossties	Joinery/ milwork	Flooring	Shakes/ shingles	Recon- stituted Products [1]	Plywood	Decorative veneers	Furniture/ cabinet- work	Turnery	Carvings	Musical instru- ments	Tool handles	Vats/tanks	Coop- erage	Boxes/ crates	Specialty items
Paratecoma peroba					x	x				x	x					x			
Parinari excelsa	x			x															
Parinari spp.			x	x															
Peltogyne spp.	x					x					x	x	x		x	x			x
Pentace spp.					x	x					x								x
Pentacme spp.		x		x	x	x		x	x		x								
Pericopsis elata					x	x				x	x								
Persea spp.		x			x	x			x		x							x	
Phoebe porosa					x	x				x	x								x
Phyllostylon brasiliensis												x	x						x
Pinus caribaea [2]	x	x		x	x	x		x								x			
Pinus insularis [2]		x			x			x	x		x							x	
Pinus merkusii [2]		x																	
Pinus oocarpa [2]	x	x		x		x												x	
Pines patula [2]		x					x	x										x	
Piptadenia pittieri	x			x		x					x	x							
Piptadeniastrum africanum	x					x													
Piratinera guianensis												x							x
Pithecellobium saman					x					x	x								
Planchonia spp.		x				x					x								
Platymiscium spp.					x					x	x	x		x					x
Podocarpus spp. [2] Podocarp		x			x			x	x		x							x	
Podocarpus spp. [2] Totara		x			x	x					x		x			x			
Podocarpus spp. [2] Podo		x			x				x		x							x	
Poga oleosa					x					x	x							x	
Pometia spp.		x			x	x			x		x						x		
Poulsenia armata		x			x														
Pradosia spp.	x	x				x										x			
Prioria copaifera					x			x	x		x								
Protium spp.		x			x				x		x								
Pseudosamanea guachapele	x	x		x		x				x	x								
Pseudosindora palustris					x	x		x	x	x	x								
Pterocarpus angolensis					x	x				x	x	x							
Pterocarpus dalbergioides					x	x				x	x								
Pterocarpus indicus					x					x	x								x
Pterocarpus macrocarpus						x					x								
Pterocarpus soyauxii					x	x				x		x	x						x
Pterocarpus spp.		x						x	x		x								
Pterogyne nitens					x						x	x					x		
Pterygota spp.					x				x		x							x	
Pycnanthus angolensis					x				x		x								
Pygeum africanum	x					x					x								
Qualea spp		x			x	x			x		x								
Quercus spp.	x	x		x		x				x	x						x		
Rheedia spp.	x			x		x					x								
Rhizophora mangle	x			x								x							
Riconodendron heudelotii									x				x					x	x
Santalum album											x	x	x						x
Sapium spp.					x			x	x		x							x	
Schima spp.		x			x	x					x								
Schinopsis spp,	x			x															
Sclerolobium spp		x									x							x	
Scorodocarpus borneensis	x	x																	
Scottellia coriacea					x	x					x	x							
Scyphocephallum ochocoa					x	x					x	x							
Shorea spp. (Balau group)	x					x					x								
Shorea spp. (Dark red meranti group)		x			x	x			x		x								
Shorea spp. (Light red meranti group)		x			x	x			x		x								
Shorea spp. (White meranti group)		x				x			x							x	x		
Shorea spp. (Yellow meranti group)		x			x	x			x		x								
Sickingia spp.		x			x							x						x	
Simarouba amara					x			x	x		x							x	
Sonneratia spp.		x				x					x							x	
Spondias mombin					x				x		x							x	
Staudtia stipitata					x	x				x	x	x							
Sterculia apetala					x			x	x									x	
Sterculia oblonga		x				x				x	x								
Sterculia pruriens		x			x			x										x	
Sterculia rhinopetala	x					x					x								

Name		Geographic	Color	Densitiy	Mechanical properties						Other properties			
					Bending	Stiffness	Crushing	Tough-	Hardness	Move-	Shrinkage		Durability	Treatability
Scientific	Commercial	region			strength		strength	ness		ment	Rad.	Tan.	(heartwood)	(heartwood)
Strombosia glaucescens var. *lucida*	Alma	AF	1, 3	6	7	5	7	7	-	-	5	5	1	4
Swartzia fistuloides	Dina	AF	1, 2, 3	6	7	5-6	7	5	-	-	3	2	1	4
Swartzia spp.	Wamara	AM	2, 3, 4	6	7	6-7	7	5	7	3	2	3	1	-
Swietenia macrophylla	Honduras mahogany	AM	3	3-5	3	2-3	3	1	2-3	1	2	1	2	4
Swintonia spp.	Merpauh	AS	1,3	4	3-5	4-5	2-4		3-4	-	2		4	1-2
Symphonia globulifera	Manni	AM, AF	1, 4	4	5-6	5	5-6	3	4	-	4	5	2	3
Syncarpia glomulifera	Turpentine	AS	3	5	7	5	7	2-4	4-5	-	5	5	1	-
Tabebuia spp. (Lapacho group)	Ipe	AM	4	6	7	7	7	7	7	1	5	4	1	4
Tabebuia spp. (Roble group)	Roble	AM	1	3-4	4	3	3-4	2	3	-	2	2	1-3	3
Tabebuia spp (White-cedar group)	White-cedar	AM	1, 3	4	5-6	4-5	5	2	4	-	3	3	4	1
Tarrietia utilis	Niangon	AF	3	3-4	4-5	3-4	4-5	3	3-4	2	3	3	2	4
Tectona grandis	Teak	AS	1, 2	4	4-5	2-3	3-5	2	3-4	1	1	2	1	4
Terminalia amazonia	Nargusta	AM	1, 3	4-5	6-7	5-7	6-7	3	5-7	-	5	4	1-3	4
Terminalia bialata	White chuglam	AS	1, 4	4	4	4	3	-	4	-	4	3	3-4	4
Terminalia catappa	Indian almond wood	AS	3	3-4	-	-	-	-	-	-	3	2	5	2
Terminals ivorensis	Idigbo	AF	1, 3	3	3	3	3	2	3	1	2	2	2	4
Terminalia procera	White bombay	AS	1, 2	3-4	4	3	4	-	3	1	2	2	4	2
Terminalia superba	Afara	AF	1, 4	3	3-4	3	2-3	1	-	1	3	2	4	4
Terminalia tomentosa complex	Indian laurel	AS	1, 2, 4	5	4-5	3-4	4-5	-.	7	-	3	3	3	3
Testulea gabonensis	Izombé	AF	3, 4	4	4-5	3-4	4-6	1	-	-	2	2	1	3
Tetraberlinia tubmaniana	Ekop	AF	3	4	5	5	6	-	-	-	4	5	3	2
Tetragastris spp.	Sali	AM	4	4-6	5-6	4-5	5-6	4	6-7	-	3	4	1-2	4
Tetrameles nudiflora	Thitpok	AS	1	2	-	-	-	-	-	-	-	-	5	-
Tetramerista glabra	Punah	AS	1, 3	4	-	-	-	-	-	-	5	5	3-4	3
Tieghemella heckelii	Makoré	AF	3	4	4-5	3	4-6	1	4	1	4	4	1	4
Triplaris spp.	Long John	AM	1, 3	3-4	4-6	4	4	2-3	3-6	-	2	4	4	3
Triplochiton scleroxylon	Obeche	AF	1	2	2	1-2	1	1	1	1	2	2	5	3
Tristania spp.	Brush box	AS	3	5-6	6-7	5-6	6-7	4-7	6-7	-	4	4	2	4
Trophis spp.	Ramón	AM	1, 2	3-4	3	-	2	1	2	-	-	-	5	1
Turreanthus africanus	Avodiré	AF	1	3	4-6	3-4	3-5	2-3	3	1	3	3	4	4
Upaca spp.	Sugar plum	AF	3	4-5	5-6	3-6	4	2-4	-	-	4	5	1-3	3
Upuna borneensis	Upun batu	AS	2	6	-	-	-	-	-	-	1	1	2	4
Vatairea spp.	Bitter angelim	AM	4	4	3-6	3-5	2-3	-	3-5	-	2	3	2-3	4
Virola spp.	Banak	AM	1, 3	2-4	2-3	2-4	1-2	1	1-2	-	3	4	5	1
Vitex doniana	Vitex	AF	1	2-3	1	1	1	-	2	1	1	2	5	2
Vitex spp.	Fiddlewood	AM	1, 4	4	4-5	3-5	4-7	2	4	-	2	2	1-3	4
Vitex spp.	Molave	AS	1, 3, 4	4-5	5-6	3-4	3-6	3	4	1-2	3	3	1	-
Vochysia spp.	Yemeri	AM	1, 3	2-4	2-3	2-3	2	1	1-2	-	2	5	4	1
Vouacapoua americana	Wacapou	AM	2, 3	5-6	7	5	7	4	6	-	3	3	1	4
Wallaceodendron celebicum	Banuyo	AS	1	4	-	-	-	-	-	-	-	-	-	-
Widdringtonia whytei [2]	Mlanje cedar	AF	1	3	-	-	-	-	-	-	-	-	1	-
Xylia xylocarpa	Pyinkado	AS	3	5-6	5-7	4-5	5-7	4	7	2	2	3	1	4
Zanthoxylum flavum	West Indian satinwood	AM	1	5	-	-	-	-	-	-	-	-	4	-

Name	Uses																		
	Construction																		
	Heavy	Light	Marine Use	Crossties	Joinery/ milwork	Flooring	Shakes/ shingles	Recon-stituted Products [1]	Plywood	Decorative veneers	Furniture/ cabinet-work	Turnery	Carvings	Musical instru-ments	Tool handles	Vats/tanks	Coop-erage	Boxes/ crates	Specialty items
Strombosia glaucescens var. *lucida*						x						x			x				
Swartzia fistuloides										x		x	x						
Swartzia spp.						x					x	x							x
Swietenia macrophylla					x					x	x	x	x	x					
Swintonia spp.		x							x									x	
Symphonia globulifera		x		x		x			x		x						x		
Syncarpia glomulifera	x		x	x															x
Tabebuia spp. (Lapacho group)	x			x		x				x		x			x				
Tabebuia spp. (Roble group)					x	x				x	x								
Tabebuia spp (White-cedar group)					x	x					x							x	
Tarrietia utilis					x						x								
Tectona grandis					x	x					x	x	x			x			
Terminalia amazonia		x		x		x			x		x	x							
Terminalia bialata						x					x								
Terminalia catappa		x				x				x	x								
Terminals ivorensis		x			x	x				x	x								
Terminalia procera					x				x		x								
Terminalia superba					x				x	x	x								
Terminalia tomentosa complex				x	x					x	x								x
Testulea gabonensis					x	x					x	x	x						
Tetraberlinia tubmaniana									x		x	x							
Tetragastris spp.	x			x	x	x					x						x		
Tetrameles nudiflora									x									x	
Tetramerista glabra		x			x	x					x								
Tieghemella heckelii					x	x			x	x	x	x							
Triplaris spp.		x			x			x			x							x	
Triplochiton scleroxylon					x			x	x		x							x	x
Tristania spp.	x					x									x				x
Trophis spp.									x										
Turreanthus africanus					x					x	x								
Upaca spp.		x				x													
Upuna borneensis	x																		
Vatairea spp.	x	x		x		x													
Virola spp.		x			x			x	x		x							x	
Vitex doniana					x						x							x	
Vitex spp. (Fiddlewood)					x	x			x		x								x
Vitex spp. (Molave)	x				x	x					x		x						
Vochysia spp.					x				x		x								
Vouacapoua americana	x			x	x	x					x								
Wallaceodendron celebicum										x	x		x						x
Widdringtonia whytei [2]		x			x	x	x				x								x
Xylia xylocarpa	x		x	x		x													
Zanthoxylum flavum										x	x	x							x

Appendix A.–Selected Forest Products Reference Material

Worldwide

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Appendix B.–Generic Synonyms

Older scientific name [1]	Newer scientific name	Region of origin [2]
Afrormosia elata	*Pericopsis elata*	AF
Brosimum guianensis	*Piratinera guianensis*	AM
Chrysophyllum africanum	*Gambeya africana*	AF
Cistanthera papaverifera	*Nesogordonia papaverifera*	AF
Coumarouna odorata	*Dipteryx odorata*	AM
Fagara flava	*Zanthoxylum flavum*	AM
Knema spp	*Myristica* spp	AS
Libidibia spp	*Caesalpinia* spp	AM
Payena spp	*Palaquium* spp	AS
Piptadenia spp	*Anadenanthera* spp	AM
Piptadenia africana	*Piptadeniastram africanum*	AF
Prunus africanum	*Pygeum africanum*	AF
Samanea saman	*Pithecellobium saman*	AM
Sarcocephalus diderrichii	*Nauclea diderrichii*	AF
Tabebuia donell-smithii	*Cybistax donell-smithii*	AM
Tarrietia spp.	*Heritiera* spp	AS

[1] Scientific names in the first column have been changed to those currently used in the second column.

[2] Tropical America (AM); Africa (AF); Southeast Asia and Oceania (AS).

Appendix C.–Generic Groupings

To locate genus [1]	See generic grouping	Region of origin [2]
Chrysophyllum	*Cynodendron*	AM
Knema	*Myristica*	AS
Melanorrhoea	*Gluta*	AS
Neesia	*Durio*	AS
Payena spp	*Palaquium* spp	AS
Sindora	*Pseudosindora*	AS
Vatica	*Cotylelobium*	AS

[1] More than one genus marketed together.

[2] Tropical America (AM); Africa (AF); Southeast Asia and Oceania (AS).

Appendix D.–Derivation of Comparative Toughness Values in Table IV-1

Studies have been made to measure the effect of machine type, specimen size, and moisture content on toughness. Vilelal compared results using the Forest Products Laboratory (FPL) toughness testing machine and the Mohr and Federhaff pendulum impact machine (similar to the Amsler machine). Specimens were 1.6 by 1.6 by 24 centimeters long loaded over a 20centimeter span equivalent to the 5/8- by 5/8- by 10-inch specimen loaded over an 8-inch span. Twenty tropical hardwood species with a sampling of 10 trees per species were evaluated in the green condition and at a moisture content of 12 percent.

Average toughness (kg-m) for all species combined for each machine type tested green and dry was:

	Green	Dry
FPL machine	1.82	2.25
Amsler-type machine	1.88	1.67
FPL/Amsler	.97	1.35

Vilela did not compare the effect of specimen volume between supports.

Gerhards[2] made such tests using the FPL machine. Six North America species were tested in the green and dry condition. There was little effect of moisture content and all toughness values combined gave a ratio of:

$$\frac{\text{2-cm}}{\text{5/8-in.}} = 1.80$$

Based on the Vilela and Gerhards results, the following conversion factors were developed:

FPL 5/8-inch green x 1.25	=FPk 5/8-inch dry
FPL 5/8-inch green x 1.80	=FPL 2-centimeter green
FPL 5/8-inch dry x 1.80	=FPL 2-centimeter dry
FPL 2-centimeter green x 1.00	=Amsler 2-centimeter green
FPL 2-centimeter dry ÷ 1.35	=Amsler 2-centimeter dry

[1] Vilela, J.E. 1977. Estudio comparativo de los ensayos del tenacidad realizados con dos equipos diferentes. Lab. Nac. Prod. For. Merida, Venezuela.

[2] Gerhards, C.C. 1968. Effects of type of testing equipment and specimen size on toughness of wood. U.S. Dep. Agric. For. Serv. Res. Pap. FPL 97. For. Prod. Lab., Madison, Wis.

Appendix E.–Kiln Schedules

Most modern dry kilns are designed to control temperature (dry bulb), relative humidity (wetbulb depression), and air circulation. Proper control of these variables throughout the drying process allows rapid removal of undesired moisture from wood and holds to an acceptable minimum defects such as checking and warp. Kiln schedules, based on available literature, are suggested for species and these “moisture content” schedules are coded to indicate desired dry-bulb temperatures, moisture content at step change, and wet-bulb depressions. For example, T6-D4 is suggested for 4/4 Honduras mahogany lumber. “T6” indicates the desired dry-bulb temperature settings, “D” the sample board moisture contents at which changes are made in the dry-bulb and wet-bulb settings, and “4” the wet-bulb depressions that accompany the dry-bulb termperatures. (See tables E-1 and E-2.) These settings are assembled to form the working kiln schedule.’

Example: T6-D4 Dry Kiln Schedule for Honduras Mahogany

Moisture content at start of step	Dry-bulb temperature	Wet-bulb depression	Wet-bulb temperature
Percent	---------- °F ----------		
Above 50	120	7	113
50	120	10	110
40	120	15	105
35	120	25	95
30	130	40	90
25	140	50	90
20	150	50	100
15 to final	180	50	130

Occasionally the letter “S” follows a kiln schedule code, e.g., T10-D4S. This refers to general wet-bulb depression schedules for the softwoods or conifers (table E-3) and is sometimes suggested as well for drying particular hardwoods.

[1] Rasmussen, E.F. 1961. Dry kiln operator’s manual. U.S. Dep. Agric., Agric. Handb. No. 188.

Table E-1.–*General temperature schedules for hardwoods and softwoods*

Temperature step number	Moisture content at start of step	Dry-bulb temperatures for temperature schedule number													
		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
	Percent	*°F*													
1	Above 30	100	100	110	110	120	120	130	130	140	140	150	160	170	180
2	30	105	110	120	120	130	130	140	140	150	150	160	170	180	190
3	25	105	120	130	130	140	140	150	150	160	160	160	170	180	190
4	20	115	130	140	140	150	150	160	160	160	170	170	180	190	200
5	15	120	150	160	180	160	180	160	180	160	180	180	180	190	200

Table E-2.–*General wet-bulb depression schedules for hardwoods*

Wet-bulb depression step number	Moisture content at start of step for moisture content class						Wet-bulb depressions for wet-bulb depression schedule number							
	A	B	C	D	E	F	1	2	3	4	5	6	7	8
	Percent						*°F*							
1	Above 30	Above 35	Above 40	Above 50	Above 60	Above 70	3	4	5	7	10	15	20	25
2	30	35	40	50	60	70	4	5	7	10	14	20	30	35
3	25	30	35	40	50	60	6	8	11	15	20	30	40	50
4	20	25	30	35	40	50	10	14	19	25	35	50	50	50
5	15	20	25	30	35	40	25	30	35	40	50	50	50	50
6	10	15	20	25	30	35	50	50	50	50	50	50	50	50

Table E-3.–*General wet-bulb depression schedules for softwoods*

Wet-bulb depression step number	Moisture content at start of step for moisture content class						Wet-bulb depressions for wet-bulb depression schedule number							
	A	B	C	D	E	F	1	2	3	4	5	6	7	8
	Percent						*°F*							
1	Above 30	Above 35	Above 40	Above 50	Above 60	Above 70	3	4	5	7	10	15	20	25
2	30	35	40	50	60	70	4	5	7	10	14	20	25	30
3	25	30	35	40	50	60	6	8	11	15	20	25	30	35
4	20	25	30	35	40	50	10	14	15	20	25	30	35	35
5	([1])	20	25	30	35	40	15	20	20	25	30	35	35	35
6	-	([1])	20	25	30	35	20	25	25	30	35	35	35	35
7	-	-	([1])	20	25	30	25	30	30	35	35	35	35	35
8	-	-	-	([1])	20	25	30	35	35	35	35	35	35	35
9	-	-	-	-	([1])	20	35	35	35	35	35	35	35	35
10	15	15	15	15	15	15	50	50	50	50	50	50	50	50

[1] Go directly to step 10

Index of Trade and Important Common Names

If only the trade name of a wood is known, this index can be used to locate the species descriptions which are listed alphabetically by scientific name in their geographical region of origin. Preference is given to English usage (e.g., mahogany rather than caoba, mogno, or acajou).

[1] Tropical America (AM); Africa (AF); Southeast Asia and Oceania (AS).

Index of Scientific Names

Dietrich Fengel – Gerd Wegener

Wood

Chemistry – Ultrastructure – Reactions

Reprint (Edition of 1989). 17 cm x 24 cm. XII, 613 pages. 351 illustrations. Paperback.
ISBN 3935638-39-6 (this version is identical to the hard-cover edition published in 1984.)

Wood is an ancient raw material, but in many respects it is also very modern. As the world supply of raw materials continues to dwindle, interest in renewable natural resources has increased remarkably, including the utilization of wood and its chemical components. This book aims to give a detailed state-of-the-art survey of the chemistry and ultrastructure of wood, covering such topics as the fundamentals of wood and bark, special reactions under various environmental conditions as well as the principles of pulping, cellulose derivation, and the conversion of wood into chemicals and energy.
The text is accompanied by numerous graphs and light and electron micrographs, many of them published for the first time. In addition to about 2,800 references there is an index compiling all species treated.

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Distribution of the Components within the Wood Cell Wall

Estimation and Calculation - Determination of the Lignin Distribution - Determination of the Polysaccharide Distribution - Models of the Internat Cell Wall Structure

Constituents of Bark

Anatomical Features - Chemical Composition (General Analysis, Cellulose, Polyoses, Lignin, Polyphenols, Suberin, Extractives, Inorganic Components and pH-Value)

Reactions in Acidic Medium

General Aspects of Wood Reactions - Reactions of Polysaccharides (Acidic Hydrolysis Mechanism, Factors Influencing Hydrolysis, Dehydration, Oxidation) - Reactions of Lignin (Reactive Sites of Lignin, Sulfite Pulping, Acidic Bleaching Reactions, Mild Solvolysis)

Reactions in Alkaline Medium

Reactions of Polysaccharides (Endwise Degradation and Alkaline Hydrolysis, Oxidative Degradation, Hydrogenation of Sugars) - Reactions of Lignin (Alkaline Pulping, Alkaline Bleaching Reactions, Mild and Selective Oxidative Degradation, Hydrogenolysis)

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Degradation by Light and Ionizing Rays

Changes Initiated by Light (Importance and General Effects, Effects Visible in Structure, Chemical Changes of Wood and Lignin, Chemical Changes of Cellulose, Formation of Free Radicals, The Mechanisms of Degradation, Formation and Nature of Yellowing Products) - Changes Initiated by Ionizing Rays (Importance and General Effects, Effects Visible in Structure, Chernical Changes of Wood and Lignin, Chemical Changes of Cellulose)

Microbial and Enzymatic Degradation

Importance of Enzymatic Reactions - Wood-Destroying Organisms - Characterization of Enzymes - Decay by Brown-rot Fungi and Action of Glycanhydrolases - Decay by Whiterot Fungi and Action of Ligninolytic Enzymes - Decay by Soft-rot Fungi - Effects of Bluestain Fungi - Bacterial Attack

Aging and Fossilization

Manner of Conversion - Structural Studies - Chemical Investigations

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