United States
Department of
Agriculture

Forest Service

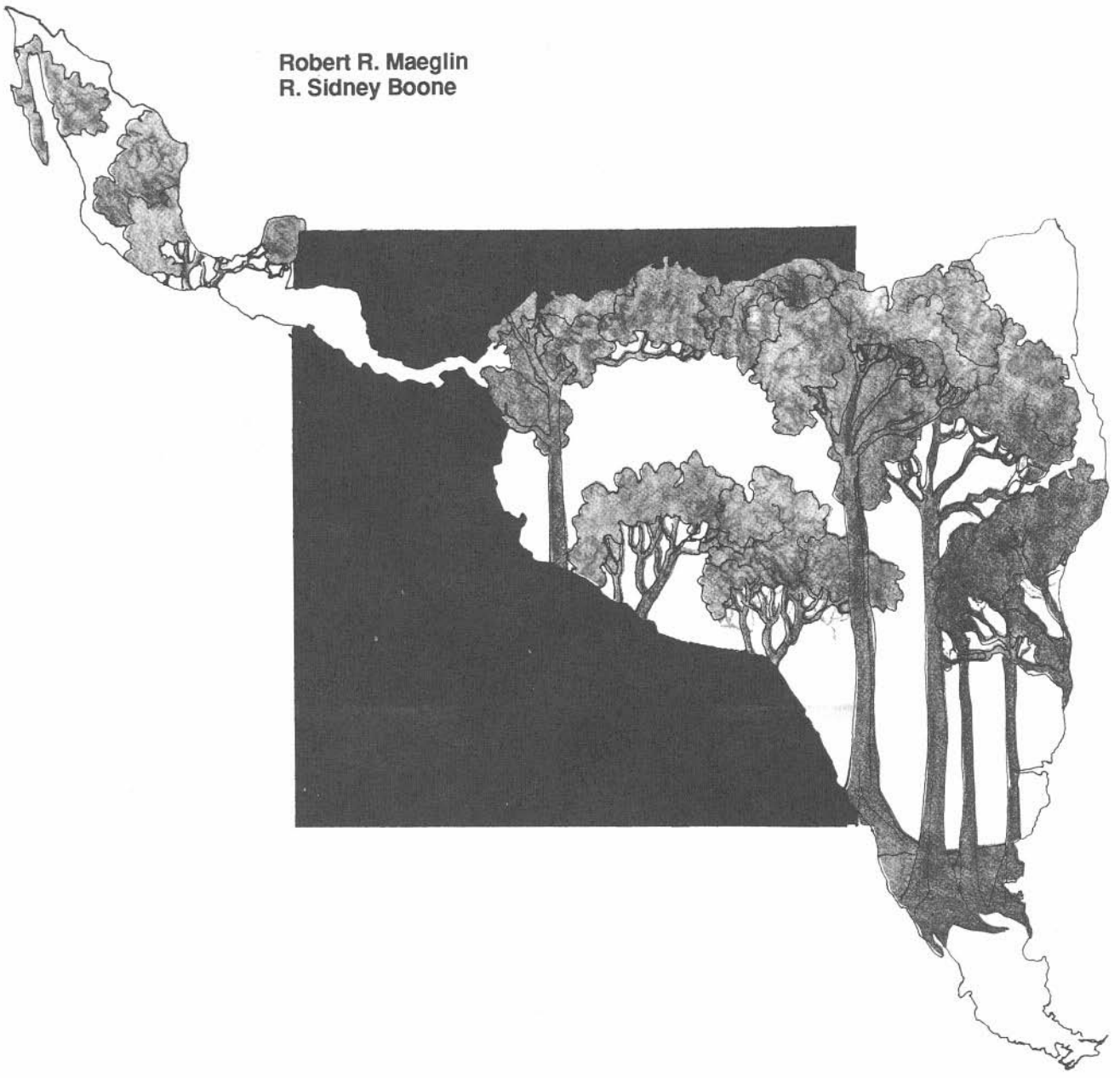
Forest
Products
Laboratory

General
Technical
Report
FPL-GTR-79

Forest Products from Latin America

Annotated Bibliography of World Literature on Research, Industry, and Resource of Latin America 1915 to 1989

Robert R. Maeglin
R. Sidney Boone



Abstract

This document provides over 4,000 citations from the world literature on forest products for Latin America. Citations are grouped in 11 subject areas, with emphasis on products made directly from wood. Excluded are nonwood products such as rattan, bamboo, nuts, fruits, honey, and mushrooms. Also excluded are services from the forest, such as watershed protection, recreation, tourism, and wildlife. Primary sources of citations include USDA–AGRICOLA, CAB, and Forest Products Society's FOREST (AIDS) system, which were searched electronically. Citations prior to the late 1960s were obtained by manual searches in the Forest Products Laboratory's (FPL) Library and searches of the literature cited in documents.

Citations are arranged by subject areas, author, and year. Annotations or abstracts are provided where possible. Approximately 4,000 citations are included; some citations are listed in more than one subject area, as appropriate.

The persons responsible for compiling this bibliography and their area of expertise are as follows:

Sidney Boone	Wood Drying
Lee Gjovik	Wood Preservation
George Harpole	Forest Products Utilization Economics
James Laundrie	Pulp and Paper
Robert Maeglin	Sawmilling and Wood Anatomy
Ronald Wolfe	Wood Housing and Structural Engineering

Keywords: Tropical timber, Latin America, research, forest products, processing, manufacturing

Contents

Acknowledgments

We wish to acknowledge the assistance of Roger Scharmer, FPL Head Librarian, and David Jourdan, Editorial Assistant, for searching the electronic databases and checking the citations for correctness and completeness. Our special thanks to Editorial Assistants Noreen Esser and Lenny J. Dyer for their dedication and effort to bring consistency to this multilanguage document.

August 1993

Maeglin, Robert R.; Boone, R. Sidney, eds. 1993. Forest products from Latin America–Annotated bibliography of world literature on research, industry, and resource of Latin America 1915 to 1989. Gen. Tech. Rep. FPL–GTR–79. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 120 p.

A limited number of free copies of this publication are available to the public from the Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705–2398. Laboratory publications are sent to more than 1,000 libraries in the United States and elsewhere.

The Forest Products Laboratory is maintained in cooperation with the University of Wisconsin.

Forest Products From Latin America

Annotated Bibliography of World Literature on Research, Industry, and Resource of Latin America 1915 to 1989

Robert R. Maeglin. Research Forest Products Technologist, retired

R. Sidney Boone, Research Forest Products Technologist

Forest Products Laboratory, Madison, Wisconsin

Introduction

This bibliography is the result of efforts to identify literature on the history and current state of research on processing and engineering technologies for the utilization of tropical forests in Latin America. The references span a period beginning about 1915 and ending in 1989. Primary sources of the citations were the USDA-AGRICOLA, CAB Information Services, the Forest Products Society AIDS system, and the Forest Products Laboratory (FPL) data bases. These sources were searched electronically. Citations prior to the late 1960s were obtained by manual searches in the FPL library, from literature obtained from Latin American institutions, and by searches of the literature cited in documents.

This bibliography is primarily concerned with products made directly from the wood of trees. For example, references on wood pulp for the manufacture of paper are included, but not references on the manufacture of paper itself. Although we recognize that nonwood products and forest-related services contribute considerably to employment and income in Latin America, these are beyond the scope of this publication. We excluded nonwood products such as rattan, leaf products, bamboo, cork, honey, fruits, mushrooms, nuts, and wildlife. We also excluded services from the forests such as watershed protection, recreation, and tourism.

Although this bibliography is extensive, it is by no means exhaustive. A large amount of data has been published in-house by laboratories and universities throughout Latin America but never listed in the world literature. We hope that this document and the previously published document *Forest Products From Latin America—An Almanac of the State of the Knowledge and the State of the Art*[1] will prompt laboratories and universities in Latin America to enter their publications in the world literature for the advancement of this scientific area.

[1] Maeglin, Robert R., ed. 1991. Forest products from Latin America—An almanac of the state of the knowledge and the state of the art. Gen. Tech. Rep. FPL–GTR–67. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 151 p.

Anatomy, Mechanical Properties, and Physical Properties

Wood anatomy, mechanical and physical properties of wood

Abascal–Y., R.; Juyo–B., R. 1969. Characteristics of 14 Colombian woods (Caracteristicas de 14 maderas Colombianas). Bogota, Colombia: Universidad Distrital. M.S. thesis.

Acosta-S., M. 1950. First numbered list of woods and timbers of Ecuador, collected by Prof. Dr. M. Acosta Solis. (Pimera lista numerada de las maderas y lenosas del Ecuador colectadas por el Prof. Dr. M. Acosta Solis). Flora, Quito. 7(17/20):7–77.

Acosta-S., M. 1951. First list of the woods of Equador (Primera lista numerada de las maderas y lenosas del Ecuador). Quito :Casa de la Cultura Ecuatoriana 10:1–65.

Acosta–Solis, M. 1951. General instructions for collection woody and timber samples (Instrucciones generales para coletar muestras lenosas y maderables). Publ. Dep. For. Ecuador. 21:4.

Acosta–Solis, M. 1952. Cataloging and describing trees and woods (La enumeracion y descripcion de los arbolas y maderas). Publ. Dep. For. Ecuador. 14:11.

Acosta–Solis, M. 1952. Formation of a wood specimen library (collection) (Formacion de la xiloteca). Publ. Dep. For. Ecuador. 15:22.

Acosta–Solis, M. 1960. Economic woods of Ecuador and their uses (Maderas economicas del Ecuador y sus usos). Quito, Ecuador: Publicaciones Cientificas M.A.S. 329 p.

Presents a list of trees in regions of Ecuador. Also explains how to collect and store woods for scientific collections, basic information on wood structure, and general data on some species found in Panama.

Almedia, D.G.; Costa, J.R. 1956. Woods of Brazil (Madeiras do Brasil). Brasilia: Ministerio da Agricultura, Servico de Economia Rural. 56 p.

Characteristics and uses of many woods of Brazil are provided. Scientific and vernacular names are given for each species.

Amaral, A.C.; Ferreira, M.; Couto, H.T.Z. do. 1977. Methods of evaluating the basic density of wood of populations of tropical pines. (Metodos de avaliacao da densidade basica da madeira de populacoes de pinheiros tropicais). Sao Paulo, Brazil: Instituto de Pesquisas e Estudos Florestais, Piracicaba. 15:47–67.

Describes studies of specific gravity from 8 species of Pinus (ages 5 to 14 years) from the Agudos area of Sao Paulo state, Brazil. Increment cores and discs from breast height were used for sampling and comparisons. Regression equations were developed expressing the relationships. Equations relating the density obtained by the two sampling methods are presented.

Anon. 1973. Information from the technological investigation gathered by the National Forest Products Laboratory for 15 woods of the Rio Suapure region in Bolivar State (Ven) (Informe de la investigacion techologica re alizada por el laboratorio national de productos forestales sobre 15 maderas de la region del rio suapure en el estado Bolivar). Lab. Nac de Prod. For. Merida. Ven. Min. of Ag. and Cria - Univ. de los Andes. 28 p.

Covers physical and mechanical properties, sawing and workability properties; drying and preservation characteristics (days to air dry to 20 percent MC).

Anon. 1973. Kakaralli *[Eschweilera* spp.]. Forest and Timber, Guyana. 1(4):4.

Briefly summarizes the distribution in Guyana and wood properties of six species of this genus.

Anon. 1975. Book of trees (Libro del arbol). [Buenos Aires]: Celulosa Argentina. 3 vol.

Volume one describes ornamental trees of Argentina while volume two covers trees with industrial applications; the third volume covers both. Color photos of the tree, and sometimes the wood and a map of the range, are provided.

Anon. 1978. Technological study of 15 timber species from the Bajo San Juan area, Choco, Colombia (Estudio tecnologico de 15 especies maderables procedentes de la zona del Bajo San Juan, Choco, Colombia). Bogota, Colombia: Universidad Distrita "Francisco Jose de Caldas," Instituto de Investigaciones y Proyectos Forestales y Madereros. 190 p.

Describes 15 species including botany, anatomy, silica content, physical and mechanical properties, working characteristics, drying, durability, preservation, and general uses of the woods.

Anon. 1978. Timbers of the world. 2. South America. High Wycombe, UK: Timber Research and Development Association. TRADA Red Booklet Series. 121 p.

Describes the nomenclature, distribution, general characteristics of the tree and the timber, drying, strength and durability properties, working qualities and uses of 82 hardwood species and 4 softwood species.

Anon. 1978. Argentine forest trees (Arboles forestales Argentinos). In: Anuario, Rural FIAT Buenos Aires, Argentina. p. 81–136.

Describes the forest regions and the characteristic tree species (by scientific and common names) for the regions of Argentina. Illustrations are shown for 24 indigenous tree species in color, with accompanying information on names, botanical characteristics, physical and mechanical properties, uses of the woods, and distribution of each species.

Anon. 1978. Characteristics of the principal Chilean woods. Chilean Forestry News. 1(9):13.

The first of a series of brief notes on the general characteristics and uses of the principal Chilean woods.

Anon. 1978. Chilean woods. Rauli–*Nothofagus alpina* (Poepp. et Endl.) Krasser. Chilean Forestry News. 1(10):12-13.

Describes Nothofagus alpina, in Chile. The species is found from Nuble province to Valdivia province, between latitudes 36 and 40 degrees south in extensive mountain stands. Data are presented on tree identification, physical and mechanical properties, uses and marketing of the wood.

Anon. 1978. Chilean woods. Ulmo (elm)–*Eucryphia cordifolia* Cav. Chilean Forestry News. 1(12):14.

Describes *Eucryphia cordifolia*, in Chile. The species is found in the central plain and adjacent hills, between latitudes 37 and 43 degrees south. Data are presented on tree identification, physical and mechanical properties, uses and marketing of the wood.

Anon. 1978. Chilean woods. Coigue–*Nothofagus dornbeyi* (Mirb.) Oerst. Chilean Forestry News. 1(11):14.

Describes *Nothofagus dombeyi*, the most abundant species of Nothofagus in Chile. The species is found from the Andes mountains of the Central Province to the Straits of Magellan, between latitudes 35 and 48 degrees south. Data are presented on tree identification, physical and mechanical properties, uses and marketing of the wood.

Anon. 1979. Chilean woods: Manio. Chilean Forestry Notes. 2(13):14.

Describes the distribution, size, visual identification characteristics, physical and mechanical properties, and uses of the wood for *Podocarpus nubigenus, P. salignus,* and *Saxegothaea conspicua.*

Anon. 1979. Chilean woods. Tepa *(Laurelia philippiana* Looser). Chilean Forestry News. 2(14):13.

Describes the distribution, size, visual identification characteristics, physical and mechanical properties and uses of the wood for the second most abundant tree species in Chile.

Anon. 1979. Chilean woods. Tineo *(Weinmannia trichosperma* Cav.). Chilean Forestry News. 2(15):14.

Describes the distribution, size, visual identification characteristics, physical and mechanical properties, and uses of the wood for Tineo.

Anon. 1981. Characteristics and physical and mechanical properties of Peruvian woods. (Caracteristicas y propiedades de especies madereras del Peru). Lima, Peru: Fondo de Promocion de Exportaciones no Tradicionales.

Characteristics and use of 34 timber species including class of air drying (number of days) and class of "artificial" drying.

Anon. 1983. Technical information sheets on French Guianan timbers: angelique (Fiches techniques sur des bois guyanais: angelique: basralocus). Bois et Forets des Tropiques. 202: 5 7–60.

Describes the physical, mechancial, and machining properties, and uses of angelique *(Dicorynia guianensis)* wood from French Guiana.

Anon. 1983. Technical information sheets on French Guianan timbers: courbaril (Fiches techniques sur des bois guyanais: courbaril). Bois et Forets des Tropiques. 202:65–68.

Describes the physical, mechancial, and machining properties, and uses of courbaril *(Hymenaea courbaril)* wood from French Guiana.

Anon. 1983. Technical information sheets on French Guianan timbers: amarante (purpleheart). (Fiches techniques sur des bois guyanais: amarante). Bois et Forets des Tropiques. 202: 53–56.

Describes the physical, mechancial, and machining properties, and uses of amarante *(Peltogyne* spp., principally *P. venosa* and *P. paniculata* subsp. pubescens) wood from French Guiana.

Anon. 1983. Technical information sheets on French Guianan timbers: coeur dehors (Fiches techniques sur des bois guyanais: coeur dehors). Bois et Forets des Tropiques. 202:61–64.

Describes the physical, mechancial, and machining properties, and uses of coeur dehors *(Diplotropis purpurea)* wood from French Guiana.

Anon. 1983. Technical information sheets on French Guianan timbers: gonfolo (Fiches techniques sur des bois guyanais: gonfolo). Bois et Forets des Tropiques. 202:69–72.

Describes the physical, mechancial, and machining properties, and uses of gonfolo *(Qualea rosea* and *Ruizterania albiffora)* wood from French Guiana.

Arauji, P.A. de M.; Mattos Filho, A. de. 1980. Wood structure of Brazilian dicotyledonous angiosperms (22). Violaceae *(Rinorea* Aubl.) (Estrutura das madeiras brasileiras de angiospermas dicotiledoneas (XXII). Violaceae *(Rinorea* Aubl.)). Rodriguesia. 32(54):125–159.

Araujo, P.A., de M.; Mattos Filho, A. de. 1978. Structure of Brazilian dicotyledonous woods (20). Violaceae, *(Leonia cymosa* and *L. glycycarpa)* (Estrutura das madeiras brasileiras de angiospermas dicotyledoneas (XX). Violaceae, *(Leonia cymosa* Mart. e *L. glycycarpa* Ruiz e Pav.)). Rodrequesia. 30(46):7–22.

Describes the macroscopic and microscopic anatomy of *Leonia cymosa* and *L. glycycarpa,* the distribution of the species in Brazil, and their general uses.

Araujo, P. A. de M.; Mattos Filho, A. de. 1973. Wood structure of Brazilian dicotyledonous angiosperms (11). Monimiaceae *(Bracteanthus glycycarpus* Ducke) (Estrutura das madeiras Brasileiras de angiospermas dicotiledoneas (XI). Monimiaceae *(Bracteanthus glycycarpus* Ducke)). Brasil Florestal. 4(16):35–39.

Describes the macro- and microscopic anatomy of *Bracteanthus glycycarpus* wood, with comments on general properties, uses, and distribution in Brazil.

Araujo, P. A. de M.; Mattos Filho, A. de. 1973. Wood structure of Brazilian dicotyledonous angiosperms **(10).** Monimiaceae *Siparuna bifida* (Estrutura das madeiras Brasileiras de angiospermas dicotiledoneas (X). Monimiaceae *Siparuna bifida).* Brasil Florestal. 4(14):41–45.

Describes the macro- and microscopic anatomy of the wood of *Siparuna bifida,* with comments on general properties, uses, and distribution.

Araujo, P.A. de M.; Mattos Filho, A. de. 1974. Wood structure of Brazilian dicotyledonous angiosperms (5). Aquifoliaceae (Estrutura das madeiras brasileiras de angiopermas dicotiledoneas (V). Aquifoliaceae). Rodriguesia. 27(39):25-51.

Describes the macroscopic and microscopic anatomy of the wood of the five Brazilian species: *Ilex amara; I. brevicuspis; I. domestica; I. paraguariensis;* and *I. parviflora.* Also provides information on general properties and uses of the woods and their distribution in Brazil.

Araujo, P.A. de M.; Mattos Filho, A. de. 1974. Wood structure of Brazilian dicotyledonous angiosperms (12). Monimiaceae *Mollinedia iomalla* (Estrutura das madeiras brasileiras de angiopermas dicotiledoneas (XII). Monimiaceae. *Mollinedia iomalla).* Brasil Florestal. 5(18):57-60.

Describes the macroscopic and microscopic anatomy of the wood, and provides information on general properties and uses of the wood and its distribution in Brazil.

Araujo, P.A. de M.; Mattos Filho, A. de. 1974. Wood structure of Brazilian dicotyledonous angiosperms **(13).** Icacinaceae *(Dendrobangia boliviana* Ruby) (Estrutura das madeiras brasileiras de angiopermas dicotiledoneas (XIII). Icacinaceae *(Dendrobangia boliviana* Ruby)). Brasil Florestal. 5(19):49–54.

Describes the macroscopic and microscopic anatomy of the wood, and provides information on general properties and uses of the wood and its distribution in Brazil.

Araujo, P.A. de M.; Mattos Filho, A. de. 1974. Wood structure of the Brazilian dicotyledonous angiosperms (6). Cyrillaceae *(Cyrilla antillana)* (7). Proteaceae *(Panopsis sessilifolia)* (8). Proteaceae *(Panopsis rubescens)* (9) Piperaceae *(Piper aduncum)* (10). Monimiaceae (Siparuna bifida) (Estrutura das madeiras brasileiras de angiopermas dicotiledoneas (VI). Cyrillaceae *(Cyrilla antillana)* (VII). Proteaceae *(Panopsis sessilifolia)* (VIII). Proteaceae *(Panopsis rubescens)* (IX) Piperaceae *(Piper aduncum)* (X). Monimiaceae *(Siparuna bifida)).* Rodriguesia. 27(39):53-93, 153–162.

Describes the macroscopic and microscopic anatomy of the woods, and provides information on general properties and uses of the woods and their distribution in Brazil.

Araujo, P.A. de M; Mattos Filho, A. de. 1975. Wood structure of Brazilian dicotyledonous angiosperms (14). Icacinaceae *(Discophora guianensis)* (Estrutura das madeiras brasileiras de angiospermas dicotiledoneas (XIV). Icacinaceae *(Discophora guianensis).* Brasil Florestal. 6(22):40–44.

Araujo, P.A. de M.; Mattos Filho, A. de. 1977. Wood structure of the Brazilian dicotyledonous angiosperms (18). Dilleniaceae *(Curatella americana* L.) (Estrutura das madeiras Brasileiras de angiospermas dicotiledoneas (XVIII). Dilleniaceae *(Curatella americana* L.)). Jardim Botanico, Rio de Janeiro, Brazil. Rodriguesia. 29(42):233–245.

Describes the macroscopic and microscopic anatomy of the wood of *Curatella americana,* as well as the general properties, uses, and distribution of the species in Brazil.

Araujo, P.A., de M.; Mattos Filho, A. de. 1978. Structure of Brazilian dicotyledonous woods (20). Violaceae, *(Leonia cymosa* and *L. glycycarpa)* (Estrutura das madeiras brasileiras de angiospermas dicotyledoneas (XX). Violaceae, *(Leonia cymosa* Mart. e *L. glycycarpa* Ruiz e Pav.)). Rodrequesia. 30(46):7–22.

Describes the macroscopic and microscopic anatomy of *Leonia cymosa* and *L. glycycarpa,* the distribution of the species in Brazil, and their general uses.

Araujo, P.A. de M.; Mattos Filho, A. de. 1978. Structure of Brazilian woods of dicotyledonous angiosperms (19). Violaceae *(Amphirrox longifolia* (St.–Hill.) Spreng. and *Amphirrox surinamensis* Eichl.) (Estrutura das madeiras brasileiras de angiospermas dicotiledoneas XIX. Violaceae *(Amphirrox longifolia* (St.–Hil.) Spreng. e *A. surinamensis* Eichl.)). Arquivos do Jardim Botanico do Rio de Janeiro. 22:29–46.

The macro and microscopic anatomy, general properties, uses, and occurrences are described.

Araujo, P.A. de M.; Mattos Filho, A. de. 1979. Wood structure of Brazilian dicotyledonous angiosperms (21). Violaceae *(Paypayrola grandiflora* and *P. guianensis* Aubl.) Estrutura das madeiras brasileiras de angiospermas dicotiledoneas (XXI). Violaceae *(Paypayrola grandiflora* Tul. e *P. guianensis* Aubl.). Rodriguesia. 31:48, 341–363.

Araujo, P.A. de M.; Mattos Filho, A. de. 1981. Wood structure of Brazilian dicotyledonous angiosperms (24). Cunoniaceae *(Weinmannia* Linn.) (Estrutura das madeiras brasileiras de angiospermas dicotiledoneas (XXIV), Cunoniaceae *(Weinmannia* Linn.)). Rodriguesia. 33:56, 117–133.

Distribution, anatomy, uses, and general properties of these Brazilian woods.

Araujo, P.A. de M.; Mattos Filho, A. de. 1982. Wood structure of Brazilian dicotyledons (25). Clethraceae *(Clethra* Linn.) (Estrutura das madeiras brasileiras de dictoyledoneas (XXV). Clethraceae *(Clethra* Linn.). Arquivos do Jardim Botanico do Rio de Janeiro. 36:5–26.

Distribution, anatomy, and some physical properties of *C. scabra,* a Brazilian species commonly used for charcoal and fuel.

Araujo, P.A. de M.; Mattos Filho, A. de. 1984. Wood structure of Brazilian dicotyledons (26). Euphorbiaceae

(Estrutura das madeiras brasilieras de Dicotiledoneas (XXVI). Euphorbiaceae). Rodriguesia. 36(59):25–40.

Distribution, anatomy, gross properties, and uses of *Drypetes variabilis, Hieronyma alchorneoides, Paradrypetes ilicifolia, Richeria australis, R. laurifolia,* and *Securinega guaraiuva.* A key using anatomical features of wood samples is given to distinguish the species.

Araujo, P.A. de M.; Mattos Filho, A. de. 1985. Wood structure of Brazilian dicotyledons (27). Humiraceae (Estrutura das madeiras brasileiras de dicotiledoneas (XXVII). Humiraceae). Rodriguesia. 37(62):91–114.

A key, the uses, and structure of *Humiria floribunda, Saccoglottis* [Sacoglottis] *amazonica, S. guianensis, S. uchi, Vantanea contracta, V. cupularis, V. guianensis* and *V. macrocarpa* are covered.

Arkwright, P. 1955. Know your timbers, some imported woods and their characteristics. No. 13, Odoko; No. 14, Parana pine; No. 15, Abura. Woodworking Industry. 12(1–3):50, 110, 177.

Arostegui–V., Antonio. 1974. Technical study of the woods of Peru. (Pucallpa Zone). Vol. 1. Technical characteristics and uses of 145 species of wood from the country (Estudio tecnologico de maderas del Peru.(Zona Pucallpa). Vol. 1. Caracteristicas tecnologicas y usos de la madera de 145 especies del pais). Lima Peru: Universidad Nacional Agraria la Molina. 483 p.

Presents a listing of Peruvian woods and provides information on each species, including a general description of the wood, macro and microscopical anatomy, physical and mechancial properties, durability, preserving characteristics, and uses.

Arostegui–V., Antonio. 1975. Technological study of the woods of Peru. (Pucallpa Zone). Vol. 2. Methods and specifications employed in the technical studies of wood (Estudio tecnologico de maderas del Peru.(Zona Pucallpa). Vol. 2. Metodos y especificaciones empleado en los estudios tecnologicos de maderas). Lima, Peru: Universidad Nacional Agraria la Molina. 104 p.

Explains, often using diagrams, how technical studies of wood are performed.

Arostegui–V., Antonio. 1975. Technological study of the woods of Peru. (Pucallpa Zone). Vol. 3. Technical characteristics and uses of the wood of 40 species from the Alexander Von Humboldt National Forest (Estudio tecnologic0 de maderas del Peru. (Zona Pucallpa). Vol. 3. Caracteristicas tecnologicas y usos de la madera de 40 especies de bosque nacional Alexander Von Humboldt). Lima, Peru: Universidad Nacional Agraria la Molina. 171 p.

Compares the technical properties of these woods, including physical and mechanical properties, drying characteristics, etc.

Arostegui–V., Antonio. 1982. Review and analysis of technical studies of Peruvian woods (Recopilacion y analisis de estudios tecnologicos de maderas peruanas). PNUD/FAO/PER/81/002, Document of Work No. 2. Lima, Peru: United Nations, Food and Agriculture Organization. 57 p.

Presents general properties of 60 species. Tables are provided to classify these species based upon color, odor, grain, texture, macroscopic features, shrinkage, mechanical properties, sawing and machining characteristics, and uses.

Arostegui–V., A.; Acevedo–M., M. 1971. Evaluation of the physical and mechanical properties and probable uses of the woods of 20 species from Jenaro Herrera, Loreto. Lima, Peru: Universidad Nacional Agraria. Revista Forestal del Peru. 5(1/2):3–14. - Describes, with tabulated data, the physical and mechanical properties of 20 Peruvian forest species from Jenaro Herrera (on the Ucayali river, Loreto), and indicates the probable uses of the woods and the imported species for which they could be substituted.

Arostegui–V., A.; Gonzalez–F., V.R.; Sato, A.A. 1981. Technical properties and uses of the wood of 40 species of the Alexander Humbolt National Forest. (Propiedades tecnologicas y usos de la madera de 40 especies de bosque nacional Alexander von Humboldt). Revista Forestal del Peru. 10(1/2):3–82.

A comprehensive evaluation of 40 species of wood, including data on their anatomy, physical and mechanical properties, drying, preservation and machining properties, and etc.

Arostegui–V., A.; Sato, A. 1970. A study of the physical and mechancial properties of 16 wood species from the forests of Peru. (Estudio de las propiedades fisico-mechanicas de las medera de 16 especies forestales de Peru). Revista Forestal del Peru. 4(1/2)13–24.

Arostequi–V., A.; Sato, A. 1970. Physical–mechanical properties and uses of 2 species of *Pedocarpus (P. rospigliosi, P. montanus)* (Propiedades fisico-mechanicas y usos de dos especies de *Podocarpus (P. respigliosi, P. montanus).* Revista Forestal del Peru. 4(1/2):3–11.

Arostegui–V., Antonio; Sobral Filho, Manoel. 1986. Binational project—Basicand applied technological study of the woods of the Brazilian and Peruvian Amazon. Advanced Technical Report of the Project: Uses of the woods from the humid tropical forest in the Colony Angamos–Rio Yavari and Jenaro Herrera (Proyecto Binacional: Estudo tecnologico basico y aplicado de maderas de la Amazonia de Brasil y Peru. Avance Tecnico del Proyecto: Usos de las maderas de bosque humedo tropical Colonia Angamos Rio Yavari y Jenaro Herrera). Serie Investigaciones Tecnologicas. Iquitos: Instituto de Investigaciones de la Amazonia Peruana. 1(2):14. (May)

Fifteen species are described by such properties as color, odor, and texture. Additional data are provided for five species.

Arostegui–V., Antonio; Valderrama–F., Heiter. 1986. Uses of the woods of the humid tropical forests of Allpahuayo–Iquitos (Usos de las maderas del bosque humedo tropical Allpahuayo–Iquitos). Serie: Investigaciones Tecnologicas. Iquitos: Peru Universidad Nacional de la Amazonia Peruana. 1(5):27. (August).

Characteristics of 10 woods, including physical and mechanical properties, drying and working properties, and density are provided for 10 woods. Suggested uses for these woods are noted.

Arroyo–P., J. 1970. Properties and possible uses of the mangroves of the Rio San Juan region in the forest reserve of Guarapiche, Edo. Mongagas. (Propiedades y usos posibles de los mangales de la region del Rio San Juan en la reserva forestal de Guarapiche, Edo. Monogas). Universidad de los Andes. 27 p.

The physical, mechanical, and durability properties of *Avicennia nitida, Rhizophora harrisonii, R. mangle,* and *R. racemosa,* are presented.

Arroyo–P., J. 1971. Classification of uses and working stress for Venezuelan woods (Clasificacion de usos y esfuerzos de trabajo para maderas venezuelanas). Merida, Venezuela: Laboratorio Nacional de Productos Forestales. 89 p.

Notes physical and mechanical properties, including working stress, for 93 species.

ATIBT (Association Technique Internationale des Bois Tropicaux). 1955. Nomenclature of tropical woods: II. South and Central America (Nomenclature des bois tropicaux; II. Amerique du Sud et Amerique Centrale). Nogent-sur-Marne, France: Edite par L'Association Technique Internationale des Bois Tropicaux, 140 p.

Provides brief information on a large number of tropical woods, including a comprehensive listing of common names and publications that cover each wood.

Azambuja, D. 1947. The Apocybacae of Brazil (Contribuicao ao conhecimento das Apocynaceae encontradas no Brazil. Arq. Sev. Flor. Brazil, 3:9–112.

Provides botanical information, systematics, and uses of some species.

Babos, K. 1979. Study of the fibre length frequency of some Cuban tree species. Acta Botanica Academiae Scientiarum Hungaricae. 25(3-4):177–185.

Describes wood properties of 15 species of trees and shrubs from Cuba analyzed and compared with the wood of *Quercus cerris* var. *austriaca* and *Populus alba* from Hungary.

Babos, K.; Borhidi, A. 1978. Xylotomic study of some woody plant species from Cuba, I. Acta Botanica Academiae Scientiarum Hungaricae. 24(1/2):15–40.

Barajas–M., J. 1980. Anatomy of the woods of Mexico, No. 3. Ten species from the montane cloud forest near Xalapa, Ver. Mexico (Anatomia de maderas de Mexico, No. 3. Diez especies del bosque caducifolio de las cercanias de Xalapa, Ver. Mexico). Biotica. 5(1):23–40.

Barajas–M., J. 1981. Descriptions and notes on the wood anatomy of Boraginaceae from western Mexico. Inst. Biol., Univ. Nacional Autonoma de Mexico, DF, Mexico. IAWA Bulletin. 2(2–3):61–67.

An illustrated description of the wood anatomy of *Cordia elaeagnoides, C. sonorae, C. hintonii, C. dentata, C. alliodora* and *Bourreria purpusii* from western Mexico. The presence of silica grains, oxalate crystals, starch and coalescent apertures is discussed, together with their taxonomic significance and diagnostic value.

Barajas–M., J. 1985. Wood structural differences between trees of two tropical forests in Mexico. In: Baas, P.; Miller, R.B., eds. Functional and ecological wood anatomy. Proceedings of the Martin H. Zimmermann memorial symposium; 1985, August 12. IAWA Bulletin. 6(4):355–364.

A comparison was made of the wood structure of trees from a tropical rain forest and a tropical deciduous forest. Qualitative as well as quantitative differences were found. In the species from the tropical deciduous forest the wood is darker and harder and inclusions like crystals and resin are more abundant than in the rain forest species. Species from the deciduous forest had generally shorter and narrower vessel elements, shorter fibres and rays, greater pore abundance, greater specific gravity, and greater vessel wall thickness than the species from the rain forest. The basic statistics for both groups of species are given. The differences found are explained as related to climate, mainly to available moisture. Some evolutionary implications are also discussed.

Barajas–M, J.; et al. 1979. Anatomy of Mexican woods. Part 2. Twenty species from the Lacandona forest. (Anatomia de maderas de Mexico no. 2. Veinte especies de la selva lacandona). Biotica. 4:4,163–193.

Barajas–M., J.; Echenique–M., R. 1976. Anatomy of woods of Mexico. No. 1: 12 species of Jalisco and Veracruz (Anatomia de maderas de Mexico. No. 1: 12 especies de Jalisco y Veracruz). Publicacion del Instituto de Investigacions de Recursos Bioticos. 1(2):29–70.

Barbosa, O.; Baitello, J.B.; Mainieri, C.; Montagna, R.G.; Negreiros, O. C. de. 1977. Identification and phenology of tree species of the Serra da Cantareira (Sao Paulo) (Identificacao e fenologia de especies arboreas da Serra da Cantareira (Sao Paulo)). Sao Paulo, Brazil: Instituto Florestal, Secretaria da Agric. Estado de Sao Paulo, Silvicultura em Sao Paulo. 11/12:1–86.

Describes the morphology and wood anatomy of 25 species with drawings and photographs. Also noted are flowering and fruiting habits, and common names.

Barbosa, O.; Gurgel–F., O. do A. 1952. Study of the anatomical elements of the wood of *Copaifera langsdorffii* Desf. I (Estudo dos elementos anathmicos do lenho de *Copaifera langsdorffii* Desf. I). Sao Paulo, Brazil: Instituto Florestal. Silvicultura em Sao Paulo. 16A(1):312–317.

Investigates the vessels, axial parenchyma, and radial parenchyma at different heights and depths of trees. Variations indicate that both the height and depth of the tree should be taken into account when these features are analyzed.

Barcenas–P., G.; Romero–R., R.; Echenique–M., R. 1980. Timber species of the Lacandona forest (Especies maderables de la selva Lacandona). Xalapa, Veracruz, Mexico: Laboratorio de Ciencias Madereras y Tecnologicas,

National Biotic Resources Research Institute. Madera y su Uso en la Construccion 6. 21 p.

Describes the physical, mechanical and technical properties of the wood of: *Astronium graveolens; Calophyllum brasiliense; Dialium guianense; Lonchocarpus castilloi; Manilkara zapota; Mosquitoxylum jamaicense; Swietenia macrophylla;* and *Terminalia amazonia* native to the Lacandona region of E. Chiapas, Mexico. Also describes the options for house construction using no wood, wood and other materials, or only wood. The species that they recommend for house construction are *A. graveolens, C. brasiliense,* and *L. castilloi. S. macrophylla* is excluded because of cost. Plans for single-family houses are provided.

Baretta–Kuipers, T. 1973. Some aspects of wood-anatomical research in the genus *Inga* (Mimosaceae) from the Guianas and especially Surinam. Acta Botanica Neerlandica. 22(3):193–205.

Presents a key based on wood characters to 35 out of 38 Inga species found in the area, and discusses the taxonomy of the genus.

Barghoorn, A.W.; Reyes–M., E.; Rojas–L., H.; Cabrera–D., H.; Alvarado–P., J. 1967. Oriented study of some anatomical, physical and mechanical properties of 41 timber species from the Carare–Opon region (Estudio orientativo de algunas propiedades anatomicos y fisico-mecanicas de 41 especies maderables de la region Carare–Opon). Bogota, Colombia: Instituto de Investigaciones y Proyectos Forest ales y Madereros de la Universidad Distrial ["Francisco Jose de Caldes." 228 p.

Barrichelo, L.E.G.; Brito, J.O. 1979. Radial variability within trees from *Pinus caribaea* var. *hondurensis* (Variabildad radial da madeira do *Pinus caribaea* var *hondurensis).* Piracicaba, SP, Barazil: IPEF Publicao Semestral. 18:81–102.

Describes a 16-year-old pine plantation in the State of Sao Paulo and provides data on the wood density, tracheid dimensions in early and late wood of trees, and within-tree variation.

Bascope, F. 1962. Key to the macroscopic identification of some dicotyledonoous woods of Latin America (Clave de identificacion macroscopica de algunas maderas dicoiledoneas de Latinoamerica). Merida: Instituto Forestal Latinoamericano. 101 p.

Basilis, G. 1978. Roble *[Catalpa longissima].* (Roble). Forestal. 2(8):18-21.

Begemann, H.F. 1968. Encyclopedia of the world's commercial timbers, Vol. 3. Lexikon der nutholzer 3. Mering bei Augsburg, Germany: Holz–Verlag. 612 p.

Bena, P. 1951. The forest tree species of French Guyana (Los essences forestieres de la Guyane francaise). Bois et Forets Tropiques. 17:55–57.

Bendtsen, B.A.; Chudnoff, M. 1981. Properties of seven Colombian woods. Res. Note FPL–0242. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 12 p.

Woods from abroad are an important raw material to the forest products industries in the United States. A major concern in the effective utilization of this resource is the lack of technical information on many species. This report presents the results of an evaluation of the mechanical properties of small, clear specimens of seven Colombian woods: Sande, *Brosimum* utile; Sajo, *Campnosperma panamensis;* Pulgande, *Dacryodes* spp.; Cuangare, *Dialyanthera* spp.; Tulapueta, *Osteophloeum platyspermum;* Anime, Protium spp.; Chalviande, *Virola* spp. These results are supplemented by information gleaned from world literature concerning other wood properties also important to effective utilization.

Benitez–R., R.F.; Montesinos–L., J.L. 1988. Catalog of 100 Honduran forest species: distribution, properties, and uses (Catalogo de cien especies forestales de Honduras: distribucion, propiedades y usos). Siguatepeque, Honduras: Esquela Nacional de Ciencias Forestales. 216 p.

Describes habitat, anatomy, mechanical drying, and preservation properties of 100 Honduran woods, complete with color photographs of the woods.

Benoist, R. 1933. The woods of French Guyana. Caen, France: Archives de Botanique. 5(1):1–292.

Dealing primarily with dicotyledonous woods, this work presents a brief description of each family, a key to the genera, and a description of each species. Microscopic anatomy and uses of each species are given. A check list of common names and a bibliography is appended.

Bernath, E.L. 1937. Coniferous forest trees of Chile. Tropical Woods. 52:19–26.

Describes morphology and wood anatomy of Podocarpaceae, Araucariaceae, and Cupressaceae.

Bendtsen, B.A. 1964. Some strengths and related properties of yagrumo hembra *(Cecropia peltata)* from Puerto Rico. Res. Note FPL–053. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. **7** p.

Berni, C.A.; Bolza, E.; Christensen, F.J. 1979. South American timbers — the characteristics, properties, and uses of **190** species. Melbourne, Australia: Division of Building Research. CSIRO. 229 p.

Describes physical and mechanical properties and general characteristics are described for each species, listed in order of scientific name, common names are also given. Species are coded to density, durability, shrinkage, strength, and uses.

Blanco, C.E. 1938. The pines of Mexico (Los pinos de Mexico). Mexico, D.F., Mexico: Boletin Departamento Forestal y de Caza y Pesca. 3(11):237–255.

Boone, R.S.; Chudnoff, M. 1970. Variations in wood density of the mahoganies of Mexico and Central America. Turrialba. 20(3):369–371.

Variations in the wood density of *Swietenia macrophyllla* and *S. humilis* are reported.

Boone, R.S.; Chudnoff, M. 1972. Compression wood formation and other characteristics of plantation-grown Pinus caribaea. Res. Pap. ITF–13. Rio Piedras, Puerto Rico: U.S. Department of Agriculture, Forest Service, Institute Tropical Forestry.

Seventy-one trees from four plantations located in two life zones were sampled to determine amount, orientation, and effect of compression wood on some physical and mechanical properties of 8–10 year old Pinus caribaea grown in Puerto Rico.

Borges-F., S.M. Barbosa, O. 1983. Wood anatomy of the Lauraceae from 'Serra da Cantareira'. I–Cryptocarya (Anatomia do lenho das lauraceas da Serra da Cantareira. I–Cryptocarya). Silvicultura em Sao Paulo. 17/19:9-16.

Descriptions of sections of *C. aschersoniana, C. mandioccana, C. moschata,* and *C. saligna.*

Bostos, H. de Miranda. 1952. A contribution to the knowledge of *Centrolobium* spp. (Contribuiglllo para e conhecimento dendrologico das especies de genero *Centrolobium).* Arq. Serv. Flor. Brasil 6:125–186.

Botosso, P.C.; Gomes, A.V. 1982. Radial vessels and series of perforated ray cells in Annonaceae. IAWA Bulletin. 3(1):39-45.

In a study on the wood anatomy of Annonaceae from Santa Catarina State, Brazil, radial vessels and/or series of perforated ray cells were observed in the following species: *Annona glabra; A. cacans* var. *glabriuscula; Duguetia lanceolata; Guatteria australis; Rollinia emarginata;* and *R. exalbida.*

Braddy, T.W. 1919. Native lumber. The Engineers Club of the Canal Zone. CB–16364/1000. 16 p.

Gives general descriptions of eight woods of Panama.

Brasil, M.A.M.; Ferreira, M. 1979. Characteristics of the fibers of the wood of *Eucalyptus grandis* Hill ex Maiden, 3 years of age (Caracteristicas das fibres de maderira de *Eucalyptus grandis* Hill ex Maiden, 3 anos de idade). Piracicaba, SP, Brazil: IPEF Publicao Semestral (Instituto de Pesquisas e Estudos Florestais). 19:80–97.

Describes fiber length and width, cell wall thickness, and lumen diameter of samples from two sites in the State of Sao Paulo. Fiber characteristics did not vary significantly at three different positions from pith to bark, taken at breast height. However, between-tree variation indicated the possibility of early selection for fiber properties.

Brasil, M.A.M.; Veiga, R.A., de A.; Mello, H.do A. 1979. Wood density in three-year-old Eucalyptus grandis (Densidade basica de madeira de Eucalyptus grandis Hill ex Maiden, aos 3 anos de idade). Sao Paulo, Brazil: Instituto de Pesquisas e Estjudos Florestais. 19:63–76.

Describes breast height wood density from two sites in the State of Sao Paulo. Density averaged 0.403 g/cm^3 at one site, and 0.414 g/cm^3 at the other. Density increased radially from pith to bark. No significant correlations were found between density and d.b.h. class or alcohol–benzene extractives content.

Brazier, J.D. 1975. Properties and uses of Brazilian woods. Journal of the Institute of Wood Science. 7(2):50–57.

Reviews the potential demand for Brazilian timbers in the UK in relation to the current UK consumption of different types of wood and wood products, especially hardwoods. Problems include the high density of many species, their uncertain technical properties, and confusion in commercial and botanical nomenclature. Descriptions of timbers of potential interest and wide availability (grouped according to region of origin and the property/use classes used for current UK imports) are given in an appendix.

Brazier, J.D. 1977. Brazilian mahogany. Princes Risborough, Aylesbury, UK: Building Res. Estab., BRE Information. IS 10/77. 4 p.

Describes the characteristics and mechanical properties of *Swietenia macrophylla* from Brazil. Strength data are presented for *S. macrophylla* from Brazil and Belize and compared with *Entandrophragma utile, Fagus sylvatica,* and *Khaya ivorensis.* Properties of *S. macrophylla* are very similar to those of *K. ivorensis.*

Brazier, J.D.; Franklin, G.L. 1967. An appraisal of the wood characteristics and potential uses of some Nicaraguan timbers. FAO: Misc/67. 49 p.

Information on approximately 70 species, including information on the characteristics of the tree and timber, technical properties, and comments on their drying.

Brazier, J.D.; Lavers, G. 1977. The density of Brazilian mahogany. Journal Institute of Wood Science. 7(5):15–19.

Describes the density, strength properties, and moisture content of two Brazilian mahoganies, *Swietenia macrophylla* and *Swietenia krukovii)* from three different geographical origins. The species are deemed suitable for structural parts in furniture so long as irregular and crossgrain are avoided in pieces of small cross section.

Broker, F.W. 1980. Technological investigations on imported Pinus radiata timber from Chile (Technologische Untersuchungen an *Pinus radiata* Importholzern aus Chile). Holz als Roh- und Werkstoff. 38(9):345–350.

Describes tests of wood properties on *Pinus radiata* wood from Chile and comparisons made with European softwood species. Results showed that average basic density and MOE were lower than that of European spruce and fir, but the pine bending strength was slightly greater. Shrink-swell was lower for the pine than the European species. German grading rules are applicable to *P. radiata.* The quality of this species was adversely affected by its knottiness.

Broker, F.W. 1982. Technological investigations into Pinus radiata timber imported from Chile. Wellington, New Zealand: Department of Internal Affairs. 14 p.

Brown, W.H. 1978. Timbers of the world: Vol. 2: South America. London, England: TRADA. 121 p.

Brown, W.H. 1979. Timbers of the world: Vol. 9: Central America and the Caribbean. High Wycombe, Bucks,

England: Timber Research and Development Association. 86 p.

Brush, W.D. 1938. Foreign woods: Lignumvitae *(Guaiacum* spp.). Washington, DC: U.S. Department of Agriculture, Forest Service. 13 p.

Bublitz, W. 1952. The most important species of Colombia's monsoon forest (Die wichtigsten Holzarten des Monsunwaldes Kolumbiana). Z. Weltforstwirt. 15(1):34–35.

Bucio-S., Y.H. 1982. Assessment of the variation in the tracheids of *Pinus douglasiana* (Determinacion de la variacion de las traqueidas en*Pinus douglasiana).* [city unknown], Mexico: Instituto Nacional de Investigaciones Forestales. Boletin Tecnico. 73:30.

Burley, J.; Hughes, J.F.; Templeman, H.J.; Gourlay, I.D. 1974. Short note on density variation in the wood of *Pinus occidentalis* from Cuba. Baracoa. 4(1/2):33–45.

Describes a study done at the Commonwealth Forestry Institute, Oxford, on *Pinus occidentalis* wood from Cuba. A uniform and rapid growth rate with density above average for tropical pines is indicated in the data. The information indicates that *P. occidentalis* wood is of promising quality.

Caceres–R., H. 1965. Technological studies on some Colombian woods. (Estudios tecnologicos sobre algunas maderas Colombianas). Bogota, Colombia: Instituto de Investigaciones Tecnologicas. 51 p.

Carabias, J.F.; Karsulovic, C.T. 1978. Density and mechanical properties of wood of second growth Rauli *(Nothofagus alpina* Poepp et Ende Oerst) (Densidad y propiedades mecanicas de madera de renovales de Rauli (Nothofagus alpina Poepp et Ende Oerst). Santiago: Universidad de Chile, Facultad de Ciencias Forestales, Boletin Tecnico. 51:36.

Carlquist, S. 1988. Wood anatomy and relationships of Duckeodendraceae and Goetzeaceae. IAWA Bulletin. 9(1):3–12.

Describes microanatomy of Duckeodendron cestroides, Espadaea amoena, and Henoonia myrtifolia.

Carreras, R.; Vales, M.A. 1986. Comparative study of the wood of *Bucida* L. (Combretaceae) (Estudo comparativo de la madera de *Bucida* L. (Combretaceae)). Acta Botanica Hungarica. 32(1–4):247–253.

Anatomy and ecology of the Cuban species *Bucida buceras; B. ophiticola; B. palustris; B. spinosa;* and *B. subinermis.*

Carvajal, P.F.S. 1978. Little-known woods of the Brazilian Amazon. In: Auchter, R. J. (coordinator). Proceedings of conference on improved utilization of tropical forests; 1978 May 21-26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 162–182.

Describes in tables, the commercial name, scientific name, and growing stock volume (m^3/ha) of nearly 70 timbers in four districts of Amazonas. The common name, scientific name, and family name for over 300 species growing on uplands and on flooded lands of Manasa, Altopurus, Amazonia are given. Wood characteristics and uses for *Pouteria* spp., *Peltogyne paniculata, Parkia multijuga, Eschweilera grata, Cedrelinga cataneaforrnis [C. catenaeformis]* and *Aldina* heterophylla are listed, and uses are given for nearly 50 species growing in upper Amazonia.

Casas–J., H.I. 1966. Anatomical study of five Colombian woods (Estudio anatomico de cinco maderas Colombianas). Bogota, Colombia: Universidad Distrital. M.S. thesis.

CCIF (Centro de Capacitacion e Investigacion Forestal). 1981. Preliminary technological study of 20 forest species of Ecuador (Estudio preliminar tecnologico de 20 especies forestales del Ecuador). Conocoto, Ecuador: Centro de Capacitacion e Investigacion Forestal, Ministerio de Agricultura y Ganaderia. 27 p.

The physical and mechanical properties, botanical features, drying and preservation features, working properties, and general uses of 20 woods from Ecuador are noted.

CETEFOR. 1972. A study of the physical and mechanical properties and anatomical structure of seven species of Pine from Guatemala. Guatemala: Centro Tecnico de Evaluacion Forestal. 115 p.

Describes the physical and mechanical properties of the seven most important Pines in Guatemala *(Pinus caribaea, P.* oocarpa, *P. ayacahuite, P. tenuifolia, P. montezurnae, P. rudis,* and *P. strobus* var.*chiapensis).* Strength properties are classified both by the ASTM (American Society of Testing Materials) and IFLA (Instituto Forestal Latinoamericano de Investigacion y Capitacion) standards. Other information given includes the topography and soils of the different Pine regions of the country; describes the selection and handling of the sample trees studied; tabulates and discusses the results of laboratory tests on the physical and mechanical properties of the woods, and classifies the timbers in terms of the ASTM structural grades in force in the USA and the standards specified by the IFLA in Venezuela; gives data on basic and working stresses; and describes and illustrates the microscopic characteristics of each Pine.

Cevallos–F., S.; Carmona–V., T. 1981. Bank of information on wood technology studies for the vegetation of Mexico (Banco de informacion de estudios tecnologicos de maderas que vegetan en Mexico). Catalogo No. 2. Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. 200 p.

General information is given on approximately 90 species. Earlier studies are noted.

Chambergo, A.A.; Arostegui–V., A. 1984. Effect of xylem elements on the physical and mechanical properties of 45 Peruvian timbers (Influencia de los elementos xilematicos en las propiedades fisico-mecanicas de 45 maderas del Peru). Peru: Revista Forestal. 12(1–2):3–17.

Chavelas–P., J. 1981. *Simarouba glauca,* a native species with multiple uses ('El negrito' *(Simarouba glauca* DC.), una especie nativa de uso multiple). Mexico, D.F., Mexico: Instituto Nacional de la Investigacion Forestales. Ciencia Forestal. 6(29):3–16.

Describes plantation grown trees, noting height, diameter, and basal area growth of the trees on 4 different soil

types in Quintana Roo, Mexico. The greatest growth for the 6 yr-old plantation was 5.95m in height on a rendzina-vertisol. Uses of the wood and natural distribution are discussed.

Chudnoff, M. 1984. Tropical timbers of the world. Agric. Handb. 607. Washington, DC: U.S. Department of Agriculture. 464 p.

Lists major tropical timbers of the world by geographic regions. Data are provided on physical and mechanical properties, as well as uses.

Chudnoff, M.; Geary, T.F. 1973. On the heritability of wood density in *Swietenia macrophylla.* Turrialba. 23(3):359-362.

The progenies from six mother trees with heavy wood and six with light wood, paired from the same collection areas, were evaluated for density. For the four Puerto Rican areas, there was no relationship between the density of the mother trees and the progeny, nor was the regression of density on diameter at breast height significant. There was a minor but significant difference in density between the Guajataca and El Verde sites and there were highly significant differences between progenies. There was no evidence that density is strongly heritable.

Cooper, G.P. 1928. Some interesting trees of western Panama. Tropical Woods. 14:1–8.

Discusses general properties and uses of wood. Covers *Brosimum, Sickingia, Minquartia,* and *Prioria.*

Cooper, G.P. 1930. Epave *(Anacardium rhinocarpus* D.C.). Tropical Woods. 22:4–9.

Describes the tree, wood, uses, anatomy, and physical properties of this species.

CORMA. 1960. Wood, properties, classification, averages and applications. 2d ed. (Maderas, propiedades, clasificacion, medicion y aplicaciones 2d ed.). Santiago, Chile: Corporacion Chilena de la Madera, Departamento Tecnico. 79 p.

Properties and uses of timbers are given. Photomicrographs of the wood and additional information on drying, preserving, and grading are provided.

Corothie, H. 1948. Woods of Venezuela (Maderas de Venezuela). Caracas: Ministerio de Agricultura y Cria. 320 p.

Corothie, H. 1960. Wood anatomy of six genera of Anacadiaceae (Anatomia de la madera de seis generos de los anacardiaceaes). Revista Forestal Venezolana. 3(3/4):9-31.

Provides general characteristics, anatomy, and principle uses of six genera of trees.

Corral–L., G. 1981. Anatomy of the wood of seven species of the genus *Quercus* (Anatomia de la madera de siete especies del genero Quercus). Boletin Tecnico. Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. 72:55.

Corral–L., M.G. 1985. Wood anatomy of eleven tropical species. (Caracteristicas anatomicas de la madera de once especies tropicales). Boletin Tecnico. Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. 127:66.

Includes *Enterolobium cyclocarpum, Guettarda elliptica, Inga spuria, Luhea speciosa, Lonchocarpus castilloi, L. longistylus, L. rugosus, Myroxylon balsamum, Prosopis laevigata, Sapium lateriflorum,* and *Sickingia salvadorensis.*

Cozzo, Domingo. 1950. Anatomy of the secondary timber of *Leguminosa papilionoides* in Argentina: natural and cultivated (Anatomia del leno secundarion de las leguminosas papilionoideas argentinas: silvestres y cultivadas). Revista del Instituto Nacional de Investigacion de las Cinecias Naturales. Ciencias Botanicas. 1(7):360.

Cozzo, D.; Cozzo, S.A. 1974. Dimensional variation in the tracheids of two *Araucaria angustifolia* trees 200 to 300 years old. Revista Forestal Argentina. 18(3):76–83.

Creemers, J.; Lemckert, D. 1981. Costa Rica: Key for the identification of the principal forest species by means of a hand lens: Costa Rica (Clave para la identificacion de las principales especies forestales mediante el uso de la lupa). San Jose, Costa Rica: United Nations Food and Agriculture Organization, PNUD/FAO–COS/79/001, Documento de Trabajo. 7:228 p.

CTFT (Centre Technique Forestier Tropical). 1984. Technical sheets on French Guyanan woods (Fiches techniques sur des bois guyanais). Nogent-sur-Marne, France: Bois et Forets des Tropiques. 204:53–72.

Descriptions of five species of tropical woods from French Guyana, including: botanical, local, and commercial names; range; technical, chemical, and energy characteristics; durability; treatability; machining and drying properties; and uses. Species covered are *Ocotea rubra, Erisma unicinatum, Andira coriacea, Vouacapoua americana, Eperua falcata, E. grandiflora,* and *E. rubiginosa.*

CTFT. 1985. The woods of Guadeloupe (Les bois de Guadeloupe). Nogent-sur-marne Cedex, France: Centre Technique Forestier Tropical.

Cummings, L.A. 1929. Forests of Venezuela. Tropical Woods. 18:32–42.

Describes the different forest types, lists trees classified according to hardness and utility, and provides a check lists of common names of timber trees in Venezuela.

Davalos–S., R.; Echenique–M., R.; Sanchez–V., J. 1978. Mechanical characteristics of three species of pine from the Cofre de Perote, Veracruz (Caracteristicas mecanicas de tres especies de pino del Cofre de Perote, Veracruz). Inst. Biol. Universidad Nacional Autonoma de Mexico. Biotica. 3(1):37–55.

Describes the physical and mechanical properties of the wood of *Pinus montezumae, P. patula,* and *P. teocote* from the Cofre de Perote area. Data are presented and discussed in relation to a proposed modification of power transmission poles specifications for the Federal Electricity Commission of Mexico.

Davalos–S.,R.; Wangaard, F.F.; Echenique–M., R. 1977. Classification of the wood of Mexican pines (Clasificacion de la madera de pinos Mexicanos). Inst. Investig. sobre Recursos Biologicos, Xalapa, Veracruz, Mexico. Madera y su Uso en la Construccion. 2:26.

Drawing from limited data on the mechanical properties of Mexican pines, and a study of correlations between the density and mechanical strength of Mexican and foreign pines, a provisional classification of Mexican pine wood for structural purposes is derived. Four quality classes, and the limits of the defects (number, size, type, and position of knots, extent of splits or cracks, etc.) permissible for each class are provided. Suggestions are made for the application of the structural classes.

Dechamps, R. 1979. Anatomical study of South American woads. Vol. 1: Acanthaceae to Lecythidacae (Etude anatomique de bois d'Amerique de sud. Volume 1: Acanthaceae 'a Lecythidaceae). Annales, Musee' Royal de 1'Afrique Centrale, Belgium, Sciences Economiques. 10:332.

Dechamps, R. 1980. Anatomical study of South American woods. Vol. 2: Leguminosae (Etude anatomique de bois d'Amerique de sud. Volume 11: Leguminosae). Annales, Musee Royal de 1'Afrique Centrale, Belgium, Sciences Economiques. 11:229.

Dechamps, R. 1985. Anatomical study of South American woods. Vol. 3: Linaceae to Zygophyllaceae (Etude anatomique de bois d'Amerique du Sud. Volume III: Lineaceae a Zigophylaceae). Annales, Musee Royal de L'Afrique Centrale, Belgium, Sciences Economiques. 14:471.

Della Lucia, R.M.; Vital, B.R. 1983. Physical properties of the wood from 3 regions in the trunk of Eucalyptus saligna Smith (Propriedades fisicas de madeira de 3 regioes do tronco de Eucalyptus saligna Smith). Vicosa, MG, Brazil: Revista Arvore. 7(1):71–75.

Detienne, P. 1980. The wood of *Moronobea coccinea* Aubl.: analogies with and differences from Manil and Parcouri (Le bois de Moronobea coccinea Aubl. analogies et differences avec le Manil et le Parcouri). Bois et forets des tropiques. 194:29–33.

Provides anatomical characteristics of the French Guianan woods *Moronobea coccinea, Symphonia globulifera,* and *Platonia insignis.*

Detienne, P.; Jacquet, P.; Mariaux, A. 1982. Identification manual of tropical woods, Vol. 3: French Guyana (Manuel d'identification des bois tropicaux. Tome 3: Guyane francaise). Nogent-sur-marne Cedex, France: Centre de Guyane, CTFT, 315 p.

Describes anatomy and properties of 352 French Guianan woods.

Detienne, P.; Jacquet, P. 1983. Atlas of the woods of the Amazon and of adjoining regions (Atlas des bois de l'Amazanie et des regions voisines). Nogent-sur-marne Cedex, France: Centre de Guyane, CTFT, Centre Technique Forestier Tropical. 640 p.

Provides macro- and microscopic descriptions for 1,314 species in 515 genera, with photomicrographs of the radial, tangential, and transverse sections. Dichotomous keys are given for families or groups of families with similar wood.

Detienne, P.; Loureiro, A.A.; Jacquet, P. 1983. Study of the wood anatomy of American Bombacaceae (Estudo anatomico do lenho da familia Bombacaceae da America). Acta-Amazonica. 13(5/6):831–867.

Descriptions of the wood anatomy of 40 species of Bombacaceae from South America are given.

Diaz–Vaz, J.E. 1979. Keys for identifying the wood of native and cultivated trees of Chile (Claves para la identificacion de maderas de arboles nativos y cultivados en chile). Bosque. 3(1):15-25.

Two keys for the identification of 43 timbers are presented, one based on macroscopic and the other on microscopic characters.

Diaz–Vaz, J.E. 1981. Delimitation of early/late and juvenile/mature wood in Douglas-fir (Deliminacion de madera tempranta/tardia y juvenil/madura en pino oregon). Chile: Bosque. 4(1):55–58.

Describes density variation that is found within growth rings.

Diaz–Vaz, J.E. 1983. Anatomical description of *Fitzroya cupressoides (Fitzroya cupressoides,* description anatomica). Bosque. 5(1):4.

Diaz–Vaz, J.E. 1984. Anatomical description of *Araucaria araucana (Araucaria araucana,* description anatomica). Bosque. 5(2):117–118.

Diaz–Vaz, J.E. 1985. Anatomical description of *Austrocedrus chilensis (Austrocedrus chilensis,* description anatomica). Bosque. 6(1):49–50.

Diaz–Vaz, J.E. 1986. Anatomy of the wood of *Podocarpus nubigena* Lindi (Cupressaceae: Anatomia de madera de Podocarpus nubigena Lindl: Cupressaceae). Bosque. 7(1):57–58.

Diaz–Vaz, J.E. 1986. Anatomy of the wood of Podocarpus saligna D. Don (Anatomia de madera de Podocarpus saligna D. Don). Bosque. 7(2):129–131.

Diaz–Vaz, J.E.; Devlieger, F.; Poblete, H.; Juacida, R. 1986. Commercial woods of Chile (Maderas comerciales de chile). Coleccion Naturaleza de Chile. Technical Document Vol. 4. Universidad Austral de Chile Valdivia. 156 p.

Diaz–Vaz, J.E.; Ojeda, F. 1980. Intra-incremental density of *Pseudotsuga menziesii* I: variations in a stem analysis (Densidad intraincremental de *Pseudotsuga menziesii* I: Variaciones en un analisis fustal). Valdivia, Chile: Bosque. 3(2):86-95.

An x-ray analysis to investigate density of samples from a tree in Chile.

Doat, J. 1977. The calorific value of tropical woods (Le pouvoir calorifique des bois tropicaux). Bois et Forets des Tropiques. 172:33–55.

Donoso, J.E.; Navarrete, R. 1972. Determination of the mechanical properties of some timbers of commercial importance in Chile. Santiago, Chile: Instituto Forestal. Informe Tecnico. 36:226–245.

Describes mechanical properties of seven native species: *Araucaria araucana, Nothofagus dombeyi, N. obliqua, Aextoxicon punctatum, Laurelia philippiana, Weinmannia trichosperma,* and *Eucryphia cordifolia.*

Ducke, A. 1938. Notes on the Purpleheart trees *(Peltogyne* Vog.) of Brazilian Amazonia. Tropical Woods. 54:l–7.

Provides a key to the species and briefly describes major uses of the woods

Echenique–M., R. 1967. Stress relaxation of wood at several levels of strain. Tech. Rep. New Haven CT: Yale School of Forestry. 37:29.

Echenique–Manrique, R. 1970. Description, characteristics, and uses of 25 tropical Mexican woods (Descripcion, caracteristicas y usos de 25 maderas tropicales Mexicanas). Mexico, D.F., Mexico: Camara Nacional de la Industria de la Construccion. Serie Maderas de Mexico. 237 p.

The natural durability, drying properties, distribution, and physical/mechanical properties of 25 species are given.

Echenique–Manrique, R.; Barajas–M., J.; Pinzon–P., L.M.; Perez–M., V. 1975. Botanical and ecological study of the region of the river Uxpanapa Veracruz. No. 1: Technical characteristics of the wood of ten species (Estudio botanico y ecologico de la region del rio Uxpanapa Veracruz. No. 1: Caracteristicas tecnologicas de la madera de diez especies). Universidad Nacional Autonoma de Mexico. Programa Nacional Indicativo de Ecologia Tropical Publicacion del INIREB (Instituto de Investigaciones sobre Recuros Bioticos). 65 p.

Describes physical and mechanical properties, drying and machining characteristics, natural durability and uses, as reported by various sources, for ten tropical species from Veracruz State, Mexico.

Echenique–Manrique, R.; Diaz–G., V. 1969. Some technical characteristics of the wood of 11 Mexican species (Algunas caracteristicas tecnologicas de la madera de once especies Mexicanas). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Boletin Tecnica. 27:61.

Physical and mechancial properties, uses, and drying characteristics are provided for 11 species.

Echenique–M., R.; Becerra–M., J. 1981. Some physical and mechanical characteristics of the wood of three species of Cordillera volcano mountain range (Alguanas caracteristicas fisicomecanicas de la madera de tres escpecies de la cordillera neovolcanica). Instituto Nacional de Investigaciones Forestales, Mexico: Nota Technica. 6:6.

Examines the properties of *Abies religiosa, Pinus rudis,* and *Quesrcus barvinervis.*

Eguiluz–Piedra, T.; Zobel, B.J. 1986. Geographic variation in wood properties of *Pinus tecunumanii.* Wood and Fiber Science. 18(1):68–75.

Wood properties of *Pinus tecunumanii* were studied for 108 trees collected from 4 different departments of Guatemala (Baja Verapaz, Zacapa, Totonicapan, and El Quiche). Unextracted and extracted densities were calculated from 108 cores (one per tree) of 4.5 mm diameter. Density varied from 0.51 to 0.56 with a weak decreasing trend from east to west. Most of the extractives were found in the core segment closest to the pith. Tracheid measurements (length, cell-wall thickness, lumen width, and diameter) were recorded on 11-mm cores from Baja Verapaz and Zacapa. With the exception of tracheid length, all the measured cell characteristics showed highly statistical differences between locations and among trees. Most of the variation was within and between trees. Tracheid diameter and lumen width were highly correlated.

Ehfurth, T.; Rusche, H. 1976. Marketing of tropical wood: wood species from South American tropical moist forests. Rome, Italy: United Nations, Food and Agriculture Organization.

Gives information on species occurence, properties and utilization of species in trade and production, and problems and potentials for less-utilized species.

Enrique V.J. 1969. Physical and mechanical properties of 137 woods of Venezuelan Guayana (Propiedades fisicas y mecanicas de 137 maderas de la guayana Venezolana). Merida, Venezuala: Universidad de los Andes: Laboratorio Nacional de Productos Forestales. 1:88.

Esspinal–T., L.S. 1963. Some trees and shrubs of Colombia (in Spanish). Bogota: Instituto Geografico "Agustin Codazzi." 104 p.

General descriptions, sometimes including information on use, of 50 species.

Fahn, A.; Burley, J.; Longman, K. A.; Mariaux, A.; Tomlinson, P.B. 1981. Possible contributions of wood anatomy to the determination of the age of tropical trees. In: Bormann, F.H.; Berlyn, G., eds. Age and growth rate of tropical trees: new directions for research. New Haven, CT: Yale University, School of Forestry and Environmental studies. Bull. 94:31–54.

Describes thoughts on and methods for determining the age of tropical trees. Probability based on periodicity is believed to be one of the most promising methods in non-seasonal climates. Anatomical methods and techniques for both living and dead trees are discussed, as is a method using dyes.

Fahnestock, G.R.; Garratt, G.A. 1938. Nicaraguan pine *(Pinus caribaea* Mor.). Tropical Woods. 55:l–16.

Discusses the harvesting, anatomy, and mechanical properties of this tree.

FAO. 1958. Proceedings of the 4th conference on wood technology; 1958 April 22–May 2; Madrid, Spain. Rome, Italy: United Nations, Food and Agriculture Organization. 60 p.

The international standards for physical and mechanical properties, as well as the testing of reconstituted board products, are noted.

Faria, C.M.S. 1981. Amazonian timbers: identification of 100 species (Madeiras da Amazonia: identificao de 100 especies). Rio de Janeiro, Brazil: Rede Ferroviaria Federal, S.A. 313 p.

Describes wood characteristics of 100 Brazilian wood species, noting color, odor, taste, polish, grain, texture, rays, and density.

Ferreira, C.A. 1979. Basic wood density from commercial plantations in the region of Mogi Guacu. Piricicaba, Brazil: IPEF (Instituto de Pesquisas e Estudos Florestais). Publicao Semestral: Piracicaba. 18:106-117.

Ferreira, C.A.; Freitas, M. de; Ferreira, M. 1978. Variation of basic density of the wood of *Eucalyptus spp* as a function of age and local quality (A variacao da densidade basica de madeira de Eucalyptus spp em funcao da idade e qualidad). Piricicabaa, Brazil: IPEFD (Instituto de Pesquisas e Estudos Forestais). Boletim informativo. 6(20):B1-B19.

Ferreira, C.A.; Freitas, M. de; Ferreira, M. 1979. Wood density in commercial plantations of Eucalyptus in the Mogi–Guacu region (Sao Paulo) (Densidade basica da madeira de plantacoes comerciais de eucaliptos, na reiao de Mogi-Guacu (S.P.)). Piricicaba, Brazil: IPEF (Instituto de Pesquisas e Estudos Forestais). Publicao Semestral. 18:106–117.

Ferreira, M. 1973. Variation in specific gravity of wood from commercial plantations of *Eucalyptus alba, E. saligna,* and *E. grandis.* Papel. 34:151–157.

Ferreira, M. 1978. Wood specific gravity variations on Eucalyptus grandis Hill ex Maiden at 11, 12, 13, 14, and 16 years. In: Proceedings of the 7th World Forestry Congress; 1972 October 4–18; Centro Cultural General San Martin, Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 5:6359–6363.

Ferreira, M.; Amaral, A.C.; Bertolani, F.; Nicoielo, N. 1978. Wood dry weight yield of pine plantations (Rendimento em peso seco de madeira de pantacoes de pinheiros). Piricicaba, Brazil: IPEF (Instituto de Pesquisas e Estudos Florestais). Publicao Semestral: Piracicaba. 17:78-89.

Flores–R., L.J. 1968. Wood anatomy of three tropical Mexican species (Anatomica de la madera de tres especies tropicales mexicanas). Tech. Bull. 24:13.

Notes that Mexican tropical timbers are poorly utilized, due in large part to the lack of technical knowledge of them. Anatomical, physical, and mechanical characteristics of *Pseudolmedia oxyphyllaria, Pouteria unilocularis,* and *P. campechiana* are given.

Foelkel, C.E.B.; Ferreira, M.; Nehring, J.H.; Rolin, M.B. 1975. Variability of slash pine wood in the radial direction (Variabilidade no sentido radial da madeira de *Pinus elliottii).* Piricicaba, Brazil: IPEF (Instituto de Pesquisas e Estudos Forestais). Publicao Semestral. 10:1–11.

Franklin, E.C. 1978. Juvenile-mature correlations. In: Nikles, D.G.; Burley, J.; Barnes, R.D., eds. Progress and problems of genetic improvement of tropical forest trees. Proceedings of a joint workshop, IUFRO working parties S2.02–08 and S2.03–01; 1977; Brisbane. 3. Selection and genetics: 205–212.

Frizzo, S.M.B.; Silva, M.C.M. da; Boas, E.R.V. 1982. Analytical composition of the wood of *Hovenia dulcis* Thunb. from a provenance of the Silvicultural Experiment Station at Boco do Monte, Santa Maria, Rio Grande do Sul, Brazil. Ciencia e Natura. 4:85–90.

Froes, R.L. 1959. Information on some economic plants of the Amazonian plateau (Informacoes sobre algumas plantas economicas do planalto Amazonico). Institute Agronomy. Norte. Tech. Bull. 35:113.

Furuno, T.; Saiki, H. 1974. Anatomical characteristics of tropical woods. Res. Rep. of Foreign Wood. Matsue, Japan: Shimane University. 3:39–119.

Describes, with numerous photomicrographs, named tropical woods, and their anatomical characteristics (vessel arrangement, perforation and pitting, vestured pits, axial parenchyma, rays, septate fibres, axial and radial intercellular canals, latex and tanniniferous tubes, oil cells, silica inclusions, crystals, tile cells, ripple marks, latex traces, included phloem, interlocked grain, brittle heart, deposits in vessels, and tropical softwood).

Gaiotti de Peralta, C.; Edlmann Abbate, M.L. 1983. Anatomical characteristics of 16 kinds of wood from Panama. 2 (Carattistiche anatomiche di 16 specie legnose provenienti dalla Repubblica di Panama. 2). Florence, Italy: Instituto Agronomico per l'oltremare. Rivista di Agricoltura Subtropicale e Tropicale. 77(4):569–599.

Garcia, R.R.; Garcia, J.J.M. 1956. A study of the physical and mechancial properties of *Piptadenia* spp (Estudio fisico y mehanico de las especies forestales del genero Piptadenia. Buenos Aires, Argentina: Administration Nacional de Bosques: 63–84.

Garduno, G.R. 1959. Notes on the utilization of forest products of arid zones (Nota sobre explotacion de productos forestales de zonas aridas). Durango, Mexico: Mensajero Forestal. 17(176):8-9.

Garratt, G.A. 1936. The wood of *Symphonia globulifera.* Tropical Woods. 45:1–15.

Gives list of common names, description of tree and wood, mechanical properties, and uses of this species.

Geary, T.F.; Macia Sanabria, F.R. 1973. Density of the juvenile wood of *Pinus caribaea* var. *hondurensis* grown in subtropical moist and wet life zones of Puerto Rico. Turrialba. 23(4):477–480.

Wood samples were collected from second thinnings in plantations of P. caribaea var. hondurensis 9 to 10 years old in Puerto Rico, at 790 m alt. (subtropical wet zone) and 90 m alt. (subtropical moist zone). Density

(measured as oven-dry weight/green volume) generally increased from pith to bark, because the later-formed wood is further from the auxin source and so consists of smaller cells. Heartwood was denser in trees from the lower altitude at all heights along the stem and at any distance from the pith. This was due to the formation of a greater proportion of late-wood cells in the periods when there was insufficient soil moisture for active elongation. In contrast, trees at the higher altitude rarely suffered from a deficit in soil moisture.

Gerry, E.; Flick. F.J. 1957. Puerto Rican woods and their utilization: a bibliography. Rept. 1793. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 15 p.

Contains literature on woods and forest of Puerto Rico to 1950.

Ghouse, A.K.M.; Yunus, M. 1972. An example of the stratified cambium among the indigenous tropical trees. Current Science. 41(15):569–570.

Briefly describes and illustrates the storied arrangement of fusiform initials (as seen in longitudinal tangential section) in the wood of *Dalbergia sissoo.*

Gilmore, R.C.; Barefoot, A.C. 1974. Evaluation of some tropical woods imported into the United States from South America. Forest Products Journal. 24(2):24–28.

Describes machining, gluing, and strength tests on six groups of tropical woods, exported under the commercial names of Andiroba *(Carapa guianensis),* Azafran *(Zanthoxylum* sp.; *Cordia* sp.), Banak or Ucuuba *(Oteophloeum* sp.; *Virola* sp.), Hura *(Hura* sp.), Sajo *(Campnosperma panamensis),* and Virola *(Dialyanthera* sp.). Comparisons were made with *Liriodendron tulipifera.* In general, strength of glue bonds, static bending strength, and toughness decreased with decreasing specific gravity of the wood.

Gomes, J.I. 1982. The wood of *Cordia goeldiana* Huber (A madeira de *Cordia goeldiana* Huber). Boletim de Pesquisa.Umido, EMBRAPA, Brazil: Centro de Pesquisa Agropecuaria do Tropico. 45:16.

Anatomy, physical and mechanical properties, durability, uses, and preservation of C. goeldiana.

Gonzalez, M.E.; Gonzalez, G.E. 1973. Mechanical and physical properties, uses, and other characteristics of some commercial woods important in Costa Rica. Part 1 (Propiedades fisicas, mecanicas, usos y otras caracteristicas de algunas maderas comercialmente importantes en Costa Rica. Parte 1). San Pedro, Costa Rica: Laboratorio de Productos Forestales, Universidad de Costa Rica. 48 p.

Gonzalez, M.E.; Slooten, H.J. van der; Richter, H.G. 1971. Latin American timbers. VIII. *Calophyllum brasiliense, Couratari panamensis, Dendropanax arboreum* and *Bombacopsis sessiles* (Maderas latinoamericanas. VIII. *Calophyllum brasiliense, Couratari panamensis, Dendropanax arboreum* y *Bombacopsis sessilis).* Turrialba. 21(4):466–477.

Describes the four species, presenting data on the anatomy and properties (physical, mechanical, seasoning, and machining) as well as possible uses of the woods.

Gonzalez, G.T.; Wiessel, B.C.; Chaverri, P.R. 1973. Investigation about the development of the forest production of northeast Nicaragua: properties and uses of 15 species of wood of northeast Nicaragua (Investigacion sobre el fomento de la produccion de los bosques del Noreste Nicaragua: Propiedades y usos de quince especies maderables del noreste de Nicaragua). Turrialba, Costa Rica: United Nations, Food and Agriculture Organization, IICA–CATIE (Instituto Interamericano de Ciencias Agricolas–Centro Agronomico Tropical de Investigacion y Ensenanza). FO/SF/NIC 9, Informe Tecnico 8. 202 p.

Gottwald, H.; Richter, H.G. 1984. Koto/Pterygota–timbers from three parts of the world (Koto/Pterygota–Holzer dreier Erdteile). Holz-Zentralblatt. 110(151): 2242–2243.

Describes the silvics, wood anatomy, wood properties, and use of *Pterygota* spp. Thirteen species are recognized, 6 in Africa, 4 in Latin America (including *P. amazonica, P. brasiliense [Basiloxylon brasiliensis],* and *P. colombiana)* , and 3 in Asia. A complete list is given of species, synonyms, distribution, and trade and common names.

Gregory, M. 1980. Wood identification: an annotated bibliography. IAWA Bull. New Series. 1(1–2):1–41.

Grupo Andino. 1981. Tables of physical and mechanical properties for 20 wood species from Bolivia (Tablas de propiedades fisicas y mecanicas de la madera de 20 especies de Bolivia). PADT REFORT (Los Proyectos Andinos de Desarrollo Technologico en el Area de los Recursos Forestales Tropicales). Lima, Peru: Junta del Acuero de Cartanegena. 53 p.

Guevara, M.R. 1981. Geographical and within-tree variation in heartwood pH of *Pinus oocarpa* from Honduras. Wood Science. 13(4):220–224.

Heartwood pH values and buffering capacity were measured from the Talanga and Siguatepeque counties in Honduras. Samples were taken at 1.5, 8.2, 14.8, and 21.3 ft up the bole of each tree. Results were analysed using a nested design with repeated samplings. There was a significant difference in heartwood pH between counties. Heartwood pH increased with sampling height. The relationship between heartwood pH and rate of growth, wood density and MOR are discussed. Variation in buffering capacity between counties was not significant. Results show that pH varied between 4.3 and 4.7, and buffering capacity varied between 6.1 and 7.4 ml of 0.025 normal solutions of H2SO4 or NaOH.

Guridi–G., L. 1978. Comparative study of the wood anatomy of some Mexican Sapotaceae. (Estudio comparativo de la anatomia de la madera de algunas sapcataceas mexicanas). Mexico: Direccion General de Investigacion y Capacitacion Forestales. Ciencia Forestal. 3(11):13–34.

Describes 10 species of Sapotaceae found in Mexico, noting that 31 species are found in the country. Tabular data are presented on the macroscopic and microscopic features

of each species. Photomicrographs of each wood are also shown.

Guth, E. 1968/69. Variation of the length of fibers in timber of *Pinus elliottii* (Variacion del largo de fibra en el leno de Pinus elliottii). IDIA (Informativo de Investigaciones Agricolas). Buenos Aires, Argentina: Centro de Investigaciones y Experiencias Forestales. Suplemento Forestales. 5:31.

Guth, E. 1970. Variation of physical and chemical characters in the subtropical species of Pinus located in north Argentina. I. Density and morphology of the tracheids (Variacion de caracteres fisicos y quimicos en especies subtropicales de *Pinus* en localidades del norte Argentina. I. Densidade morfologia de las traqueidas). Buenos Aires, Argentina: Centro de Investigaciones y Experiencias Forestales. IDIA Suplemento Forestales. 6:33.

Guth, E.B. de. 1973. Density and tracheid morphology in species of Pine planted on deep red soils in the province of Misiones, Argentina. IDIA Suplemento Forestales. 8:1–7.

Describes wood specific gravity, fiber length, and weight yield of *Pinus caribaea* var. *caribaea, P. c.* var. *hondurensis, P. c.* var. *bahamensis, P. elliottii, P. taeda,* and *P. oocarpa.*

Guth, E.; Piussan, C. 1987. Variation of the characteristics of the timber of individuals of *Salix nigra* cultivated in the Parana delta. (Variacion de las caracteristicas del leno de individuo en Salix nigra cultivado en el Delta del Parana). Actas del Simposio sobre Silvicultura y Mejoramiento Genetico de Especies Forestales. CIEF–Toma IV. Centro de Investigaciones y Experiencias Forestales, Buenos Aires, Argentina.

Gutierrez–D., M. 1983. Structure and physical and mechanical properties of *Laurelia philippiana* (Caracteristicas estructurales y propiedades fisico-mecanicas de la tepa *(Laurelia philippiana* (Phil.) Loesser)). Ciencias Forestales. 3(1):21–32.

Guyana Timber Export Board. 1979. Guyana timber species: Wallaba *(Eperua falcata).* Georgetown, Guyana: Guyana Timber Export Board. 30 p.

Describes distribution, supply, general characteristics of the tree and wood, drying, mechanical and working properties, durability and uses including specifications for transmission poles, siding, and shingles of *Eucalyptus falcata.*

Hager, H.M. 1971. Physical and mechanical characteristics of woods of the Amazon region (Caracteristicas fisico-mecanicas de madeiras da regiao Amazonica). Belem, Para, Brazil: Superintendencia do Desenvolvimento da Amazonia. SUDAM Documenta. 3(1/4):59–82.

Describes methods of testing and data on mechanical and physical properties of 31 tree species from the Amazon region of Brazil.

Harzmann, L.; Koch, H. 1982. Structural development of tropical hardwoods. (Beitrag zur Kenntnis der Strukturentwicklung bei tropischem Laubholz). Holztechnologie. 23(1):8-13.

Describes studies on *Cedrela odorata,* and *Tetraberlinia bifoliolata,* including information on radial and longitudinal variations of wood density, fibers, and contents of cellulose, lignin, and extractives.

Hayashi, S.; Tsunoda, K.; Nishimoto, K. 1978. Anatomy and properties of tropical woods. Manual III — anatomy of 10 Argentine wood species. Wood Research Review. 12:29.

Heringer, E.P. 1955. Physical properties of the wood of *Trattinicki ferruginea* (Propriedades fisicas de madeira da Trattinicki *ferruginea.* Botetim de Agricultura do Departamento de Producao Vegetal, Secretaria da Agricultura do Estado de Minas Gerais. Belo Horizonte. 4(7/8):27–46.

Higa, A.R.; Kageyama, P.Y.; Ferreira, M. 1973. Variation in the basic density of wood of *Pinus elliottii* and *P. taeda.* Piricicaba, Brazil: IPEF (Instituto de Pesquisas e Estudos Forestains). Publicao Semestral. 7:79–91.

Holdridge, L. 1954. *Cupressus lusitanica* in Costa Rica (El cipres mexicano en Costa Rica). Costa Rica: Boletin Tecnico del Minesterio de Agriculture e Industria. 12:5–31.

Honda, M. 1970. Contribution to the study of the wood of the genus *Vochysia* from Brazilian Amazonia. 11. *V. maxima, V. vismiifolia,* and *V. rufa.* Boletin do INPA. Pesquisas Florestais. 16:11.

Describes species of the genus Vochysia from the Brazilian Amazon region. Both macroscopic and microscopic data are provided to make identification of three species easier *(Vochysia maxima; Vochysia vismiifolia; Vochysia rufa).*

Honda, M. 1970. Contribution to the study of the wood of the genus *Vochysia* from Brazilian Amazonia. *I. Vochysia guinanensis* Aubl., *V. obscura* Warm., and *V. inundata* Ducke. Boletim do INPA. Pesquisas Florestais. 5:15.

Describes species of the genus Vochysia from the Brazilian Amazon region. Both macroscopic and microscopic data are provided to make identification of three species easier (Vochysia guianensis; Vochysia obscura; Vochysia inundata).

Horn, E.F. 1918. Properties and uses of some of the more important woods grown in Brazil. Washington, DC: 1.S. Department of Agriculture, Forest Service. 53 p.

Houkal, D. 1982. Spiral grain in Pinus oocarpa. Wood and Fiber. 14(4):320–330.

Howe, J.P. 1974. Relationship of climate to the specific gravity of four Costa Rican hardwoods. Wood and Fiber. 5(4):347–352.

Increment cores were taken from trees of four hardwood species *(Brosimum* sp., *Cedrela mexicana, Cordia alliodora, Virola koschnyi),* each growing in areas of Costa Rica having widely different climatic conditions (heat, precipitation, humidity). Results show that climate significantly influences the specific gravity of Cedrela mexicana, *Cordia alliodora, V. koschnyi* in different ways, but not significantly effect that of Brosimum sp. Relations between specific gravity and other features of the trees were examined.

Huerta–Crespo, J. 1963. The wood anatomy of 12 Mexican conifers. Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Boletin Tecnico. 8:51.

Discusses the macroscopic and microscopic anatomy of *Abies religiosa, Cupressus benthami, C. lindleyi, Juniperus monosperma, Pinus ayacahuite, P. cembroides, P. leiophylla, P. monophylla, P. nelsoni, P. pinceana, P. quadrifolia,* and *P. strobus rhiapensis.* Gross anatomical features and three microphotographs are given for each species. The structural elements described include tracheids, wood rays, wood parenchyma, growth rings, and resin ducts.

Huerta–C., J.; Cervantes–G., V. 1973. Easy identification of the wood of *Cedrela mexicana, Swietenia macrophylla,* and *Calophyllum brasiliense.* Bosques y Fauna. 10(6):60–64.

Describes characteristics of the wood of the three species, and how to use them for identification; illustrations are provided.

Huerta–C., J. 1975. 100 Mexican woods (100 maderas Mexicanas). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Publicacion Especial. 9:21.

Color photographs of 76 hardwoods and 24 softwoods are presented along with the scientific and common names of each wood.

Hughes, J.F. 1970. A preliminary investigation of some structural features and properties of the wood of Pinus caribaea from British Honduras. Commonwealth Forest. Review 49(4):336–355.

Huizzi, A. 1964. Macroscopic anatomy of some commercial woods of Venezuela and some keys to their identification (Anatomia macroscopica de algunas maderas comerciales de Venezuela y clava para su identificacion). Merida, Venezuela: Universidad de Los Andes. 121 p.

Huizzi, A. 1974. Key for the macroscopic identification of some commercial woods of Venezuela (Clave para la identificacion macrografica de algunas maderas comerciales de Venezuela). Merida, Venezuela: Universidad de los Andes. Acta Botanica Venezuelica. 9(1/4):399–420.

Thirty-four woods listed by common and scientific names, are described and keyed for their identification using macroscopic features.

IBDF. 1981. Amazonian timbers: Characteristics and utilization. (Madeiras da Amazonia: caracteristicas e utilizacao). Brasilia, Brazil: Instituto Brasiliero de Desenvolvimento Florestal. Conselho Nacional de Desenvolimento Cientifico e Technologico. (CNPq). 2 Vol.

IBDF. 1983. Potential woods of Grande Carajas (Potenicial madeireiro do Grande Carajas). Brasilia, Brazil: Instituto Brazileiro de Desenvolvimento Florestal. Laboratorio de Produtos Florestais. 134 p.

IICA (Instituto Interamericanas de Ciencias Agricolas). 1968. Report on a wood testing program carried out for UNDP project 192. Survey and development of selected forest areas, Costa Rica. Turrialba, Costa Rica: Wood Technology Laboratory of the Instituto Interamericanas de Ciencias Agricolas. 134 p.

Institute of Inter-American Affairs. 1947. The forest resources of Paraguay. Special Rep. Washington, DC: Institute of Inter-American Affairs. 112 p.

Instituto Pesquisas Tecnicas. 1956. Tables of results obtained from tests of native woods. (Tabelas de resultados obtidos para madeiras nacionais). Sao Paulo, Brazil: Boletin Instituto Pesquisas Tecnologicas. 31:29 p.

Tests are reported on 300 wood samples.

IUFRO. 1985. Properties and utilization of tropical woods. International Union of Forestry Research Organizations. Manaus, [s.l.]. [Various pagings].

A summary of the proceedings of the IUFRO meeting in Manaus, 1984. Topics cover properties, means to achieve greater utilization, and processing techniques.

Japing, C.H.; Japing H.W. 1960. Woodhandbook of Surinam wood species. (Houthandboek Surinaamse Houtsoorten). Paramaribo, Suriname: Utgave Dienst's Lands Bosbeheer. 264 p.

Japing, H.W. 1957. Tests of the most important mechanical and physical properties of 41 Surinam wood species (Onderzoek naar belangrijkste mechanische en fysische eigenschappen van 41 Surinaamse houtsoorten). The Netherlands: Mededeling No. 122. Instituut voor de Tropen Amsterdam. Afdeling Tropische Production. 46:249.

Japing, H.W. 1960. Data from tests on the most important mechanical and physical properties of 5 well-known Surinam timbers, compared with those of 41 lesser known ones tested earlier (Gegevens van proeven over de belangrijkste mechanische en fysische eigenschappen van 5 bekende Surinaamse houtsoorten, in vergelijking met die van vroeger ondersochte 41 minder bekende soorten). The Netherlands: Mededling Instituut voor de Tropen Amsterdam. 136:57.

Jesus, R.M. de; Vital, B.R. 1986. Comparison between Eucalyptus grandis mother tree and clone densities (Comparacao entre densidades de matrizes e de clones de *Eucalyptus grandis).* Viscosa, MG, Brazil: Revista Arvore. 10(1):82-90.

Karstedt, P.; Mesa, M. 1972. Anatomical description of the xylem of the four indigenous Cuban pines (Descripcion anatomica del xilema de los cuatro pinos endemicos de Cuba). Baracoa. 2(2):24-47.

Describes the microscopic wood anatomy of *Pinus caribaea, P. cubensis, P. occidentalis,* and *P. tropicalis.* Important distinguishing characteristics of the four species are given in tables and photos. Differences are described between the species in pits of the radial parenchyma and between the teeth located in the walls of the radial tracheids.

Karstedt, P.; Mesa, M. 1978. Anatomical description of the xylem of four pines endemic to Cuba (Descripcion anatomica del xilema de los cuatro pinos endemicos de Cuba). In: Proceedings of the 7th World Forestry Congress; 1972 October 4–18; Centro Cultural General San

Martin, Buenos Aires, Argentina. Vol. 5. Instituto Forestal Nacional, Buenos Aires, Argentina: 6365–6369.

Karsulovic–C., T.; Navarrete–M., R. 1977. I. Mechanical properties of commercial woods of Chile. II. Basic strength of some Chilean woods. (I. Propiedades mecanicas de maderas comerciales Chilenas. II. Tensiones basicas de algunas maderas Chilenas). Santiago, Chile: Universidad de Chile, Facultad de Ciencias Forestales. Boletim Tecnico. 46:60.

I. Describes the studies of nine woods: *Aextoxicon punctatum; Araucaria araucana; Eucryphia cordifolia; Fitzroya cupressoides; Nothofagus dombeyi; N. obliqua; N. alpina [N. procera]; Laurelia philippiana;* and Weinmannia *trichosperma.* Mechanical properties are presented for each species, green and at 12 percent moisture content for static and dynamic bending; compression parallel to grain; tension; shear; cleavage; hardness; and nail-holding properties. II. Basic strength data are shown for the same nine species in the green condition.

Keylwerth, R. 1951. Brasil pine. *Araucaria angustifolia.* Tables of wood properties (Araucaria angustifolia. Holzeigenschaftstafeln. Brasilkiefer). Holz Roh- und Werkstoff. 9(5):211–212.

Kribs, D.A. 1927. Comparative anatomy of the woods of the Juglandaceae. Tropical Woods. 12:16-21.

Briefly describes the characteristics of the tree as well as gross and minute anatomy of the genera *Platycarya, Carya, Pterocarya, Juglans, Engelhardtia,* and *Alfaroa.*

Kribs, D.A. 1928. The Persaud collection of British Guiana woods. Tropical Woods. 13:7–46.

Describes the gross and minute anatomy of 68 species. Provides a check list of common names of these species.

Kukachka, B.F. 1979. Wood anatomy of the neotropical Sapotaaeae: VIII. Diploon. Res. Pap. FPL–349. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 4 p.

The genus *Diploon* is represented here by *D. cuspidatum,* which is native to southeastern Brazil. Originally described as *Chrysophyllum cuspidatum* by Hoehne in 1933, it was raised to generic status by Cronquist, A. in 1946. The anatomy of the secondary xylem substantiates this transfer.

Kukachka, B.F. 1979. Wood anatomy of the neotropical Sapotaceae: IX. *Pseudoxythece.* Res. Pap. FPL–350. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 4 p.

Pseudoxythece ambelaniifolia (Sandwith) Aubreville is the sole representative of this genus established by Aubreville in 1972. Floristically and anatomically, its affinities are with Neoxythece (Oxythece). Whether it can be maintained as a distinct taxon remains to be determined.

Kukachka, B.F. 1979. Wood anatomy of the neotropical Sapotaceae: *X. Micropholis.* Res. Pap. FPL–351. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 16 p.

The genus *Micropholis,* originally maintained as a section of the large pan-tropical genus *Sideroxylon,* was raised to the generic status in 1891 by Pierre. The genus was adopted by most students of the family with exception of Baehni who reduced the various species to synonomy within his very large and overwhelming genus Pouteria. This study of the wood anatomy confirms the establishment of Micropholis as a distinct entity among the American Sapotaceae.

Kukachka, B.F. 1979. Wood anatomy of the neotropical Sapotaceae: XI. *Prieurella.* Res. Pap. FPL–352. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 8 p.

Prieurella currently consists of seven South American species. The best known and most abundantly collected species are *P. cuneifolia* (Rudge) Pierre and *P. prieurii* (A.DC.) Aubr. Since 1964, five additional species have been described by Aubreville: *colombiana, lanceolata, maguirei, manaosensis,* and *wurdackii.* For many decades the original species were maintained under *Chrysophyllum* until Pierre established the genus Prieurella in 1891. The wood anatomy substantiates the separation from *Chrysophyllum.*

Kukachka, B.F. 1979. Wood anatomy of the Neotropical Sapotaceae: XII. *Neoxythece.* Res. Pap. FPL–353. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 10 p.

The genus *Neoxythece* consists of a small number of species concentrated in the Amazon region and northern South America with a single species native to the West Indies. Anatomically and physically, the woods investigated appeared to be a very closely related group. They were light brown, very heavy, and characterized anatomically by their narrow banded parenchyma, pores in radial/echelon arrangement, abundant vascular tracheids, long vessel members, and the presence of silica in the wood rays. Woods of Caramuri could not be anatomically distinguished from Neoxythece and have been included in the latter. It seems likely that *Pseudoxythece* will also be reduced to synonomy.

Kukachka, B.F. 1979. Wood anatomy of the neotropical Sapotaceae: XIII. *Podoluma.* Res. Pap. FPL–354. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 4 p.

The wood anatomy described here is based on the only available specimen of the genus and is represented by *Podoluma benai* from French Guiana. The specimen represents mature wood from the type tree. The wood is readily differentiated from the other hard, heavy, and dark colored Sapotaceae by the presence of microcrystals in the axial parenchyma.

Kukachka, B.F. 1980. Wood anatomy of the neotropical Sapotaceae. XIV. *Elaeoluma.* Res. Pap. FPL–358. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 6 p.

The genus *Elaeoluma* consists of three species distributed in the Amazon Basin, Surinam, Guyana, and Venezuela. The description presented here is based on *E. glabrescens* of the Amazon Basin. The wood is easily differentiated from all other neotropical Sapotaceae by its pale brown color, reticulate parenchyma, which is hardly discernible with a hand lens, and a low relative density averaging 0.50.

Whether the correct nomenclature is Elaeoluma or *Gymnoluma* is problematical and remains to be resolved by a monographer.

Kukachka, B.F. 1980. Wood anatomy of the neotropical Sapotaceae. XV. *Sandwithiodoxa.* Res. Pap. FPL–359. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 4 p.

Sandwithiodoxa is a monotypic genus established by Aubreville and Pellegrin. making the new combination *Sandwithiodoxa egregia* (Sandw.) Aubr. and Pellegr. The wood is light brown, very hard, and heavy with an average relative density of 1.09. Individual specimens attain a relative density of 1.21. Floristically it is said to have affinities with *Sarcaulus* and *Pseudocladia,* but anatomically it differs from these genera in several details.

Kukachka, B.F. 1980. Wood anatomy of the neotropical Sapotaceae. XVI. *Paralabatia.* Res. Pap. FPL–360. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 6 p.

Paralabatia is a small genus of five or six species ranging from the Amazon to the West Indies. From the anatomical standpoint the genus as constituted by Aubreville forms a group of closely related species. In marked contrast, the four species cited by Baehni belong to four different anatomical groups. The woods of *Paralabatia* are somewhat similar to those of Neoxythece but can be readily distinguished by the smaller pores and shorter vessel members characteristic of *Paralabatia.*

Kukachka, B.F. 1980. Wood anatomy of the neotropical Sapotaceae. XVII. *Gambeya.* Res. Pap. FPL–361. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 6 p.

Gambeya is an African genus to which Aubreville added *Gambeya excelsa* (Huber) Aubr., based on the Amazonian *Chrysophyllum excelsum* Huber. Whether *Gambeya* is the appropriate taxon for the American species remains to be resolved. Wood specimens indicate that several species occur in the Americas ranging from Southern Mexico to the Peruvian Amazon. The woods of the neotropical *Gambeya* are an off-white color unique among the predominant browns and red browns typical of the Sapotaceae. The wood is further distinguished by the radial arrangement of the pores, reticulate parenchyma, lack of silica, and the presence of microcrystals in the wood rays and axial parenchyma. A unique genus of the Sapotaceae.

Kukachka, B.F. 1980. Wood anatomy of the neotropical Sapotaceae. XVIII. *Gomphiluma.* Res. Pap. FPL–362. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 3 p.

As now constituted, *Gomphiluma* consists of two species of small trees limited to the Brazilian Amazon. Formerly submerged in the large genus *Pouteria*, *Gomphiluma* was reinstated to generic status by Aubreville in 1961. The pale brown wood of moderate density is quite unlike that of *Pouteria* and appears more nearly allied with certain species of *Micropholis.*

Kukachka, B.F. 1980. Wood anatomy of the neotropical Sapotaceae. XIX. *Chromolucuma.* Res. Pap. FPL–363. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 4 p.

Chromolucuma was established by Adolpho Ducke in 1925 based on the single species *C. rubriflora* native to the middle amazon of Brazil. A second species, *C. baehniana,* was described in 1949 by Monachino. It occurs in the Amazon and Guyana. A third species, *C. sericea,* was named by Gilly but it is not known at the present time whether this was validly published. Anatomically the affinities of *Chromolucuma* appear to be with *Pouteria* (sensu Aubreville) but it differs from the latter in several respects.

Kukachka, B.F. 1981. Wood anatomy of the neotropical Sapotaceae. XX. Manilkara. Res. Pap. FPL–371. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 13 p.

Consisting of about 32 neotropical species, the genus *Manilkara* has a widespread distribution in the Americas ranging from southeastern Brazil and northern Bolivia as far north as southern Florida. It is probably the most important of the American genera, being the source of commercial timbers, fruits, and gums. *Manilkara,* as constituted here, consists of a generic complex that includes *Achras, Muriaeanthe, Schaferodendron, Manilkariopsis,* and *Chiclea.* This complex exhibits remarkable anatomical uniformity; the variability exhibited between genera is no greater than that which may be encountered within a single species.

Kukachka, B.F. 1981. Wood anatomy of the Sapotaceae. XXI. *Barylucuma.* Res. Pap. FPL–372. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 3 p.

Barylucuma decussata, the sole member of the genus, was established in 1925 by Adolpho Ducke. Eyma (1936) suggested its affinity with *Pouteria* and *Baehni* (1942) made the new combination *Bouteria decussata* (Ducke) Baehni. In 1942, Ducke revised his opinion regarding the status of his new genus indicating that it was untenable but did not suggest its placement in one of the known genera. Aubreville (1961) retained *Barylucuma* as distinct. Anatomically and physically the wood of Barylucuma is similar to certain species of *Neoxythece, Paralabatia,* and *Myrtiluma,* but seems to be most closely allied with *Podoluma.*

Kukachka, B.F. 1981. Wood anatomy of the neotropical Sapotaceae. XXII. *Pradosia.* Res. Pap. FPL–373. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 10 p.

As constituted here, the genus *Pradosia* consists of a group of closely related species including the species attributed to *Glycoxylon* and *Neopometia.* The members of Pradosia are readily separable anatomically from other American Sapotaceae by the presence of silica in the wood rays and of microcrystals (crystal sand) in the axial parenchyma. Although *Podoluma* does share these features with *Pradosia,* it has much larger pores arranged in a clustered-echelon arrangement.

Kukachka, B.F. 1981. Wood anatomy of the neotropical Sapotaceae. XXIII. *Gayella.* Res. Pap. FPL–374. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 3 p.

Gayella splendens (A. DC.) Aubr., the sole member of this genus, is a tall shrub, endemic to Chile. Baehni (1965) and Eyma (1936) place *G. splendens* in Pouteria but Aubreville (1961) recognizes *Gayella* as distinct. Anatomically, the alliance of Gayella is not with Pouteria but with *Pradosia* and particularly with *P. lactescens* and *ptychandra.*

Kukachka, B.F. 1981. Wood anatomy of the neotropical Sapotaceae. XXIV. *Ecclinusa.* Res. Pap. FPL–395. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 6 p.

Ecclinusa is a small genus of South American species characterized by their pale-brown, roseate, or sometimes rust-colored woods of medium density (relative density averages 0.71). The small pores are in clustered-echelon arrangement or in laterally spaced files in echelon or radial arrangement. Ecclinusa is a silica-accumulating genus, attaining concentrations of 2.05 percent in *E. guianensis.* Since its inception in 1839, the genus has remained remarkably stable and has few synonyms.

Kukachka, B.F. 1981. Wood anatomy of the neotropical Sapotaceae. XXV. Ragala. Res. Pap. FPL–396. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 5 p.

Ragala is a small genus of 4 species limited to the Guianas and the Amazon Basin. At one time its species were included in the genus Ecclinusa and another time both *Ecclinusa* and Ragala were a part of the very large genus *Chrysophyllum.* This study of the wood anatomy supports the separation of *Ecclinusa* and *Ragala* as well as their removal from *Chrysophyllum. Ragala* is a silica-accumulating genus.

Kukachka, B.F. 1981. Wood anatomy of the neotropical Sapotaceae. XXVI. *Myrtiluma.* Res. Pap. FPL–397. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 5 p.

Myrtiluma eugeniaefolia (Pierre) Baillon, the sole member of this genus, is limited to northern South America and the lower Amazon Basin. It was originally described as a species of *Micropholis* and at a much later date was reduced to synonomy under *Pouteria.* Anatomically it shows little affinity with *Micropholis* or *Pouteria* but would appear to be closely allied with *Sandwithiodoxa.* The wood is among the heaviest of the Sapotaceae.

Kukachka, B.F. 1981. Wood anatomy of the neotropical Sapotaceae. XXVII. *Sarcaulus.* Res. Pap. FPL–398. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 5 p.

This study is based on wood specimens of Sarcaulus brasiliensis (A. DC.) Eyma which was, for a long time, the sole representative of the genus. [A second species, *S. wurdackii* Aubr., was described in 1965 from Peru; wood of the latter species was not available for this study]. The genus is anatomically well-defined and, although the topography is rather similar to some species of *Ecclinusa* and *Ragala,* it can be readily separated by several anatomical features.

Kukachka, B.F. 1982. Wood anatomy of the neotropical Sapotaceae. XXVIII. *Labatia.* Res. Pap. FPL–416. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 5 p.

The genus *Labatia,* first described in 1788, was maintained as a distinct entity until the 1930s when it was submerged in Pouteria. In 1972, it was reestablished as the new genus *Neolabatia* and stated to be very closely related to the earlier described genus *Pseudolabatia.* Anatomically, *Psuedolabatia* is here regarded as a synonym of *Labatia* and, because of the appreciable differences in wood anatomy, Labatia is here regarded as distinct from Pouteria.

Kukachka, B.F. 1982. Wood anatomy of the neotropical Sapotaceae. XXIX. *Eglerodendron.* Res. Pap. FPL–417. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 3 p.

The monotypic genus *Eglerodendron pariry* (Ducke) Aubr. and Pellegr. is based on *Lucuma pariry* Ducke. The wood is physically similar to *Pouteria* but readily separated from the latter by (1) wider and more conspicuous axial parenchyma bands and (2) wood ray commonly 3 to 4 seriate, with an appreciably higher maximum body height. This species is known only from the Amazon Basin.

Kukachka, B.F. 1982. Wood anatomy of the neotropical Sapotaceae. XXX. Pseudocladia. Res. Pap. FPL–418. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 3 p.

Pseudocladia is a small genus of six species of trees occurring in Guyana, Surinam, Brazil, and adjacent Venezuela. Although first described by Pierre in 1891, it soon became submerged in the extremely large genus Pouteria until 1961 when Aubreville reinstated it to generic status. The woods are very hard, heavy, and rather drab brown and lusterless. Its affinities appear to be with Sandwithiodoxa which occupies the same range.

Kukachka, B.F. 1982. Wood anatomy of the neotropical Sapotaceae. XXXV *Urbanella.* Res. Pap. FPL–423. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 6 p.

Kukachka, B.F. 1982. Wood anatomy of the neotropical Sapotaceae. XXXVI. *Syzygiopsis.* Res. Pap. FPL–424. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 4 p.

Syzygiopsis consists of three species, oppositifolia and oblanceolata native to Amazonia and sericea of adjacent Venezuela. Syzygiopsis was first described by Adolpho Ducke in 1925 and consisted of the single species, *S. oppositifolia.* Later he had some doubts regarding the taxanomic status of his new genus but did not suggest any possible alternatives or alliances. In 1942 Baehni transferred Ducke's monotypic genus to Pouteria, producing the new combination Pouteria oppositifolia (Ducke) Baehni; in 1957 van Royen, making it a part of the large Asiatic genus *Planchonella.* Anatomically, the wood shows little, if any, alliance with *Planchonella* but shares some features with species of *Pouteria.*

Kukachka, B.F. 1982. Wood anatomy of the neotropical Sapotaceae. XXXVII. Genus novo. Res. Pap. FPL–425. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 3 p.

This anatomical group or genus is represented by a number of specimens from Brazil bearing the name

Syzygiopsis pachycarpa Pires, *S. oblanceolata* Pires, *S. oppositifolia,* and a number of unassigned specimens from Panama, Surinam, and Venezuela. On the basis of wood color and anatomy, the woods of this group are very different from the *Syzygiopsis* described earlier in this series and cannot be included in that genus because they exhibit little or no degree of alliance. The members of this group also are separable anatomically from both *Bumelia* (Group B) (FPL Res. Pap. 325 in this series) and *Panchonella* (Asiatic) and may well represent an undescribed genus. It appears quite probable that several species are represented here.

Kukachka, B.F. 1982. Wood anatomy of the neotropical Sapotaceae. XXXVIII. Miscellaneous. Res. Pap. FPL–426. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 5 p.

Described here are three very distinctive specimens from eastern Brazil and a specimen from Amazonian Colombia alleged to be *Piresodendron ucuqui* (syn. *Pouteria ucuqui).* The Brazilian specimens are rather unique in that the pores are in clustered- echelon arrangement (resembling the woods of *Bumelia* (Group A) of the continental United States) and the occurrence of silica in the woods rays. The Colombian specimen of *Piresodendron* is poorly documented but because it may be the only extant wood specimen of this genus, an anatomical description has been provided for the record.

Kukachka, B.F.; McClay, T.A.; Beltranena–M., E. 1968. Selected properties of 52 timber species from the department of El Peten, Guatemala (Propiedades seleccionadas de 52 especies de madera del departamento del Peten, Guatemala). Proyecto de Evaluacion Forestal, FAO–FYDEP Boletin No. 2. Rome, Italy: United Nations, Food and Agriculture Organization. 88 p.

Provides description of woods and their range. Data of physical and mechancial properties include shrinkage, hardness, density, bending, and uses.

Labate, P.J. 1974. Study of the physical-mechanical properties of wood of Pinus elliottii cultivated in the Delta of Parana (Esstudio de las propiedades fisico-mecanicas de la madera de Pinus elliottii cultivado en el Delta del Parana - su evaluacion). Buenos Aires, Argentina: Instituto Forestal Nacional. Folleto Technico Forestal. 35:11.

Labate, P.J. 1975. Evaluation of the wood of indigenous and exotic forest species according to their physical and mechanical properties. Buenos Aires, Argentina: Instituto Forestal Nacional. Folleto Technico Forestal. 36:19.

Describes a large number of commercial native Argentine woods and some potentially useful secondary and exotic species. Data tabulated include: radial, tangential, and volumetric shrinkage when dried from green moisture content to 12 to 15 percent moisture content (air-dry); density (kg/m^3) and hardness (kg/cm^2); modulus of rupture in longitudinal compression and specific index (m.o.r./100 X density 2); modulus of rupture in bending and bending index (m.o.r./100 X specific gravity); and measures of resistance to cutting, splitting, tensile stress, etc. Values in tables are grouped into hardness classes, strength classes, and flexibility classes.

Ladrach, W.E. 1978. Recapitulation of the taxonomy and establishment of a wood library of commercial species for the region of Bajo Calima. Cali, Colombia: Celulosa y Papel de Colombia SA. Investigacion Forestal. 35:16.

Describes the density and fiber length of 99 common wood species in the area of Bajo Calima, Colombia. Also listed are a total of 258 species by family and common names. Wood samples of the 99 species have been used to establish the library.

Lamb, A. 1946. Notes on forty-two secondary hardwood timbers of British Honduras. British Honduras: Forestry Department Bull. 1:123.

Langwig, J.E.; Skaar, C. 1975. Electrical resistivities of 18 Venezuelan and 13 North American hardwoods. Wood Science. 8(1):350-354.

Tabulates equations for DC resistivities parallel and activation energies for electrical conduction as functions of moisture content and temperature on the basis of resistivity measurements on 11 North American and 18 tropical Venezuelan wood species. Relations between the logarithm of resistivity and m.c. (range 8 to 20 percent) were linear at constant temperature. The logarithm of resistivity was linear with the reciprocal of Kelvin temperature from 283° to 323°K (10 to 50°C). Activation energies for electrical conduction and temperature corrections for moisture meters were calculated by analysis of the data. Differences between the resistivities of the Venezuelan and N. American groups of species were not significant.

Lao–M., R. 1969. Catalog of principle forest species of Peru (Catalogo preliminar de las especies forestales del Peru). Revista Forestal del Peru. 3(2):3–61.

Lists 685 species by family and common names, and provides bibliographic references to each.

Lastera–R., J.A. 1986. Compilation of the physical-mechanical properties and possible uses of 178 Columbian woods. (Compilacion de las propiedades fisico-mecanico y usos posibles de 178 maderas de Colombia. Bogota: Asociacion Colombiana de Ingenieros Forestales, Libro tecnico 1:75.

Lastra,–R., J.A.; Royas–L., H. 1971. Some physical and mechancial properties of three Columbian woods (Algunas propiedades fisicas y mecanicas de tres maderas Colombianas). Bogata, Colombia: Instituto de Investigaciones y Proyectos Forestales y Madereras. 24 p.

Standard properties of *Dialyanthera parvifolia, Campnosperma panamaensis,* and *Brosimum utile* are listed.

Latham, Bryan. 1957. Timber, its development and distribution, a historical survey. London: George G. Harrap and Co. 303 p.

Latorre, F.; Vivero, W.; Barrera, M.E. 1975. Wood of three tree species from Ecuador (Leno de tres especies arboreas Ecuatorianas). Instituto Ciencias Naturales, Quito, Ecuador. Ciencia y Naturaleza. 16(1):3–12.

Describes, with photomicrographs the microscopic characteristics of the wood structure of duco *(Clusia* sp.), achotillo *(Vismia baccifera),* and bella maria (Vochysia sp.).

Lebacq, L.; Hinostroza–C., D.; Bravo–M., M.; Ayuque–A., C. 1973. Classification of woods from Amazonian Peru (anatomical and physical characteristics). Documentation Economique, Musee Royal de l'Afrique Centrale, Tervuren. 3:1-124.

Describes studies of a large number of woods from the Amazonian region of Peru. Tabular data on anatomical and physical characteristics of the specimens are given with lists of the woods alphabetically by common and scientific names with vernacular equivalents and by vernacular names with scientific equivalents. Some of the woods have not yet been identified.

Leonardo, P.B. 1968. Commercial woods of Brazil (Madeiras commercais Brasleiras). Sao Paulo, Brazil: Instituto de Pesquisas Tecnologicas. 857:25.

Lepe, B.G. 1959. Anatomy and histology of 21 species of trees of Chiapaneco (Estructura anatomica e histologica de un grupo de 21 especies del bosque Chiapaneco). Inst. Mex. Invest. Tec. 199 p.

Lima, J.T.; Della Lucia, R.M.; Vital, B.R. 1986. The influence of moisture on mechanical properties of woad from *Eucalyptus saligna* Smith (Influencia do teor de umidade nas propiedades mecanicas de madeira de Eucalyptus saligna Smith). Vicosa, MG, Brazil: Revista Arvore. 10(1):27-43.

Lincoln, W.A. 1986. World woods in color. New York: MacMillan. 320 p.

Link, R.R. 1954. Study of native timbers (Estudio sobre maderas indigenas. Uruguay). Silvicultura. 5:7–62.

Physical and mechanical properties are provided for 11 species.

Lisboa, H. 1983. Technical side of Chilean pine. Division of Planning and Development, Arauco Co. Ltd., Chile. Wellington, New Zealand, Department of Internal Affairs. 8 p.

Describes Chilean pine (Pinus radiata) with data on wood density, strength, drying and shrinkage, decay and preservation, and uses. Comparisons are made with P. radiata grown in New Zealand and other Chilean conifers.

LNPF (Laboratorio Nacional de Productos Forestales). 1974. Characteristics, properties, and uses of 104 woods of the high western plains (Caracteristicas, propiedades, y usos de 104 maderas de los altos llanos occidentales). Merida, Venezuela: Universidad de los Andes, LNPF. 106 p.

Provides standard properties of 104 woods.

Londono–A, A. 1967. Structural anatomy of 20 woods of Colombia and keys to their identification (Estructura anatomica de 20 maderas colombianas y clave para su identificacion). Merida, Venezuela: Universidad de Los Andes. 62 p.

Longwood, F.R. 1962. Present and potential commercial timbers of the Caribbean—with special reference to the West Indies, the Guianas, and British Honduras. Agric. Handb. 207. Washington, DC: U.S. Department of Agriculture.

Presents a summary of information on 71 important timbers of the area. Includes: distribution and habitat; descriptions of tree and wood; seasoning and shrinkage; strength properties; working properties; natural resistance; and permeability.

Lopes, C.A.C.; Pinto, R.G.; Dourado, R.S.A.[and others]. 1983. Contribution to the anatomical study of some woods of Amazonia (Contribuicao ao estudo anatomico de algumas madeiras da Amazonia). Belem, Para, Brazil: Superintendencia do Desenvolvimento da Amazonia. 23 p.

The following woods from Para are covered: *Bombax globosum; B. longipedicellatum, Hevea guianensis; Mouriri brevipes, Sacoglottis guianensis, Stryphnodendronsp., Pithecolobium pedicellare, P. amplissimum, Neea* sp., *Qualea* cf. *dinizii.*

Lopez, H.; Ortega, F. 1989. Tree angiosperms of Mexico, No. 2, anatomy of 11 species (Angiospermas arboreas de Mexico, Num. 2, Anatomia de once especies). In: Boletin Tecnico, La Madera y Su Uso 23. Mexico, DF, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, INIREB. 128 p.

Describes the anatomy, nomenclature, and ecology of the following species: *Acer saccharus* Marsh subsp. skutchii (Rehder) E. Murray; *Avicennia germinans* (L.) L.; *Carya ovata* (Mill.) K. Koch var. mexicana (Engelm. ex Hemsley) M.; *Casuarina erectus* L.; *Casuarina equisetifolia* L.; *Conocarpus erectus* L.; *Eysenhardtia polystachya* (Ort.) Sarg.; *Haematoxylon campechianum* L.; *Laguncularia racemosa* (L.) Gaertn; *Magnolia schiedeana* Schlecht; and *Rhizophora mangle* L.

Loureiro, A.A. 1976. Macroscopic and microscopic study of the anatomy of 10 species of the genus *Aniba* (Lauraceae) from Amazonia (Estudo anatomico macro e microscopica de 10 especies do genero Aniba (Lauraceae) da Amazonia). Acta Amazonica. 6(2, supl.):1–85.

Loureiro, A.A.; Lisboa, P.L.B. 1979. Wood anatomy of six species of *Ormosia* (Leguminosae) from the Amazon Basin (Anatomia do lenho de seis especies de *Ormosia* (Leguminosae) da Amazonia). Acta Amazonica. 9(4):731-746.

Covers several species of Leguminosae found in the Amazon, including *Ormosia coccinea, O. costulata, O. flava, O. macrocalyx, O. nobilis,* and *O. paraensis.* Macro- and microscopic anatomy and common uses of the woods are noted.

Loureiro, A.A.; Rodrigues, W.A. 1975. Anatomical study of the wood of the genus *Swartzia* (Leguminosae) from Amazonia–I. Acta Amazonica. 5(1):79–86.

Describes *Swartzia laevicarpa, S. recurva,* and *S. ulei* wood anatomy with photomicrographs (macroscopic and microscopic), and discusses botany, nomenclature, habitat,

distribution, and gives data on the general characteristics and common uses of the woods.

Loureiro, A.A. and Silva da Freitas, M. 1968. Catalog of Amazon trees (Catalogo das madeiras da Amazonia). Belem, Brazil: Superintendencia do Desenvolvimento da Amazonia (SUDAM). 2 Vols: Vol. 1, 429 p.; Vol. 2, 411 p.

Survey of 117 species including information on nomenclature, distribution, anatomy, and uses.

Loureiro, A.A.; Silva, da Freitas, M. 1977. Dendrology and wood anatomy of three species of *Qualea* (Vochysiaceae) from Amazonia (Contribuicao para o estudo dendrologico e anatomico da madeira de tres especies de Qualea (Vochysiaceae) da Amazonia). Acta–Amazonica. 7(3) : 407–416.

Describes the macro- and microscopic wood anatomy, the botany, distribution, habitat, and uses of *Qualea albiffora, Q. cassiquiarensis* and *Q. paraensis.*

Loureiro, A.A.; Silva, da Freitas, M.; Alencar, J. da C. 1979. Wood species of the Amazon. (Essencias madeireiras da Amazonia). Manaus, Amazonas, Brazil: Instituto Nacional de Pesquisas da Amazonia. 2 vol.

Provides descriptions of 105 woods native to Amazonia.

Loureiro, A.A.; Silva, da Freitas, M.; Vasconcellos, F.J. de. 1984. Contribution to the anatomical study of the wood of 7 species of Dimorphandra (Leguminosae - Caesalpinioideae) (Contribuicao ao estudo anatomico do lenho de 7 especies de Dimorphandra (Leguminosae - Caesalpinioideae)). Acta–Amazonica. 14(1-2):289-313.

Covers *Dimorphandra conjugata, D. gardneriana, D. gigantea, D. mollis, D. multiflora, D. pullei,* and *D. unijuga.*

Loureiro, A.A.; Silva, da Freitas, M. 1981. Dendrological and anatomical study of the wood of 7 species and 3 subspecies of Dimorphandra (Leguminosae-Caesalpinioideae) (Estudo dendrologico e anatomico do lenho de 7 especies e 3 subespecies de *Dimorphandra* (Leguminosae-Caesalpinioideae)). Acta–Amazonica. 11(3):561-581.

Primarily provides microanatomy of several species, but also provides distribution and ecological information for them.

Loureiro, A.A.; Vasconcelos, F.J. de; Alburquerque, B.W.P. de. 1981. Wood anatomy of 4 Amazonian species of *Zanthoxylum* (Rutaceae) (Anatomia do lenho de 4 especies de Zanthoxylum Linnaeus (Rutaceae) da Amazonia). Acta–Amazonica. 11(4):809–820.

Anatomy, uses, distribution, and ecology of *Z. compactum, Z. dellomei, Z. [Fagara] machadoi,* and *Z. rhoifolium [F. rhoifolia].*

Loureiro, A.A.; Vasconcellos, F.J. de; Freitas, J.A. de. 1983. Anatomical study of the wood of 5 species of *Sclerolobium* and 5 species of *Tachigalia* (Leguminosae) of Amazonia (Contribuicao ao estudo anatomico do lenho de 5 especies de *Sclerolobium* e 5 especies de *Tachigalia* (Leguminosae) da Amazonia). Acta Amazonica. 13(1):149–170.

Presents the uses, microscopic anatomy, and general features of ten woods from the Amazon. The species studied include: *Sclerolobium* chrysophyllum, *S. eriopetalum, S. hypoleucum, S. melanocarpum, S. subbullatum, Tachigalia alba, T. cavipes, T. myrmecophila, T. paniculata,* and *T. plumbea.*

Luca, L. de; Abbate, M.L.E. 1983. Anatomical defects found in a Chilean wood sample, *Eucryphia cordifolia* Cav. (Alterazioni anatomiche riscontrate in un campione di legno cileno: Eucryphia cordifolia Cav). Rivista di Agricoltura Subtropicale e Tropicale. 77(3):381–395.

An anatomical study of a Chilean sample of *Eucryphia cordifolia* revealed a series of deep, close, vertical undulations, resembling wavy grain in section. Comparisons showed a similarity between this defect and that found in frost-damaged wood.

Macbride, J.F. 1929. Identity of the Peruvian Balsa. Tropical Woods. 17:5–7.

Comments of the need for better study of the systematics and anatomy of members of the *Ochroma* genus, which is distributed throughout Latin America.

Machado, O.X. de B. 1949. Tinguaciba of the saltmarsh *Fagara arenaria* (Tinguaciba da restinga, Fagara arenaria Engl). Rodriguesia. 12(24):79-119.

Mainieri, C. 1958. Brazilian timbers 2: Description, common uses, and physical and mechanical properties (Madeiras do Brasil, 2: Sua caracterizacao, usos comuns e indices qualificativos fisicos e mecanicos). Publicacao IPT 573. San Paulo, Brazil: Instituto de Pesquisas Tecnilogicas. 108 p.

Mainieri, Calvino. 1958. Identification of the principal commercial woods of Brazil (Identificacao das principais madeiras de comercion no Brasil). Sao Paulo, Brazil: Instituto de Pesquisas Tecnologicas. Boletim. 46:189.

Mainieri, C. 1970. Brazilian woods (Madeiras brasileiras). Sao Paulo, Brazil: Instituto Florestal. 109 p.

Describes 108 species or species groups of Brazilian woods, including common and scientific names, description of the trees, illustration of leaves, general wood characteristics and uses, and their geographical distribution.

Mainieri, C. 1971. Twenty-five Amazonian woods of commercial value, characterization, microscopic anatomy, common uses, and qualitative indices (25 madeiras da amazonia de valor comercial, caracterizacao, microscopia, usos comunse, indices qualificativos). Sao Paulo, Brazil: Instituto de Pesquisas Tecnologicas. Publ. 798. 33 p.

Describes the mechanical, physical, and other properties of 25 Brazilian woods, 17 from Para and 8 from Amazonas.

Mainieri, C. 1972. Contribution to the anatomical study of the woods of the eastern region of Paraguay (Contribucion al estudio anatomico de las maderas de la region

oriental del Paraguay). FAO Report FAO:SF/PAR 15. Asuncion, Paraguay: Documento de Trabajo 4:86.

Describes the macroscopic anatomy of 45 Paraguayan woods using a 10X hand lens. Also described are different uses of the woods and a classification system with four different commercial categories.

Mainieri, C. 1973. Timbers of the south coast: states of Sao Paulo, Parana and Santa Catarina. Botanical and common names, general characteristics and common uses. Sao Paulo, Brazil: Instituto Florestal. Boletim Tecnico. 3:86.

Describes several hundred native broadleaved species of the South coastal region of Brazil, listing common names and synonyms, and scientific names. More than 150 genera, species, and species- groups are presented. Also given are data on the physical and mechanical properties of the woods and some uses.

Mainieri, C. 1978. Book of characteristics of wood of Brazil (Fichas de caracteristicas das madeiras Brasileiras). Publicacao IPT 966. Sao Paulo, Brazil: Instituto de Pesquisas Tecnologicas, Divisao de Madeiras. 360 p.

Mainieri, C.; Chimelo, J.P.; Alfonso, V.A. 1983. Manual for identification of the principal commercial timbers of Brazil (Manual de identificacao das principais madeiras comerciais brasileiras). Publicacao, Instituto de Pesquisas Tecnologicas, Brazil. No. 1226. Serie Publicacoes Especiais. 14:241.

Provides comprehensive information on 268 Brazilian woods, including macroscopic anatomy, distribution, photomicrographs, nomenclature, and more.

Mainieri, C.; Chimelo, J.P. 1989. Tables of characteristics of Brazilian woods (Fichas de caracteristicas das madeiras Brasileiras). 2nd ed. Sao Paulo, Brazil: Instituto de Pesquisas Tecnologicas Divisao de Madeiras. Publication IPT 1791. 418 p.

Mainieri, C.; Pereira, J.A. 1965. Brazilian timbers: macroscopic characteristics, common uses, and physical and mechanical properties. An. Bras. Econ. Flor. Inst. Nac. Pinho. 17:135–416.

Mainieri, C.; Pires, J.M. 1973. The genus Podocarpus in Brazil. Silvicultura em Sao Paulo. 8:1–24.

Describes 6 species of Podocarpus: 4 found at the northern limit of the Amazon region, and *P. lambertii* and *P. sellowii* found widely distributed in southern Brazil have their wood anatomy described. Differentiating characters include height of the rays is >15 cells in *P. lambertii* and <15 cells in *P. sellowii*. A rare exception is *P. sellowii* trees from Vilhena, which can have rays 30 cells high. *P. sellowii* has slightly more abundant longitudinal parenchyma, and the tracheids of *P. lambertii* are slightly shorter.

Marchiori, J.N.C. 1986. Descriptive anatomy of the wood of *Terminalia australis* (Combretaceae) (Anatomia descritiva da madeira de amarilho, Terminalia australis Camb. (Combretaceae)). Revista do Centro de Ciencias Rurais. 16(4): 329–340.

Reports on microanatomy of material collected from Brazil.

Marchiori, J.N.C. 1987. Wood anatomy of *Randia armata* (Sw.) DC. (Anatomia da madeira de limoeiro-do-mato, *Randia armata* (Sw.) DC.). Revista do Centro de Ciencias Rurais. 17(1–2):39–48.

Includes macroscopic and microscopic features of herbarium samples.

Marquez, Y.O.; Caballero–D., M. 1982. Study of the variation of some characteristics of *Pinus strobus* var *chiapensis* Martinez, from three locations in the natural distribution; relative density and length of tracheids of the wood (Estudio de la variacion de algunas caracteristicas de Pinus strobus var. chiapensis Martinez de tres localidades de su distribucion natural I, densidad relitiva y longitud de traqueida de la madera). Mexico, D.F., Mexico: Ciencia Foresta1. 7(37):3-18.

Martinez, M. 1928. The most useful plants existing in the Republic of Mexico (Las plantas mas utiles que existen en la Republica Mexicana). Mexico D.F, Mexico. 381 p.

Mattos, N.F.; Guaranha, J. 1983. Study of grapia *(Apuleia leiocarpa)* (Contribuicao ao estudo da grapia *(Apuleia leiocarpa)).* Porto Alegre, Brazil. Instituto de Pesquisas de Recursos Naturais Renovaveis. Publicacao IPRNR.

Mechanisch-technologisches Institut der Reichsanstalt fur Holzforschung. 1941. Wood properties table (Mahagoni) (Holzeigenschaftstafel (Mahagoni)). Holz als Roh- und Werkstoff. 4(11):411–412.

Melo, E.C. 1950. A dendrological study of forest species of Italiaia National Park, and the anatomical characteristics of the woods. (Parque Nacional do Italiaia. Estudo dendrologico de essencias florestais do parque Nacional de Italiaia e os caracteres anatomicos de sons lenhos). Boletim Servico Florestal Ministerio da Agricultura, Rio de Janeiro. 2:174.

Descriptions of 30 hardwood species.

Mendes, M.J.B.; Paula, J.E. de. 1980. Studies on *Ouratea nitida* (Sw.) Engl. from the State of Alagoas (Contribuicao para o conhecimento de *Ouratea nitida* (Sw.) Engl., ocorrente no Estado de Alagoas. Brasil Florestal. 10(41):51–61.

Describes the wood, foliage, and seed anatomy for this Brazilian tree.

Migone, E.; Preston, S.B. 1955. Physical and mechanical properties of certain woods from Paraguay. Ann Arbor, MI: Michigan Wood Technology. 7:4.

Strength, density, and colorific values are provided for nine species.

Milanez, F.R. 1936. Anatomy of the wood of Pau mulato (Anatomia do lenho do Pau mulato). Rio de Janeiro, Brazil: Archnos Instuto Vegetal. 3:111–129.

Milanez, F.R.; Mattos Filho, A. de. 1956. The occurrence of silica in the wood of Leguminosae (Nota sobre a

occorrencia de silica no lenho de leguminosas). Rodriguesia. 18/19(30/31):7–16.

Miller. R.B. 1986. Timbers of Central and South America. In: Bever, M.B., ed. Encyclopedia of Materials Science and Engineering. Elmsforth, N.Y.: Pergamon Press, Inc. 8:5025–5031.

Mills, T.H. 1957. Timber trees of the Northern Chiapas. Mexico City, Mexico: Cosmos. 230 p.

Provides range data for species in Latin America and very general descriptions of the woods.

Montagna, R.G.; Barbosa, O.; Brasil, M.A.M.; Veiga, R.A. de A.; Toledo, D.V. de Filho. 1979/80. Weight of dry material, basic density and fiber dimensions of *Pinus caribaea* Mor. var *hondurensis* Bar. et Golf (Peso de materia seca, densidade basica e dimensoes de fibras de Pinus caribaea Mor. var hondurensis Bar. et Golf). Sao Paulo, Brazil: Instituto Florestal. Silvicultura em Sao Paulo. 13/14:23–32.

Describes studies on 17 year-old *Pinus caribaea* var. *hondurensis* plantation material from 3 spacings. The plantations were from Moji Mirim, San Paulo state. Data are provided on the longitudinal variation of wood density and total wood weight in relation to dbh and height.

Moore, G. 1983. Cerejeira *(Amburana acreana, Amburana cearensis).* Aylesbury, Bucks., UK: BRE Information. 5(83):2.

Describes the properties and uses of cerejeira, a tree from the dry areas of Brazil, parts of Peru, Bolivia, and northern Argentina.

Moore, G.L. 1984. Canafistula *(Peltophorum vogelianum).* Aylesbury, Bucks., UK: BRE Princes Risborough Lab., BRE Information. 2(84):2.

Describes the source, dimensions, availability, properties, and uses of *Pletophorum vogelianum,* a new commercial wood from Argentina, Brazil, and Paraguay.

Mora, J.J. 1974. Technical characteristics of 37 Venezuelan woods (Caracteristicas tecnologicas de 37 maderas venezolanas). Merida, Venezuela: Escuela de Ingeieria Forestal, Universidad de los Andes. 224 p.

Mora, J.J.; Arroyo, P.J. 1968. Physical and mechancial properties of 44 woods from the province of Guayanaian, Venezuela. Merida, Venezuela: Ministerio de Agricultura y Cria, Universidad de los Andes. 2:8.

Navarro de Andrade, E.; Vecchi, O. 1916. The woods indigenous to Sao Paulo (Les bois indigenes de Sao Paulo. Sao Paulo, Brazil: Secretaria de Agricultura e Commercio etat de Sao Paulo. 376 p.

Ninin, L. 1969. The relations between sawing properties and some physical, mechanical and chemical characters of three tropical timbers. Revista Forestal Venezolana. 12(18): 67–117.

Noack, D. 1971. Evaluation of properties of tropical timbers. Wood Science. 5(5):17–23.

Describes quick methods for the evaluation of lesser known tropical timber species. A two-level system of sampling is discussed, beginning with a sub-sample of 5 to 10 trees selected randomly, followed by a more intensive sample of about 30 trees.

Nolde, I. von. 1953. The most important species of Colombia's monsoon forests (Die wichtigesten Holzarten des Monsunwaldes Kolubiens). Z. Weltforstwirt. 16(2):72–92.

Normand, D. 1977. Botanical identification of Kouali Neyrat from French Guiana (Identification botanique du 'Kouali-Neyrat' de Guyane francaise). Adansonia. 17(1):11-17.

Describes a species of *Vochysia* first collected in 1956 and named Kouali Neyrat, in 1966 is named *Vochysia neyratii* sp. nov. A drawing, distribution map, and photomicrographs of wood sections are given.

O'Donell, C.A. 1937. Comparative anatomy of the timber of three Argentinian Simarubaceas (Anatomia comparada del leno de tres Simarubaceas Argentinas). Tucuman, Argentina: Lilloa. 1:263–282.

Olguin–Q, J.O. 1974. Physical and mechanical properties of the wood of five Mexican species. Mexico, D.F., Mexico: Boletin Technico de Instituto Nacional de Investigaciones Forestales. 42:21.

Describes the results of tests on wood specimens of *Pinus ayacahuite, P. leiophylla, P. patula, P. ponderosa,* and *P. rudis* from several localities in Mexico. Tabulated test data include moisture content and shrinkage from the green condition, specific gravaity, strength in static bending, compression parallel and perpendicular, hardness, shear strength, impact strength, tensile strength parallel, and nail-holding power of green wood and wood at 12 percent moisture content. Test procedures are described, and comparative data for wood of *P. banksiana, P. echinata, P. ponderosa,* and *P. resinosa* grown in the USA are provided.

Olveira, J.T.S.; Della-Lucia, R.M.; Ramalho, R.S.; Vale, A.B. 1987. Study of the physical and technological properties of the wood of Pindaiba *(Xylopia sericea* St. Hill). Estudo das propriedades fisicas e tecnologicas da madeira da Pindaiba (Xylopia sericea St. Hill). Arvore. 11(2):175-183.

Describes the morphology of the stems of 18 pindaiba trees sampled in the study. The stems are straight and cyliudrical but numerous knots could impede the use of the species commercially.

Olvera–C., L.P. 1981. Anatomical study of the wood of seven species of the genus *Pinus* (Estudio anatomico de la madera de siete especies del genero *Pinus).* Mexico, D.F., Mexico: Boletin Technico de Instituto Nacional de Investigaciones Forestales. 71:52.

Olvera–C., L.P. 1985. Anatomical description of the wood of seven Pinus species (Descripcion anatomica de la madera de siete especies del genero Pinus). Mexico, D.F., Mexico: Boletin Techuico de Instituto Nacional de Investigaciones Forestales. 126:73.

Includes coverage of *P. arizonica, P. ayacahuite, P. douglasiana, P. montezumae, P. oocarpa, P. pringlei,* and *P. teocote.*

Ordonez–C., V.; Barcenas–P., G.; Quiroz–S., A. 1988. Physical and mechanical characteristics of the wood of 10 species from San Pablo Macuiltianguis, Oaxaca (Caracteristicas fisico-mecanicas de la madera de diez especies de Sab Pablo Macuiltianguis, Oaxaca.) Instituto de Ecologia, La Madera y Su Uso. 21:29.

Data from physical and mechanical tests of ten wood species from San Pablo, Macuiltianguis, Oaxaca are presented. Uses of the woods are recommended, and a procedure that enhances the statistical confidence of the species' characteristics is proposed.

Ortega, F.; Guerrero, L.; Carmona, T.; Cordoba, C. 1988. Tree angiosperms of Mexico, No. 1, Wood anatomy of 28 species of Cosautlan de Carvajal, Veracruz (Angiospermas arboreas de Mexico, Num. 1, Anatomia de la madera de veintiocho especies de Cosautlan de Carvajal, Veracruz). Mexico, DF, Mexico: Boletin Technico de Instituto Nacional de Investigaciones, Sobre Recursos Bioticos, INIREB., La Madera y Su Uso 19:206.

The wood anatomy of 28 species of 18 genera of the angiosperms is described in detail; each with a distribution covering both pine-oak forest and tropical deciduous forest of the east of Mexico. The wood anatomical diversity has been used for identification. The descriptions are made with new knowledge and in the light of experience in LACITEMA. The descriptions were modified and some additions were made and most individual descriptions are followed by ecological and uses notes. The wood anatomical range encountered is presented in the descriptions for each species.

Pardo, L.L.; Ricci, E. 1957. Identification of *Schinopsis* spp. by means of their tanstuffs (Identificacion de las especies de Schinopsis por sus materias tanantes). Buenos Aires, Argentina: Revista Investigaciones Forestales. 1(1/2):59-69.

Paredes, A. 1952. Species of Ecuador important to industry—arranged according to the system of Wettstein (Especies Ecuatorianas de importancia industrial–ordenadas segun el sistema de Wettstein). Quito, Ecuador: Boletin del Instituto de Ciencias Naturales. 1(1):80–99.

Brief notes on trees and other plants and their wood or other products.

Paula, J.E. de. 1974. Wood anatomy: Guttiferae (Anatomia de madeira: Guttiferae). Acta Amazonica. 4(1):27–64.

Discusses the anatomy of 33 species of Brazilian Guttiferae, covering those of the genera *Caraipa, Calophyllum, Clusia, Haploclathra, Kielmeyera, Lorostemon, Mahurea, Moronobea, Platonia, Rheedia, Symphonia, Tovomita,* and *Vismia.* Notes the presence of rhombic crystals, intercellular radial canals, unilateral axial parenchyma, vascular elements with cribiform areas, and silica bodies.

Paula, J.E., de. 1979. Comparative study of the anatomical structure of the woods of seventy-two little known Brazilian species (Estudo comparativo de estrutura anatomica das madeiras de setenta e duas especies Brasileiras pouco conhecidas). Brasil Florestal. 9(40):29–62.

Paula, J.E. de; Alves, J.L. de H. 1980. Studies on the anatomical structure and some physical properties of the wood of 14 species occurring in the caatinga areas (Estudo das estruturas anatomicas e de algumas propriedades fisicas da madeira de 14 especies ocorrentes em areas de caatinga). Brasil Florestal. 10(43):47-58.

Describes the physical and anatomical properties of *Aspidosperma pyrifolium, Astronium urundeuva, Bumelia sartorum, Bursera leptophloeos, Caesalpinia ferrea, Caesalpinia pyramidalis, Cnidoscolus phyllacanthus, Euphorbia tirucalli, Mimosa acutistipula, Mimosa caesalpiniaefolia, Parkinsonia aculeata, Schinopsis brasiliensis, Spondias tuberosa,* and *Ziziphus joazeiro.*

Paz Perez–O., C. de la. 1974. Wood anatomy of five species of oak from Durango. Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Boletin Technico. 43:35.

Describes the macroscopic characteristics of *Quercus crassifolia, Q. convalleta, Q. obtusata, Q. potosina,* and *Q. sideroxyla.* The locality of tabulated, and illustrated by photomicrographs, and the general appearance and density of the woods are listed. The suitability of the five species for various purposes, including pulp are discussed. Recommendations include a forest inventory and habitat description of the Oaks of Mexico, as well as basic studies of wood anatomy for each species.

Paz Perez–O., C. de la. 1976. Anatomical characteristics of five Mexican oaks (Caracteristicas anatomicas de cinco encinos de Mexico). Mexico, D.F., Mexico: Instituto Nacional de Investigacious Forestales. Boletin Technico. 46:43.

Distribution and anatomy of *Quercus rugosa, Q. acutifolia, Q. candicans, Q. crispipilis,* and *Q. scytophylla.*

Paz Perez–O., C. de la. 1982. Anatomical structure of five Quercus species (Estructura anatomica de cinco especies del genero Quercus). Mexico, D.F., Mexico: Instituto Nacional de. Investigacious Forestales. Boletin Technico. 88:62.

Covers *Q. resinosa, Q. Castanea, Q. conspera, Q. crassipes,* and *Q. skinnerii.*

Paz Perez–O., C. de la. 1985. Wood anatomy of 7 Quercus species (Caracteristicas anatomicas de 7 especies del genero Quercus. Mexico, D.F., Mexico: Instituto Nacional de Investigacious Forestales. Boletin Technico. 123:70.

Covers the species *Q. coccolobifolia, Q. crassifolia, Q. durifolia, Q. laurina, Q. glabrescens, Q. martinezii,* and *Q. obtusata.*

Paz Perez–O., C. de la. 1974. Wood anatomy of 5 species of oak of Durango (Anatomia de la madera de 5 especies de encino de Durango). Mexico, D.F., Mexico: Instituto Nacional de Investigacious Forestales. Boletin Technico. 43:35.

Paz Perez–O., C. de la.; Corral–L., G. 1980. Anatomical study of the woods of eleven species of angiosperms (Estudio anatomico de la madera de once especies de angiospermas). Mexico, D.F., Mexico: Instituto Nacional de Investigacious Forestales. Boletin Technico. 64:79.

Presents a macroscopic and microscopic study of angiosperms found in Mexico. Photographs illustrate the account of these species, which include *Alnus arguta, Arbutus xalapensis, Aspidosperma megalocarpon, Fraxinus uhdei, Inga vera* var. spuria, *Liquidambar styraciflua, Platanus lindeniana, Styrax ramirezii, Tabebuia rosea, Terminalia amazonia,* and *Zinowiewia concinna.*

Paz Perez–O., C. de la.; Olvera–C., P. 1981. Anatomy of the wood of 16 species of conifers (Anatomia de la madera de 16 especies de coniferas). Mexico, D.F., Mexico: Instituto Nacional de Investigacious Forestales. Boletin Technico. 69:111.

Describes the macro and microscopic anatomy and suggests uses for 16 species of conifers, including: *Abies religiosa, Pinus arizonica, P. ayacahuite, P. cooperi, P. chihuahuana, P. durangensis, P. engelmanni, P. greggi, P. lawsonii, P. lumhortzii, P. michoacana, P. oocarpa, P. patula, P. pseudostrobus, P. rudis,* and *Taxodium mucronatum.*

Paz Perez–O., C de la.; Robles–G., F.; Simental–S., A. 1979. Determination of the anatomical and physical-mechanical characteristics of the woods of four species of Leguminosa (Determicacion de las caracteristicas anatomicas y fisicomecanicas de la madera de cuarto especies de leguminoses). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Boletin Tecnico. 61:35.

Reports on the micro anatomy and standard mechanical properties of several Leguminosae found in Mexico. Species tested include *Pithecellobium arboreum, Dialium guianense, Swartzia cubensis,* and *Acosmium panamense.*

Peralta, C.G. de.; Abbate, M.L.E. 1981. Anatomical characteristics and uses of 25 species of woody plant from Panama (Caratteristiche anatomiche ed usi di 25 specie legnose provenienti dalla Repubblica di Panama). Panama, Panama: Fac. Natural Sci. and Pharm., Univ. Panama. Rivista di Agricoltura Subtropicale e Tropicale. 75(4): 325–379.

Describes the wood anatomy and uses of 25 Panamanian species.

Peralta, C.G. de; Abbate, M.L.E. 1983. Anatomical characteristics of 16 species of woody plant from Panama. Part 2 (Caratteristiche anatomiche di 16 specie legnose provenienti dalla Repubblica di Panama (2deg contributo). Rivista di Agricoltura Subtropicale e Tropicale. 77(4):569-599.

Describes the wood anatomy of *Apeiba tibourbou, Brosimum guianensis, Castilla elastica, Cavanillesia platanifolia, Cupania rufescens, Didymopanax morototoni, Guatteria inuncta, Gustavia superba, Ixora floribunda, Lecythis tuyrana, Luehea seemannii, Miconia argentea, Pithecellobium mangense, Platymiscium pinnatum, Pouteria pentasperma,* and *Sapium biglandulosum.*

Pereira, J.A. 1933. A micrographic identification of our woods (A identificacao rnicrographica das nessas madeiras). Sao Paulo, Brazil: Escola Polytechnica de Sao Paulo, Laboratorio de Ensaio de Materiaes. Boletim 9:165.

Pereira, J.A.; de Vasconcellos, J.M.; Tavares, S.; Tavares, E.J. 1970. Technical characteristics of 25 wood species of Northeast Brazil (Caracteres tecnologicos de 25 especies de madeiras do nordeste do Brasil). Recife, Brazil: SUDENE (Superintendencia de Desenvolvimento do Nordeste). 8(1/2):5–148.

Pereira, J.A.; Mainieri, C. 1949. Brazilian timbers, description, common uses, and physical and mechanical properties (Sua caracterizacao, usos comins e indices qualifacativos fisicos e mecanicos). An. Bras. Econ. Flor. Inst. Nac. Pinho. 2(2):283-351.

This paper was revised and expanded in 1957.

Pereira, J.A.; Mainieri, C. 1957. Brazilian timbers: description, common uses, and physical and mechancial properties. (Madeiras do Brasil. Sua caracterizacao, usos comuns e indices qualificativos fisicos e mecanicos). An. Bras. Econ. Flor. Inst. Nac. Pinho. 9:331–498.

A revision of their 1949 work, this paper covers 80 species.

Pereira, J.C.D.; Barrichelo, L.E.G.; Couto, H.T.Z. do; Jankowsky, I.P.; Timoni, J.L. 1983. Effect of growth rate on the density of wood from *Pinus elliotti* var. *elliottii.* In: Proceedings of the Technical Association of the Brazilian Pulp and Paper Industry (ABCP) 16th annual meeting/3rd Latin-American cellulose and paper congress; 1983 November 21–26; Sao Paulo, Brazil: 139–146.

Describes a wood density evaluation of 15 year-old Pinus elliottii trees grown in Brazil. Cross sections taken at breast height were sampled from 24 trees of differing heights and diameters. Through multiple regression, basic density was correlated to both tree height and diameter at breast height.

Pereles, J. 1960. The acidity of selected Puerto Rican woods. Caribbean Forester. 21(1/2):41–44.

Perez–G, V.A. 1982. Mechanical and associated properties of Oregon pine (Pseudotsuga menziesii) grown in Chile (Propiedades mecanicas y associades del pino Oregon (Pseudotsuga menziesii) crecido en Chile). Santiago, Chile: Instituto Forestal. Informe Tecnico. 85:17.

Perez–Galaz, V.A. 1982. Physical-mechanical char acteristics of ten species of eucalyptus grown in Chile (Caracteristicas fisico-mecanicas de diez especies de eucalyptus crecido en Chile). Informe Tecnico No. 84. Chile: Instituto Forestal Chile. 118 p.

Perez–G., V.A. 1982. Determination of the resistance to toughness for some wood species grown in Chile (Determination de la resistencia a la tenacidad de algunas especies madereras a la tenacidad de algunas especies madereras que credea en Chile). Santiago, Chile: Instituto Forestal. Informe Tecnico. 83:26.

Perez–G., V.A. 1983. Manual of the physical and mechanical properties of Chilean woods (Manual de

propiedades fisicas y mecanicas de maderas chilenas). Santiago, Chile: Proyecto CONAF/PNUD/FAO-CHI/76/003, Documento de Trabajo. 47:451.

Perez–Galaz, V.A. 1985. Physical and mechanical properties of pino insigne and other woods for common use in construction (Propiedades fisicas y mecanicas del pino insigne y de otras maderas de uso comun en la construccion). In: Seminario internao sobre definicion de lineas de accion el el uso de la maderaen vivendas. Concepcion, Chile: Intendencia Region del Biobio. 18 p.

Perez–G., V.A. 1987. Grouping of species of timber that grow in Chile by their mechanical properties (Agrupamiento de especies madereras que crecen en Chile segun sus propiedades mecanicas). Ciencia e Investigacion Forestal. 1:89–103.

Describes an Australian system for the classification of timber species by mechanical properties and provides tables of data with such information for Chilean species.

Perez–G., V.A. 1989. Effect of tree age on the physical and mechanical properties of radiata pine (Incidencia de la edad del arbol sobre las propiedades fisicas y mecanicas del pino radiata). Ciencia e Investigacion Forestal. 6:85–99.

This work establishes the influence of age on mechanical properties of radiata pine wood by testing small clear specimens obtained from 25 and 35 year old trees. Comparing the results of the two populations using normalized methods, strength of older trees is shown to be higher than of young trees, obtaining, on average, a 20 percent increase on the different mechanical properties determined in green condition and 11 percent for those determined in air dry conditions (H=12 percent).

Perez–G., V.A.; Zuniga–A.,R.; Hidalgo–S.,H. 1973. Mechanical and associated properties of wood of Nothofagus pumilio from Magallanes province. Santiago, Chile: Instituto Forestal. Informe Tecnico. 44:27.

A preliminary report giving details of the properties in the green state, and comparing them with data for Aisen province.

Perez–G., V.A.; Zuniga–A., R.; Hidalgo–S., H. 1975. Mechanical and associated properties of *Nothofagus pumilio* (Propiedades mecanicas y associadas de la lenga de Magallanes. Santiago, Chile: Instituto Forestal. Informe Tecnico. 50:27.

Notes on specific gravities, moisture content, comparative strength, and other properties.

Perez–G., V.A.; Hidalgo–S., H. 1982. Mechanical and associated properties of Tepa *(Laurelia philippinana* Looser). (Propiedades mecanicas y associades de la Tepa *(Laurelia philippinana* Looser). Santiago, Chile: Instituto Forestal. Informe Tecnico. 96:22.

Perez, J.A. 1971. Classification of uses and working properties for Venezuelan woods (Clasificacion de usos y esfuerzos de trabajo para maderas Venezolanas). Merida, Venezuela: Universidad de los Andes. 89 p.

Perez–M, A. 1969. Structural anatomy of 37 woods of Venezuelan Guiana and keys to their identification (Estructura anatomica de 37 maderas de la Guyana venezolana y clave para su identificacion. Merida, Venezuela: Universidad de Los Andes. 122 p.

Perez–M., A. 1974. Macroscopic identification of some woods of the Llanos Occidentales of Venezuela (Identificacion macroscopica de alguanas maderas de Los Lanos Occidentales de Venezuela). Merida, Venezuela: Universidad de Los Andes. 39 p.

Perez–M., A. 1981. Macroscopic identificiation of some woods of Latin America (Identificacion macroscopica de lagunas maderas de latinoamerica). Merida, Venezuela: Universidad de Los Andes. 2 vol.

Provides some photographs and computer punch cards to aid in identifying woods.

Pfeiffer, J.P. 1926–1927. The woods of Suriname (De houtsoorten van Suriname). Amsterdam, The Netherlands: Koninklijke Vereeniging Koloniaal Institut. Part I-II.

Section I provides a nontechnical introduction to the woods of Suriname. A key to the families and principle species is provided, as are lists of common names and references. General anatomical features of the woods are provided, and are enhanced by accompanying plates showing the wood in cross section.

Pinheiro, G de S.; Pontinha, A de AS.; Gurgel Garrido, LM do A.; Zandarin, MA. 1987. Estimation of the dry weight in species of the Cerrado (Estimativa do peso de materia seca em especies de Cerrado). San Paulo, Brazil: Boletim Tecnico de Instituto Florestal. 41(2): 243–254.

Describes a study to develop equations to predict the dry weight of five woody species grown on the cerrado of Brazil. Equations are given for the prediction of dry weight based on measures of breast height diameter and height of stem.

Pinho, R.A. de.; Camargo, T.M. 1979. Anatomical study of the secondary wood of trees of the cerrado flora. III. Sao Paulo, Brazil (Contribuicao ao estudo anatomico do lenho secundario de arvores da flora dos cerrados. III. Sao Paulo, Brasil). Sao Paulo, Brazil: Instituto de Botanica. Hoehnea 8:l–91.

PROEXPO. 1972. Colombian woods (Maderas Colombianas). Bogota, Colombia: Fondo de Promocion de Exportaciones. 117 p.

Pujol, E.; Arreghini, R.I. 1982. Growth and physiomechanical wood properties of poplars grown in Mendoza province (Estudio de crecimiento y de las caracteristicas fisico-mecanicas de la madera de los alamos cultivados en Mendoza). Mendoza, Argentina: Universidad Nacional de Cuyo. Revista de la Facultad de Ciencias Agrarias. 22(2):27–39.

Rebollar–D., S. 1977. The wood of *Alnus firmifolia* and its uses. (La madera de *Alnus firmifolia* y sus usos). Direccion General de Investigacion y Capacitacion Forestales, Mexico. Ciencia Forestal. 2(8):51–63.

Describes the macroscopic and microscopic features of *Alnus firmifolia* wood from samples of two trees each from Puebla and the Federal District of Mexico. No significant differences in the wood were found. The wood was similar to that of other Alnus species. Some uses of the wood are described. Substitution for *Nothofagus* and *Betula* spp. is noted.

Record, S.J. 1926. Trees of the Bayano River watershed, Panama. Tropical Woods. 5:4–14.

Fifty-four species in 26 families are listed. The location of where these trees are generally found is noted, as is the general characteristics of the wood. A check list of common names is appended.

Record, S.J. 1927. Trees of Honduras. Tropical Woods. 10:10–47.

Briefly lists about 200 species of Honduran trees. A description of the trees and their uses is provided. A check list of common names is also supplied.

Record, S.J. 1928. The Palo Prieto of west central Mexico. Tropical Woods. 142–12.

Provides a gross and minute anatomical description of the wood of *Celaenodendron mexicanum.* Also contains a description of the physical properties of this wood, including compression, tension, flexion, etc.

Record, S.J. 1929. Notes on Brazilian woods. Tropical Woods. 20:22–24.

Very brief random notes on *Araucaria, Carapa, Ocotea,* and *Dalbergia species.*

Record, S.J. 1931. Notes on Brazilian timbers. Tropical Woods. 27:14–15.

Brief description on utilization on three popular Brazilian woods, *Bowdichia* spp., *Platymiscium* spp., and *Parateroma peroba.*

Record, S.J. 1931. The wood of *Escallonia tortuosa.* Tropical Woods. 26:12–13.

Briefly notes the general properties, gross anatomy, and minute anatomy of this species.

Record, S.J. 1931. Brazilian Kingwood *(Dalbergia cearensis).* Tropical Woods. 28:1–3.

Gives a brief description of the anatomy of this wood

Record, S.J. 1932. The wood of *Gleasonia duidana.* Tropical Woods. 32:18–20.

Describes the gross and minute anatomy of wood taken from a specimen located on Mount Duida, Venezuela.

Record, S.J. 1932. Notes on new species of Brazilian woods. Tropical Woods. 31:22–29.

Provides brief synopsis of gross and minute anatomy, with some comments on wood utilization. Covers the trees *Brosimum amplicoma, Helicostylis asperifolia, Iryanthera tricornis, Peltogyne* spp., *Melanoxylon amazonicum, Jacqueshuberia purpurea, Vouacapoua pallidior, Clathrotropis macrocarpa, Swartzia ingaefolia, Cariniana integrifolia, Ecclinusa balata, Vitex spongiocarpa,* and *Ladenbergia amazonensis.*

Record, S.J. 1936. The woods of *Hymenolobiurn.* Tropical Woods. 47:7–10.

Provides brief notes on the anatomy of seven unidentified species of *Hymenolobium.*

Record, S.J. 1941. American timbers of the mahogany family. Tropical Woods. 66:7–34.

Record, S.J.; Mell, C.D. 1924. Timbers of tropical America. New Haven, CT: Yale University Press. 610 p.

The first section describes the forests and potential for extracting wood from Latin America. The second section analizes the wood from 75 countries. Physical and mechanical data are provided for each wood. Also listed are current and potential uses of the woods, common names, and other relevant data.

Record, S.J.; Hess, R.W. 1943. Timbers of the new world. New Haven, CT: Yale University Press. 640 p.

Record, S.J.; Kuylen, H. 1926. Trees of the lower Rio Montagua Valley, Guatemala. Tropical Woods. 7:10–29.

Provides an introduction to almost 40 families of trees. A brief description of the characteristics of both tree and wood is followed by uses of the wood. A check list of over 110 common names is included.

Reitz, P.R.; Klein, R.M.; Reis, A. 1979. Brazilian woods. (Madeiras do Brasil). Florianopolis, Brazil: Lunardelli: 293–300.

Rendel, B.J. 1969. World timbers, Vol. 2, North and South America (including Central America and the West Indies). London, United Kingdom: Ernest Benn Ltd. and Toronto, ON, Canada: University of Toronto Press. 150 p.

Resch, H.; Bastendorff, K. 1978. Some wood properties of plantation pines *(Pinus caribaea)* and *(P. oocarpa).* Wood and Fiber. 10(3):210–217.

Research Team of South American Hardwood. 1986. Studies on the properties and utilization of several hardwoods from South America. Three Chilean hardwoods. Res. Rep. Republic of Korea: Forest Research Institute. 33:117-125.

A broad study including anatomy, physical properties, drying, pulping, durabilty, and particleboard and fiberboard manufacture. Specific recommendations are made for *Nothofagus dombeyi, Laurelia philippiana,* and *Eucryphia cordifolia.*

Rezende, M.A.; Ferraz, E.S.B. 1985. Annual density of the wood of *Eucalyptus grandis* (Densidade anual da madeira de *Eucalyptus grandis).* Piracicaba, Brazil: Instituto de Pesquisas e Estudos Florestais. 30:37–41.

Richter, H.G. 1979. On the occurrence, morphology, and taxonomic implications of crystalline and siliceous inclusions in the secondary xylem of Lauraceae and related families. In: Tamolang, F.N., ed. Wood quality and utilization of tropical species. Proceedings: International Union of Forestry Research Organizations (IUFRO) Conference, 1978, October 30-November 3; College, Laguna, Philippines. FORPRIDECOM: 65–73.

Rizzini, C.T. 1978. Useful trees and woods of Brazil: a manual of Brazilian dendrology (Arvores e madeiras uteis do Brasil: Manual de dendrologia brasileira). Jardim Botanico do Rio de Janeiro, Academia Brasileira de Ciencias, Rio de Janeiro, Brazil. Sao Paulo, Brazil: Edgard Blucher: 304.

Rizzini, C.T. 1978. The discovery of sebastiao-de-arruda, a fine Brazilian wood that was botanically unknown. Economic Botany. 32(1):51–58.

An illustrated description is given of the tree of this important export wood (English name: Brazilian tulipwood) found in a semideciduous forest in Andarai, Bahia State, Brazil. It is identified as an undescribed species of *Dalbergia, D. decipularis.*

Rizzini, C.T.; Mattos Filho, A. de. 1977. On *Luetzelburgia* (Leguminosae) (Sobre *Leutzelburgia* Harms (Leguminosae)). Rio de Janeiro, Brazil: Jardim Botanico, Rodriguesia. 29(42):7-31.

Describes the wood of *Luetzelburgia freire-allemani* sp. nov., a small dry woodland tree from Bahia, with photomicrographs of anatomical features (vessels, wood and ray parenchyma, fibres, growth rings, and ripple marks). The wood is very hard and heavy. Differences between wood of *Luetzelburgia* and *Sweetia* (Ferreirea) spp. are noted.

Robles–Galvez, F. 1978. Properties and uses of 14 tropical timbers of rapid-growing species at the Forest Experiment Station, El Tormento (Mexico) (Propiedades y usos de 14 especies de maderas tropicales de rapido crecimiento del Campo Experimental Forestal El Tormento). INIF, Mexico. Ciencia Forestal. 3(16):32–44.

Describes ll native and 3 exotic tree species, their physical characteristics (density, shrinkage), and uses. Recommendations are made for additional use.

Rodriguez, A. 1951. Biometrical study of spiral grain in stems of *(Eucalyptus globulus* Labill.) (Estudo biometricas sobre o onrolamento dos troncos no *(Eucalyptus globulus* Labill.)). Agronomica Lusitana. 13(4):319–331.

Rodriguez, E. 1958. The timber of the Argentinian trees of Sapindaceae: Structure, characteristics, and applications (El leno de las Sapindaceas arboreas argentinas. Estructura, caracteristicas y aplicaciones). Buenos Aires, Argentina: Revista de la Facultad de Agronomia y Veterinaria. 14(3):211.

Rodriguez, E. 1960. Comparative study of the wood structure of Oregon pine *(Psedotsuga menziesii)* (Estudio comparado de la estructura de la madera de pino oregon *(Pseudotsuga menziesii)).* Buenos Aires, Argentina: Administration Nacional de Bosques. Revista Investigaciones Forestales. 2(1):89.

Rodriguez, W.A. 1972. *Virola surinamensis* and its uses. Acta Amazonica. 2(2):29–47.

Rogel–G, M. de los A. 1982. Wood anatomy of seven tropical species (Caracteristicas anatomicas de la madera de siete especies tropicales). Mexico, D.F., Mexico: Boletin Tecnico de Instituto Nacional de Investigacious Forestales. 86:55.

Covers *Chiranthodendron pentadactylon, Guarea glabra, Gymnanthes lucida, Talisia olivaeformis, Protium copal, Quararibea funebris,* and *Parmentiera edulis.*

Rogel–G., M. de los A. 1982. Wood anatomy study of six tropical species (Estudio anatomico de la madera de seis especies tropicales). Mexico, D.F., Mexico: Boletin Tecnico de Instituto Nacional de Investigacious Forestales. 89:70.

Describes the anatomy of *Guatteria anomala, Licaria campechiana, Nectandra tabascensis, Persea americana, Phoebe effusa,* and *Talauma mexicana.*

Roig, J.T. 1935. Cedar: study of the botany and cultivation (El cedro: estudio botanico y agricola). Circular No. 79. Santiago de las Vegas, Cuba: Estacion Exp. Agronomica. 31 p.

Romero–A., C.; Paz Perez–O., C. de la. 1978. Anatomical, physical, and mechanical characteristics of eight species of conifers from Baja California Norte (Characteristicas anatomicas y fisico-mecanicas de ocho especies de coniferas de Baja California Norte). Mexico, F.B., Mexico: Instituto Nacional de Investigaciones Forestales, Direccion General de Investigacion y Capacitacion Boletin. 57:48.

Describes the woods of *Abies concolor, Libocedrus decurrens, Pinus contorta* var. *latifolia, P. coulteri, P. jeffreyi, P. lambertiana, P. ponderosa,* and *P. quadrifolia* by illustration and tabulated data.

Rosa, H.M.M. da. 1983. Study of guapuruvu *Schizolobium parayba* (Vell.) Blake (Contribuicao ao estudo do guapuruvu *(Schizolobium parayba* (Vell., Blake)). Porto Alegre, Brazil: Instituto de Pesquisas de Recursos Naturais Renovaveis, Publicacao IPRNR.

Describes the Brazilian timber tree guapuruvu, its taxonomy, ecology, and propagation.

Rudall, P.J. 1985. Perforated ray cells in *Hyptis hagei*–a new record for Labiatae. International Association of Wood Anatomists Bull. 6(2):161–162.

Perforated ray cells are recorded for the first time in wood of Labiatae, in Hyptis hagei, a Brazilian species of small trees. It is noted that this phenomenon is often correlated with the presence of heterocellular rays.

Sachsse, H.; Schulte, A. 1987. Some important wood properties of the Bolivian *Podocarpus parlatorei* (Untersuchung einiger wichtiger Holzeigenschaften der bolivianischen Podocarpus parlatorei (Pilger)). Holz als Roh– und Werkstoff. 45(12):475–480.

Salazar, A. 1966. Identification of trees of Peru. Final Report. Lima, Peru: Servicio Forestal y de Caza. 24 p.

Santander, C.; Albertin, W. 1980. *Anacardium excelsum,* a timber species of the American tropics (Costa Rica) *(Anacardium excelsum,* especie forestal de los tropicos americanos) . Turrialba.

SARH. (Secretaria de Agricultura Y Recursos Hidraulicos). 1985. Forest plantations (Plantaciones Forestales). In: Proceedings, 3a reunion nacional, memoria. Publ. Esp. No. 48. 1985 April. Mexico: SARH. INIF (Instituto Nacional de Investigaciones Forestales).

Saudoval–Z., G.; Navarrete–A., J.; Zurita–E., R. 1986. Preliminary study of the physical-mechanical strength of sawn Pinus radiata without resin tapping. (Estudio preliminar de resistencia fisico- mecanica de madera aserrada y sin resuinar de *Pinus radiata.* Concepcion, Chile: Universidad del Biobio, CEDIF. 12 p.

Senft, J.F.; Lucia, R.M.D. 1979. Increased utilization of tropical hardwoods through species-independent structural grading. Forest Products Journal. 29(6):22–28.

Small, clear specimens of 3 Brazilian hardwoods: banak (Virola spp.), tachi *(Tachigalia paniculatum),* and pequia *(Caryocar villosum)* were tested to determine mean species values of MOR, MOE, and density. Ten-foot lengths of 2 by 4 in. and 2 by 6 in. were tested in bending. The data indicated that machine-stress-grading techniques are applicable to grouped species of tropical hardwoods within the density range of 0.40 to 0.80 and that grading accuracy is comparable with that of machine-graded commercial softwoods.

Siemon, G.R. 1981. Effect of C.C.A.-preservative treatment on bending strength of small clear specimens of high-temperature- dried and air-dried Caribbean pine. Tech. Pap. 27. Queensland, Australia: Department of Forestry. 4 p.

Describes static bending tests performed on samples of *Pinus caribaea varieties caribaea, hondurensis,* and *bahamensis,* treated with CCA. The treatment resulted in a small but significant loss of strength and stiffness. High temperature drying of the specimens reduced MOR in CCA-treated specimens. Appropriate grade classifications were assigned to the varieties based on strength according to the Standards Association of Australia.

Slooten, H.J. van der. 1968. Research and development of selected forest zones of Costa Rica (Investigacion y desarrollo de zonas forestales selectas de Costa Rica). Iforme sobre un Programa de ensayo de maderas, Proyecto UNDP 192. Turrialba, Costa Rica: FAO/IICA. 1–131.

Slooten, H.J. van der; Corothie, H.; Arroyo–P., J. 1959. Anatomical characteristics and physical–mechanical properties of some species of wood of Brazil (Caracteristicas anatomicas y propiedades fisico-mecanicas de algunas especies maderables del Brasil). Boletin Technico de Instituto Forestales Lationoamericas Investigacious 10:39–93.

Slooten, H.J. van der; Lisboa, C.D.J.; Pastore, F., Jr.; Sobral Filho, M. 1976. Forestry development and research. Brazil. Characteristics, properties, and engineering data of 16 commercial Amazon species. FAO Rep. Brasilia, Brazil: FO:DP/BRA/71/545 Field Doc. 20:73.

Describes general wood characteristics, weight, strength properties, allowable stresses, shrinkage and drying, working properties, durability, preservation, and uses.

Slooten, H.J. van der; Lisboa, C.D.J.; Sobral Filho, M.; Pastore, F., Jr. 1976. Forest tree species of Amazonia - Characteristics, properties, and mechanical data of wood (Especies florestais da Amazonia - caracteristicas, propriedades e dados de engenharia da madeira). FAO Rep. Brasilia, Brazil: Lab. de Prod. Florest., PRODEPEF, PNUD/FAO/IBDF/BRA–45, Serie Tecnica. 6:90.

Describes physical and mechanical properties, drying behavior, treatability with preservatives, and tentative allowable stresses for the woods of 16 Amazon species. The range of variation in properties within each species is presented based on a wide distribution of samples throughout the Amazon region. The species included are: *Astronium lecointei, Bagassa guianensis, Bowdichia nitida, Calophyllum brasiliense, Carapa guianensis, Caryocar spp., Cedrela spp., Copaifera spp., Cordia spp., Euxylophora paraensis, Manilkara spp., Mezilaurus itauba, Ocotea bracellensis, Platymiscium spp., Swietenia macrophylla,* and *Tabebuia Serratifolia.*

Slooten, H.J. van der; Martinez–E., P. 1959. Description and properties of some Venezuelan woods (Descripcion y propiedades de algunas maderas venezolanas). Sec de Documentacion y Publicaciones. Merida, Venezuela: Institute Forestal Latinamericano. 103 p.

Slooten, H.J. van der; Richter, H.G.; Aune, J.E.; Llach–C., L. 1971. Properties and uses of 113 timber yielding species of Panama. FAO FO-UNDP/SF PAN/6 Rome. 3 vol.

Part 1: Divided into sections covering physical and mechanical properties, drying characteristics, preservation, durability, evaluation of pulp and paper, and a list of the possible uses of the woods. Each section compares the woods with one another.

Part 2: Presents the general characteristics of the wood, macro- and microscopic anatomy, and dimensions of the fibers. Also includes photomicrographs illustrating their anatomy.

Part 3. Gives a description of the characteristics of selected woods. Each section provides information on a wood's physical and mechanical properties, drying, and preserving characteristics. Comparative data of other woods of North and South America are also provided.

Solari, F.S. 1952. Systematic study of the woods produced in the province of Buenos Aires (Estudio sistematica de las maderas producidas en la provincia de Buenos Aires). Publicaciones del Laboratrorio de Ensayos de mataeriales e Investigaciones Tecnologicas, Eva Peron. (Ser. 2) 42:25.

Sotela M.J.; Carpio M.I.; Blanco R.L.; Cruz, M., L.; Altamirano–M., J.L.; Rivera, G., D. 1985. Study of 10 forest species of SARAPIQUI (Estudio de 10 especies forestales de SARAPIQUI). UCR–MAG–AID/515–t–032. San Jose, Costa Rica: Universidad de Costa Rica. 239 p.

Souza, J.P. de.; Oliveira, A.L.P.C. de; Souza, M.M. de. 1982. Contribution to the knowledge of the wood of *Laguncularia racemosa* (L.) Gaertn f. (Contribuicao ao conhecimento do lenho de *Laguncularia racemosa* (L.) Gaertn f. In: Malvesi, I.T.O., and others, eds. Proceedings of the national conference on native species; 1982, September 12-18; Campos do Jordao, Sao Paulo, Brazil. Sao Paulo, Brazil: Silvicultura em Sao Paulo. 16A(1):280–292.

Souza, J.P. de; Pereira, S.A.; Lemos, M.B.N. 1982. Contributions to the knowledge of *Rhizophora mangle* Linnaeus. wood (Contribuicao ao conhecimento da madeira de *Rhizophora mangle* Linnaeus. In: Malvesi, I.T.O., and others, eds. Proceedings of the national conference on native species; 1982, September 12–18; Campos do Jordao, Sao Paulo, Brazil. Sao Paulo, Brazil: Silvicultura em Sao Paulo. 16A(1):269-279.

Describes the wood anatomy of white mangrove from Brazil.

Standley, P.C. 1934. The Caobanilla tree of the Dominican Republic. Tropical Woods. 40:15–17.

The morphology and gross wood anatomy of Stahlia monosperma is discussed. Several uses of its wood are given.

Stefanov, B.; Naidenova, Ts. 1974. Some tree species with valuable wood in Cuba. Gorsko Stopanstvo. 30(11,12):34-39, 48–51.

Gives brief notes on the properties and uses of the wood of 48 commercial species of native trees in Cuba. These notes are taken from the authors' compilation entitled *Flora cubensis selecta* (1974), a work based on A.J. Fors' classic *Maderas cubanas.*

Stern, W. 1978. Index xylariorum. Institutional wood collections of the world. 2. Taxon. 27(2/3):233–269.

Stevenson, D.W. 1979. Systematic anatomy of Bahamian species of *Bursera* (Burseraceae). Journal of the Arnold Arboretum. 60(1):163–165.

Describes the wood anatomy of stem sections from 3 species *(Bursera inaguensis, B. frenningae, and B. simaruba)* occurring in the Bahamas, Turks, and Caicos Islands, and in the Fairchild Tropical Garden, Miami, Florida. The woods showed similarities and differences. The differences, which include variable vessel diam., presence of fibers in the secondary phloem, and arrangement of oil cells and resin canals, were used to construct a key.

Surinam Forest Service. 1955. Surinam timber. Paramaribo, Surinam: Surinam Forest Service. 2d. ed. 97 p.

Suss, H.; Vales, M.A. 1982. Pith flecks in the wood of Cuban tree species (Uber Markflecke im Holz kubanischer Baumarten). Berlin, E. Germany: Akademie. Feddes Repertorium.

Describes pith flecks in the wood of *Catalpa punctata* and *Guazuma ulmifolia* and reports for the first time, the occurrence of miners of the genus *Phytobia,* family Agromyzidae, Diptera.

Tainter, F.H. 1968. Microscopic identification of commercial Chilean woods (La identificaion microscopica de las maderas comerciales Chilenas). Special Pub. 3. Missoula, MT: Montana Forest and Conservation Station, School of Forestry, University of Montana. 27 p.

Tamolang, F.N., ed. 1979. Wood quality and utilization of tropical species. Proceedings, International Union of Forestry Research Organizations (IUFRO) Conference; 1978 October 30–November 3; College, Laguna, Philippines. FORPRIDECOM. 386 p.

Includes the keynote address and 44 papers presented at five sessions: Anatomical characteristics and wood properties; Wood quality problems associated with utilization; Identifying wood properties for processing and marketing; Wood quality and utilization of tropical hardwoods; and Improving wood quality and final recovery of tropical species by silviculture, forest operation, and utilization.

Teixeira, D.E.; Santana, M.A.E.; Souza, M.R de. 1988. Amazonian timbers for the international market. Yakohama, Japan: International Tropical Timber Organization (ITTO). 78 p.

Describes timbers available from the Brazilian Amazon for world markets.

Teixeira, L.L. 1977. Botanic and dendrologic identification and wood anatomy of six euxylofloristic species in the southwesternpart of Parana State (Identificacao botanico-dendrologica e anatomica da madeira de seis especies euxiloforas do sudoeste paranaense). Curitiba, Brazil: Floresta. 8(1):35–37.

Tejada–V., M. 1981. Table of the physical and mechanical properties of 20 Venezuelan wood species (Tablas de propiedades fisicas y mechanicas de la madera de 20 especies de Veneuela). Lima, Peru: Grupo Andino. 53 p.

Thiel, J. 1984. Practical identification of standing trees in the forests of French Guiana. (Reconaissance pratique des arbres sur pied de la foret guyanaise). In: Groupe de travail no. 1. La matiere premiere. Sous-groupe 1.1.— Peuplements–Sylviculture. Colloque sciences et industries du bois. 1982, September 20–22; Grenoble, France. Paris France: Centre Technique Forestier Tropical (CTFT): 7-19.

A method of identification is described using characters that can be determined at the base of the tree, in particular bark characters, rooting, form of base of stem and growth habit.

Tochigi, T.; Shiokura, T.; Lantican, C.B. [and others]. 1984. Computer assisted tropical wood identification (CATWI). In: Sudo, S., ed. Proceedings, Pacific regional wood anatomy conference; 1984, October, 1–7; Tsukuba, Ibaraki, Japan. Sakura, Ibaraki, Japan: University of Tsukuba: 174–176.

Describes a computer program for hardwood identification using wood characters which have been converted into numerical form. The program is proposed for use by field workers who are not necessarily wood anatomists.

Toledo–E., Nelson; Orbe–V., Jorge; Vasquez–M., Edgar; Montesdeoca, Jorge. 1981. Preliminary

technological study of 20 forest species of Ecuador (Estudio preliminar technologico de 20 especies forestales del Ecuador). Conocoto, Ecuador: Centro de Capacitacion e investigacion Forestal. 27 p.

Information on botanical and anatomical characteristics, physical and mechanical properties, drying, preservation, durability, workability, and general uses of 20 species grown in Ecuador.

Tomazello Filho, M. 1985. Anatomical structure of the wood of eight species of Eucalyptus cultivated in Brazil (Estrutura anatomica da madeira de oito especies de eucalipto cultivada no Brasil). Piracicaba, SP, Brazil: IPEF (Instituto de Pesquisas e Estudos Forestais). 29:25–36.

Tomazello Filho, M. 1985. Radial variation of the basic density and the anatomical structure of the wood of *Eucalyptus saligna* and *E. grandis* (Variacao radial da densidade basica e da estrutura anatomica da madeira do *Eucalyptus saligna* e *E. grandis).* Piracicaba, SP, Brazil: IPEF (Instituto de Pesquisas e Estudos Forestais). 29:37–45.

Tomazello Filho, M. 1985. Radial variation of the basic density and the anatomical structure of the wood of *Eucalyptus gummifera, E. microcorys* e *E. pilularis* (Variacao radial da densidade basica e da estrutura anatomica da madeira do *Eucalyptus gummifera, E. microcorys* e *E. pilularis).* Piracicaba, SP, Brazil: IPEF (Instituto de Pesquisas e Estudos Forestais). 30:45–54.

Tomazello Filho, M.; Chimelo, J.P.; Garcia, P.V. 1983. Wood of forest species of the state of Maranhao, Brazil: II–Anatomical characterization (Madeiras de especies florestais do estado do Maranhao: II–Caracterizacao anatomica). Piracicaba, SP, Brzil: IPEF (Instituto de Pesquisas e Estudos Florestais). 23:29–35.

Brief descriptions of a variety of woods identified during an inventory.

Torricelli–D, E. 1937. Anatomical study of Chilean woods (Estudio Anatomico de las Maderas Chile). Santiago, Chile: Soc. Imp. y Lito. Universo. Ahumada 32. 114 p.

Tortorelli, L.A. 1956. Argentine forests and trees (Maderas y bosques Argentinos). Buenos Aires, Argentina: Editorial Acme S.A. 910 p.

TTIC (Tropical Timber Information Center). 1975. TTIC Brief 1–32, TTIC Bull. 2–3. Syracuse, NY: State University of New York.

Individual papers published on a variety of woods, including information on their common and trade names, structure, physical and working properties, durability, and possible uses. Species covered include *Amburana acreana, Amburana cearensis, Belotia, Calophyllum brasiliense, Carapa, Ceiba samauma, Hymenaea courbaril, Terminalia lucida, Hevea brasilienses, Maquira schlerophylla, Naucleopsis, Noyera, Perebea, Pentaclethra macroloba, Peltogyne, Quararibea, Quercus,* and others.

Tuset, R. 1958. Physical and mechanical characters of some woods of common interest in Uruguay (Caracteres fisico-mecanico de algunas maderas de interes commun en el Uruguay). Montevideo, Uruguay: Revista de la asociacion de Ingenieros Agronomos. 30(102):28-42.

Tuset, R.; Duran, F. 1970. Description and macroscopic key to the commercial woods in Uruguay (Descripcion y clave macroscopicas de maderas comerciales en Uruguay). Boletin No. 114. Montevideo, Uruguay: Universidad de la Republica.

Valderrama, F.H. 1984. Study of the physical properties and their variation in the trunk of *Tachigalia longiflora* Ducke and *Sclerolobium melinonii* Herns in Puerto Almendras-Iquitos. Iquitos, Peru: Tesis, Ingenieria Forestal, Universidad Nacional de la Amazonia Peruana. 92 p.

Valente, M. da C.; Costa, C.G.; Silva, J.D. e. 1975. A botanical bibliography. Plant anatomy. I (Bibliografia de botanica. Anatomia vegetal. I). Rio de Janeiro, Brazil: Jardim Botanico. 28(40):61.

Part 1 of bibliography arranged in alphabetical order by author (A and B names only in this part), covering plant anatomy (including wood anatomy) published in the principal reviews held by botanical institutions of the state of Rio de Janeiro.

Vales, M.A. 1983. Vestures in the perforation plates in the wood of some endemic Rubiaceae species from Cuba (Verzierte einfache Gef ssdurchbrechungen im Holz einiger endemischer Rubiaceen-Arten aus Kuba). Feddes Repertorium. 94(7/8):493–495.

Reports the discovery of vestures in the perforation plates of the vessel members of secondary xylem in certain Cuban Rubiaceae.

Vales, M.A. 1983. Ornamental vessel and wood fiber pits in the wood of some endemic Rubiaceae species from Cuba (Verzierte Gef ss– und Holzfaser–Hoft pfel im Holz einiger endemischer Rubiaceen- Arten aus Kuba). Feddes Repertorium. 94(7/8):497–500.

Describes the vestured pits found in the vessel members and wood fibers of five genera of the Rubiaceae.

Vales, M.A.; Babos, K. 1977. Wood anatomy of *Ceratopyxis* Hooker f. ex Hooker (Rubiaceae), a monotypic endemic genus of west Cuba. Acta Botanica Academiae Scientiarum Hungaricae. 23(1/2):275–283.

Describes the microscopic anatomy of the genus *Ceratopyxis* using photomicrographs. Xylem element dimensions are listed and compared with mean data for the family Rubiaceae.

Vales, M.A; Carreras, R. 1986. Anatomy of Cuban woods. I (Anatomia de maderas de Cuba. I). Acta Botanica Hungarica. 32(1–4):231–245.

Includes descriptions of *Cinnamomum montanum, Dendropanax arboreus, Lysiloma sabicu, Matayba apetala, Ochroma pyrimidalis [O. pyramidale], Swietenia mahagoni, S. macrophylla, S. macrophylla X S. mahagoni, Trichilia havanensis,* and *Talauma minor.*

Vales, M.A.; Cameras, R. 1987. Anatomy of woods of Cuba. III (Anatomia de maderas de Cuba. III). Acta Botanica Hungarica. 33(3–4):333–351.

Covers *Celtis trinervia, Grimmeodendron eglandulosum, Laguncularia racernosa, Leucocroton moncadae, Oxandra lanceolata, Pseudolmedia spuria, Rhizophora mangle, Spathodea campanulata, Symplocos strigillosa,* and *Tabebuia calcicola.*

Vales, M.A.; Martinez, C. 1983. Contribution of the study of the wood anatomy of the family Simarubaceae in Cuba. I. Alvaradoa and Simarouba (Contribucion al estudio anatomico del xilema de la familia Simarubaceae en Cuba. I. Alvaradoa Liebm. y Simarouba Aubl). Acta Botanica Hungarica. 29(1–4):231–240.

Vales, M.A.; Suss, H. 1985. Wood anatomy of Rubiaceae endemic in Cuba,*Acunaeanthus tinifolius* (Griseb.) Borhidi, *Ariadne shaferi* (Standl.) Urb. and *Neomazaea phiallanthoides* (Grieseb.) Krug and Urb. (Die Holzanazomie der in Kuba endemischen Rubiaceae *Acunaeanthus tinifolius* (Griseb.) Borhidi, *Ariadne shaferi* (Standl.) Urb. und *Neomazaea phiallanthoides* (Grieseb.) Krug et Urb). Feddes Repertorium. 96(3):215–225.

Verna, M.M. 1979. Secondary wood of Argentinian Meliaceae (El leno secundario de las Meliaceas Argentinas). Buenos Aires, Arsgentina: Instituto de Forestales Nacional, Folleto Tecnico Fporestal. 53:29.

Describes the wood anatomy of *Cabralea oblongifolia, Cedrela balansae, C. mexicana [C. odorata], C. tubiflora, Guarea pohlii, G. spiciflora, Trichilia elegans, T. hieronymi,* and *T. mollis.* Included are photomicrographs of wood and a wood identification key.

Vilela, J.E. 1969. Physical and mechanical properties of 137 woods of Venezuelan Guayana (Propiedades fisicas y mecanicas de 137 maderas de la Guayana Venezolana). Merida, Venezuela: Universidad de los Andes, Laboratoria Nacional de Productos Forestales. 1:88.

Villalba, R. 1985. Xylem structure and cambial activity in *Prosopis flexuosa* DC. International Association of Wood Anatomists Bulletin. 6(2):119–130.

A description of the wood structure of *Prosopis flexuosa* DC. (Legum.) is given. It is semi-ring porous, shows pores solitary, in multiples, and in clusters; small to large-sized vessels with simple perforation plates, and thick vessel walls. Ray multiseriate and homogenous. Paratracheal axial parenchyma and libriform fibers. The hydraulic tissue seems well adapted to very low rainfall and prolonged dry periods.

Wahlgren, H.E.; Laundrie, J.F. 1977. Properties of 50 Philippine, 22 Ghanaian, and 18 Colombian hardwood barks. AID Rep. 10. Washington, DC: U.S. Department of State, Agency for International Development.

Bark properties, silica and ash content, specific gravity, thermal values, and pulping properties are noted.

Webber, Irma. 1934. Systematic anatomy of the woods of the Malvaceae. Tropical Woods. 38:15–36.

Provides a summary of the various taxonomic classifications proposed for the Malvaceae. Also presents an annotated list of the genera, many of which are found in Latin America. The general properties and gross and minute anatomy of the genera are discussed.

Welle, B.J.H. 1976. Silica grains in woody plants of the neotropics, especially Surinam. In: Wood structure in biological and technological research; Inst. Systematic Bot., Utrecht University, Utrecht, Netherlands. The Hague, Netherlands: Leiden University Press. Leiden Botanical Series 3:107-142.

Distribution patterns, frequency, size, shape, and surface texture of silica grains in the secondary xylem of neotropical taxa, especially from Surinam, were studied extensively. Silica grains occur in about 300 species (32 families and about 90 genera). Grains were present in many taxa so far considered as nonsiliceous. They are most frequently found in the parenchymatous tissues (in 80 percent of siliceous material studied, grains were present in the ray cells). Their distribution is very constant, especially when they are restricted to one type of tissue. The diagnostic value of silica grains appears to be very high. The shape of the grains is usually variable, though in a few cases it is very characteristic. Various types of surface structure are recognized. The great variation in grain size reduces its importance as a diagnostic tool.

Whitmore, J.L. 1973. Wood density variation in Costa Rican balsa. Wood Science. 5(3):223–229.

Describes wood density variation in wood of *Ochroma lagopus,* within tree, between trees in a specific area, and between trees from different areas of Costa Rica. Within tree variation was measured in the first log of each tree. Results were correlated with site and tree characteristics, showing the within tree density increases linearly with distance from the pith and decreases with increasing height above the root-collar. Between trees on the same site, greater average density was found in larger diameter trees or those with water heart. Substantial variation in average density is accounted for by major environmental factors, found in the three lowland regions of Costa Rica: Atlantic, Pacific wet, and Pacific dry.

Wiemann, M.C. 1987. Keys for the identification of various woods from Costa Rica (Claves para la identificacion de algunas maderos en Costa Rica). Turrialba. 37(4):381–403.

Two keys, one based on macroscopic features and the other on microscopic anatomical features, identify over 150 species of woods commercially important in Costa Rica.

Wiemann, M.C.; Williamson, G.B. 1988. Extreme radial changes in wood specific gravity in some tropical pioneers. Wood and Fiber Science. 20(3):344–349.

Describes the radial specific gravity variation in *Hampea appendiculata, Heliocarpus appendiculatus,* and *Ochroma pyramidale* found in Costa Rica. Data show an average gain of 0.1 units of specific gravity per 10 cm. of radial distance from pith to bark; this translates to 300 to 400 percent increase in specific gravity from pith to bark in larger trees. The change is related to structural stability of the trees.

Wilkes, J. 1988. Variations in wood anatomy within species of Eucalyptus. International Association of Wood Anatomists Bulletin. 9(1):13–23.

Eucalyptus species are characterized by substantial genetically predetermined within- and between-tree variations in wood anatomical features including fiber and vessel dimensions. This effect of genotype outweighs that of growing conditions; indeed the influence of rate of growth on wood anatomy is minor. It must therefore be assumed that the reputed difference in wood quality between regrowth/plantation stands and old growth forests is founded on nonanatomical features, or reflects simply the greater proportion of juvenile wood in small, rapidly grown stems.

Williams, L. 1928. Studies of some tropical American woods. Tropical Woods. 15:14–24.

Discusses the general properties, gross anatomy, and minute anatomy of several woods from Latin America. Covers *Ottoschulzia rhodoxylon, O. cubensis, O. domingensis, Goethalsia meiantha, Trichanthera gigantea, Cybianthus venezuelensis, Clethra lanata, Dipterodendron costaricense,* and *Heisteria macrophylla.*

Williams, L. 1929. The woods of *Caryodendron angustifolium* Standley. Tropical Woods. 20:26–27.

Brief description of the tree, gross anatomy, and minute anatomy from a specimen in Panama.

Williams, L. 1935. A study of the Caryocaraceae. Tropical Woods. 42:l–17.

Describes the gross and minute anatomy, as well as the economic importance, of these trees. Also provides a brief taxonomic history and key to the species.

Williams, Llewelyn. 1936. Woods of northeast Peru. Botanical Series. Chicago, IL: Field Museum of Natural History. 15:585.

This work is based upon a study of 2,500 wood samples collected in Peru. A brief description of the area, covering geography, climate, and so on, is presented. This is followed by an extensive description of the characteristics of the tree and its wood. Both macroscopic and main microscopic features are described. A check list of common names and a bibliography are provided.

Williams, L. 1938. Forest trees of the isthmus of Tehuantepec, Mexico. Tropical Woods. 53:1–11.

Discusses the distribution and uses of trees in Tehuantepec.

Williams, L. 1939. Commercial woods of Venezuela (Maderas economicas de Venezuela). Caracas, Venezuela: Cooperativa de Artes Graficas: Boletin Technico Minist. Agric. y Cria. 2:97.

Wormald, T.J. 1975. Tropical forestry papers. No. 7. *Pinus patula.* Oxford, UK: Department of Forestry. 215 p.

Yanez–Marquez, O.; Caballero–Deloya, M. 1982. Study of the variation of some characteristics of Pinus strobus var chiapensis Martinez, from three locations in the natural distribution; relative density and length of tracheids of the wood (Estudio de la variacion de algunas caracteristicas de Pinus strobus var chiapensis Martinez de tres localidades de su distribucion natural I, densidad relitiva y longitud de traqueida de la madera). Mexico, D.F., Mexico: Ciencia Forestal. 7(37):3–18.

Relative wood density and tracheid length were studied from 55 trees sampled in three locations in Mexico. No significant differences were found between trees, despite the distance between the localities and the differences in the environmental conditions.

Yatsenko–Khmelevskii, A.A.; Kolosova, M.I. 1972. Role of the anatomical features of the wood in the make-up of tropical rain forest. Moscow, USSR: Lesnaya Promyshlen nost'. Referativnyi Zhurnal. 12.56.29:384–389.

Discusses wood anatomy in relation to the coenotic and economic role of individual species, the distribution of tree species, and competition in a tropical rain forest.

Zamora–S., C.; Velasco–F., V. 1977. *Pinus strobus* var. *chiapensis,* a species in danger of extinction in the state of Chiapas *(Pinus strobus* var. *chiapensis,* una especie en peligro de extincion en el estado de Chiapas). Departamento Mejoramiento Genetico de Arboles Forestales, Mexico. Ciencia Forestal. 2(8):3–23.

Describes the botany, ecology, silvicultural characters, and distribution in Mexico of this species. Wood properties and some uses are noted.

Zamora–V., N.; Poveda–A., L. J .; Canessa-A., E. 1988. A new species of *Caryodaphnopsis* Airy Shaw (Lauraceae) from the neotropics (Una nueva especie de *Caryodaphnopsis* Airy Shaw (Lauraceae) para la region neotropical). Annals of the Missouri Botanical Garden. 75(3): 1160–1166.

The distribution, taxonomy, and anatomy of *C. burgeri* are covered.

Zobel, B.J. 1985. Juvenile wood in tropical forest plantations: its characteristics and effect on the final product. Raleigh, NC: North Carolina State University, CAMCORE: Bulletin on Tropical Forestry, Central America and Mexico Resources Cooperative. 2:17.

Remarks on anatomical and working differences found in juvenile wood, commonly produced on plantations, compared with mature wood. These include a decreased yield of pulp and a greater likelihood of having warped, cracked, or otherwise less desirable wood.

Sawmilling and Machining

Saw design, sawing techniques, sawing and machining properties of wood, saw sharpening, shaping, planing, and related topics.

AIMA. 1985. Catalogo. AIMA (Asociacion de Industriales Madereros Ecuador). Quito, Ecuador. 62 p.

A listing of member companies, their products, species used, and production levels.

Anon. 1974. The blades of circular saws with tungsten-carbide teeth. Cahier, Center Technique du Bois. No. 94: 45 p.

Anon. 1975. Trials of a tungsten-carbide-tipped saw–blade that cannot be re–set, for portable circular saws. Bulletin d'Informations Techniques, Centre Technique de Bois. 72:11–12.

An inexpensive saw blade with tungsten-carbide tips proved to have promising potential for both softwoods and hardwoods.

Anon. 1977. Carbide tools: selection and maintenance (Les outils cabure: choix et entretien). Cahiers, Centre Technique du Bois. No. 105: 57 p.

Provides a thorough review of carbide tools and how they should be maintained.

Anon. 1980. Safety guides for the cutting of carbide tipped rotary cutting tools. Philadelphia, PA: Woodworking Machinery Manufacturers of America. 24 p.

Anon. 1983. Manaus–location of a modern timber research centre for the Amazon region (Manaus–modernes Holzforschungszentrum im Amazonasgebiet). Holz–Zentralblatt. 109(64):918.

Describes the Centro de Pesquisas de Produtos Florestais (CPPF) (Forest Products Research Center) part of INPA, the National Institute for Amazonian Research, in Manaus, Brazil. Construction of the facility was completed in 1982. The focus of the institute is on the utilization of the Amazonian forest resource. Six technical divisions, staffed by 25 scientists, are involved in wood anatomy, timber construction, wood chemistry and energy, wood drying, wood preservation, sawmilling, furniture manufacture, and panel products and veneer.

Anon. 1985. Twenty-four percent increase in sawnwood output in 1984. Chilean Forestry News. 89:11.

Describes the sawmilling industry in Chile with 1984 statistics, including information on production and output volumes and the number of sawmills in Chile.

Anon. 1988. The sawmill industry 1987: La industria del aserrio 1987. Santiago, Chile: Boletin de Mercado Forestal. 6(88):2-5.

Antoine, R. 1963. The joint action of stellite facing and reduction in speed on tool life in sawing abrasive timbers (Influences conjuuees du stellitage et de la reduction de vitesse sur la duree de coupe dans le sciage des bois abrasifs). Bois et Forets Tropiques. 90:33–38.

Stellite facing increased saw blade life eight times and stelliting with a slow speed increased saw life 40 times in experiments on the sawing of *Parinari* sp.

Assini, J.L.; Yamazoe, G.; Montagna, R.G. 1984. Performance of an assembly of double and single bandsaws and a double edger in Pinus processing (Desempenho de um conjunto de serras de fita geminada e simples e canteadeira dupla no processamento de Pinus). Sao Paulo, Brazil: Instituto Florestal. Boletim Tecnico. 38(2): 127–141.

The yield of a sawmill using the noted equipment when cutting 22 year old *Pinus elliottii* logs is discussed.

Bejar–M., G. 1982. Sawing oak wood (Aserrio de la madera de encino). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Boletin Divulgacion. No. 62. 33 p.

Blackman, Ted. 1980. Bandsaws cut labor needs at world's southernmost mill. World Wood. 21(4):14–15.

Blackman, Ted. 1980. New north Argentine sawmills process hardwoods and softwoods. World Wood. 21(5):12–13.

Blackman, Ted. 1981. Dimensions sawmill added to box manufacturing firm. World Wood. 22(3):15.

Blackman, Ted. 1983. Gangsaws, chipper-canter cut pine lumber for export. World Wood. 24(7):16–17.

Blackman, Ted. 1984. Mills use three tree species to produce lumber, veneer. World Wood. 25(6):24–25.

Borgo, G. 1980. Forestry development project, Paraguay. Some notes on sawmills (Proyecto de desarrollo forestal, Paraguay. Algunos apuntes sobre aserraderos). FAO Rep. FO:DP/PAR/76/005 Documento Especial No. 1. 108 p.

A reference work, based in part on material prepared for courses at universities in Paraguay and Colombia. Major sections include: a bibliography on sawmills, largely of Spanish-language literature; a list of 479 logging, sawmill, and other forest products industry terms in Spanish, Portuguese, and English; and a glossary of 264 Spanish sawmilling terms, with English equivalents.

Brown, W.H. 1978. Comparative studies of lesser-known timbers. 13: Working properties of some tropical American timbers. Woodworking Industry. 35(8):15–16.

Describes sawing and machining properties of banak and Virola and explores their increased use.

Bruce, R.W. 1976. Production and distribution of Amazon timber (Producao e distribuicao de madeira amazonica). Brasilia, Brazil. FO:DP/BRA/71/545, Field Doc. 21. UNDP/FAO. 60 p.

The consumption and output of forest products is discussed. Information on problems facing the sawmilling industry, such as technical and staffing problems, are noted.

Castaneda, M.I. 1985. Practical suggestions for the care and use of saws (Sugerencias practicas para el cuidado y uso de sierras). Mexico, DF, Mexico: 10(53):48–63.

Types of saws, their use, maintenance, and equipment needed for maintenance are discussed.

Chardin, Andre. 1960. Choice of sawmill type for a tropical forest area (Choix d'un type de scierie pour l'equipement d'une region forestiere tropicale). In: Proceedings, 5th world forestry congress, Multiple use of forest lands. 3:1422–1428.

Reviews the factors that should be considered before specific sawmilling equipment is selected, such as the importance of the species available, abrasiveness of wood, power requirements, and other factors.

Chardin, Andre. 1971. Saw tooth performance: Variables affecting tooth wear. In: Proceedings, wood machining seminar; 1971 March 24–25; Richmond, CA. Richmond, CA: University of California, Forest Products Laboratory: 1–14.

Chudnoff, M.; Goytia, E. 1969. Spindle carving of tropical hardwoods. Turrialba. 17(4):430–435.

Spindle carving tests of 132 green and 66 dry-laminated models representing 11 tropical hardwood species were made. Smoothness and integrity of surfaces determined machining quality.

Compton, K.C. 1965. Report of technical assistance to sawmill industry of southern Peru. Report to: International Agricultural Development Service. Washington, DC: U.S. Department of Agriculture and Agency for International Development. 55 p.

Describes the sawmilling situation in southern Peru in 1965, and discusses the problems, needs, and potential.

Dalois, C. 1977. Manual of sawing and saw-sharpening (Manuel de sciage et d'affutage). Nogent-sur-Marne Cedex, France: Centre Technique Forestier Tropical. 200 p.

Davis, S.H. 1985. The Ayoreode–Zapoco communal sawmill: a social forestry project in eastern Bolivia. Washington, DC: Anthropology Recource Center. Grassroots Development. 9(2) :2–9.

Describes a community of lowland Indians in the region of Santa Cruz, Bolivia, who own and operate a basic sawmill. The project forms a part of a larger program to demonstrate that indigenous groups of the tropical lowlands can preserve and protect their natural resources while becoming self sufficient.

Davis, W.E. 1973. Mexican mill has big and small log sides. World Wood. 14(7):9.

DeBonis, J.N.; Brozka, R.J. 1986. Observations and practical recommendations for forest exploitation in the tropics of Ecuador (Observaciones y recomendaciones practicas de explotacion forestal en los tropicos del Ecuador). Ecuador: Revista de la Facultad de Ciencias Agricolas, Universidad Nacional de Loja. 13(1-2):60–64.

Discusses means to prevent ecological damage, improve the utilization of wood, increase the effiency of extraction, and improve saw operation safety.

Deon, G. 1978. Manual of wood preservation in tropical climates (Manuel de preservation des bois en climat tropical). Nogent–sur–Marne, France: Centre Technique Forestier Tropical. 111 p.

Describes tropical wood protection in a manual covering subjects such as: protection of saw-logs; temporary protection of fresh sawn timber and rotary-cut veneers; protection of wood installation; agents of deterioration; natural durability of timber; preservation of wood before installation (materials and processes); impregnability of wood; protection of building timber; protection of squared timber used in contact with the soil; protection of roundwood (mine timbers, posts, and poles); protection of plywood; and protection of wood in marine uses.

Departamento de Pesquisa Tecnologica dos Recursos Naturais, Acre. 1986. Characteristics of the sawmilling industries of the Rio Branco forest region (Diagnostico das industrias de serraria da regiao florestal de Rio Branco). Rio Branco, Acre, Brazil: Departamento de Pesquisa Tecnologica dos Recursos Naturais, Governo do Estado do Acre. 130 p.

Describes the distribution, output, and marketing based on data from 20 sawmills.

Dijkmans, M.A.F. 1961. The Peruvian sawmill industry (La industria peruana de aserrar madera). Rome, Italy: United Nations, Food and Agriculture Organization. No. 1348: 43 p.

The state of the wood industry in Peru, including logging, sawmilling, and plywood manufacturing, is discussed.

Dudek, S. 1974. Forestry and the wood industry in Santa Cruz, Bolivia. Holz–Zentralblatt. 100(29):477.

Describes the forested area, the forest types, the major species in the forest reserves, logging, sawmilling, veneer and plywood production, export of roundwood and sawtimber, etc.

Dunaev, V.D. 1977. An efficient method for preparing carbide-tipped circular saws (Ratsional'nyi sposob osnashcheniya kruglykh pil plastinkami iz tverdogo splava). Derevoobrabatyvayushchaya Promyshlennost'. 26 (10) : 18. Translated, Fisheries and Environment Canada, 1978 (No. OOENV–1445). 4 p.

Explains how hard-alloy tips are soldered onto the front of the tooth, resulting in increased joint strength and simplified manufacture.

Durgnat, P.A. 1972. Aspects of lumber production. Trinidad, Trinidad and Tobago: Forest Division, Ministry of Agriculture, Lands and Fisheries. 43 p.

Describes the timber resources of Trinidad and problems that have curtailed employment opportunities in timber processing and have led to the dependence of Trinidad on imported sawn timber. Basic information is given on the development of logging, sawmilling, seasoning, grading, and wood preservation not currently used in the country. Possible changes in the industrial structure for modernization of the industry are discussed.

Eisenhauer, G. 1975. Utilization of natural forests, exemplified by conditions in Chile. Forstarchiv. 46(6):120–124.

Describes waste in logging methods used in Chile, including the harvesting systems used, e.g. logging methods, improper annual harvest, inefficient utilization in logging, sawmilling, and transportation. Increased mechanization is discussed relative to effectiveness, cost, and influence on socio-economic situations. Harvest of natural forests should be limited or even stopped so sustained yield management can be developed, according to the author. Concentration on high-yield plantations of exotics is recommended to meet timber needs.

Eisenhauer, G. 1975. Costs and degree of utilization in the exploitation of natural forests in Chile. Holz-Zentralblatt. 101(3/4):18–20.

Describes problems, such as transportation, decay, and lack of mechanization that result in low efficiency of wood utilization. Also investigates the economics of mill siting, machine cost, and mechanization.

FAO. 1970. Development of the sawmilling industry in Latin America. In: Proceedings, Regional consultation on the development of the forest and pulp and papaer industries in Latin America; 1970 May 19–26; Mexico, D.F., Mexico. ECLA/FAO/UNIDO. Forind 70. Paper 2. 160 p.

Reviews the history, production, consumption, markets, and problems of the sawmilling industry in Latin America. Also notes develpment opportunities and a list of techinical assistance given to Latin America.

FAO. 1975. Expanding the national forestry program in Chile: the primary conversion of wood (present position and future prospects). FAO Report, FO/SF/CHI 26, Tech. Rep. No. 5. 71 p.

Describes present and possible future methods of primary conversion in Chile, based on a study by H. Schrewe from field work in Cautin province in 1971 to 1974. Poor utilization of wood by the mobile circular sawmills being used is discussed, and suggestions are made for improving mill efficiency with the sawmilling facilities presently available. Also suggested are means for establishing effective sustained-yield management, including the gradual substitution of modern stationary mills for the mobile sawmills, and by combining primary and secondary processing in economical units. Legal measures to ensure control of forest use, necessary for sustained-yield mangagement are given.

FAO. 1981. Small and medium sawmills in developing countries. FAO Forestry Paper No. 28. Rome, Italy: United Nations, Food and Agriculture Organization, 149 p.

FAO. 1982. Frame saw manual. FAO Forestry Paper No. 39. Rome, Italy: United Nations, Food and Agriculture Organization. 105 p.

FAO. 1983. Circular saw manual. FAO Forestry Paper No. 40. Rome, Italy: United Nations, Food and Agriculture Organization. 72 p.

FAO. 1984. Cost estimating in sawmilling industries: guidelines. FA0 Forestry Paper No. 52/1. Rome, Italy: United Nations, Food and Agriculture Organization. 92 p.

FAO. 1985. Sawdoctoring manual. FA0 Forestry Paper No. 58. Rome, Italy: United Nations, Food and Agriculture Organization. 227 p.

Felker, P.; Roberson, S., eds. 1983. Mesquite woodworking. In: Proceedings of a workshop on the cutting, drying, and fabrication of mesquite wood into flooring, handcrafted items, and furniture; 1982, June 10; Kingsville, TX. 35 p.

Provides information on the sawing, utilization, logging, and silviculture of mesquite (Prosopis).

Fronius, K. 1984. The Chilean sawmilling industry (Die chilenische Sageindustrie). Holz–Zentralblatt 110(153):2266-2267.

Describes the Chilean sawmilling industry, including machinery, operations, productivity, and species used (about 95 percent is Pinus radiata).

Gaillard, J.B. 1977. Fire prevention methods in sawmills (Medidas de prevencion contra incendios en aserraderos). Buenos Aires, Argentina: Instituto Forestal Nacional, Argentina Forestal. 35(314):5–8.

Describes fire-prevention regulations to be considered before establishing a sawmill; siting and protecting timber yards; precautions for stacking sawn timber; fire prevention within the sawmill; disposal of offcuts, sawdust, shavings and other wood waste; and fire-control organization, equipment, and staff.

Gallardo–L., M. 1981. Determining the amount of credit that the sawmill owners in Zinacantepec State, Mexico, ought to use to maximize their incomes. (Determinacion de la cantidad de credito que deben utilizar los aserraderos de Zinacantepec, Estado de Mexico para maximizar sus ingresos). Chapingo, Mexico; Colegio de Postgraduados, Centro de Botanica, Programa Bosques. Escuela Nacional de Agricultura. (Tesis 1981, No. 15).

Gilmore, R.C.; Barefoot, A.C. 1974. Evaluation of some tropical woods imported into the United States from South America. Forest Products Journal. 24(2):24–28.

Describes machining, gluing, and strength tests on six groups of tropical woods, exported under the commercial names of Andiroba *(Carapa guianensis),* Azafran *(Zanthoxylum* sp.; *Cordia* sp.), Banak or Ucuuba *(Oteophloeum* sp.; *Virola* sp.), Hura *(Hura* sp.), Sajo *(Campnosperma panamensis),* and Virola *(Dialyanthera* sp.). Comparisons were made with *Liriodendron tulipifera.* In general, strength of glue bonds, static bending strength, and toughness decreased with decreasing specific gravity of the wood.

Gonzalez, M.R. 1975. Census of sawmills, conducted in January and February 1975 (Censo de aserraderos, realizado durante Enero y Febrero 1975). San Jose, Costa Rica: Escuela de Ciencias Ambientales, Universidad Nacional, Papel ocasional No. 1, Serie Silvicultura. 48 p.

Hallren, T.P. 1985. Small, thin carbide strobe saws. In: Sawing technology: the key to improved profits. Proceedings No. 7322. Madison, WI: Forest Products Research Society: 100–101.

Halvorson, H.N.; Stuart, W.M.P. 1963. Improvement of sawmill cutting tool sharp life by surface hardening. Forest Products Journal. 13(3):108–111.

Saw tooth hardening methods via chromium plating and carbitroning (with tungsten carbide) are noted for their ability to increase tooth life.

Hasek, V.C. 1960. Choosing the right type of sawmill to fit specific needs. In: Proceedings, 5th world forestry congress, Multiple use of forest lands. 3:1428–1432.

Several items should be considered before a sawmill is established. These include species availablilty, transport and logging infrastructure, marketing potential, etc. Specific topics, such as recommendations for specific equipment and plant layout are mentioned.

Hasek, V.C.; Ponce, R.H. 1973. Dimension sawmills. Brasil Florestal. 4(14):47-60.

Describes the use of dimensional, i.e., portable, sawmills to minimize log transport. The layout and operation of these mills is discussed, as are the advantages and disadvantages of each type.

Hernandez, L.H.; Hiramatsu, K.; Roby, H.O.; Sancho, E.R. 1982. Technical–economic study of the timber industry in Mendoza Province. Part 2: Economic characterization of the sawmilling sector (Estudio tecnico–economico de la industria maderera en la Provincia de Mendoza. Parte Segunda: Caracterizacion economica del

Sector aserraderos). Mendoza, Argentina:Revista de la Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo. 22(2):97-107.

Describes and analyzes the economics of sawmill operations in 1979/80, in Mendoza Province, Argentina, including capital value, lumber production, and profitability. Productivity and efficiency of the mills is discussed.

Herrera–B., A. 1981. Advances in the determination of the machining characteristics of five oaks growing in Mexico (Avance en la determinacion de las characteristicas de maquinando de cinco aspecies de encino que vegetan en Mexico). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales, Ciencias Forestal. 6(34):45–64.

Describes machining properties (planing, sanding, drilling, moulding, and turning) of the wood of *Quercus candicans, Q. castarea, Q. resinosa, Q. obtusata,* and *Q. sideroxyla.* For all five species, machining properties were generally good, except for turning quality. Sanding was poor for *Q. candicans.* Best results in planing were with a knife angle of 20° and a feed velocity producing 19.7 knife marks/cm. Additional information provided in Quinones–O and Herrera–B., 1984.

Hinrichsen, M.P. 1989. Analysis and diagnosis of the industrial processes for mechanically transforming wood. Part 3. A study of the work time in sawmills (Analisis y diagnostico de procesos industriales de transformacion mecanica de la madera. Parte III. Estudio de la utilizacion del tiempo de trabajo en plantas de aserrio). Santiago, Chile: INFOR-CORFO (Instituto Forestal — Corporacion de Fomento de la Produccion), Informe Tecnico. 119:50.

Describes a study of four sawmills cutting radiata pine. The study showed that nearly 28 percent of lost time is due to machinery failure. For canting sawmills the lost time was less, at about 19 percent. Human causes were not significant. Maintenance of machinery could improve the situation.

INDERENA. 1972. Investigation: technical economics of the sawmill industry in Colombia (Investigacion: tecnico economica de la industria del aserrio en Colombia). Bogota, Colombia: Instituto de Desarrollo de los Recursos Naturales Renovables. 141 p.

Review the state of the sawmill industry in Colombia. The variety of species sawn and several problems encountered by mills are noted.

INFOR–CORFO. 1983. The dimension and wood production industry: Regions 5–8 — Metropolitana 1983 (La industria demensionadora y elaboradora de madera: Regiones V–VIII — Metropolitana 1983). Santiago, Chile: Instituto Forestal, Serie Informatica No. 15. 165 p.

Information is provided on sawing and end-use industries in three regions in Chile.

INFOR–CORFO. 1984. The sawmill industry 1983 (La industria del aserrio 1983). Santiago, Chile: Iristituto Forestal. Serie Informatica No. 14. 89 p.

INFOR–CORFO. 1985. The sawmill industry 1984 (La industria de aserrio 1984). Santiago, Chile: Instituto Forestal — Corporacion de Fomento de la Produccion, Serie Informatica No. 25. 90 p.

INFOR–CORFO. 1987. Technological vision of the Chilean forest industry (Vision tecnologica de la industria forestal chilena). Santiago, Chile: Instituto Forestal–Corporacion de Fomento de la Produccion, Informe Tecnico No. 105.

INFOR–CORFO. 1987. Tables of mechanical conversion and production (Tablas de conversion mecanica y elaboration). Santiago, Chile: Division Industrias Forestales, Instituto Forestal. 15:115.

The manual has 66 tables on the conversion of logs to lumber and lumber to secondary products. A chapter is dedicated to saws and their use. Other tables pertain to standards of production and allowances for product size. Several tables provide information of interest to both the producers and users of wood, such as equilibrium moisture content by species and region of use, and properties of Chilean woods.

INFOR–CORFO. 1987. The sawmill industry 1986 (La industria del aserrio 1986). Santiago, Chile: Instituto Forestal — Corporacion de Fomento de la Produccion, Boletin Estadistico. No. 2. 100 p.

Describes the sawmill industry of Chile by region, production, species cut, and type of mill.

INFOR–CORFO. 1988. Operation and capital costs of forestry activities in Chile 1988 (II Part) (Costos operacionales y de capital de las actividades forestales en Chile 1988 (II Parte)). Santiago, Chile: INFOR-CORFO (Instituto Forestal — Corporacion de Fomento de la Produccion. Informe Tecnico. 118:49.

Describes the operation and costs associated with sawmilling and secondary wood products manufacture.

INFOR–CORFO. 1988. The sawmill industry 1987 (La industria del aserrio 1987). Santiago, Chile: Instituto Forestal — Corporacion de Fomento de la Produccion, Boletin Estadistico. 7:132.

INFOR–CORFO. 1989. The sawmill industry 1988 (La industria del asserio 1988). Santiago, Chile: INFOR–CORFO (Instituto Forestal — Corporacion de Fomento de la Produccion. Boletin Estadistico. 12:139.

Describes the sawmill industry of Chile by region, production, species cut, and type of mill.

IUFRO. 1980. Processing high density tropical woods (Procesamiento de maderas tropicales de alta densidad). In: Acta de la reunion de IUFRO; 1977, October 2–9; Merida, Venezuela: Laboratorio Nacional de Productos Forestales, MARNR., Universidad de los Andes.

Twenty-nine papers on adhesives and gluing, drying, wood properties, sawing and machining, and new uses for high density tropical woods.

Jones, D.S. 1963. Wear resistant tips for saw teeth. Australian Timber Journal. 29 (8) :70,71,75.

Six types of hard saw tooth edges are noted for their ability to cut high density woods.

Jones, D.S. 1965. Cemented tungsten carbide in the woodworking industry. Australian Timber Journal. 31(8):37–44.

Gives an overview of tungsten carbide in woodworking equipment and the potential economic saving that may result if they are used. A bibliography on tungsten carbide is provided.

Kernan, H.S. 1951. Forestry in Bolivia. Unasylva. 5(1):59-63.

Describes the forest resources and problems of their development in Bolivia. The history and status of the forest industry is presented.

Kirbach, E. 1979. Methods of improving wear resistance and maintenance of saw teeth. Tech. Rep. 3. Vancouver, BC, Canada: Canadian Forestry Service, Western Forest Products Laboratory. 45 p.

Kirbach, E. 1985. Methods of reducing sawtooth dulling. In: Sawing technology: The key to improved profits. Proceedings 7322. Madison, WI: Forest Products Research Society: 83–88.

Kirbach, E.; Bonac, T. 1981. Stellite tipping of saws for cutting softwood lumber. Tech. Rep. 17. Forintek Canada Corp. 16 p.

Kirbach, E.; Bonac, T. 1982. Dulling of sawteefh tipped with a stellite and two cobalt-cemented tungsten carbides. Forest Products Journal. 32(9):42–45.

Of three types of blades tested in cutting unseasoned western redcedar, stellite (with 59 percent cobalt) proved superior over tungsten carbide (with 6 percent cobalt). Carbide blades with 18 percent cobalt experienced excessive dulling.

Kirbach, E.; Bonac, T. 1982. Alloy tipping for reduced sawtooth dulling. Forest Products Journal. 32(8):36–40.

Kirbach, E.; Chow, S. 1976. Chemical wear of tungsten carbide cutting tools by western redcedar. Forest Products Journal. 26(3):44–48.

Western redcedar *(Thuja plicata)* heartwood contains tropolones and polyphenolic lignans that attack the cobalt matrix. It is noted that increased tool temperature accelerates the production of these compounds.

Komatsu, M. 1977. Machine boring properties of wood. III. The comparison of the machinability of tropical woods in machine boring tests with that in sawing tests by circular saw. Mokuzai Gakkaishi. 23(12):640-647.

Boring tests in which torque and thrust were measured were carried out on 26 tropical timbers ranging in relative density from 0.28 to 0.81. Relations between torque and thrust and both feed speed and density were established. In sawing tests on the same timbers with a circular saw, feed force and torque were likewise related to density. In tropical timbers the effects of density on the boring and sawing properties were in general very complicated.

Krilov, A. 1976. Stellite-tipping versus high-frequency hardening of bandsaw teeth. Journal of the Institute of Wood Science. 7(3):10–12.

These two sawing techniques, which have been developed to cope with silica often found in tropical woods, are evaluated. Thermal high-frequency hardening was noted as being advantageous for timber of medium hardness.

Lamiaux, R.; Tinto, J.C. 1975. A study of the technological properties of the wood of Poplars cultivated in Mendoza Province. Buenos Aires, Argentina: Instituto Forestal Nacional. Nota Tecnologica Forestal. 28:11.

Describes the wood of *Populus alba* var. *pyramidalis* and *P. canescens* from plantations in western Argentina and presents tabulated data on their physical and mechanical properties including density at 15 percent moisture content, shrinkage, hardness, and strength in compression parallel, in static bending, dynamic bending, and working properties for sawing, planing, moulding, and finishing.

Latham, Bryan. 1957. Timber, its development and distribution, a historical survey. London, United Kingdom: George G. Harrap and Co. Ltd. 303 p.

Longwood, F.R. 1961. Puerto Rican woods; their machining, seasoning, and related characteristics. Agric. Handb. 205. Washington, DC: U.S. Department of Agriculture. 98 p.

Provides information on the machining, physical properties, and response to air seasoning of 60 species. A description and photo of each wood is provided.

Longwood, F.R. 1962. Present and potential commercial timbers of the Caribbean — with special reference to the West Indies, the Guianas, and British Honduras. Agric. Handb. 207. Washington, DC: U.S. Department of Agriculture. 167 p.

Presents a summary of information on 71 important timbers of the area. Includes: distribution and habitat; descriptions of tree and wood; seasoning and shrinkage; strength properties; working properties; natural resistance; and permeability.

Lunstrum, S.J. 1968. Modernizing the sawmill industry of Paraguay. Report to International Agricultural Development Service. Washington, DC: U.S. Department of Agriculture and Agency for International Development. 59 p.

The problems, needs, and potential of the sawmill industry in Paraguay are noted.

Maier-Witt, H.J. 1977. Technical requirements for tropical sawtimber (Technische Anforderungen an tropische Sageholzer). Holz–Zentralblatt. 103(79): 1182.

Describes uses of tropical woods (including secondary species) in buildings, furniture, marine construction, etc. Also discussed are problems encountered in working the woods and sawing methods.

Maldonado, E.D.; Boone, R.S. 1968. Shaping and planing characateristics of plantation-grown mahogany and teak. Res. Pap. ITF-7. Puerto Rico: U.S. Forest Service, Institute of Tropical Forestry.

Shaping and planing characteristics of Puerto Rico plantation-grown mahogany and teak are reported. Included is small-leaf (West Indies) mahogany from the U.S. Virgin Islands; forest-grown mahogany from Mexico, Honduras, and Peru; teak from Burma; sweetgum from the U.S.A.; and birch from Canada were also tested for comparison. Small-leaf mahogany proved superior in shaping and planing properties to those of all other woods tested. In shaping, two mahogany plantations and both teak plantations yielded wood that rated as good as the imported forest grown material. In general, all the woods performed well in planing. Shaping quality is only weakly correlated with specific gravity and growth rate.

Marroquin–C., I. 1985. Practical suggestions for the care and use of saws (Sugerencias practicas para el cuidado y uso de sierras). Mexico, D.F., Mexico: Ciencia Forestal. 10(53):48–63.

Covers bandsaws and circular saws.

Martinez, B.J. 1976. Importance and care of bandsaw teeth (Importancia y cuidados en los dientes de la sierra cinta). Mexico, D.F., Mexico: Ciencia Forestal 1(4):17–29.

Provides terms on band saw teeth and information on the design and maintanence of band saw teeth.

McNutt, J.W. 1971. National School of Forest Sciences, Siguatepeque, Honduras. Sawmilling and carpentry. FAO Rep. FO:SF/HON 5, Informe Tecnico 1:47.

Describes the state of the art in sawmilling in Honduras especially for pine. Recommendations are given to improve the sawmill industry.

McVeigh, J. 1971. Forest inventory and demonstrations, Panama: study of sawmill and wood manufacturing industries (Inventariacion y demostraciones forestales, Panama: estudio de aserio y industrias manufactureras de la madera). Food and Agriculture Organization, United Nations Development Program, FAO Rep. FO:SF/PAN 6, Informe Tecnico 4:21.

Describes the state of the art in Panama for sawmilling and wood manufacturing and recommends changes to improve the situation.

Melchor–Marroquin, J.I. 1984. The sawing industry in the state of Tabasco, Mexico (La industria de aserrio en el Estado de Tabasco, Mexico). Chapingo, Mexico: Universidad Autonoma de Chapingo. M.S. thesis.

Melo e Silva, H.J.; Guimaraes, A.J.F.; Souza, T.C.; Sena, J.C.A. 1978. Use of mobile sawmills for the better utilization of wood in colonized strips (Uso de serrarias moveis para melhor aproveitamento madeireiro nas faixas de colonizacao). Brasil Florestal. 9(35):63–74.

Analysis is presented on the technical and economic practicability of using mobile sawmills to obtain the best use of trees cut from strips along the Transamazon highway. Situations where this type of equipment use is particularly advantageous are noted.

Melo-S., R.; Madsen, P.E. 1966. Pulps from sawmill waste and thinnings. Tappi. 49(9):54A–55A.

Notes the physicomechancial properties of the pulp of Pinus radiata produced via sulfate and sodium bisulfate pulping.

Morrow, E.A. 1972. Report to the Government of Guyana on aspects of timber processing. FAO Rep. TA 3144. Rome, Italy: FAO (Food and Agriculture Organization of the United Nations), UNDP (United Nations Development Program). 10 p.

Discusses the operations of the Central Timber Manufacturing Plant, Guyana Timbers Ltd., and the Forest Department's Mobile Sawmill, and makes recommendations for improvements.

Nelson, B.W.; [and others]. 1985. Distributional and ecological notes on Polygonanthus amazonicus Ducke. Acta Amazonica. 15(1–2 Supplement):63–69.

Describes habitat and dispersal of this tree, commonly called the "laranjinha." It has been used for lumber, but many trees are unsuitable because they are hollow.

Ninin, Luc. 1969. The relations between sawing properties and some physical, mechanical, and chemical characters of three tropical timbers. Revista Forestal Venezolana. 12(18):67–117.

Describes research done in France and Belgium on four tropical hardwood species *(Entandrophragma angolense, Virols* spp., *Baillonella toxisperma,* and *Afzelia bipindensis).* Impact bending strength, hardness, and shear strength parallel were determined to be as important as density for determining the energy requirements for sawing these species. Further trials with other species are needed to determine if the relationship is true for different species.

Ninin, Luc. 1970. Relationship between machining and several physical, mechanical, and chemical properties of four tropical woods (Relaciones entre la aptitud al aserrado y algunas propiedades fisicas, mecanicas y quimicas de cuatro maderas tropicales). Merida, Venezuela: Univeridad de los Andes, Laboratorio Nacional de Productos Forestales. 55 p.

Provides chemical, physical, and mechanical data of several samples of wood and discusses how these influence machining and sawing.

Ninin, L. 1974. Splits and breaks in bandsaws (Picaduras y ruturas de las cintas). Merida, Venezuela: Universidad de los Andes. 6 p.

Describes the possible causes for failure in bandsaws.

Ninin–S., L. 1974. Some important aspects of the production of sawn wood in the country (Algunon aspectos releventes de la produccion de madera aserrada en el pais) Merida, Venezuela: Laboratorio Nacional de Productos Forestales. Revista Forestal Venezolana. 17(24):21–28.

Describes the main reasons why little progress has been made in developing the production of sawn timber in Venezuela in spite of publicized work by the National Forest Products Laboratory on the properties and potential uses of tree species previously considered as marginal, and in spite of government insistence that a greater range of timbers should be used. Recommendations are given to aid this situation.

Ninin, Luc. 1975. Elements of a bandsaw (Elementos de una cinta). Merida, Venezuela: Universidad de los Andes. 10 p.

The parts and function of bandsaws are noted. Bandsaw maintenance and operation are explained.

Ninin, Luc. 1980. Some basic considerations for the sawing of hard timbers (Algunos lineamientos basicos para el aserrado de maderas de dureza elevada). Acta de la reunion International Union of Forestry Research Organizations. Merida, Venezuela: Universidad de los Andes, Laboratorio Nacional de Productos Forestales. 9 p.

Describes the effects of physical properties of tropical woods on the sawing process, and methods for sawing most efficiently.

Noack, D.; Fruhwald, A. 1980. The influence of wood properties on wood processing (Procesamiento de maderas topicales de alta densidad). Acta de la reunion de International Union of Forestry Research Organizations. Merida, Venezuela: Universidad de los Andes, Laboratorio Nacional de Productos Forestales: 22 p.

Describes the relationships between physical and mechanical properties of wood, and sawing behavior. Discusses applying the results to new or lesser-known species. The effects of wood properties on other processing steps such as planing and gluing are discussed.

Norlander, N. 1985. Saw specifications—what they are and the benefits they offer. In: Sawing technology: the key to improved profits. Proceedings 7322. Madison, WI: Forest Products Research Society: 38–48.

Ogle, Peter. 1981. Austrians lend hand with automated Mexican mill. World Wood. 22(5):48–49.

Ogle, Peter. 1982. Peru mill represents major evolutionary step. World Wood. 23(4):12–13.

Okumura, S.; Sugihara, H.; Ikeuchi, K. 1978. Wearing process of tungsten carbide tipped circular saw-interrupted cutting of particleboard with a single saw tooth. Bulletin No. 50. Kyoto University Forests: 201–208.

Main article is in Japanese, but English summary is provided.

Page, M.W. 1978. Hardwood sawmilling—an economic means of assisting social development in tropical regions. In: Proceedings, 7th world forestry congress; Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: FAO-Instituto Forestal Nacional. 5:6553–6576.

Pahlitzsch, G. 1962. Situation in international sawing research (Internationaler Stand der Forschung auf dem Gebiet des Sägens). Holz als Roh– und Werkstoff. 20(10):381–392.

Provides an overview of international sawing research through the early 1960s. Topics covered include: cutting speed, force, and edge; feed rate; tooth design; and tipping.

Plumptre, R.A. 1971. The efficiency of sawmilling in utilising forest resources. Oxford, UK: Commonwealth Forestry Institute. 29 p.

Compares utilization of temperate forests with tropical forests. Presently, <10 percent of the above-ground biomass of tropical forest is used as sawn timber. Improvements are technically and economically possible, and a system is suggested for grouping species for different end uses. Utilization of more species is also suggested along with the reduction of minimum log sizes, and the installation of machinery suitable for converting both large and small logs.

Plumtre, R.A. 1978. The potential of small sawmills for increasing the utilization of tropical forests. In: Proceedings, 8th world forestry congress: Forestry for industrial development; 1978 October 16–28; Jakarta. 2:15.

Potma, H.L.; Lima, J.P.C. de; Mercado, R.S.; Kengen, s. 1975. Survey of the sawmilling and plywood industry of the new state of Rio de Janeiro (Levantamento da industria de serrarias e laminados do novo estado do Rio de Janeiro). PRODEPEF, Brasilia, Brazil: FAO Rep. PNUD/FAO/IBDF/BRA-45, Serie Estudos 3:70.

Describes an estimate of the total number of sawmills (106) in the new State, including data on total output, marketing methods, technical and economic operations, and the type of products made. Total production in 1974 was 81,100 m^3, accounting for about 16 percent of local consumption. Most of the sawmills are small.

Potter, W.G. 1975. The founding of a sawmill in Paraguay. The international effort behind a new venture. Timber Trades Journal. (Anniversary special issue). p. 120–122.

Describes a sawmill located in south-east Paraguay which became operational in 1974. The mill has a capacity of 40,000 m^3 per year and is located in an area with 180,000 hectares of high forest with an estimated timber volume of 1,900,000 m^3. An appendix describes the five commercial timber specks of the forest.

Quesada, A.F.; Roseberry, R.L. 1969. Manual for setting up and maintaining bandsaws (Manual acondicionamiento y matencion sierra huincha). Manual 6. Santiago, Chile: Instituto Forestal. 102 p.

Lists equipment and methods used to set up and maintain bandsaws.

Quesada, A.F.; Roseberry, R.L.; Proulx, C. 1969. Manual for setting up and maintaining circular saws (Manual ascondicionamiento y mantencion: sierras circulares). Manual 5. Santiago, Chile: Instituto Forestal. 90 p.

Provides information on how to set up and maintain circular saws, including tooth changing, tension sharpening, and so on.

Quinones–O., J.O.; Herrera–B., A. 1984. Potential and utilization of the oaks in the northern part of the country (Potencialidad y utilizacion de los encinos en el norte del pais). Mexico, D.F., Mexico: Ciencias Forestal. 9(52):3–10.

Sawing and machining characteristics of *Querus resinosa, Q. Castanea, Q. candicans, Q. obtusada,* and *Q. sideroxyla* are given.

Saldarriago, J. 1979. Working (machining) characteristics of ten species of the region Uraba. Colombia: Revista Facultad Nacional de Agronomia. 32(1):45-63.

Provides results of machining ten species from Colombia.

Sanchez, R.L. 1983. Techniques for the siting of sawmills in Mexico (Tecnicas para la ubicacion de aserraderos en Mexico). Boletin Tecnico No. 17. Chapingo, Mexico: Departamento de Bosques, Universidad Autonoma de Chapingo. 105 p.

Sanev, V.I.; Nazarenko, I.G.; Oborin, L.A. 1977. Stengthening wood-cutting tools with stellite in argon atmosphere (Uprochnenie derevorezhushchikh instrumentov stellitom v srede argona). Leningrad, U.S.S.R.: Lesnoi Zhurnal. 1:154–155.

Saw blades tipped with stellite had acceptable accuracy and were more than twice as wear resistant as teeth made of alloy steel.

Saravia, F. 1978. Small-scale sawmills in industrial and social development of backward forestry areas: the Panguipulli case study (1970–73) in southern Chile. In: Proceedings, 8th world forestry congress: Forestry for industrial development; 1978 October 16–28; Jakarta. Vol. 2. 20 p.

Segal, A.R. 1975. Trial and error analysis of carbide saw vibrations as affected by tooth form. Proceedings, 9th symposium on particleboard. Pullman, WA: Washington State University: 235–245.

Silva de M, H.J.; Guimares, A.J.F.; Souza, T.C.; Sena, J. 1978. Use of mobile sawmills for the better utilization of wood in colonized strips (Uso de serrarias moveis para melhor aproveitamento madeireiro nas faixas de colonizacao). Brasil Florestal. 9(35) : 63–74.

Simmons, R.E. 1916. Lumber markets of the east coast of South America. Special Agents Series 112. Washington, DC: U.S. Department of Commerce, Bureau of Foreign and Domestic Commerce. 121 p.

A discussion of the species used for lumber, including information on their sawing and drying, in Chile, Ecuador, Colombia, Venezuela, Trinidad, and Peru.

Simmons, R.E. 1916. Lumber markets of the west and north coasts of South America. Special Agents Series 117. Washington, DC: U.S. Department of Commerce, Bureau of Foreign and Domestic Commerce. 149 p.

The species used for lumber, and their sawing and drying, in Argentina, Uruguay, and Brazil are described.

Solov'ev, V.V.; Morgachev, A.M.; Mikhailova, A.R. 1986. The effect of welding stellite on the strength of frame saws. Archangel, U.S.S.R.: Lesnoi Zhurnal 2: 59–62.

Welding stellite tips to saws can reduce the strength of the saw. Measures to minimize this effect are provided.

Stahelin, R.; Everard, W.P. 1964. Forests and forest industries of Brazil. Resource Rep. 16. Washington, DC: U.S. Department of Agriculture, Forest Service. 50 p.

Describes the status of Brazilian forest resources and industry to 1960.

Stewart, H.A.; Shatynski, S.K.; Harbison, B.; Rabin, B. 1986. High-temperature corrosion of tungsten carbide from machining medium-density fiberboard. Carbide and Tool Journal. 18(1):2–7.

Provides evidence that high temperatures contribute more to wear than to erosion. Tool treatments (ion implantation, boriding, and coating with titanium nitride) and ceramic tools were tested and showed reduced blade wear.

Sugihara, H.; Okumura, S.; Haoka, M.; Ohi, T. Makino, Y. 1979. Wear of tungsten carbide tipped circular saws in cutting particleboard: effect of carbide grain size on wear characteristics. Wood Science and Technology. 13(4):283–299.

Notes that coarse-grained carbide tips had a longer life than saws with fine or medium grained tips. Provides additional information on the process of wearing.

Sumi, H. 1977. Processing qualities of tropical woods: sawing, drying, and surfacing. In: More effective use of tropical woods. Mokuzai Kogyo. 32(11):27–33.

Describes results from sawing, drying, and surfacing tests. Data are summarized in a table where 25 species or genera (listed by scientific name) are evaluated by yield, drying time, cutting resistance, and blunting of planer blades.

Superintendencia do Desenvolvimento da Amazonia. 1981. Sawmill yields of thirty species of Amazonian woods (Rendimento em serraria de trinta especies de madeiras amazonicas). Belem, Brazil: SUDAM/Centro de Tecnologia Madeireira No. 12. 186 p.

Covers the yields of 30 of the most commonly harvested species.

Terreros Ll., V. 1965. Power equipment for sawmills (Plantas motrices para aserraderos). Santiago, Chile: Instituto Forestal. Informe Tecnico No. 16. 29 p.

Describes different power sources for sawmills, including electric, diesel, gasoline, and wood gas. Provides economic information on each source.

Torres–S., L. 1973. The cutting force in sawing as a function of three mechanical properties (hardness, machinability, and toughness) in several tropical woods (El esfuerzo de corte en aserrado como funcion de tres propiedades mecanicas (Dureza, Cizallamiento y Tenacidad) en alguanas maderas tropicales. Bucaramanga, Mexico: Universidad Industrial de Santander. 32 p.

UNDP/FAO. 1968. Survey of pine forests: Honduras. Rome, Italy: United Nations Development Program/Food and Agriculture Organization: 80 p.

The status of Honduran pine forests, their harvest, and wood utilization is reported. Appendices provide information on wood housing, charcoal production, and sawmills.

Valdes–S., H. 1983. Industries derived from wood (Industrias derivadas de la madera). Proceedings: 1st Congreso nacional de industrias derivadas de la madera; 1983; Medellin, Colombia: 101–112.

Vidaurre–E., S. 1987. Needs of the sawnwood industry in Chile. (Necesidades de la industria de madera aserrada en Chile). Ciencia e Investigacion Forestal. 1:105–115.

Describes the current status of the sawmill industry of Chile and provides suggestions for improving the industry in the future.

Villasuso, J.M. 1979. Production functions of forestry and wood processing in Costa Rica. (Funciones de produccion en la actividad forestal y maderera en Costa Rica). Turrialba. 29(3):207–212.

Provides production data for 1976 forestry activities and sawmilling, which were used to produce linear production and Cobb- Douglas production functions for the two sectors. Using a model based on the data collected and analyzed, the stage of decreasing returns is shown in both sectors.

Volatron, B. 1976. The exploitation of the forest resources of Amazonian Brazil and Colombia, and the medium-term outlook for imports of logs and sawn timber from these countries on the French tropical-woods market. Part 3. Bois et Forets des Tropiques. 168:65–79.

The last of three articles describes the forests of Colombia, noting that between 1966 and 1972 the forest area purportedly has diminished from 64.4 to 51.2 million ha because of shifting cultivation, burning, and over-cutting. About 45 percent of the land area is still forested. About 10 million ha on the Pacific coast can now be exploited. Descriptions of these accessible forests are given, showing vegetation types, forestry administration (felling permits), logging and sawmilling industries, and exports. The export of logs is being stopped.

Wettling, G.A.; Planas, U.E. 1965. Yields of logs in sawmills (Rendimiento de trozas en aserraderos). Santiago, Chile: Instituto Forestal. Informe Tecnico No. 12. 14 p.

The efficiency of yields from five hardwoods and one pine cut on different types of sawmills is described.

White, V.S. 1976. Saw and knife running–time increased substantially with titanium carbide. San Francisco, CA: Forest Industries. 103 (13) :42–43.

A thin layer of titanium carbide increases saw blade life by 2 to 5 times. The process of this application and the results obtained are explained.

Zavala–Z., R.; [and others] 1982. Assessment of the sawmilling industry in the state of Durango, Mexico. (Diagnostico de la industria de aserrio del Estado de Durango). Boletin Tecnico 87. Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. 86 p.

Wood Drying

Air and kiln drying (seasoning); solar kilns, moisture content of wood, equilibrium moisture content, and shrinkage.

Albin–A., R.; Jaramillo–L., R. 1980. Variation in moisture content of Pinus radiata industrial wood (Observaciones sobre la variacion de contenido de humedad en madera industrial astillable de Pinus radiata (D. Don)). Valdivia, Chile: Universidad Austral de Chile. Bosque. 3(2):101–105.

Describes the sampling of the moisture content of Pinus radiata logs over a period of one year. Within-tree variation and individual log moisture contents were recorded. Analysis showed that storage with or without direct exposure to solar radiation, and log size, had little effect on final moisture content after 6-month storage (75 to 80 percent). Moisture content in whole stems with crowns, monitored over a 6-wk period in Nov.–Jan., fell from 89 to 45 percent, and those without crowns from 85 to 50 percent.

Anon. 1926. Seasoning of native timbers. Leaflet 2. Port–of–Spain, Trinidad and Tabago. Forest Department Trinidad and Tabago. 16 p.

Reports on the air drying in a covered shed of 22 species of lumber. Notes time required, shrinkage, warp, insect, and fungus attack.

Anon. 1965. Proceedings of the conference on forest product research (Actas de la Reunion sobre Investigaciones en Productos Forestales). Santiago, Chile: Instituto Forestal. Informe Tecnico. 21:136–171.

Six papers presented at this conference cover drying and reconditioning of coigue and eucalypts, corrections of electrical moisture meters, and equilibrium moisture contents in woods from the various regions of Chile.

Anon. 1971. Moulding stock produced for export to Canada and the USA. World Wood. 12(13):10–11.

Anon. 1973. Information from the technological investigation, gathered by the National Forest Products Laboratory for 15 woods of the Rio Suapure region Bolivar State (Ven) (Informe de la investigacion techologica realizada por el laboratorio nacional de productos forestales sobre 15 maderas de la region del Rio Suapure en el estado Bolivar). Merida, Venenzuela: Laboratorio Nacional de Productos Forestales. Ministerio de Agricutura y Cria–Universidad de Los Andes. 28 p.

Physical and mechanical properties, sawing and workability properties; drying and preservation characteristics (days to air dry to 20 percent moisture content).

Anon. 1978. Technological study of 15 timber species from the Bajo San Juan area, Choco, Colombia (Estudio tecnologico de 15 especies maderables procedentes de la zona del Bajo San Juan, Choco, Colombia). Colombia, Universidad Distrital "Francisco Jose de Caldas" Bogota, Colombia: Instituto de Investigaciones y Proyectos Forestales y Madereros. 190 p.

Describes 15 species including botany, anatomy, silica content, physical and mechanical properties, working characteristics, drying, durability, preservation, and general uses of the woods.

Anon. 1978. Timbers of the world. 2. South America. High Wycombe, UK: Timber Research and Development Association. TRADA Red Booklet Series. 121 p.

Describes the nomenclature, distribution, general characteristics of the tree and the timber, drying, strength and durability properties, working qualities, and uses of 82 hardwood species and 4 softwood species.

Anon. 1979. Big chilean mill also planes. World Wood. 20(11):23.

Anon. 1981. Characteristics and physical and mechanical properties of Peruvian woods (Caracteristicas y propiedades de especies madereras del Peru). Fondo de Promocion de Exportaciones no Tradicionales, Lima, Peru.

Characteristics and uses of 34 timber species including class of air drying (number of days) and class of artificial drying.

Arostegui–V., A. 1974. Technical studies of the woods of Peru. Technical characteristics and uses of the wood of 145 species of the country (Estudio technologico de maderas del Peru. Caracteristicas tecnologies usos a de la madera de 145 especies del pais). Lima, Peru: Universidad National Agraria–Ministerio de Agricultura. Vol. 1. 483 p.

Presents a listing of Peruvian woods and provides information on each species, including a general description of the wood, macro and microscopical anatomy, physical and mechancial properties, durability, preserving characteristics, and uses.

Arostegui–V., A. 1975. Technical studies of the woods of Peru. Vol. 11. Methods and specifications employed in the technical studies of wood (Estudio tecnologico de maderas del Peru. Metodos y especificaciones empleados en los estudios tecnologico de madera). Lima, Peru: Universidad National Agraria—Ministeriode Agricultura. Vol. 2. 104 p.

Explains, often using diagrams, how technical studies of wood are performed.

Arostegui–V., A. 1975. Technical studies of the woods of Peru. Vol. III. Technical characteristics and uses of the wood of 40 species of the Alexander Von Humboldt National Forest (Estudio tecnologico de maderas del Peru. Caracteristicas tecnologices y us os dela Madera de 40 especies del Bosque National Alexander Von Humboldt). Lima, Peru: Universidad National Agraria—Ministerio de Agricultura. Vol. 3. 171 p.

Compares the technical properties of these woods, including physical and mechanical properties, drying characteristics, and so on.

Arostegui–V., A. 1982. Compilation and analysis of technical studies of Peruvian woods (Recopilacion y Analisis de estudios tecnologicos de maderas Peruanas). PNUD/FAO/PER/81/002. Rome, Italy: United Nations, Food and Agriculture Organization. 57 p.

General description; anatomical, physical and mechanical properties; workability and uses, and drying characteristics of 60 species.

Arroyo–P., J. 1970. Properties and possible uses of mangroves in the region of the San Juan River in the Guarapiche Forest Reserve (State of Monagas) (Venezuela) (Propiedades y usos posibles de los mangles de la region del Rio San Juan en la Reserva Forestal de Guarapiche, Estado, Monagas). Boletin Instituto Forestal Latino–Americano. (33/34):53–76.

Barretero–J., A.: Murguia–P., J.R. 1982. Air drying wood in different seasons of the year (Secado de la madera

a1 aire libre en distintas epocas del ano). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. 14 p.

Bejar–Maldonado, G. 1983. Seasoning of sawn oak timber (Mexico) (Secado de la madera aserrada de encino). Coyoacan, Mexico: Instituto Nacional de Investigaciones Forestales. Ciencia Forestal. 8(42):37–63.

Oak lumber was air dried or dried in a conventional kiln or dehumidifying kiln. Drying defects were recorded for each species. The conventional kiln produced lumber with the fewest defects, while the dehumidifying kiln produced the most.

Blackman, Ted. 1985. Mill owner says,"We always want to try something new." World Wood. 26(4):24–25.

Bluhm, S.E.; Kauman, W.G.; Melo–S., R.; Neira–M., C. 1965. Collapse in wood and its reconditioning. Experiments on recovery of collapse in wood of Chilean-grown *Eucalyptus globulus* (El colapso en la madera y su reacondicionamiento: Ensayos de recuperation de colapso en madera de eucalipto *Eucalyptus globulus* crecido en Chile). Informe Tecnico No. 22. Santiago, Chile: Ciencia forestal. 23 p.

Excessive and irregular shrinkage (collapse) is frequently encountered in *Eucalyptus* spp. The technological aspects of collapse and means of removal via steam reconditioning are described. Experimental data on collapse recoveries are also presented.

Bluhm, E. [and others]. 1967. Recovery from collapse in Eucalypt timber (*Eucalyptus globulus*). Santiago, Chile: Maderero. 22:27–28, 30.

Boone, R. Sidney; Kozlik, Charles J.; Bois, Paul J.; Wengert, Eugene M. 1988. Dry-kiln schedules for commercial woods—temperate and tropical. FPL–GTR–57. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 158 p.

This report provides dry kiln schedules for more than 500 temperate and tropical woods, with special schedules for wooden squares, handle stocks, and gun stock blanks. Primarily for use by dry kiln operators and others interested in dry-kilning wood, the report consolidates and updates drying schedules from many sources, making them easy to find and convenient to use.

Brazier, J.D.; Franklin, G.L. 1967. An appraisal of the wood characteristics and potential uses of some Nicaraguan timbers. FAO: Misc/67. Rome, Italy: United Nations, Food and Agriculture Organization. 49 p.

Information on approximately 70 species, including information on the characteristics of the tree and timber, technical properties, and comments on their drying.

Brooks, R.L. 1931. Air–Seasoning of native timbers. Leaflet No. 3. Port–of–Spain, Trinidad: Forest Department Trinidad and Tabago. 21 p.

Elaboration of earlier work (Leaflet 2, 1926) with some additional information.

Brotero, Abranches Frederico. 1941. Drying of wood in a kiln (Secagem da Madeira em Estufa). Boletim 27. Sao Paulo, Brazil: Instituto de Pesquisas Technologicas de Sao Paulo. 47 p.

Brotero, A.F. 1948. Kiln drying of wood (Secagem de madeira em estufa). Anales Brasilira Economica Florista. Instituto Nacional de Pinto. 1(1):71–107.

Caceres–R., H. 1965. Technological studies on some Colombian woods (Estudios Technologicos Sobre Algunas Maderas Colombianas). Bogota, Colombia: Instituto de Investigaciones Technologicas. 51 p.

Presents physical and mechanical properties and suggested kiln schedules for 31 species of wood.

Carreon, R.F. 1947. Air drying of wood (Secado al aire de la madera). Thesis Profesional. Chapingo, Mexico: Escuela Nacional de Agricultura. 101 p.

Cevallos–F., S.; Carmona–V., T. 1981. Information bank of technological studies of woods that grow in Mexico (Banco de informacion de estudios tecnologicos de maderas que vegetan en Mexico). Catalogo No. 2. Mexico: Instituto Nacional de Investigaciones Forestales: 200 p.

Compilation of data on woods grown in Mexico including anatomical, physical, and mechanical properties, natural durability, preservation, chemical, sawing and working properties, and drying, including schedules.

Chudnoff, M. 1984. Tropical timbers of the world. Agric. Handb. 607. Washington, DC: U.S. Department of Agriculture. 464 p.

This handbook contains descriptions of 370 species or generic groupings of tropical trees and their timbers grouped by region of origin. Standardized descriptions emphasize physical and mechanical properties, processing characteristics, and uses. Data have been compiled, evaluated, and synthesized from the world literature.

Chudnoff, M.; Maldonado, E.D.; Goytia, E. 1966. Solar drying of tropical hardwoods. Research Paper ITF–2. Rio Piedras, Puerto Rico: U.S. Department of Agriculture, Forest Service, Institute of Tropical Forestry. 26 p.

Discusses design and performance of greenhouse type solar dryer in Puerto Rico. Results of 7 charges of Honduras mahogany and 1 charge of 11 local hardwood species presented. The I-in. mahogany dried from 50 percent moisture content to 12 percent moisture content in 18 days; 1 1/4 in. requires 25 days and 2-in. about 41 days.

Chudnoff, M.; Goytia, E. 1967. The effect of incising on drying, treatability, and bending strength of posts. Res. Pap. ITF–5. Rio Piedras, Puerto Rico: U.S. Department of Agriculture, Forest Service, Institute of Tropical Forestry. 20 p.

Cuevas–I., E. 1972. Incidence of shrinkage and collapse during drying of some commercial timbers in Chile (Incidencia de los fenomenos de contraccion y colapso en el secado de algunas maderas commericales de Chile). Informe Tecnico, No. 36. Santiago, Chile: Instituto Forestal: 145–155.

Describes variation of density and shrinkage during reconditioning from green to 12 percent moisture content for eight commercial timbers: *Pinus radiata, Laurelia philippiana, Eucalyptus globulus, Nothofagus dombeyi, N. obliqua, Aextoxicon punctatum, Weinmannia trichosperma,* and *Eucryphia cordifolia.* Species other than *P. radiata* exhibited considerable shrinkage, which in most species was more than twice as great (in percent) tangentially as radially. *L. philippiana* was the only hardwood that didn't demonstrate

collapse. Estimates are made of the volume and value of wood that could be recovered by the introduction of reconditioning to eliminate collapse, especially with *E. globulus* and *N. dombeyi.*

Cuevas–I, E.; Franco, J. 1968. Determination of shrinkage values for some timbers of commercial importance. In: Actas de las Terceras Jornadas Forestales, Valdivia 1967. Santiago, Chile: Asociacion Chilena de Ingenieros Forestales: 95–98.

Dickinson, F.E. 1950. The seasoning properties of Determa *(Ocotea rubra* Mez.) Tech. Rep. No. 5. New Haven, CT: Yale School of Forestry. 8 p.

Duran, F. 1972. (Eucalyptus saligna: air drying of poles for aerial cables.) Boletin del Departamento Forestal, Uruguay. No. 18:8–12 ref.

Durgnat, P.A. 1972. Aspects of lumber production. Trinidad, Trinidad and Tobago: Forest Division, Ministry of Agriculture, Lands and Fisheries. 43 p.

Describes the timber resources of Trinidad and problems that have curtailed employment opportunities in timber processing and have led to the dependence of Trinidad on imported sawn timber. Basic information is given on the development of logging, sawmilling, seasoning, grading, and wood preservation not currently used in the country. Possible changes in the industrial structure for modernization of the industry are discussed.

Echenique–Manrique, R. 1970. Description, characteristics and uses of 25 Mexican tropical woods (Descripcion, caracteristicas y usos de 25 maderas tropicales mexicanas). Mexico, DF, Mexico: Camara Nacional de la Industria de la Construccion. 237 p.

Includes information on drying; kiln schedules when known.

Echenique–Manrique, R. 1971. Characteristics of wood and its use in construction (Caracteristicas de la Madera y su uso en la construccion). Mexico, DF, Mexico: Camara Nacional de la Industria de la Construccion. 173 p.

Limited information on drying.

Echenique–Manrique, R.; Barajas–Morales, J. 1977. PEG, a dimensional stabilizer of wood (El PEG, estabilizante dimensional de la madera). Veracruz, Mexico: Instituto de Investigaciones Sobre Recursos Bioticos, Xalapa. Botica. 2(3):37–43.

Echenigue–Manrique, R.; Barajas–Morales, J.; Pinzon–P., L.M. 1975. Botanical and ecological study of the Rio Uxparapa Region of Veracruz No. 1: Technical characteristics of 10 wood species (Estudio botanico y ecologico de la region del Rio Uxpanapa Veracruz No. 1: Characteristicas technologicas de la madera de diez especies). Publication of Instituto de Investigaciones Sobre Recursos Bioticos, Universidad Nacional Autionoma de Mexico. 65 p.

Describes physical and mechanical properties, drying and machining characteristics, natural durability and uses, as reported by various sources, for ten tropical species from Veracruz State, Mexico. The information is hoped to promote increased use of the native woods.

Echenique–Manrique, R.; Diaz–G., V. 1969. Some technological characteristics of wood of 11 Mexican species (Algunas caracteristicas technologicas de la madera de once especies Mexicanas). Bull. Tecnico No. 27. Mexico: Instituto Nacional de Investigaciones Forestales. 61 p.

Samples of eleven species of woods of commerical value were collected from Escaracega and Uruapan, Mexico. The anatomy, uses, and drying characteristics of these woods were presented. Mechanical tests, including specific gravity, hardness, static bending, and shrinkage were performed all on woods. Common and commerical names of these woods are noted.

Englerth, G.H. 1960. Air drying conditions for lumber in the San Juan area, Puerto Rico. Tropical Forestry Note No. 1. Rio Piedras, Puerto Rico: U.S. Department of Agriculture Forest Service, Tropical Forest Research Center. 2 p.

Enrique–V., J. 1969. Physical and mechanical properties of 137 woods of the Venezalean Guayana (Propiedades fiscas y mecanicas de 137 maderas de la guayana Venezolana). Merida, Venezuela: Laboratorio Nacional de Productos Forestales. Ministerio de Agricultura y Cria, Universidad de Los Andes. 88 p.

Presents information on physical and mechanical properties of woods, including shrinkage, etc.

Fernandez, G. 1962. The kiln drying of wood—theory and practice (El estufado de la madera–teoria y practica). 1st ed. Mexico, DF, Mexico: Privately published. 120 p.

Presents information similar to that of Rasmussen, 1961.

Fernandez, P. de S.; Galvao, A.P.M. 1977. Moisture gradients in *Hymenaea stilbocarpa* timber (Gradiente de umidade em pecas de jatoba *(Hymenaea stilbocarpa* Hayne). Sao Paulo, Brazil: Instituto Florestal, Secretaria da Agric. Estado de Sao Paulo. Silvicutura em Sao Paulo. 1977–1978(11/12):87–92.

Galdames–Casorzo, M. 1979. Drying wood by reducing ambient humidity. Part 1 (El secado de la madera por deshumidificacion del aire. I Parte). Chile Forestal. 4(41):14-15.

Galdames–Casorzo, M. 1979. Energy consumption of wood drying plants involving reduction of ambient humidity. Part 2 (El consumo energetico de los secadores por deshumidificacion de aire. 2d Parte). Chile Forestal. 4(42):14–15.

Galvao, A.P.M. 1975. Estimates of equilibrium moisture content of wood in different cities in Brazil. Sao Paulo, Brazil: Inst. de Pesquisas e Estudos Florestais, Piracicaba. 11:53-65.

Using the Forest Products Laboratory, Madison, Wisconsin, method (1955) and W.T. Simpson's method (1971) the equilibrium moisture content (EMC) of wood in 12 dispersed Brazilian cities was predicted. A large variation in the EMC of wood in the various cities was noted. However, the values of EMC determined by the two methods were not significantly different for the range of temperatures studied. While the predicted EMC values are of practical use, values for the most commonly used Brazilian woods should be determined.

Galvao, A.P.M. 1976. Accelerated seasoning: a schedule for the wood of jatoba *(Hymenaea stilbocarpa)* (Secagem acelerada: programa para a madeira de jatoba *(Hymenaea stilbocarpa* Hayne)). Sao Paulo, Brazil: Inst. de Pesquisas e Estudos Florestais, Piracicaba. 12:151–161.

An accelerated drying schedule is presented which saved time but did cause some warping. No other defects were noted with this method.

Garcia, J.J.M. 1962. Moisture-content variations in Eucalyptus viminalis bolts. Notas tecnologicas 20. Buenos Aires, Argentina: Administration Nacional de Bosques. 9 p.

Garcia, R.R.,; Garcia, J.J.M. 1956. The physical and mechanical properties of *Piptadenia* spp (Estudio fisico y mecanico de las especies forestales del genero Piptadenia). Anades Administration Nacional de Bosques, Buenos Aires, Argentina: 63–84.

Gonzales–F., R.; Campos–R., R. 1970. Kiln drying the wood of Casuarina (Secado Artificial de la Madera de Casuarina). La Molina, Peru: Universidad Nacional Agraria. Revista Forestal del Peru. 4(1/2):90–101.

The wood was dried in Moore Experimental Kiln by two schedules, and drying defects (warp, collapse, and splits) were noted and measured. Previous attempts to dry this wood were unsucessful, but this attempt was satisfactory.

Gonzalez–T., G.E.; Krones, M. 1974. Comparison of the drying and preservation properties of *E. deglupta* and *E. saligna* posts (Comparacion de las propiedades de secado y perservacion de postes de E. deglupta y saligna). Laboratorio de Productos Forestales, CATIE, and Universidad de Costa Rica.

Evaluated drying time and defects during drying, penetration distribution, and retention of preservative of CCA-C. Sapwood easy to impregnate, heartwood difficult.

Guyana Timber Export Board. 1979. Guyana timber species: Wallaba *(Eperua falcata).* Georgetown, Guyana: Guyana Timber Export Board. 30 p.

Describes distribution, supply, general characteristics of the tree and wood, drying, mechanical and working properties, durability, and uses including specifications for transmission poles, siding, and shingles of Eucalyptus falcata.

Han–R., M. 1964. Survey of artificial drying of wood in Chile. Santiago, Chile: Maderero. 10:9–14.

Hoheisel, H.; Lopez–G., O. 1973. Air drying and kiln drying of fence posts of Cypress and *Pinus patula.* Medellin, Colombia: Revista, Facultad Nacional de Agronomia. 28(3):42-51.

Huerta–C., J. 1976. Notes on wood anatomy as related to drying. (Notas sobre anatomia de maderas en relacion al secado). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Ciencia Forestal. 1(1):42-53.

Describes morphological elements and chemical composition of wood as it dries, in both angiosperms and gymnosperms.

ICAITI. [about 1980]. Solar drying for wood (Secador solar para madera). Unnumbered pamphlet. Guatemala City, Guatemala: Instituto Centroamericano de Investigacion y Tecnologia Industrial (ICAITI), unnumbered pamphlet.

Pamphlet describing benefits of solar drying over air drying.

IICA. 1968. Report on a wood testing program carried out for United Nations Development Program (UNDP) Project 192, survey and development of selected forest areas. Costa Rica: Wood Technology Laboratory, Instituto Interamericano de Ciencias Agricolas (IICA), Turrialba. 134 p.

Reports of a wood testing program of 23 species from the Rio Macho area and 9 species from the Carian area of Costa Rica. Includes information on: nomenclature; habitat, tree, and wood descriptions; physical and mechanical properties, including shrinkage; seasoning characteristics; machining properties; and wood uses.

Instituto Forestal. 1987. Drying of woods of commercial interest through dehumidification. (Secado por deshumidificacion de especies madereras de interes comercial). Santiago, Chile: Instituto forestal. Informe Technico 100, 111 p.

Jankowsky, I.P.; Galvao, A.P.M. 1979. Influence of extractive content, on the equilibrium moisture content of wood (Influencia do teor extrativos na umidade de equilibrio da madeira). Piracicaba, Brazil: Instituto de Pesquisas e Estudos Florestais (IPEF). (18):l–33.

The purpose of this investigation was to obtain information about the influence of extractives content on the equilibrium moisture content of Parana pine (Araucaria angustifolia (Bert.) O. Ktze.), Mahogany *(Swietenia macrophylla* King) and *Eucalyptus citriodora* Hook woods. Water-soluble and alcohol-benzene-soluble extractives content, and the equilibrium moisture content at temperatures of 40°C., 50°C., and 60°C, and relative humidities of 40, 60, and 79 percent were determined for samples of the three species.

Jankowsky, I.P.; Henriquez, E.Z. 1983. Moisture gradient and stress development during the kiln drying of *Pinus caribaea* var. *hondurensis* wood (Brazil). (Gradiente de umidade e desenvolvimento de tensoes da secagem artificial da madeira de *Pinus caribaea* var *hondurensis).* Piracicba, Brazil: Instituto de Pesquisas e Estudos Florestais (IPEF): 27–31.

An accelerated kiln schedule is provided for the drying of this species.

Japing, C.H.; Japing, H.W. 1960. Wood handbook of Surinam wood species. (Houthandboek Surinaamse Houtsoorten). Utgave Dienst's Lands Bosbeheer Paramaribo Suriname. 264 p.

Wood handbook of Surinam woods. Includes chapter on drying of wood, though no kiln information.

Japing, H.W. 1957. Tests about the most important mechanical and physical properties of 41 Surinam wood species (Onderzoek naar de belangrykste mechanische en fysische eigenschappen van 41 Surinaamse houtsoorten). Mededeling No. 122. Afdeling Tropische Producten No. 46. Amsterdam, Netherlands. Instituut voor de Tropen. 249 p.

Provides mechanical and physical properties of 41 woods of Suriname, as well as listing the ease of air seasoning.

JUNAC. 1989. Manual of the Andean Group for the drying of wood. (Manual del Grupo Andino para el secado de maderas). Lima, Peru: Junta del Acuerdo de Cartegena. 437 p.

A complete manual for all aspects of wood drying, from wood properties to schedules for kiln drying. A glossary of terms is included.

Karstedt, P. 1972. Center for Forestry Research and Training, Cuba. Wood technology and wood preservation

(Centro de Investigaciones y Capacitacion Forestales, Cuba. Cuba, tecnologia y preservacion de la madera) Rome: FAO Rep. FO:SF/CUB 3, Informe Tecnico. 5. p. 81.

Describes the present technology in Cuba, in drying and preservative treatment of wood. Recommendations are made for establishing a Timber Technology and Preservation Section within the center and a program of study in wood drying, preservation, and wood anatomy.

Kauman, W.G.; Mittak, K.G. 1966. Drying trials with coihue (Ensayos de secado en coihue). Santiago, Chile: Instituto Forestal. Informe Tecnico. 25. 25 p.

The severity of defects that developed in Chilean coihue (Nothofagus dombeyi) during nine different drying programs was measured. Tentative drying programs are recommended to aid in the utilization of this species.

Keenan, F.J.; Tejada–V., M. 1984. Tropical timber for building materials in the Andean group countries of South America. Ottawa, Ontario: International Technical Development Research Center, IDRC–TS 49e. 151 p.

Keer, G.A. 1978. Timber drying — its economic justification. In: Proceedings, 7th World Forestry Congress, Centro Cultural General San Martin: 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: World Forestry Congress, Instituto Forestal Nacional: 6370–6374.

Discusses principles of air and kiln drying and compares the economic costs of each. Recommends kiln drying for a variety of reasons, including quicker turnover, less loss, and less storage space required.

Kukachka, B.F.; Tejada–V., M.E. 1968. Selected properties of 52 timber species from the department of El Peten, Guatemala (Propiedades seleccionadas de 52 especies de madera del departamento del Peten, Guatemala). Proyecto de Evaluacion Forestal, FAO–FYDEP Boletin 2. Rome, Italy: United Nations Food and Agriculture Organization. 88 p.

Physical and mechanical properties, shrinkage, and silica content of 52 species is given.

Labate, P.J. 1960. The importance of equilibrium moisture content of wood in relation with drying and uses (Importanicia del equilibrio higroscopico de la madera en relacion con su secado y usos). Buenos Aires, Argentina: Folleto Tecnico Forestales No. 6, Administration Nacional de Bosques.

Discusses importance of knowing EMC for different areas or zone of country and lists temperature, RH, and EMC for many areas of Argentina.

Labate, P.J. 1964. Pilot trial in air drying of Eucalyptus viminalis wood for parquet: Buenos Aires, Argentina: Folletos Tecnicos Forestales No. 24, Administracion Nacional de Bosques. 6 p.

Labate, P.J. 1973. Industrial applications of Casuarina wood (Aprovechamiento industrial de la madera de Casuarina). Buenos Aires, Argentina: Folletos Tecnicos Forestales No. 32, Administracion Nacional de Bosques. 32 p.

Characteristics of *Casuarina cunninghamiara* from different sources including sawing and seasoning method used: Data on reconditioning to recover collapse, color, specific gravity, shrinkage, and trials in manufacturing of several products; parquet, packing boxes and crates, veneer.

Labate, P.J. 1975. Evaluation of the wood of indigenous and exotic forest species according to their physical and mechanical properties. Buenos Aires, Argentina: Folleto Tecnico Forestal, Instituto Forestal Nacional. 36. 19 p.

Describes a large number of commercial native Argentine woods and some potentially useful secondary and exotic species. Data tabulated include: radial, tangential, and volumetric shrinkage when dried from green moisture content to 12 to 15 percent moisture content (air-dry); density (kg/m^3) and hardness (kg/cm^2); modulus of rupture in longitudinal compression and specific index (MOR/100 X density'); modulus of rupture in bending and bending index (MOR/100 X specific gravity); and measures of resistance to cutting, splitting, tensile stress, etc. Values in tables are grouped into hardness classes, strength classes, and flexibility classes.

Lastra–R., J.A. 1974. How to prepare kiln schedules for timber of hardwood species. Como elaborar programas y horarios de secaso artificial para madera de latifoliades. Bogota, Columbia: Uni. Dist. Eco. Jose de Caldas. 17 p.

An abridged method of estimating the time required in each stage of kiln drying.

Lisboa, H. 1983. Technical side of Chilean pine. Division of Planning and Development, Arauco Co. Ltd., Chile. Wellington, New Zealand: Department of Internal Affairs. 8 p.

Describes Chilean pine *(Pinus radiata)* with data on wood density, strength, drying and shrinkage, decay and preservation, and uses. Comparisons are made with *P. radiata* grown in New Zealand and other Chilean conifers.

Longwood, F.R. 1961. Puerto Rican woods; their machining, seasoning, and related characteristics. Agric. Handb. 205. Washington, DC: U.S. Department of Agriculture. 98 p.

Provides information on the machining, physical properties, and response to air seasoning of 60 species. A description and photo of each wood is provided.

Longwood, F.R. 1962. Present and potential commercial timbers of the Caribbean — with special reference to the West Indies, the Guianas, and British Honduras. Agric. Handb. **207.** Washington, DC: U.S. Department of Agriculture. 167 p.

Presents a summary of information on 71 important timbers of the area. Includes: distribution and habitat; descriptions of tree and wood; seasoning and shrinkage; strength properties; working properties; natural resistance; and permeability.

Lopez–P., Vladimir. 1985. Air drying of sawn wood of *Pinus hartwegii* in Chapingo State, Mexico (Secado al aire libre de madera aserrado de *Pinus hartwegii* Lindl. en Chapingo, Edo. de Mexico). Tesis. Chapingo, Mexico: Universidad Autonoma. 51 p.

Maldonado, E.D. 1962. Solar radiation used to dry mahogany lumber in Puerto Rico. Tropical Forest Note ITF–14. Rio Piedras, PR: U.S. Department of Agricluture, Forest Service, Institute of Tropical Forestry. 5 p.

Maldonado, E.D.; Peck, E.C. 1962. Drying by solar radiation in Puerto Rico. Madison, WI: Forest Products Journal. 12(10) :487–488.

An experimental solar kiln proved to have many advantages over traditional kiln drying.

Martinez–S, J.E. 1973. Standards for kiln drying timber, and schedules for five Colombian species (Normas para el secado artificial de maderas y programas para cinco especies colombianas). Bogota, Colombia: Facultad de Ingenieria Forestal, Universidad Distrital 'Francisco Jose de Caldas'. 71 p.

Describes kiln-drying trials with 2.5 cm-thick lumber of *Abarema jupumba, Clathrotropis brunnea, Elaeodendron* sp., *Goupia glabra,* and *Ormosia paraense.* Results are discussed and schedules recommended for drying the species from green to 10 percent moisture content.

Martins, Varlone A.; Oliveira, Luis C. 1984. Conventional drying of nine species of woods from the Amazon Region (Secagem convencional de nove especies de madeira da Amazonia). Brazil Florestal. No. 60. October/November/December 7 p.

Nine wood species from the Amazon Region were dried together in a conventional dry kiln using an industrial schedule and practice. Seven of the species dried satisfactorily in an average of 8 days. Suggested kiln schedules are given for the two species *(Goupia glabra* and *Ocetea rubra)* for which the common schedule was not satisfactory.

Martins, Varlone A.; Teixeira, Pauplo Sergio das D.; Silva, Sizelmo J.C. da; [and others]. 1985. Air drying of wood in the region of the Federal District. (Secagem de madeiras ao ar livre na regiao do distrito federal). Sao Paulo, Brazil: Associacao Brasilia de Preservadores de Madeira, IPT, Div. de Madeiras, Cidade Universitaria. Boletim ABPM No. 35. 16 p.

Analyzes the behavior of wood of 63 species from three different regions of Amazonia (Buriticupu-MA, Jurua-Solimoes-AM, and Tucuma- PA) when air dried in the weather conditions of the Federal District (Brazilia).

Mason, C.G.W.; Smith, K.F. 1971. Forest industries development survey, Guyana. Preservation and seasoning. FAO Report No. FO: SF/GUY 9, Technical Report 6. Rome, Italy: United Nations, Food and Agriculture Organization. 64 p.

Describes preservation and drying of Guyana woods, including kiln schedules, state of the art in preservation within the country, and natural durability of native species against decay and insect attack. Recommendations on research and application are made concerning preservation and wood drying.

McMillen, J.M. 1961. Kiln schedules for Puerto Rican yagrumo hembra. *(Cecropia peltata).* Caribbean Forester. 22(3/4) 234–90.

Recommends kiln schedules for 1 and 2 in. lumber, as well as 2 by 3 in. and 3 by 4 in. stock.

McMillen, J.M. 1973. Brief mission on wood drying in Central America furniture industry. Washington, D.C.: U.S. Department of State, Agency for International Development PASA LA(AJ) 35–73.

A report on a 29-day AID-sponsored mission to examine the status of lumber drying at major furniture companies in Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua. This paper reviews research facilities available at two universities and an international development laboratory and comments on export development organizations and personnel.

McMillen, J.M.; Boone, R.S. 1974. Kiln drying selected Colombian woods. Madison, WI: Forest Products Journal. 24(4):31–36.

An approach to kiln drying three Columbian woods *(Dialyanthera* spp., *Brosimum utile,* and *Campnosperma panamensis)* is described, and results are given of exploratory research to improve the efficiency and quality of the kiln-drying. Procedures for drying the woods separately or together from the green condition or from a a partly air-dried condition and shortened procedures for relieving drying stress are included. Of three schedules — severe, moderate, and mild in the degree to which they induce degrade — the moderate schedule was ultimately chosen as the most satisfactory.

Melo–H., R. 1987. Factorial design in industrial drying at high temperatures for radiata pine. (Diseno factorial en secado industrial a alta temperatura, de pinp radiata). Ciencia e Investigacion Forestal. 2:115-126.

Describes an application of the factorial experimental design to determine the best conditions for high temperature drying of radiata pine in a regional factory. The design is carried out independently for three important drying parameters; cost for unit of evaporated water mass and by unit of wood volume; productive capacity, and disuniformity of the final moisture content.

Melo–H., R.; Pavon–H., M. 1987. High temperature industrial drying of radiata pine. (Secado industrial de pino radiata a alta temperatura). Ciencia e Investigacion Forestal. 1:117-129.

Describes 16 industrial tests and several laboratory studies, varying the principal parameters involved in wood drying, such as: dry bulb temperature, wet bulb depression, conditioning, warming up period, thickness of stickers and distance between them, width of stacks, initial moisture content, and final moisture content. The results are analyzed comparing different drying schedules in relation to final moisture content distribution, drying defects, energy requirements, cost, and shrinkage.

Mendes, A. De S. 1977. Kiln drying schedule for wood of Pinus elliottii and P. taeda from the first thinning (Programas de secagem para madeira de *P. elliottii e P. taeda* proveniente do primeiro desbaste). FAO Rep. No. PNUD/UNDP/FAO/BRA-45. Brasilia, Brazil: Comunicacao Tecnica 11:9.

Presents drying schedules that yielded 3 percent and 7 percent defects.

Ogle, Peter. 1982. Resource base dwindles for Venezuelan sawmill. World Wood. 23(3):20–22.

Ogle, Peter. 1982. Peru mill represents major evolutionary step. World Wood. 23(4):12–13.

Olguin–Q, J.O. 1974. Physical and mechanical properties of the wood of five Mexican species. Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales, Boletin Tecnico. 42, 21 p.

Describes the results of tests on wood specimens of *Pinus ayacahuite, P. leiophylla, P. patula, P. ponderosa,* and *P. rudis* from several localities in Mexico. Tabulated test data

include moisture content and shrinkage from the green condition, specific gravity, strength in static bending, compression parallel and perpendicular, hardness, shear strength, impact strength, tensile strength parallel, and nail-holding power of green wood and wood at 12 percent moisture content. Test procedures are described, and comparative data for wood of *P. banksiana, P. echinata, P. ponderosa,* and *P. resinosa* grown in the USA are provided.

Orbe–V., Jorge; Valarezo–G., Vladimir. 1981. A drying study of wood of several species from southeastern Ecuador (Estudio de Secado de la Madera de Varias Especies del Sur–Oriente del Ecuador). Conocoto, Ecuador: Centro de Capacitacion e Investigacion Forestal. 18 p.

Lumber (25-mm thick?) from 33 species of Southeastern Ecuador was air dried and kiln dried (mild, moderate, and severe schedule) at Conocoto (near Quito). The presence and intensity of drying defects (warp, splits, checks) was measured. Air dried woods were grouped in 3 groups depending on amount of drying defect incurred. Kiln dried woods were grouped by their response to the three severities of kiln schedules.

Parra, A.; Borgo, G.; Valdes, F. 1953. The kiln drying of timber (El secado de maderas en estufa). Mexico: Asociacion Mexicana de Profesionistas Forestales. 119 p.

The structure of wood, with an emphasis on its water content, is explained. The components of kilns are explained, and tables to determine drying time are provided.

Pavon–H., M. 1987. Design of a warp measuring device for sawnwood. (Diseno de un banco de medicion de defectos de madera aserrada). Ciencia e Investigacion Forestal. 2:126-132.

Describes in detail, with drawings, a device with which to measure warp in sawn lumber.

Pedraza–M., S.H. 1984. Recommendations for air drying of wood (Recomendacions para el secado de la madera a1 aire libre). Coyoacan, D.F., Mexico: Ciencia Forestal, Revista del Instituto Nacional de Investigacones Forestales. 9(52):51–63.

General discussion of air drying techniques given at a meeting in Durango in 1979.

Perez–G., V.A. 1978. Wood construction manual (Manual de construcciones en madera). Santiago, Chile: Instituto Forestal. 500 p.

A manual of 10 chapters including: wood structure and properties; uses and products; engineering; drying; service life of wood; standards; insulation; constructional systems; and other wooden components (doors, windows, etc.); laminated wood; and glossary.

Perez–R., J. 1965. Drying schedules for *Pinus montezumae* Lamb. and *P. ayacahuite* var. *veitchii* lumber (Secuelas de secado para madera aserrada de *Pinus montezumae* Lamb. y *Pinus ayacahuite* var. *veitchii).* Tesis Profesional. Chapingo, Mexico: Escuela Nacional de Agriculturas. 51 p.

Rasmussen, E.F. 1961. Dry kiln operator's manual. Agric. Handb. No. 188. Washington, DC: U.S. Department of Agriculture, Forest Service. 197 p.

Complete information on the operation of dry kilns, including theoretical aspects, drying effects, kiln schedules, equipment, and so on. A revised edition was published in 1991. (W.T. Simpson, ed.)

Record, S.J.; Hess, R.W. 1943. Timbers of the new world. New Haven, CT: Yale University Press. 640 p.

Contains descriptions of trees, where they grow. It supplies basis for identification of the trees and their woods, correlates the vernacular, trade and scientific names, and gives technical data on various subjects, including drying.

Rice, W.W. 1966. (1) Virola's problems unmasked. (2) Domestic shortages? Have you tried Virola. Woodworking Digest. 68(8):11, 26–30, 33–36.

Rosende–B., R. 1972. Equilibrium moisture content of some Chilean timbers. Santiago, Chile: Instituto Forestal. Informe Tecnico 36:135-144.

Tabulates data on the EMC of wood from six trees from each of six species *(Araucaria araucana, Eucalyptus globulus, Nothofagus alpina, N. obliqua, Laurelia philippiana, Eucryphia cordifolia)* at four places in Chile in various months from July 1967 to August 1968.

Rosende–B., R.; Castillo–B., H. 1973. Shrinkage, collapse and movement of Chilean timbers. Boletin Informativo, Instituto Forestal. 27:39.

Describes wood shrinkage, collapse, and movement of timber for nontechnical audience. Examples of formulae are given for calculating the amounts of shrinkage, collapse, and movement for a variety of conditions. Data are shown in tabular form giving the maximum shrinkage and movement of the main native and exotic Chilean species.

Sahlman, E.J.; Han–R., M. 1963. Kiln drying of timber (Secamiento artifical de la madera). Santiago, Chile: Manual No. 1, Instituto Forestal. 64 p.

Presents an introduction to the structure of wood, water in wood, principles of drying, different types of drying, and several different methods of drying wood.

Simpson, William T., ed. 1991. Dry kiln operator's manual. Agric. Handb. 188. (Rev.) Washington, DC: U.S. Department of Agriculture, Forest Service. 274 p.

Simpson, W.T.; Tschernitz, J.L. 1984. Solar dry kiln for tropical latitudes. Madison, WI: Forest Products Journal. 34(5):25–34.

Reports on a 2.4 m^3 solar dry kiln developed for use in tropical areas. The kiln was designed to be low cost and provide automatic control of scheduled drying. Field performance demonstrated the success of the design.

Simpson, W.T.; Baah, C.J. 1989. Grouping tropical wood species for kiln drying. Res. Note FPL-RN-0256. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 14 p.

The most efficient method to kiln dry tropical hardwood species is in groups because of the large number of them and their diffuse occurrence in the forest. However, this large number of species presents a wide variety of drying properties, which make it difficult to dry mixtures of species. This report develops a mathematical model for grouping species by similar drying times. The goal is to kiln dry so all species will emerge from the same kiln at the same time within set limits of moisture content and with minimum drying defects.

Simpson, W.T.; Tschernitz, J.L. 1989. Performance of a solar/wood energy kiln in tropical latitudes. Forest Products Journal. 39(1):23-30.

This paper reports observations on the energy efficiency of the kiln, its durability, and its overall ability to dry lumber.

Slooten, H.J. van der. 1972. Report to the government of Costa Rica on timber technology. FAO Rep. No. AT 3066. Rome, Italy: United Nations, Food and Agriculture Organization. 12 p.

Describes 8 upland species and 18 lowland species, from Costa Rica, suitable for the construction of prefabricated houses, with details on density, working properties, drying, nailing, etc.

Slooten, H.J. van der; Lisboa, C.D.J.; Pastore, F., Jr.; Sobral Filho, M. 1976. Characteristics, properties and engineering data of sixteen commercial Amazon species. Brasilia, Brazil: FO: DP/BRA/71/545. Field Doc. 20. 73 p.

Describes general wood characteristics, weight, strength properties, allowable stresses, shrinkage and drying, working properties, durability, preservation, and uses.

Slooten, H.J. van der; Lisboa, C.D.J.; Sobral Filho, M.; Pastore, F., Jr. 1976. Forest tree species of Amazonia — Characteristics, properties, and mechanical data of wood (Especies florestais da Amazonia — caracteristicas, propriedades e dados de engenharia da madeira). FAO Rep., Lab. de Prod. Florest. Brasilia, Brazil: PRODEPEF, Brasilia, Brazil. PNUD/FAO/IBDF/BRA-45, Serie Tecnica 6. 90 p.

Describes physical and mechanical properties, drying behavior, treatability with preservatives, and tentative allowable stresses for the woods of sixteen Amazon species. The range of variation in properties within each species is presented based on a wide distribution of samples throughout the Amazon region. The species included are: *Astronium lecointei, Bagassa guianensis, Bowdichia nitida, Calophyllum brasiliense, Carapa guianensis, Caryocar* spp., *Cedrela* spp., *Copaifera* spp., *Cordia* spp., *Euxylophora paraensis, Manilkara* spp., *Mezilaurus itauba, Ocotea bracellensis, Platymiscium* spp., *Swietenia macrophylla,* and *Tabebuia serratifolia.*

Slooten, H.J. van der; Martinez–E., P. 1959. Description and properties of some Venezuelean woods (Descripcion y propiedades de algunas maderas venezolanas). Sec de Documentacion y Publicaciones. Merida, Venezuela: Institute Forestal Latinamericano. 103 p.

Slooten, H.J. van der; Richter, H.G.; Aune, J.E.; Llach–C., L. 1971. Properties and uses of 113 timber yielding species of Panama. 3 Vols. Rome, Italy: FAO, FO–UNDP/SF PAN/6. 103 p.

Part 1: Divided into sections covering physical and mechanical properties, drying characteristics, preservation, durability, evaluation of pulp and paper, and a list of the possible uses of the woods. Each section compares the woods with one another.

Part 2: Presents the general characteristics of the wood, macro and microscopic anatomy, and dimensions of the fibers. Also includes photomicrographs illustrating their anatomy.

Part 3. Gives a description of the characteristics of selected woods. Each section provides information on a wood's physical and mechanical properties, drying, and preserving characteristics. Comparative data of other woods of North and South America are also provided.

Tejada–V., M. 1980. Primer of construction with wood (Cartilla de construccion con madera). Lima, Peru: Junta del Acuerdo de Cartagena. PADT- REFORT, JUNAC.

A wood construction manual with many drawings. Many topics covered including: forest resource in 5 Andean Pact countries, wood properties, drying and preservation prior to construction, wood engineering of structures, equipment needed for constructing with wood.

Tinto, J.C. 1957. Treatment of Eucalypt timber. Correction of collapse in *E. globulus* (Tratamiento fisico de madera de eucalipto. Correccion del colapso en *Eucalyptus globulus* Labill). Buenos Aires, Argentina: Revista Investigaciones Forestales. 1 (1/2): 123–151.

Tinto, J.C. 1961. Considerations on the drying of coihue wood (Consideracions sobre el secado de la madera de coihue). Buenos Aires, Argentina: Folletos Tecnicos Forestales. Administracion Nacional de Bosques. 11:21.

Includes information on the proper cutting, stacking, and kiln schedules for the drying of Nothofagus dombeyi.

Tinto, J.C. 1963. Manual on the air drying of timber (Manual sobre Estacionamiento de la Madera). Buenos Aires, Argentina: Administration Nacional de Bosques. Folletos Tecnicos Forestales. 17:109 p.

Toledo–E., Nelson; Orbe–V., Jorge; Vasquez–M., Edgar; Montesdeoca, Jorge. 1981. Preliminary technological study of 20 forest species of Ecuador (Estudio preliminar technologico de 20 especies forestales del Ecuador). Conocoto, Ecuador: Centro de Capacitacion e Investigacion Forestal. 27 p.

Information on botanical, anatomical characteristics, physical and mechanical properties, drying, preservation, durability, workability, and general uses of 20 species grown in Ecuador.

Tomaselli, I. 1976. High-temperature drying and its application under Brazilian conditions (Secagem a alta temperatura e sua aplicacao nas condicoes Brasileiras). Curitiba, Brazil: Centro de Pesquisas Florestais. Floresta. 7(1): 50–57.

Describes some theoretical aspects of high-temperature kiln drying, not used in Brazil. Experience of other countries and the prospects for high-temperature drying in Brazil are discussed. Information indicates that the process should work especially well in southern states for processing plantation wood of Pinus elliottii and P. taeda, resulting in lower costs and better wood quality.

Tomaselli, I. 1980. Drying wood (Secagem de madeira). Curitiba, Brazil: University of Brasilia. FUPEF. 29 p.

A review of drying processes and procedures with particular reference to high temperature drying and its possibilities for use in Brazil.

Tomaselli, I.; Nock, H.P.; Richter, H.G. 1976. Conditions of kiln drying sawn timber in Parana and Santa Catarina (Brazil). Floresta. 6(2):5-13.

Identifies deficiencies in the kiln-drying methods used in the states of Parana and Santa Catarina (low quality of kiln equipment, lack of proper drying schedules, inadequate education and technical knowledge among kiln operators, etc.), and proposes remedies.

Torres-S., L. 1973. Design for a lumber dry kiln with a 16 m^3 capacity (Diseno de una secadora de maderas capacidad 16 m^3. Bucaramanga, Colombia: Universidad industrial de Santander. [17] 1. + blueprint.

Provides practical information on the general considerations, costs, and specifics of building a kiln.

Trubswetter, T. 1980. Technical seasoning of tropical timbers (Technische Trocknung von Tropenholzern). Holz-Zentralblatt. 106(49/50):763.

Describes different drying processes and provides guidelines on quality control and costs. The cost of seasoning 65-mm-thick *Entandrophragma utile* in an oil-fired steam kiln is estimated at 209 DM/m^3.

Tschernitz, J.L.; Simpson, W.T. 1979. Solar-heated, forced-air, lumber dryer for tropical latitudes. Solar Energy. 22:563–566.

Describes a prototype solar lumber drier for tropical areas. The unit consists of a horizontal solar collector and a drying chamber with controlling fans and vents. Data are presented on the drying of red oak lumber in Madison, Wisconsin, USA.

Tschernitz, J.L.; Simpson, W.T. 1985. FPL design for lumber dry kiln using solar/wood energy in tropical latitudes. FPL–GTR–44. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 17 p.

The low-cost solar/wood energy lumber dry kiln described in this report was designed and tested by the Forest Products Laboratory (FPL) for such countries where solar dry kilns can be built and operated at low cost.

The FPL design is for a 6,000-fbm capacity kiln having an insulated drying compartment, an external horizontal solar collector, and a furnace room containing a wood burner. Capacities larger or smaller than 6,000 fbm are also possible. This design allows collector and wood burner sizing to match the energy demands of the dryer. The design also incorporated low-cost controls that allow unattended drying when operated as a solar-only dryer. Manual firing is necessary when the wood-burning system is supplying the energy.

Tschernitz, J.L.; Simpson, W.T. 1986. Design for lumber dry kiln using solar/wood energy in tropical latitudes. Drying Technology. 4(4) : 651-670.

Developing countries with a timber resource that can be manufactured into finished products either for local use or export often lack the capital to build high-cost dry kilns. The low-cost solar/wood energy lumber dry kiln described in this report was designed and tested for such countries where solar dry kilns can be built and operated at low cost.

Turc, C.O.; Cutter, B.E. 1984. Sorption and shrinkage studies of six Argentine woods. Wood and Fiber Science. 16(4):575–582.

Describes a study of the sorption isotherms and shrinkage values of six valuable Argentinean wood species: *Araucaria angustifolia; Aspidosperma quebracho- blanco; Cedrela tubiflora; Cordia trichotoma; Prosopis alba;* and *Schinopsis quebracho-colorado.* Fiber saturation points were calculated for each species. Shrinkage values are given with tangential ranging from 3.1 to 8.5 percent and radial from 2.2 to 6.4 percent.

USAID (U.S. Agency for International Development). 1962. Lumber seasoning (Secado de Madera). Un Manual de Operaciones para el Programa de Cooperation. Centro Regional de Ayuda Technica. Mexico. 159 p.

Valladares, Jaime. 1981. Practical manual for air drying wood; designed especially for small and medium workshops (Manual Practico para el Secado de Madera al Aire Libre; diseno especial para pequenos y medianos talleres). Guatemala City, Guatemala: Instituto Centroamericano de Investigacion y Technologia Industrial (ICATI). 40 p.

Manual with many drawings describing good air drying practices for lumber.

Vital, B.R. 1976. Use of solar energy for drying wood (Utilizacao de energia solar para secagem de madeira). Minas Gerais, Brasil: Universdade Federal de Vicosa. Revista Ceres. 23(125):1–10.

Wood Preservation — Fungi and Insects

Natural resistance to decay and insects, chemical treatments, (including fire-retardant treatments), preservation techniques, mycology, and entomology.

Abalos–R., M. 1988. The preservation industry in Chile (La industria de impregnation en Chile). Ciencia e Investigacion Forestal. 3: 121-134.

Describes the current status of the wood preservation industry, installed capacity, and production by regions in Chile. Chilean production is compared to that in other countries, and to the potential that could exist in the country. Uses of preserved wood products are discussed including construction wood, transmission poles, agricultural posts, railroad ties, furniture, and other products.

Acebal, S.R.A. 1970. Durability of treated eucalypt poles (Durabilidade de postes de eucalipto presevado). Preservacao de Madeiras. 1(4):183–203.

Acebal, S.R.A. 1973. Comparative study on the natural durability of some eucalypt species and some durable hardwoods (Estudo comparativo da resistencia natural de algumas especies de eucalipto com a de algumas essencias frequentemente incluidas entre as denominadas madeira de lei). Preservacao de Madeiras. 3/4(1):99–106.

AIMA. 1985. Catalogo. Quito, Ecuador: Asociacion de Industriales Madereros (AIMA) Ecuador. 62 p.

Alvarez, A. 1988. Evaluation of the biological resistance of woods impregnated with furfuryl alcohol. Sobre Deriv. Cana Azucar. 22(1):30–34.

Describes the impregnation of wood with furfuryl alcohol and the resulting improvement of physical qualities of wood. Results showed a 30 to 40 percent increase in physical properties and resistance to fungi. *Abies pinsapo* and *Pinus caribaea* were studied for resistance to two fungi, *Gloephyllum streatum* and *Cerreana maxima.* After 16 weeks, treated A. pinsapo was extremely resistant to *G. streatum* and moderately resistant to *C. maxima,* while *P. caribaea* was moderately resistant to both fungi. Controls of both species showed considerable weight loss and dimensional stability.

Alves, M.V. da S.; Goncalves, J .C.; Nakamura, R.M. 1987. Evaluation of the efficiency of wood preservatives after two years of ground contact in fields subject to decay in different regions (Avaliacao da eficiencia de preservativas em madeira apos dois anos de implantacao em campos de apodrecimento de diferentes regioes). Brasil–Florestal. 15(61):19-26.

Six-, 10-, and 13-year-old posts of *Eucalyptus citriodora* and *E. paniculata* were treated with: creosote; a mixture of creosote with 1 percent PCP; a mineral oil/5 percent PCP mixture; with CCA; or left untreated. These posts were buried and examined after one and two years. Untreated posts were heavily damaged by insects and fungi while treated posts were in good condition but showed some variation in condition.

Alves, M.V. da S. 1988. Evaluation of soil insecticides for subterranean termite control in tropical conditions. IUFRO (International Union of Forestry Research Organizations) All Division 5 conference; 1988 May 15–20; Sao Paulo, Brazil. 126 p.

Anon. 1976. Publications of the Department of Wood Science and Technology, 1963–1973 (Publicaciones del Departamento de Ciencia y Tecnologia de la Madera. Anos 1963–1973). Facultad de Ciencias Forestales, Universidad de Chile. Boletin Informativo. 2:29.

An annotated bibliography including 17 references on decay and preservative treatment of wood.

Arostegui, A. 1968. Penetration and retention of pentachlorophenol and boliden by means of pressure treatment of the woods of Tingo Maria (Penetracion y retencion del Pentaaclorogonol y Boliden Mediante Tratamiento sin Presion en Maderas de Tingo Maria). Revista Forestal del Peru. 2(1):22–33.

Many of the trees of the Tingo Maria area could be used for posts if suitable preservative methods are utilized. Numerous species have been tested and classified according to their post-treatment resistance.

Arostegui, V.A.; Gonzalez–F., V.R.; Sato, A.A. 1981. Technical properties and uses of the wood of 40 species of the Alexander Humbolt National Forest (Propiedades tecnologicas y usos de la madera de 40 especies de bosque nacional Alexander von Humboldt). Revista Forestal del Peru. 10(1/2):3-82.

A comprehensive evaluation of 40 species of wood which includes information on their preservation.

Arreghini, R. 1978. Durability of poplar *(Populus bolleana [P. alba* var. *pyramidalis])* preserved with pentachlorophenol (Durabilidad del alamo preservado con pentaclorofenol). Mendoza, Argentina: Cuadernos de Dasonomia, Cientifica, Instituto Forestal, Facultad de Ciencias Agrarias, Universidade Nacional de Cuyo. 2:13–15.

Arreghini, R. 1978. Preservation of poplar *(Populus nigra* var. *thaysiana)* poles by partial immersion in pentachlorophenol (Preservacion de postes de alamo por immersion parcial en pentaclorofenol). Mendoza, Argentina: Cuadernos de Dasonomia, Cientifica, Instituto Forestal, Facultad de Ciencias Agrarias, Universidade Nacional de Cuyo. 219–11.

Arreghini, R.I. 1982. Treatment of poplar posts with various concentrations of pentachlorophenol (Tratamiento de postes de alamo con pentaclorofenol en distintas concentraciones). Fac. Cien. Agrar., Univ. Nacional de Cuyo, Mendoza, Argentina. Revista de la Facultad de Ciencias Agrarias. 22(2):41–44.

Describes treatment and analysis of Populus nigra posts treated with three levels of pentachlorophenol (3,4, and 5 percent) and a control treatment. After 10 years, all treated posts were still in good condition, but 39 percent of the control posts were in various stages of decay.

Arreghini, R.I. 1985. Impregnation of poplar by the double diffusion method (Impregnacion de alamos por el sistema de doble difusion). Cuadernos-de-Dasonomia:-Serie-Cientifica. 5:1-5.

Poplar poles were treated with either 5 percent NaF + 4 percent $CuSO_4$ or 4 percent $CuSO_4$ + 4 percent $K_2Cr_2O_7$. Best absorption was obtained with the former, while best penetration was obtained with the latter. After three years in the field, there was no difference in the durability of poles treated with either method, but untreated poles had been destroyed.

Arroyo–P., J. 1970. Properties and possible uses of the mangroves of the Rio San Juan region in the forest reserve of Guarapiche, Mongagas (Propiedades y usos posibles de los mangales de la region del Rio San Juan en la reserva forestal de Guarapiche, Edo. Monogas). Universidad de los Andes. 27 p.

Comments on the durabiity of *Avicennia nitida, Rhizophora harrisonii, R. mangle,* and *R. racemosa,* are presented.

Arroyo–P., J. 1985. Technical guide for the use of Venezuelan woods (Guia tecnologica para la utilizacion de maderas venzolanas). Merida, Venezuela: Facultad de Ciencias Forestales, Universidad de los Andes.

Asenjo, C.F. [and others]. 1958. Termite-repellent activity and chemical composition of West Indian mahogany wood *(Swietenia mahagoni* Jacq.) with special reference to P_2 fraction. Rio Piedras, Puerto Rico: Journal of Agriculture of the University of Puerto Rico. 42(3):185–195.

Assumpcao, R.M.V.; Lepage, E.S.; Fugimori, K. 1973. The use of x-ray spectrophotometry for the analysis of preserved wood (Aplicacao de espectrometria de raios-x em analise de madeira preservada. Preservacao de Madeiras. 3/4(1):51–82.

Barros, D.P. 1966. Comments about a fence built with posts treated with preservative (Consideracoes sobre uma cerca construida com moiroes tratados com preservatio). Silvacultura em Sao Paulo. 4/5(4):155–170.

Beal, R.H. 1979. Preventing termite attack by adding insecticide to particleboard, hardboard, and plywood adhesive. Forest Products Journal. 29(12):29–34.

Chlordane, heptachlor, and HCS–3260 (a modified chlordane with all heptachlor removed) were applied to the glue of particleboard, hardboard, and plywood. Samples of the 3 types of material were cut into 4-in. squares and exposed to attack by the subterranean termites *Reticulitermes flavipes* (Koll.) and *R. virginicus* (Banks) in southern Mississippi and *Coptotermes niger* Snyder and *Heterotermes tenuis* (Hagen) in the Panama Canal Zone. Samples were also exposed to attack by the drywood termite *Cryptotermes brevis* (Wlk.) in a laboratory test in the Panama Canal Zone. After 4 years of evaluation, subterranean termite damage was greatest to plywood and least to hardboard. However, heptachlor at 0.02 percent to 0.10 percent and chlordane at 0.05 percent to 0.20 percent protected plywood structurally. Drywood termites damaged treated particleboard only at the low levels (0.05 and 0.10 percent) of chlordane and HCS–3260, and damaged treated hardboard only at the lowest level of chlordane.

Beal, R.H.; Bultman, J.D.; Amburgey, T.L.; Roberts, D.R. 1979. Resistance of wood from paraquat-treated southern pines to subterranean termites, decay fungi, and marine borers. Forest Products Journal. 29(4):35–38.

Sapwood of *Pinus elliottii, P. palustris,* and *P. taeda* that had been treated with paraquat was exposed to termites, fungi, and marine boring molluscs. In terrestrial conditions the wood from untreated trees was completely destroyed by termites, fungi, or both in 2 years. Treated woods, however, suffered much less damage in both Mississippi and in Panama.

Belas, M.R.; Zachary, A.; Allen, D.; Austin, B.; Colwell, R.R. 1979. Microbial colonization of naphthalene/creosote-treated wood pilings in a tropical marine environment. Proceedings, American Wood-Preservers' Association, Bethesda, MD. 75:20–27.

Water, sediment, and wood samples were taken in association with new naphthalene/creosote-treated pilings (installed 3 wk before sampling) and old, heavily fouled pilings from the same pier on the east coast of Puerto Rico, and from a control site. New pilings were rapidly colonized by *Hyphomicrobium vulgare* (many strains of which can utilize naphthalene as their sole carbon source); the species succession pattern was much slower in treated than in untreated piles. The bacterial flora of old piles was more diverse and the succession led to mature fouling by macro-organisms, including *Limnoria tripunctata.* SEM photographs show some of the microbes present.

Bena, P.; Vignaux, F. du. 1960. Forest trees of French Guiana (Essences Forestieres de Guyane). Imprimerie Nationale, Paris, France. 488 p.

Describes 110 timber species from French Guiana, with names, distribution, tree characteristics, wood anatomy, physical and mechanical properties, natural durability, and uses.

Bernal–R., M. 1978. Notes on wood preservation (Anotaciones sobre preservacion de la madera). In: International Union of Forestry Research Organisations (IUFRO): Meeting of IUFRO Working Parties S 2.06.12 and S 2.07.07, Pests and diseases of pines in the tropics. 'Piedras Blancas;' 1978 September 3–14; Medellin, Colombia. 8 p.

Describes the damage due to fungi and bacterial decay and insect attack on wood and wood products and discusses the methods of protection used in Colombia to prevent wood degradation. Good results have been obtained over a period of 7 years with vacuum pressure treatment of pine and cypress.

Bettucci, L. 1984. Study of fungal colonization of *Abies religiosa* wood stakes (Etude de la colonisation fongique d'eprouvettes de bois d'Abies religiosa). Mycologie. 5(3):247–268.

Describes evaluations of *Abies religiosa* wood from stakes that were exposed in an andosol soil. The stakes were chipped after exposure and 7,680 chips analysed. Colonization of 40.5 percent of the chips had occurred by species of Moniliaceae and Cematiaceae. Isolates of basidomycetes were first isolated from above and below ground portions of the stakes and later from the ground line portion. Blue stain, white, and brown rot fungi were isolated from all three portions of the stakes.

Bluhm–S., E.; Rosende–B., R.; Melo–S., R. 1972. Natural durability of the main timber species produced in Chile; results after five years' exposure in the field. Instituto Forestal. Santiago, Chile: Informe Tecnico. 36:89–96.

Gives results after 5 years of a graveyard test at Concepcion, Chile, of sapwood and heartwood stakes (2 by 2 in., 70 cm long) of 12 species of native and exotic Chilean timbers. Data are also given for some of the species from graveyard tests at Santiago (1 year), Chillan (2 years), and Valdivia (25 months). Estimates are made of the average useful life for each species (sapwood and heartwood separately).

Blumenfeld, S. N. 1984. Studies on the degradation of pine wood blocks by Aphyllophorales. Material und Organismen. 19(4):253–262.

Describes a decay study of 18 species of Aphyllophorales previously isolated from wood of *Pinus elliottii* and *P. taeda plantations* in Argentina. Inoculated wood blocks growing on malt agar were evaluated for weight loss. *Pinus elliottii* blocks had the greatest resistance to decay. Thirteen of the wood rotting fungi were Polyporaceae, one Hymenochaetaceae, one Ganodermataceae, and three Corticiaceae.

Boone, R. S.; Chudnoff, M.; Goytia, E. 1969. Chemical control of bostrichidae during air drying of fence posts. Res. Pap. ITF–8. U.S. Department of Agriculture, Forest Service, Institute of Tropical Forestry. 8 p.

Presents effectiveness of chemical dips and/or sprays to control insect attack on white mangrove posts, a highly vulnerable species, while air drying prior to preservative treatment.

Bultman, J.D.; Southwell, C.R. 1976. Natural resistance of tropical American woods to terrestrial wood-destroying organisms. Biotropica. 8(2):71–95.

Bultman, J.D.; Parrish, K.K. 1982. N-tritylmorpholine as a protectant against marine wood-destroying molluscs. International Journal of Wood Preservation. 2(4):159–163.

Describes a study of pine sapwood treated with N-tritylmorpholine as protection against marine boring mollusks. Exposure tests of 3 months at two different marine sites in Panama showed no damage due to teredinids or pholads. The treatment is only effective against the boring organisms.

Bultman, J.D.; Beal, R.H.; Huffman, J.B.; Parrish, K.K. 1983. An investigation of the natural resistance of *Melaleuca quinquenervia* to tropical and terrestrial wood-destroying organisms. Forest Products Journal. 33(3): 39–43.

Wood from Melaleuca quinquenervia was exposed in the Panamanian rain forest and in the Bay of Panama and Limon Bay. Within 18 months, samples were heavily damaged by fungi, termites, and marine borers, indicating low natural resistance to these organisms.

Butin, H.; Aquilar, A.M. 1984. Blue-stain fungi on Nothofagus from Chile—including two new species of *Ceratocystis* Ellis & Halst. Phytopathologische Zeitschrift. 109 (1):80-89.

Describes four *Ceratocystis* spp. isolated from the bark and wood Nothofagus spp. in Chile. Species illustrated are *C. nothofagi, C. piceae, C. pilifera and C. valdiviana. C. piceae* and *C. pilifera* caused heavy blue staining in the wood of *Nothofagus pumilio. C. nothofagi* and *C. valdiviana* are new species described and cause a lower level of blue staining.

Cardoso, L. 1953. Causes of discoloration in wood (Causas da coloracao anormal da madeira). Sao Paulo, Brazil: Edio. Prop. Serv. Flor. Est. S. Paulo. 33:15.

Discusses discoloration of wood caused by fungi, its effect, and means of preventing fungal stain.

Carranza, J.; Saenz, J.A. 1984. Wood decay fungi of Costa Rica. Mycotaxon. 19:151–166.

The first part of a larger work, it describes 32 species of wood decaying Polyporaceae in Costa Rica.

Carrasco–Z., F. 1978. South-Peruvian cerambycids (Insecta: Coleoptera) (Cerambicidos (Insecta: Coleoptera) surperuanos). Cuzco, Peru. Revista Peruana de Entomologia. 21(1):75-78.

Describes 56 species of wood boring cerambycids collected from the Departments of Cusco, Apurimac, Madre de Dios, and Arequipa, Peru. Some species are important for their economic impact. Included are: Parandra glabra (Deg.), found at elevations to 3000 m, it bores in felled timber; *Stenodontes spinibarbis* (L.); *Eburia pilosa* (Erichs.), has been noted to cause severe damage in construction timber; *Megaderus stigma* (L.), has been recorded as attacking transmission poles in Brazil); *Acrocinus longimanus; Macropophora accentifer; Taeniotes orbignyi;* and *Oreodera* sp.

Carter, F.L.; Beal, R.H.; Bultman, H.D. 1975. Extraction of antiterimitic substances from 23 tropical hardwoods. Wood Science. 8(1):406–410.

Carter, F.L.; Camargo, C.R.R. de. 1983. Testing antitermitic properties of Brazilian woods and their extracts. Wood and Fiber Science. 15(4):350–357.

Comparisons were made of the survival and feeding responses of *Reticulitermes flavipes* (Kollar) and *Coptotermes formosanus* Shiraki exposed to heartwood blocks and paper pads treated with extracts from 11 Brazilian woods. In no-choice block tests, no survival and little feeding occurred on Calophyllum brasiliense, Carapa guianensis, *Cedrela odorata, Diplotropis, Mezilaurus itauba, Ocotea cymbarum, Platymiscium ulei,* and *Sweetia nitens. Micrandra siphonioides* was the most favorable wood for both termite species. In choice block tests of 11 woods, termites ignored most woods, eating primarily *M. siphonioides* and then small amounts of a few others. Success in extracting antitermitic substances from milled heartwood of the 11 species varied with woods and solvents (successive cold extraction with hexane, acetone, a mixture of acetone/hexane/water, and 80 percent methanol). Termiticidal extracts were obtained from 9 woods. In no-choice tests *R. Aavipes* did not survive the 8-week test period on seventeen extracts: *C. formosanus* did not survive on fourteen extracts. These extracts will be used for further study in research on potential termiticides from termite-resistant woods. Methods used in this study will be applied to tests in Brazil on various wood species against Brazilian termites.

Carter, F.L.; Jones, S.C.; Mauldin, J.K.; Camargo, C.R.R. 1983. Responses of Coptotermes formosanus Shiraki to extracts from five Brazilian hardwoods. Zeitschrift für Angewandte Entomologie. 95(1):5-14.

Describes a study of 5 Brazilian hardwoods that were extracted to obtain extracts to test for toxic and repellent characteristics to *Coptotermes formosanus* Shiraki. The toxicity and repellency were found to differ with the wood and solvent used and in some cases with the concentration of the extract. Toxicity was greatest with the extracts of *Cedrela odorata* and *Ocotea cymbarum.* The greatest, repellency was from the hexane, acetone, and acetone-hexane-water extracts of these 2 species. The termites generally preferred untreated to treated paper in a choice test for antifeedant properties. Some of the paper was not consumed but was used by the termites in nest-building activities.

Cavalcante, M.S. 1971. Methods for the evaluation of the natural durability of wood (Metodos de avaliacao da

resistencia de madeiras ao ataque de fungos xilofagos.) Preservacao de madeiras. 2(1):27–47.

Cavalcante, M.S. 1976. Problems caused by termites in buildings in the State of Sao Paulo, Brazil. International Research Group on Wood Preservation. Document. IRG/WP/150. 3 p.

Cavalcante, M.S. 1978. Natural durability of timbers in contact with soil (Durabilidae natural de madeiras em contato com o solo). Sao Paulo, Brazil: Boletin Tecnico IF. 29:15.

A preliminary report on resistance of 20 timber species to attack by termites and fungi.

Cavalcante, M.S. 1979. Wood preservation in Brazil (Preservacao de madeiras no Brasil.) Instituto de Pesquisas Tecnologicas do Estado de Sao Paulo, Pesquisa e Desenvolvimento. 3:26.

Provides parallel Portugese and English texts that describe wood preservation plants and research, laws, education, and proposals for future direction.

Cavalcante, M.S. 1982. Wood-attacking organisms in Brazil. In: Proceedings, 13th annual meeting of the International Research Group on Wood Preservation, Working Group I, Biological problems; 1982 May 24–28; Cesme, Turkey. Document IRG/WP/1168. 10 p.

Describes the principal wood attacking organisms in Brazil, including: 7 beetles, 16 termites, 28 fungi, and 10 marine borers, and the woods from which they were collected.

Cavalcante, M.S. 1983. Introduction and development of wood preservation in Brazil (Implantacao e desenvolvimento da preservacao de madeiras no Brazil. Pesquisa & Desenvolvimento. 14:57.

Cavalcante, M.S.; Cockroft, R. 1984. Wood preservation in Brazil. IRG/ WP/3321. Styrelsen for teknisk utveckling Information No. 445–1984. Stockholm, Sweden. 70 p.

Reviews wood preservation in Brazil, concentrating on both the preservation facilities and the types of wood treated. Legal aspects of wood preservation and training of personnel are also covered.

Cavalcante, M.S.; Lelis, A.T. de. 1974. Wood-attacking organisms from fence posts of Convenio IPT-IF field tests in the State of Sao Paulo (Organismos xilofagos coletados nos campos de apodrecimento instalados pelo Convenio IPT-IF em diversas regioes do Estado de Sao Paulo). Preservacao de Madeiras. 5(1):29–50.

Cavalcante, M.S. [and others]. 1982. Brazilian bibliography on wood preservation (Bibliografia Brasileira em preservacao de madeiras.) In: Anais do I Encontro Brasileiro em Preservacao de Madeiras: 39–158.

Cavalcante, M. S.; Geraldo, F. C.; Freitas, A. R. de. 1982. Some statistics on the Brazilian wood preservation industry: 1980–1981. In: Proceedings, 13th annual meeting of the International Research Group on Wood Preservation, Working Group I, Biological problems; 1982 May 24–28; Cesme, Turkey. Document IkG/WP/3214. 4 p.

Cavalcante, M.S.; Montagna, R.G.; Lopez, G.A.C.; Fosco Mucci, E.S. 1982. Natural durability of timbers in contact with the soil (Durabilidade natural de madeiras em contato com o solo). 2. In: Malvesi, I.T.O. [and others], eds. Proceedings of the national conference on native species. Campos do Jordao; 1982 September 12–18; Sao Paulo, Brazil. Sao Paulo, Brazil: Instituto de Pesquisas Tecnologicas. Silvicultura em Sao Paulo 16A(2):1383–1389.

Describes results of field and laboratory tests in Sao Paulo on the natural durability of 20 Brazilian hardwoods: *Anadenanthera macrocarpa, Apuleia leiocarpa, Aspidosperma polyneuron; Astronium gracile, Centrolobium tomentosum; Copaifera* spp., *Diplotropis* spp., *Dipteryx data; Diptychandra aurantiaca; Hymenaea stilbocarpa, Myrocarpus frondosus, Peltophorum dubium, Piptadenia spp., Plathymenia foliolosa, Plathymenia reticulata, Pterodon pubescens, Pterogyne nitens, Tabebuia impetiginosa, Vatairea heteroptera,* and *Vatairea* spp.

CCIF (Centro de Capacitacion e Investigacion Forestal). 1981. Preliminary technological study of 20 forest species of Ecuador (Estudio preliminar tecnologico de 20 especies forestales del Ecuador). Conocoto, Ecuador: Centro de Capacitacion e Investigacion Forestal, Ministerio de Agricultura y Ganaderia. 27 p.

The physical and mechanical properties, botanical features, drying and preservation features, working properties, and general uses of 20 woods from Ecuador are noted.

Cheynery, S.L.H. 1987. Production of treated timber in Brazil in 1986 (Producao de madeira preservada no Brasil em 1986). Bull. 61. November. Brazilian Wood Preservers Association.

Chianai, R.O. 1961. Impregnation of poplar wood (Impregnacion de tablas de alamo). Folletos Tecnicos Forestales). 14:21.

Reports on impregnation tests performed on Populus eurameicana and Salix alba.

Chiani, R.G. 1967. Trials on the durability of poles for electrical lines with and without treatment carried out in the area of Buenos Aires (Ensayo de durabilidad de postes para alambrado con y sin tratamiento realizado en terrenos de la ciudad de Buenos Aires). Folletos Tecnicos Forestales. 31:30.

Chiani, R.G. 1973. Methods for impregnating posts in rural areas (Methods rurales para impregnacion de postes redon dos para alambrado). Buenos Aires, Argentina: Instituto Forestal, Miscelaneas. 12/13:1–5.

Discusses the ascension, cold hot dripping, and Boucherie methods of treating posts.

Chiani, R.G. 1978. Impregnation of poles by the Boucherie method in Argentina (La impregnacion de postes por el metodo Boucherie en la Republica Argentina). In: Proceedings of the 7th, World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina, Buenos Aires, Argentina; Instituto Forestal Nacional. 5:6353–6355.

Chudnoff, Martin. 1984. Tropical timbers of the world. Agric. Handb. 607. Washington, DC: U.S. Department of Agriculture. 464 p.

This handbook contains descriptions of 370 species or generic groupings of tropical trees and their timbers grouped by regional origin. Standardized descriptions emphasize physical and mechanical properties, processing characteristics, and uses. Data have been compiled, evaluated, and synthesized from the world literature.

Chudnoff, M.; Goytia, E. 1967. The effect of incising on drying, treatability, and bending strength of posts. Res. Pap. ITF–5. U.S. Department of Agriculture, Forest Service, Institute of Tropical Forestry.

A commercially feasible post incising machine is described and was used to prepare test material to determine the effect of incisions on: (1) air drying time, (2) preservative absorption and penetration, and (3) bending strength of small diameter posts. Incising had no significant effect on air drying time but resulted in significant improvement in the treatability of the 20 species evaluated. Incising does result in a 15 to 25 percent reduction in bending strength but this loss is tolerable compared to benefits gained by preservative enrichment of the vulnerable groundlines.

Chudnoff, M.; Goytia, E. 1971. Treatability of Puerto Rican woods. Res. Pap. ITF–11. U.S. Department of Agriculture, Forest Service, Institute of Tropical Forestry.

A simple but highly sensitive wafer assay was used to classify the treatability of the more common woods of Puerto Rico and the Virgin Islands. Sapwood only was treated. Oil absorption of coated and uncoated wafers can be related to the absorption of nonincised and incised posts treated in a hot- and cold-bath system. For nonincised posts only 6 out of the 53 species evaluated were predicted to obtain an adequate treatment (6–12 lb/ft^3). If incised, 32 species would have an acceptable retention. Similar results may be anticipated for water-borne preserving salts.

Chudnoff, M.; Goytia, E. 1972. Preservative treatments and service life of fence posts in Puerto Rico (1972 Progress Report). Res. Pap. ITF–12. U.S. Department of Agriculture, Forest Service, Institute of Tropical Forestry.

Posts treated by four nonpressure techniques using five wood preservation chemicals have been set out at four test locations. About 6,700 treated and nontreated control posts representing some 70 species are under study. This report describes materials and methods used, chemical retentions and penetrations obtained, and reviews the condition of the posts up through the April 1972 inspection. Some installations date back to 1944, but most of the test posts have been in service for 13 years or less. Vertical cold-soaking and the hot- and cold-bath technique are most effective and should be preferred over conventional cold soaking or salt combinations applied by double diffusion.

Chudnoff, M.; Maldonado, E.D. 1964. Preservative treatments and service life of fence posts in Puerto Rico. Res. Pap. ITF–1. U.S. Department of Agriculture, Forest Service, Institute of Tropical Forestry.

Posts treated by four nonpressure techniques using five wood preservation chemicals have been set out at four test locations. About 6,000 treated and nontreated control posts representing 68 species are under study. This report describes materials and methods used, chemical retentions and penetrations obtained, and reviews the condition of the posts up through the September 1963 inspection. Some installations date back to 1944, but most of the test posts have been in service for only 3.5 to 4.5 years. Vertical cold-soaking, the hot- and cold-bath technique, and double diffusion salts applied by complete immersion are most effective and should be preferred over conventional cold-soaking or salt combinations applied by end diffusion.

Chudnoff, M.; Boone, R.S.; Goytia, E. 1967. Preservative treatments and service life of fence posts in Puerto Rico. Res. Pap. ITF–4. U.S. Department of Agriculture, Forest Service, Institute of Tropical Forestry.

Posts treated by four nonpressure techniques using five wood preservation chemicals have been set out at four test locations. About 6,000 treated and nontreated control posts representing 70 species are under study. This report describes materials and methods used, chemical retentions and penetrations obtained, and reviews the condition of the posts up through the April 1967 inspection. Some installations date back to 1944, but most of the test posts have been in service for 8 years or less. Vertical cold-soaking, the hot- and cold-bath technique, and double diffusion salts applied by complete immersion are most effective and should be preferred over conventional cold-soaking or salt combinations applied by end diffusion.

Chudnoff, M.; Gjovik, L. R.; Wawriw, R. 1973. Effectiveness of groundline treatments of creosoted pine poles under tropical exposure. Forest Products Journal. 23(9):80–84.

Reports on a trial after 5 years of exposure in Puerto Rico. Results showed that preservation with creosote alone is inadequate under these conditions. The three proprietary paste treatments tested were all highly effective in preventing decay (despite low retention of preservative in some cases).

Chudnoff, M.; Eslyn, W.E.; Wawriw, R. 1978. Effectiveness of groundline treatments of creosoted pine poles under tropical exposure. Forest Products Journal. 28(4):28-32.

The final report on a study in which poles of southern pine were treated with creosote and stored outdoors for 8 years before being treated with penta-gel, F-creosote paste, or F-As injection and tested in contact with the ground in Puerto Rico for 10 years. Freedom from decay and preservative retention as measured by toxicity to *Lentinus lepideus* in soil block tests increased in the order creosote, penta-gel, F-creosote, F-As injection. Results indicate that creosote-treated poles require supplementary ground level protection for tropical use; where decay is most likely, F-As injections are recommended.

Clark, J.W. 1969. Natural decay resistance of 15 exotic woods imported for exterior use. Res. Pap. 103. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory.

Conejos, J. 1969. Preservation characteristics of 127 woods of the Venezuelan Guayana (Caracteristicas de preservacion de 127 maderas de la Guayana, Venezolana). Merida, Venezuela: Laboratorio Nacional de Productos Forestales.

CTFT (Centre Technique Forestier Tropical). 1984. Technical sheets on French Guyanan woods (Fiches techniques sur des bois guyanais). Nogent-sur-Marne, France: Bois et Forets des Tropiques. 204:53–72.

Descriptions of five species of tropical woods from French Guyana, including information on the durability and treatability of *Ocotea rubra, Erisma unicinatum, Adnira coriacea, Vouacapoua americana, Eperua falcata, E. grandiflora,* and *E. rubiginosa.*

De Groot, R.C. 1986. Durability of utility poles in Panama. Res. Pap. FPL–RP–478. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 12 p.

Creosote-treated southern pine and Douglas-fir utility poles, produced in the United States and installed in Panama, were inspected for termites and for decay at the groundline. Findings indicate that current U.S. industrial and Federal specifications for creosote treatment of southern pine poles provide adequate protection in most tropical environments, but some variation in performance was observed between poles set in different ecological biomes. In tropical regions, such as Panama, where termites pose a serious hazard, specifications for creosote treatment of Douglas-fir poles should be supplemented with requirements for treatment of soil around the pole with an approved termiticide.

De Groot, R. C.; Stoukoff, M. 1986. Efficacy of alternative preservatives used in dip treatments for wood boxes. Res. Pap. FPL–RP–481. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 21 p.

Nailed pine boxes, wire-bound gum boxes, and wire-bound plywood boxes were dip treated with alternative wood preservatives and exposed above ground in a jungle in an open field in Panama, and in a partially shaded field in southern Mississippi. Results from the open field in Panama were intermediate between those from the jungle site and those from the site in Mississippi.

Deon, G. 1978. Manual of wood preservation in tropical climates (Manuel de preservation des bois en climat tropical). Nogent-sur-marne, Cendex, France: Centre Technique Forestier Tropical. 111 p.

Describes tropical wood protection in a manual covering subjects such as: protection of saw-logs; temporary protection of fresh sawn timber and rotary-cut veneers; protection of wood installation; agents of deterioration; natural durability of timber; preservation of wood before installation (materials and processes); impregnability of wood; protection of building timber; protection of squared timber used in contact with the soil; protection of roundwood (mine timbers, posts, and poles); protection of plywood; protection of wood in marine uses.

Deon, G. 1984. The correlation between the natural durability of some tropical species and their contents of extractives (Vers une recherche de correlation entre la durabilite naturelle de certaines essences tropicales et leurs teneurs en extraits). In: Groupe de travail 2. Les transformations physico-mecaniques. Sous-groupe 2.5—Preservation. Colloque sciences et industries du bois. Grenoble du; September 20–22, 1982; Paris, France. Cendex, France: Centre Technique Forestier Tropical: 351–366.

Describes the extraction of naturally durable woods and testing of the woods for resistance to fungal attack without the extractives present. Wood species evaluated *(Afzelia bipindensis, Cylicodiscus gabunensis, Erythrophleum ivorense, Morus mesozygia,* and *Pterocarpus soyauxii)* lost their natural resistance to fungal attack after extraction. Natural durability was found to be closely correlated with contents of extractives, although some woods with low extractives are durable. The authors suggest that durability can be predicted from extractive analyses.

Deon, G. 1986. Manual of preservation for woods from tropical climates (Manual de preservation des bois en climat tropical). Cedex, France: Centre Technique Forstier Tropical. 116 p.

Reissued in 1990

Dickinson, D.J.; Levy, J.F. 1979. The action of wood preservatives in relation to wood anatomy. In: International Association of Wood Anatomists: Abstracts of papers for the Wood Anatomy Congress of the Afro-European regional group, IAWA, Wood Quality Subject Group of IUFRO division 5, and the Plant Morphology and Anatomy Section of the Royal Botanical Society of the Netherlands; 1979 August 27–30; Royal Tropical Institute, Amsterdam. IAWA Bulletin. 2/3:36.

Describes the effects of wood inhabiting fungi on the structure of wood cell walls. Discusses the effectiveness of wood preservatives based on penetration into the wood, and especially into the cell walls.

Dolores, M.; Santos, G.S. 1982. The susceptibility of 35 Amazon wood species to *Cryptotermes brevis* (Walker). In: Proceedings, 13th annual meeting of the International Research Group on Wood Preservation, Working Group I, Biological problems; 1982 May 24–28; Cesme, Turkey. Document IRG/WP/llGO. 11 p.

Describes the testing of 35 wood species for attack by Cryptotermes brevis, over 45 days. Five species were nonresistant, 21 fairly resistant, and 9 highly resistant: *Bowdichia nitida, Clarisia racemosa, Dinizia excelsa, Dipteryx odorata, Enterolobium maximum, Garapa guianensis, Goupia glabra, Laetia procera,* and *Symphonia globulifera.*

Echenique–M., R. 1970. Description, characteristics, and uses of 25 tropical Mexican woods (Descripcion, caracteristicas y usos de 25 maderas tropicales Mexicanas). Mexico, D.F., Mexico: Camara Nacional de la Industria de la Construccion. Serie Maderas de Mexico. 237 p.

Includes information on the natural durability of 25 species.

Erdoiza–S., J.J. 1982. Bibliography on various aspects of wood preservation (Lista bibliografica sobre diferentes aspectos de la preservacion de la madera). Nota Tecnica. Veracruz, Mexico: Laboratorio de Ciencia y Tecnologia de la Madera. Instituto Nacional de Investigaciones sobre Recursos Bioticos, Mexico. 5:4.

Erdoiza–S., J.J. 1982. Preservation of pine timber by brush, immersion and diffusion treatments (Tratamientos para madera de pino por los metodos de brocha, inmersion y aspersion). Nota Tecnica. Veracruz, Mexico: Laboratorio de Ciencia y Tecnologia de la Madera. Instituto Nacional de Investigaciones sobre Recursos Bioticos. 4:4.

Erdoiza–S., J.J. 1982. Immersion treatment with pentachlorophenol to preserve pine and oak timber (Tratamiento por inmersion para preservar madera de pino y encino a base de pentaclorofenol). Nota Tecnica. Veracruz, Mexico: Laboratorio de Ciencia y Tecnologia de la Madera. Instituto Nacional de Investigaciones sobre Recursos Bioticos. 3:4.

Erdoiza–S., J.J. 1983. Treatment of pine fence posts with creosote using hot- and cold-open-tank treatments (Tratamiento para postes de cerca de madera de pino por el metodo de bano caliente-bano frio con creosota). Madera y su Uso en la Construccion. Veracruz, Mexico: Instituto Nacional de Investigaciones sobre Recursos Bioticos. 8:8.

Erdoiza–S., J.J. 1984. Preservation of 2X4 inch cross-section pine timber with water-soluble salts by hot- and cold-open-tank treatments (Tratamiento de madera de pino de 2X4 pulgadas de seccion, con sales hidrosolubles por el

metodo de bano caliente y frio). Nota Tecnica. Veracruz, Mexico: Laboratorio de Ciencia y Tecnologia de la Madera, Instituto Nacional de Investigaciones sobre Recursos Bioticos. 9:7.

Erdoiza–S., J.J.; Castillo, I. 1988. Techniques for the determination of retention and penetration of preservative substances in wood (Tecnicas para la determinacion de la retencion y penetracion de las substancias preservadoras dentro de la madera). Veracruz, Mexico: Universidad Autonoma Metropolitana. Boletin Tecnico, La Madera y su Uso. 20:31.

Describes simple and reliable tests to determine the retention and penetration of preservatives, specifically arsenic, boron, chrome, copper, creosote, fluoride, and pentachlorophenol.

Erdoiza–S., J.J.; Castillo–M., I. 1989. Treatability with wood preservatives of 50 Mexican species (Susceptibilidad de impregnacion con perservadores de cencuenta especies maderables Mexicanas). Veracruz, Mexico: Universidad Autonoma Metropolitana. Boletin Tecnico, La Madera y Su Uso 22:17.

Lists 50 species arranged according to their penetration and retention of preservatives.

Erdoiza–S., J.J.; Echenique–M., R. 1980. Preservation of pine wood with boron salts (Preservacion de madera de pino con sales de boro). Veracruz, Mexico: Instituto Nacional de Investigaciones sobre Recursos Bioticos. La Madera y su Uso en la Construccion. 4:17.

Eslyn, W.E.; Bultman, J.D.; Jurd, L. 1981. Wood decay inhibition by tropical hardwood extractives and related compounds. Physiology and Biochemistry. 71(5):521–524.

Describes the impregnation of sterilized pine blocks with extractives obtained from tropical hardwoods (obtusaquinone, obtusastyrene, or lapachol) and one synthetic compound (2-benzyl-4,6-di-t-butylphenol). The treated blocks were exposed to the wood decay fungi, *Coriolus versicolor*, *Gloeophyllum trabeum*, or *Poria placenta.* Obtusastyrene and obtusaquinone were most effective against the brown-rot fungi. Lapachol was effective at its highest concentration only against *P. placenta.* The synthetic compound reduced all decay-associated weight losses. Chemical sterilization resulted in increased decay by *G. trabeum* and *P. placenta* on treated wood, but no statistical difference was noted on the control blocks.

FAO. 1973. Forestry and forest industries development program in Paraguay. Wood preservation. FAO Rep. FO:SF/PAR 15. Documento de Trabajo. 7:124.

Presents the results of trials with 32 Paraguayan wood species to determine their suitability for treatment by the vacuum/pressure and hot- and cold-bath methods. The majority of the species tested proved suitable for the vacuum/pressure process, while 16 species could be suitably treated by the hot- and cold-bath method. The main object of the trial was to find timbers suitable to replace Cedrela spp. and Tabebuia spp., which make up nearly 70 percent of the wood used in local markets in Paraguay.

Fougerousse, M. 1979. The problem of the protection of logs in the tropics (La probleme de la protection des billes sous les tropiques). In: Proceedings. Part I. Tropical crops. Part 11. Human and animal health. Congress on the control of insects in the tropical environment. Chamber of Commerce and Industry of Marseilles; 1979 March 13–16. pp. 663–678.

Francis, G.W.E. 1926. Native woods used for railway crossties in British Honduras. Tropical Woods. 7:30–32

Several native woods were tested as crossties: these lasted 3.5 to 6 years. All woods tested were untreated or were only surfaced brushed with preservative.

Freitas, A.R. de. 1970. Laboratory evaluation methods for wood preservatives (Metodos de avaliacao de preservativo em laboratorio). Preservacao de Madeiras. 1(3): 151–173.

Freitas, A.R. de. 1980. Wood preservation research in Brazil. In: Proceedings of the annual meeting of the American Wood-Preservers' Association. Bethesda, MD. 76:205–211.

Presents information on the use of wood preservatives on crossties, poles, fence posts, and building timbers in Brazil. Also notes quality control, standards, and perspectives for future development.

French, D.W.; Tainter, F.H. 1973. Comparative decay resistance of Chilean woods. Forest Products Journal. 23(8):49-51.

Gives the results of soil/block and agar/block tests of the resistance of 19 commercial wood species to *Lenzites trabea* and *Polyporus versicolor. Fitzroya cupressoides* and *Nothofagus obliqua* were classed as highly resistant and *N. pumilio* as resistant. It is noted that house builders are tending to use nonresistant timbers (e.g. *N. dombeyi)* on an increasing scale, without treatment, as the more resistant species become more scarce.

Galvan–V., R.; Guzman, G. 1977. A floristic study of wood decaying Polyporaceae in the State of Morelos (Estudio floristico sobre los hongos destructores de la madera del grupo de los Poliporaceos, en el Estado de Morelos). Boletin de la Sociedad Mexicana de Micologia. 11:35–98.

Describes a study of 67 species, based on herbarium material. Most subtropical forests had the most species, followed by Abies forests, tropical, and *Pinus/Quercus* forests. A key is provided for identification of the main genera and species.

Galvao, A.P.M. 1969. A practical process to increase the life of wood (Processos praticos para aumentar a duracao da madeira). Boletin de Divulgacao No. 14. Sao Paulo, Brazil: Universidade de Sao Paulo, Escola Superior de Agricultura Luiz de Queiroz. 24 p.

Galvao, A.P.M.; Jankowsky, I.P. 1986. Durability of *Eucalyptus urophylla* wood preserved by processes at atmospheric pressure: evaluation of field trials (Durabilidade da madeira de *Eucalyptus urophylla* S. T. Blake preservada por processos sem pressao: Avaliacao de ensaios de campo). IPEF-Instituto-de-Pesquisas-e- Estudos-Florestais. 33:59–64.

Posts treated with a double diffusion method of 50 percent $CuSO_4$: 50 percent $K_2CR_2O_7$ proved to be the most durable, and had an average durability of 17 years, as compared to 2 years for untreated posts.

Garcia–C., G. 1948. Relative resistance of some Mexican tropical woods to wood destroying fungi (Resistencia relativa de algunas maderas tropicales mexicanas a los hongos

xilofagos). Mexico, D.F., Mexico: Facultad de Quimica, Universidad Nacional Autonoma de Mexico. M.S. thesis.

Geraldo, F.C. 1982. Considerations about utilizing preserved eucalypt posts (Consideracoes sobre a utilizacao de postes de Eucalipto preservado). In: Anais do I Encountro Brasileiro em Preservacao de Madeiras: 257–264.

Gomes, J.I. 1982. The wood of Cordia goeldiana (A madeira de Cordia goeldiana Huber). Boletin de Pesquisa. Embrapa, Brazil: Centro de Pesquisa Agropecuaria do Tropico Umido. 45:16.

A description of this wood, including information on its durability and preservation.

Gomez–N., M.S.; Echenique–M., R.; Salinas–Q., R. 1969. Laboratory indices on the resistance of wood to decay in eleven Mexican forest species (Indices de laboratorio sobre resistencia de la madera a la pudricion en once especies forestales mexicanas). Boletin Technico. Veracruz, Mexico: Instituto Nacional de Investigacion Forestal. 31:40.

Mexican woods from both warm-humid and cold-temperate zones were exposed to three native fungi. Six of the tropical woods were observed to be moderately to highly resistant to decay, while the temperate pines and the tropical Pseudobombax ellipticum were nonresistant to moderately resistant to fungal attack.

Gomez–N., M.S.; Echenique–M., R.; Salinas–Q., R. 1978. Laboratory indices on resistance, of the wood, to rot for eleven Mexican forest species (Indices de laboratorio sobre resistencia de la madera a la pudricion en once especies — forestales Mexicanas). Mexico: Boletin Tecnico, Instituto Nacional de Investigaciones Forestales. 31:40.

Gonzalez–F., R.; Abad–C.,J. 1975. *Armillaria mellea* Quel. Departamento de Industrias Forestales, Lima, Peru. Revista Forestal del Peru. 6(1/2):89–93.

Armillaria mellea is reported to occur in four areas of Peru (Huanuco, Junin, Loreto, and Lima). The macroscopic and microscopic characteristics of the fungus are described, as are the symptoms of attack, the types of degradation, and some methods of control.

Gonzalez–F., V.R. 1970. Natural durability of 53 forest species from Yurimaguas (Durabailidad natnral lde 53 especies forestales de Yurimaguas). Revista Forestal de Peru. 4(1-2):50-74.

Wood samples were subjected to five varieties of xilofagus fungi for 90 days. Samples were then classified into five catagories of resistance to decay.

Gonzalez, V.R.; Bueno, J. 1967. Behaviour of timbers of Tingo Maria (from the forests of the Unidad Tecnica de Capacitacion Forestal) in preservative treatment under pressure. Revista Forestal de Peru. 1(2):48–64.

Gonzalez–F., V.R. 1970. Penetrability of 53 forest species of Yurimaguas (Caracteristicas de penetrabilidad en 53 especies forestales de Yurimaguas). Revista Forestal de Peru. 4(1–2):75–89.

Fifty-three species were impregnated by the Lowry process. Twenty-four species were readily permeable, while 10 were quite impenetrable to preservative.

Gonzalez–F., V.R.; Ames de Icochea, T. 1980. Decomposition of the wood of ten forest species due to the action of five wood-destroying fungi (Pudricion de la madera de diez especies forestales por accion de cinco hongos xilofagos). Revista Forestal de Peru. 10(1–2):102–137.

Sap and heartwood of 10 tropical wood spp. were exposed to five wood decay fungi: *Armillaria mellea, Coriolus versicolor, Ganoderma applanatum, Lenzites trabea [Gloeophyllum trabeum]* and *Pycnoporus sanguineus.* Wood of high density species was not always durable. The woods that were most decay resistant were Brosimum uleanum, Caryocar coccineum, and Ormosia coccinea.

Graham, R.D.; Cantara, G.M.; Erdoizo–S., J. 1980. Wood preservation research in the United States and Mexico. In: Proceedings of the annual meeting of the American Wood-Preservers' Association. Bethesda, MD. 76:212–225.

Reviews the research facilities in the U.S.A. and Mexico engaged in wood preservation research.

Greenwood, B.F. de; Tainter, F.H. 1980. Comparative decay resistance of Paraguayan woods. Turrialba. 30(2): 137–139.

Describes the evaluation, for decay resistance, of 16 Paraguayan wood species, using agar-block and soil-block tests against three wood decaying fungi: Coriolus versicolor, *Gloeophyllum trabeum,* and *Poria placenta.* Thirteen of the species were highly decay resistant, two resistant, and one *(Bastardiopis densiflora)* not resistant.

Han–R., M. 1963. Preservation of fence posts by simple methods (Preservacion de postes de cerco por metodos sencillos). Informe Tecnico. 4:23.

Provides information on how to treat posts using a minimum of equipment.

Han–R., M.; Micheli–S., H. 1967. Pressure-treatment preservatives on Chilean woods (La preservacion a presion de maderas en Chile). Santiago, Chile: Instituto forestal. Boletin Informativo. 14:32.

Han–R., M.; Wettling–G., A. 1965. Treatment for the removal of stain marks on the Insigne pine with sodium pentachlorophenol (Tratamiento Antimancha de Pino Insigne con Pentaclorofenato de Sodio). Santiago, Chile: Instituto Forestal. Informe Tecnico. 13:11.

Hector–S., F. 1965. Aspects of damage caused by insect-eating woods (Fases lunares e insectos que apolillan maderas). Buenos Aires, Argentina: Administracion Nacional de Bosques. Folletos Technicos Forestales. 1:11.

Herrera–R., J.A. 1977. Wood preservation by simple and cheap methods (Preservacion de maderas por metodos sencillos y de bajo costo). Ciencia Forestal. 2(8):25–50.

A practical guide to wood preservation methods appropriate to Mexican conditions.

Herrera–R., J.; Barretero–G., J.E.; Herrera–B., A. 1982. Shoes made of Mexican timbers for the braking system of the subway (Zapatas de maderas mexicanas para el sistema de frenos del 'METRO)'. Boletin Tecnico. Mexico: Instituto Nacional de Investigaciones Forestales. 76:59.

Studies of 24 species showed that 12 had notable natural preservation qualities.

Herrera–R., J.; Gomez–Nava, M.S.; Barretero–Gomez, E. 1980. Natural durability of the wood of 14 Mexican forest species (Durabilidad natural de la madera de catorce especies forestales mexicanas).

Boletin Tecnico. 61. Mexico: INIF (Instituto Nacional de Investigaciones Forestales), SFF (Subsecretario Forestal y de la Fauna), SARH (Secretaria de Agricultura Y Recursos Hidraulicos). 21 p.

Describes tests of natural durability to fungi rot from *Lentinus lepideus, Polyporus sanguineus,* and *Poria monticola,* on 14 Mexican wood species.

Herrera–R., J.A.; Gomez–N., M. del S.; Herrera–B., A. 1976. Natural durability of the wood of Mexican tree species. 1. Natural durability indices of 15 species (Duribilidad natural de la madera de especies forestales Mexicanas. 1. Indices de duribilidad natural de quince especies forestales). Boletin Tecnico. Mexico: Instituto Nacional de Investigaciones Forest ales. 52:24.

Highley, T.L.; Scheffer, T.C. 1970. Natural decay resistance of 30 Peruvian woods. Res. Pap. 143. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory.

Using outdoor stake and soil block tests, 30 Peruvian woods were evaluated for resistence to fungal decay by three fungi. Tables list relative resistance and physical properties of the woods.

Hoheisel, H.; Romero–A., E. 1969. First seminar on wood preservation. Technical notes (Primer seminario sobre preservacion de maderas. Notas tecnicas). In: Lopez–G., O.; Mejia–M., L.C. Facultad de Ciencias Agricolas, Universidad Nacional, Medellin, Colombia: 121.

Describes a series of technical notes used at Universidad Nacional, Medellin, Colombia. Lists information on wood preservatives and their manufacturers, naturally durable species of native woods, and state of the art in wood preservation in Colombia and other Latin American countries. Also discusses insect attack and protection against them.

Holmquist, O. 1972. On some Venezuelan polypores important in wood decay. Thesis. Syracuse, NY: Syracuse University.

Holmquist, O. 1973. On some Venezuelan polypores important in wood decay. Dissertation Abstracts International. 33(9):4149.

Thirty species of Polyporaceae were commonly found associated with decay in living and dead wood of the main timber species of a representative dry forest formation in the State of Barinas. A detailed study of the anatomical and cultural characteristics of 13 of the species is included.

Hrdy, I.; Krecek, J. 1972. Bionomical-ecological classification of termites, pests of wood and materials: contribution to the ecology of the termites of Cuba. In: Proceedings of the 13th International Congress of Entomology; 1968 August 2–9; Moscow, Russia. Moscow, Russia: Forest Entomology. Leningrad, USSR, Academy of Sciences of the USSR, All-Union Entomological Society. 3(11):38–40.

Hunt, I.S. 1964. The protection of wood against attack by insects and fungus in Venezuela (La proteccion de la madera contra el ataque de insectos y hongos en Venezuela). Boletin Venezuela. 14:43–81.

Hunt, I.S.; Sobrino, J.C. 1963. Preservative characteristics of 47 species from the Venezuelan Guayana (Caracteristicas de preservacion de 47 especies de Guayanas). Merida, Venezuela: Ministerio de Agrucultura y Cria. 50 p.

Ibanez, R.; Sosa, C.; Castro, J.; Gonzalez, G. 1983. Preservation of the wood of *Bursera simaruba* (mastic-tree) and *Avicennia germinans* (black mangrove) by the immersion-diffusion method using Dohnalit-U salts (Preservacion de madera de *Bursera simaruba* (L) Sargent (almacigo) y *Avicennia germinans* (L) L. (mangle prieto) por el metodo de inmersion-difusion con la sal Dohnalit-U. Boletin Tecnico Forestal. 1(83):7–14.

IBDF–IPT–ABPM. 1971. Program of controlling the quality of preservatives and treated wood (Programa de controle de qualidade de preservativos e madeira preservada). Sao Paulo, Brazil: Preservacao de Madeiras. 2(1):101-107.

IBDF–IPT–ABPM. 1976. Wood preservation manual (Manual de Preservacao de Madeiras). Sao Paulo, Brazil: Instituto des Pesquisas Tecnologicas.

Instituto Forestal. 1973. General information for the uses of preserved wood (Informacion general para los usuarios de madera tratada). Santiago, Chile: Instituto Forestal. Boletin Informativo. 26:22.

Presents a compilation of information on the Chilean preservation standards.

Jankowsky, I.P.; Lepage, E.S. 1986. Eucalyptus creosote as a wood preservative (O creosoto de Eucalyptus spp. como preservativo para madeiras). IPEF–Instituto-de-Pesquisas-e-Estudos-Florestais. 33:47–57.

Wood tar creosotes protected Pinus caribaea var. hondurensis against termites and white and brown rot fungi, but not against soft rot fungi. Wood tar creosotes are thus satisfactory for treating fence posts, but not for treating structural timber.

Johnson, B.R.; Gjovik, L.R.; Roth, H.G. 1973. Single- and dual-treated panels in a semi-tropical harbor: preservative and retention variables and performance. American Wood-Preservers' Association proceedings, Progress Rep. 1. 69:207–216.

Tests were made with 130 combinations of preservative salts (Cu-Cr-As or ammoniacal Cu arsenite) and creosotes in Florida, where attack by borers, mainly *Limnoria tripunctata*, was severe. After exposure for 30 months, moderate to high preservative-salt retentions alone or in combination with high retentions of marine or land and freshwater grades of creosote afforded good protection against attack.

Johnson, B.R.; Gonzales–T., G.E. 1976. Experimental preservative treatment of three tropical hardwoods by double-diffusion processes. Forest Products Journal. 26(1):39–46.

Numerous modifications of double-diffusion treatment were evaluated with three tropical American hardwoods: cativo, gallinazo, and lechoso. Duration of soak had the most pronounced effect on retention, but time needed was shown to depend on sample condition and preparation, solution concentration, and retention level desired. With all three species, nearly all the variously modified treatments produced chemical retentions considered adequate to protect wood against severe decay and insect attack. It seems probable that schedules for double-diffusion process could be found that would yield effective treatments of numerous other tropical species.

Jones, S.C.; Carter, F.L.; Mauldin, J.K. 1983. *Reticulitermes flavipes* Kollar (Isoterpa: rhinotermitiidae) responses to extracts from six Brazilian woods. Environmental Entomology. 12(2):458-462.

Describes tests of extractives from six Brasilian hardwoods as anti-termitic agents. The tests were conducted in Mississippi on the termite *Reticulitermes flavipes* (Koll.) during a four-week period in no-choice tests. The success of the extracts varied with the species from which they were extracted and the solvent used for extraction. Termite feeding and survival was lowest on *Copaifera multijuga, Mezilaurus itauba, and Platymiscium ulei,* and highest on *Couroupita subsessilis* and on some extracts of *Micrandra siphonioides.* Where termites survived the no-choice test, protozoan numbers were reduced most on all extracts of *Carapa guianensis* and the hexane extracts of *Mezilaurus itaubi* and *P. ulei.* Termites exposed to choice tests generally consumed more untreated than treated paper pads. No significant difference occured between pad weights of controls and those treated with some extracts of *Couroupita subsessilis* and *Micrandra siphonioides.* One to three extracts of each of the six woods were repellent to termites.

Juacida, R.; Willeitner, H. 1981. On the treatability of four Chilean wood species in relation to site and wood properties (Uber die Trankbarkeit von vier chilenischen Holzarten in Abhangigkeit von Standort und Holzeigenschaften). Holz als Roh- und Werkstoff. 39(8):335–340.

Describes an impregnation study of four important Chilean hardwoods: *Aextoxicon punctatum, Eucryphia cordifolia, Laurelia philippiana,* and *Nothofagus dombeyi,* from three different sites. Treatments used were the vacuum-pressure process with aniline blue and with a cold water-borne preservative and hot creosote. The distribution of treatment in all directions in the wood samples was analyzed within and between species. Site effects were noted only with *L. philippiana.* Retention in heartwood was affected by extractives in the wood.

Juacida, R.; Peek, R.D. 1982. The natural durability of Chilean woods (Die naturliche Dauerhaftigkeit von vier chilenischen Holzarten). Holz als Roh- und Werkstoff. 40(8):307–310.

Describes tests conducted to evaluate the natural durability of *Aextoxicon punctatum, Eucryphia cordifolia, Laurelia philippiana,* and *Nothofagus dombeyi.* All species had low durability against the fungi: *Coniophora puteana, Coriolus versicolor,* and *Gloeophyllum trabeum.*

Juacida, R.; Peredo, M. 1985. Efficacy of some preservatives on the prevention of blue stain in *Pinus radiata* (Eficacia de algunos preservantes en la prevencion de la mancha azul en *Pinus radiata).* Valdivia, Chile: Facultad de Ciencias Forestales, Universidad Austral de Chile.

JUNAC. 1988. Manual of the Andeau Pact for the preservation of woods (Manual del Grupo Andino para la preservacion de maderas). Junta del Acuerdo de Cartegena y Comunidad Economica Europa. JUNAC, Lima, Peru. 406 p.

A complete manual for all aspects of wood preservation, from wood properties to the most recent methods of preservative treatment. A glossary of terms is included.

Karstedt, P.; Gloger, C. 1978. The preservation of fence stakes, poles, sleepers and construction timbers for housing in Brazil. Curitiba, Brazil: Universidad Federal do Parana. Floresta. 9(2):57-64.

Describes current preservation practices in Brazil. Notes that current methods used for some purposes are inadequate and often improperly applied, or the methods used are too sophisticated and expensive. The recommendation is made that better methods be developed and introduced for local conditions.

LABONAC. 1974. Technological study of the woods of the Llanos Occidentales (Expedited study, first part) (Estudio tecnologico de las maderas de los llanos occidentales (Estudio expeditivo, primera parte)). Merida, Venezuela: Laboratorio Nacional de Productos Forestales. 94 p.

Lamas–R., R.; Vazquez–V., M.O.; Castelo–E., D.E. 1982. Use of sodium pentachlorophenate as a fungicide for tropical woods (Utilizacion de pentachlorofenato sodico como agente fungicida en maderas tropicales). Tecnologia-y-Sociedad. 3:12–18.

Bursera arborea, Ficus goldmannii, F. petiolaris, F. lentiginosa, F. glaucescens, and *Sapium pedicellatum* (used for the production of wooden boxes) treated with a 0.3 percent solution of PCP–NA were no longer susceptible to attack by Aspergillus, Mucor, or Penicillium spp.

Lelis, A.T. 1976. Termites — prevention and eradication (Cupins - prevencao e erradicadao.) Preservacao de Madeiras. 6/7(1):51–58.

Lelis, A.T. 1978. Damage by wood-attacking insects in buildings in Sao Paulo State, Brazil: International Group on Wood Preservation Doc. IRG/WP/175. 10 p.

Lepage, E.S. 1970. Methods of analysis employed in wood preservation — Part 11: Oil-borne preservatives (Metodos de analise quimica empregados em preservacao de madeiras–II parte: preservativos do tipo oleoso. Preservacao de Madeiras. 1(3):133–149.

Lepage, E.S. 1970. Methods of chemical analysis employed in wood preservation (Metodos de analise quimica empregados em preservacao de madeiras). Preservacao de Madeiras. 1(2):49–65.

Lepage, E.S. 1974. Wood preservation (Preservacao de madeiras). Sao Paulo, Brazil: Boletin Tecnico. 2(1):37–83.

Lepage, E. S.; F'reitas, A. R. de. 1982. Preservative treatment of Eucalyptus saligna fence posts by the double-diffusion method. In: Working Group I, Biological Problems, 13th annual meeting of the IRG, 1982 May 24–28; Cesme, Turkey. International Group on Wood Preservation Doc. IRG/WP/3196. 20 p.

Describes preservation of *Eucalyptus saligna* fence posts by the double-diffusion process in Brazil. The posts were tested at five different test locations in Sao Paulo, showing a service life of 11.2 years for $CuSO_4$-KCr_2 at 10.5 kg/m^3 retention, and 14.3 years for $CuSO_4$-Na mono-H arsenate at 7.1 kg/m^3 retention.

Lepage, E.S.; Montagna, R.G. 1973. Study on wood preservatives and treatment processes (Estudo de preservativos de madeira e processos de tratamento.) Sao Paulo, Brazil: Instituto Florestal Boletin Tecnico. 7.

Lepage, E.S.; Eatanabe, L.Y.; Cavalcante, M.S. 1973. Studies on the treatability and resistance to termite and decay fungi attack of *Pinus elliottii* (Estudo das caracteristicas de resistencia ao ataque de cupins, de fungos apodrecedores e de tratabiliidade de madeira de Pinus elliottii. Preservacao de Madeiras. 3/4(1):95–98.

Levy, C.R. 1982. Methods of treatment of wood preservatives. The selection of appropriate preservation process with particular reference to mixed tropical forest resources. In: Proceedings, 13th annual meeting of the International Research Group on Wood Preservation, Working Group I, Biological problems; 1982 May 24–28; Cesme, Turkey. Document IRG/WP/3177. 10 p.

Describes the development of wood preservation, factors affecting the choice of treatment method, permeability of timbers to preservative, and research needs with special emphasis on the tropics.

Lima, A.M.C. 1941. On termites boring of goiabeira Isoptera: Kalotermitidae. (Sobre cupims brocas da goiabeira, Isoptera: Kalotermitidae). Rio de Janeiro, Brazil: Boletin da Sociedade Brasileira de Agronomia. 4(4): 377–387.

Lisboa, P.L.B. 1983. Notes on the wood crossties of the Tocantins Railroad (Notas sobre os dormentes da Estrada de Ferro do Tocantins). Acta Amazonica. 13(2):467–471.

Reports on the suitability of selected woods to serve as crossties. *Mezilaurus itauba* was noted as having the greatest durability, while *Vouacapoua americana, Manilkara huberi, Browdickia nitida,* and *Eschweilera* sp. were also highly durable.

MacLean, J.D. 1959. Report on the study of preservative treatment of Chilean woods. Washington, DC: International Cooperation Administration. 12 p.

Procedures are given for treating several Chilean wood species, and suggestions are listed for testing effectivenenss of treating other species.

Mayorca, L.de. 1969. Natural durability of 125 woods from Venezuelan Guayana (Duribilidad natural de 125 maderas de la Guayana Venezolana). Merida, Venezuela: Laboratorio Nacional de Productos Forestales.

Mayorca, L.de. 1972. Natural durability of 115 woods from Venezuelan Guayana (Durabilidad natural de 125 maderas de la Guayana Venezolana). Revista Forestal Venezolana. 15 (22):27–36.

Describes results after 8 years in a graveyard test of stakes of the heartwood of 115 negative species in Venezuela. Results, shown in a table, indicate that 69 species could be classed as highly susceptible (failing in 0 to 2 years), 6 as durable (mean life 6 to 8 years), and 7 as very durable (mean life >8 years). The durable and very durable species included Eschweilera spp., *Peltogyne* spp., *Piranhea longepedunculata, Platymiscium pinnatum, Tabebuia serratifolia, Tetragastris mucronata, Centrolobium paraense, Cordia alliodora, Lecythis davisii,* and *Manilkara bidentata.*

Mayorca, L.de. 1978. Durability trial of 17 woods from west central Venezuela (Estudio de durabilidad de 17 maderas de la region centro occidental de Venezuela). Revista Forestal Venezolana. 26:61–72.

Describes cemetary trial to determine the suitability of the woods for use as fruit and vegetable crates and boxes. The weight loss of samples in controlled conditions, after inoculation with the wood-rotting fungi *Lenzites trabea* and Polyporus versicolor, was also measured. *Quaraiba guianensis* and *Hura crepitans* showed the greatest durability and the least weight loss, during the 3 to 4 year test.

McNamara, W.S.; Greaves, H.; Triana, J.F. 1981. Tropical field exposure of CCA-treated eucalypt stakes. Material und Organismen. 16(2):81–94.

Describes results of field tests, in Colombia, on eucalyptus stakes treated with CCA preservatives.

Mena, L. 1972. Comparative test of four methods for preserving wood (Ensayo comparativo de cuatro medios preservadores para madera). Bogota, Colombia: Universidad Distrital. M.S. thesis.

Mendez, A. de S. 1977. Some tree species from Amazonia recommended for the production of railroad ties (Algumas especies florestais da Amazonia indicadas para producao de dormentes.) Brasilia, Brazil: Laboratorio de Produtos Florestais, PRODEPEF. FAO Rep. PNUD/FAO/IBDF/BRA–45. Comunicacao Tecnica 14:5.

A list is given of 8 naturally durable species that can be used for railroad ties untreated, and 14 species that are suitable if treated with preservative. The density of each wood is given.

Meyenfeldt, C.F.W.M. von. 1985. The use of and alternatives for tropical hardwood in the Netherlands. Netherlands Journal of Agricultural Science. 33(2):115–123.

Describes tropical hardwood imports and their uses in the Netherlands. Since 1972 most of the imports have been used for the building industry (75 percent), primarily for windows and window frames. Another use for tropical woods has been for retainers on canal banks. Substitutes suggested included treated softwoods and recycled waste materials. Methods for conservation of the tropical forests are discussed and a policy proposed.

Micheli, H.; Rio–G., E. del. 1966. Termite attacks on woods in the north of Chile and their prevention (El Ataque de Termitos a la Madera en el Norte de Chile y su Prevencion.) Santiago, Chile: Instituto Forestal. Informe Tecnico. 23:24.

Discusses the natural history of termites, the species collected from various locations in Chile, and measures to reduce termite damage, including painting, chemical preservation, insecticides, etc.

Micheli, H.; Rio–G., E. del. 1972. Resistance of some woods to attack by Cryptotermes brevis (Resistencia de algunas maderas a1 ataque de Cryptotermes brevis) Santiago, Chile: Instituto Forestal. Serie Investigacion. 6:33.

Field tests of *Laurelia philippiana, Nothofagus dombeyi,* and *Pinus radiata* all showed little natural resistance to attack by this insect.

Milano, S. 1981. Effectiveness of some microbiocides against the development of molds and sapstain in Pinus elliottii. International Research Group on Wood Preservation. Doc. IRG/WP/3169, 12 p.

Milano, S.; Neto, J.A.A.V. 1982. Evaluation of the effectiveness of three microbiocides in the control of sapstains. In: Proceedings, 13th annual meeting of the International Research Group on Wood Preservation, Working Group I, Biological problems; 1982 May 24–28; Cesme, Turkey. Document IRG/WP/3212. 13 p.

Describes field tests on the effectiveness of Busan 30, captan, and folpet against mold and sapstain in Pinus elliottii. Folpet is recommended as an alternative to pentachlorophenate for treating pine because of its effectiveness, low cost, and low risk to humans.

Milano, S.; Lepage, E.S.; Cavalcante, M.S. 1978. Comparative study on the behavior of wood preservatives and impregnation processes. Results of inspection of field stakes (Estudo comparativo do comportamento de preservativos de madeira e processos de impregnacao). Resultados da inspecao aos campos de implantacao. Preservacao de Madeiras. 8/9(1):9–22.

Musalem, S.M.; Steiner, W.J.; Contreras, O.I. 1984. Cellulase production by fungi isolated from wood and soils in Southern Chile (Produccion de celulasas por hongos aislados de madera y suelos del Sur de Chile). Boletin Micologico. 2(1):17–25.

Describes studies of cellulase production by 15 species of fungi from 5 genera. The fungi were isolated and grown on a solid medium which was pre-treated with phosphoric acid and mycelial growth inhibitors. Results showed that *Trichoderma aureoviride, T. harzianum, Penicillium* sp., *and P. citreoviride* formed the largest transparent halos of hydrolysis. Endo- and exoglucanase, beta- glucosidase, and filter paper activities were maximum in *T. aureoviride, T. harzianum* I, III, and V, and *P. citreoviride.*

Navarrete–A., J.; Sandoval Z., G.; Zurita–E., R. 1986. Preliminary study on the impregnation, with CCA salts, of resin tapped wood and untapped wood of *Pinus radiata* D.Don (Estudio preliminar sobre impregnacion de madera resinada y sin resinar de *Pinus radiata* D.Don. con sales impregnantes CCA). Concepcion, Chile: Universidad del Biobio. 12 p.

Netto, S.P.; Hosokawa, R.T.; Brito Neto, O. 1972. A study on the toxicity of creosote to Lenzites trabea (Estudo da concentracao e grau de toxidez do creosoto em relacao ao fungo Lenzites trabea). Revista Floresta. 3(3):63–68.

Niederauer, F.R. 1967. Wood preservation and preservatives (Preservacao de madeiras e preservativos). Belo Horizonte, RFFSA, Depto. de Via Permanente. 84 p.

Obregon–A., M.C.; Echenique–M., R. 1974. Identification of wood-inhabiting fungi in wooden poles (Identification de hongos habitantes en postes de madera.) Anales del Instituto de Biologia Universidad Nacional Autonoma de Mexico. Botanica. 45(1):11–20.

Results of study show that *Lentinus lepideus, Polyporus mollis,* and *Poria monticola* were the principal fungi isolated from posts of various *Pinus* sp. used by the Electricity Commission in Mexico. The type of rot caused by each fungus is described. Also isolated were *Aspergillus, Paecilomyces, Fusarium, Cladosporium, Mucor, Penicillium,* and *Torula* spp.

Ortiz–C., M.R.; Cuevas, E. 1965. Natural resistance of wood and wood-based products to attack by biological agents. Instituto Forestal. Informe Tecnico. 21:112–126.

Reports on experiments in which Pinus radiata, Nothofagus dombeyi, particleboards, and fiberboards were tested for resistance to fungi.

Peredo, M. 1978. Impregnation of fence posts (Impregnation de postes para cercos). Valdivia, Chile: Facultad de Ciencias Forestales, Universidad Austral de Chile.

Pereira, J.A. 1936. Wood deterioration in yards and warehouses by fungi and insects (A deterioracaodas madeiras, em patios e depositos, por fungos e insetos). Pub. IPT 51. Sao Paulo, Brazil: Instituto de Pesquisas Tecnologicas. Separada Boletin Institute Engenharia. 23(124):75-84.

Perez–G., V.A. 1981. Assessment of the permeability of Chilean species, with the aim of determining the possibility of impregnating them with preservatives (Determinacion de la permeabilidad de las especies chilenas, orientada a establecer las posibilidades de impregnacion). Santiago, Chile: Instituto Forestal. Informe Tecnico. 82:21.

Reports on the permeability of creosote, pentachlorophenol, and a CCA-type hydrosoluble salt on 19 major Chilean commercial wood species.

Perez–G., V.A. 1982. Determination of the permeability of Chilian species, oriented toward the establishment of impregnation possibilities (Determinacion de la permeabilidad de las especies Chilenas, orientada a establecer las posibilidades de impregnacion). Informe Tecnico. 82:21.

Nineteen major Chilean commercial wood species were investigated to determine their permeability to creosote, pentachlorophenol, and a CCA-type hydrosoluble salt. From this, a classification of the woods based on penetration of these preservatives is presented.

Perez–M., V.; Heras, G.; Echenique–M., R. 1977. Danger of decay of wood in different Mexican climates (Riesgo a la pudricion de la madera en diferentes climas de Mexico). Veracruz, Mexico: Inst. de Investig. sobre Recursos Bioticos, A.C., Xalapa. Madera y su Uso en la Construccion. 1: 11.

Describes a formula for determining the decay index of different localities in Mexico, (a) low-, (b) medium-, and (c) high-risk areas are classified. Techniques for preventing decay in pine lumber used for construction are given with regard to the level of decay risk.

Perez-M., V.; Heras, G.' Echenique-M., R. 1981. Prevention and control of termite damage in wooden structures (Prevencion y control de dano por termitas en estructuras con madera). Veracruz, Mexico: Instituto Nacional de Investigaciones sobre Recursos Bioticos. La Madera y su Uso en la Construccion. 7:16.

Information oriented toward the general public on the natural history of the termite and methods of controlling its damage.

Paz–Perez–O.,C. De la; Salinas–Q., R. 1977. Rapid proof of laboratory indicators of rot resistance in two species of oak (Prueba rapida de laboratorio indicadora de resistencia a pudricion en dos especies de encinos). Mexico: INIF (Instituto Nacional de Investigaciones Forestales). Ciencia Forestal 6. 2:64.

Pesspa, A.L. 1978. Characteristics and natural durability of wood of the Aripuana-MT municipality (Madeiras do Municipio de Aripuana-MT, caracterizacao e durabilitdade natural). Governo do Estado de Mato Grosse, Secretaria da Agricultura, D.P.V.-D.R.N. 20 p.

Pinzon–P., L.M.; Echenique–M., R. 1974. Tests of the toxicity of four wood preservatives on some wood destroying fungi (Ensayo de toxicidad de cuatro preservadores para madera sobre algunos hongos xilofagos). Annles of the Inst. of Biology, National University of Mexico. 45(1):57–73.

Describes tests of CCA-type A (greensalt) and CCA-type B (Boliden salt) creosote, pentachlorophenol, with *Lentinus lepideus, Lenzites trabea [Gloeophyllum trabeum], Peniophora* sp. and *Poria monticola* isolated from timber in

Mexico. *Pinus douglasiana* and *P. pseudostrobus* timbers were used in the soil block test. Untreated *Pinus pseudostrobus* was attacked most by *L. lepideus* and least by *Peniphora* and *Poria* sp. Leaching tests and tests for minimal retention for protection were made.

Pinzon–P., L.M.; Lopez–G., M.T.; Veliz–A., F.A.; Martinez Marcial, J.D. 1982. Methods for the study of some characteristics of wood fungi as degrading organisms of wood (Metodos para el estudio de algunas caracteristicas de los hongos xilofagos como organismos degradadores de la madera). Boletin de la Sociedad Mexicana de Micologia. 17:147–157.

Describes methods for determining the aggressiveness of fungi, the tolerance of the fungi to wood preservatives, and ways to separate the types of rot. The methods are discussed in relation to the following fungi: *Cymatoderma caperatum, Lenzites trabea,* and *Polyporus sulphureus.*

Pinzon–P., L.M.; Veliz–A., F.A. 1984. Type of rot and aggressiveness towards wood of four Mexican wood decomposing fungi (Tipo de pudricion y agresividad hacia la madera en cuatro cepas de hongos xilofagos mexicanos). Boletin de la Sociedad Mexicana de Micologia. 19:65–72.

Describes a study of degradation by four fungi of pine and sweetgum wood. Sawdust was used to test the type of rot and the aggressiveness of the fungi was evaluated using malt agar and soil. *Daedalea confragosa* was slightly aggressive towards pine in malt agar and soil, moderately aggressive towards sweetgum in malt agar, and highly aggressive toward sweetgum in soil. Favolus brasiliensis, Fomes [Rigidoporus] ulmarius, and Polyporus occidentalis were slightly aggressive to pine and sweetgum wood in both malt agar and soil. All the fungi produced a white rot reaction.

Pinzon–P., L.M.; Echenique–M., R. 1976. Copper-chrome-arsenic preservatives, their fixation in wood and their effects on wood-destroying fungi (Preservadores a base de cobre, cromo y arsenico, su fijacion en la madera y su efecto sobre hongos xilofagos). Mexico: Instituto Nacional de Investigaciones Forestales, Boletin Divulgativo. 39:16.

Price, E.A.S. 1978. Economic approaches to wood preservation. In: Proceedings, 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 5:6292–6319.

Raimbault, G.; Carlos, V.J. 1983. The preservation of woods applied to structures (A preservacao de Madeiras aplicada as estrutura). In: Topicos Especiais proceeding of 1st EBRAMEM Po USP–EESC–SET–LAMEM.

Ram, C. 1971. Timber-attacking fungi from the State of Maranhao, Brazil. New species of Pyrenomycetes. 11. Nova Hedwigia. In: Berichte Biochemie und Biologie. (1973) 21(2):225–230.

Describes *Microascus decorticatus, Cephalotheca zeyheriae,* and *Dichlaena pterodontis.*

Ram, C.; Ram, A. 1972. Timber-attacking fungi from the state of Maranhao, Brazil. 9. Some new or interesting wood-staining fungi. Broteria. 41(1/2):89–112.

Describes research done at the Institute of Mycology, Recife. Many of the species had been recorded by previous workers, but five are described as new species: *Cylindrocladium couratariae, Humicola zollerniae, Leptographium hymenaeae, Tilachlidiopsis brasiliensis,* and *Aspergillus tapirirae.*

Ramirez, G.I.; Barieri–B., C.M. 1981. Fire retardant chemical treatment of wood (Tratamientos ignifugos en maderas). Hurlingham, Buenos Aires, Argentina: Centro de Investigacion Tecnologica de la Madera y Afines. 20 p.

Describes wood fires and treatments that retard the spread of fire. General classes of retardants are discussed, and specific products are listed.

Ramirez, G.I.; Felix, R.A. 1982. Study on the behavior of fire on poplar wood treated with fire retardant (Estudio sobre el comportamiento al fuego de la madera de alamo tratada con retardante). Hurlingham, Buenos Aires, Argentina: Centro de Investigacion Tecnologica de la Madera y Afines. 23 p.

Realino, B.D. 1979. Processes for preserving wood (Processos para preservar madeira). Cuiaba, Secretaria da Agri-Cultura, Departmento de Producao Vegetal, Secao de Tecnologia da Madeira: 22 p.

Realino, B.D.; Bueno, C.R. 1979. Evaluating natural durability of woods in field tests (Duribilidade da madeira natural avaliada atraves de ensaios de campo). Brazil: Cientifica. 7(1):9–13.

Describes field tests of 14 Brazilian woods at two sites, Aripuana and Santo Antonio do leveger. Results after 6 months indicate that three woods remained free of decay at Aripuana, including Aspidosperma polyneuron, Diplotropis purpurea, and Mezilaurus itauba. At Santo Antonio only Manilkara huberi was free from decay.

Realino, B.D. [and others]. 1978. Evaluation of the durability using outside field tests (Avaliacao da durabilidade de madeiras atraves de ensaios de campo). D.P.V.—D.R.N. Brazil: Governo do Estado de Mato Grosso, Secretaria da Agricultura. 11 p.

Record, S.J.; Hess, R.W. 1943. Timbers of the new world. New Haven, CT: Yale University Press. 640 p.

Contains descriptions of trees and where they grow. Supplies basis for identification of trees and their woods. Correlates the vernacular, trade, and scientific names, and gives technical data such as durability and specific gravity. Also lists present and perspective uses of the woods.

Reis, M.S. 1972. Decay resistance of six wood species from the Amazon Basin of Brazil. Holzforschung. 26(5):185–191.

Describes tests using representative white-rot and brown-rot test fungi (Polyporus versicolor and Poria monticola) in soil/block tests with six different wood species. Sapwood of all species was nonresistant to decay. Outer heartwood of *Cordia goeldiana, Manilkara huberi,* and *Peltogyne maranhensis* was minimally resistant to decay; *Carapa guianensis* moderately resistant; and *Virola surinamensis* and *Virola* sp. (common name Ucuuba) was not resistant. *Polyporus* versicolor was responsible for more decay than *P. monticola* in all species except *Peltogyne maranhensis.* Extraction with acetone, methanol, and hot water of the heartwood of *C. goeldiana* and *P. maranhensis* yielded chemicals that strongly inhibited decay by both fungi. All woods showed increased decay with increased nitrogen content in the sapwood.

Reis, M.S. 1973. Variation in decay resistance of four wood species from Southeastern Brazil. Holzforschung. 27(3):103–111.

Describes the soil-block tests and results for four wood species, *Anadenanthera peregrina, Eucalyptus citriodora, Piptadenia gonoacantha,* and *Platypodium elegans* exposed to two fungi, *Polyporus versicolor* and *Poria monticola. Anadenanthera peregrina* and *Eucalyptus citriodora* were highly resistant to sapwood, Platypodium elegans moderately resistant, and *Piptadenia gonoacantha* moderately to nonresistant to both fungi.

Rendon, O.E. 1975. Natural resistance of three tropical woods to rot by *Polyporus* sp. and *Lenzites* sp. (Resistencia natural de tres maderas tropicales a pudricion par *Polyporus* sp. and *Lenzites* sp.). Bogata, Colombia: Bosques de Colombia. January–June 1975:95–104.

Reports preliminary results on *Tectona grandis, Didymopanx morototonia,* and *Couma* sp. The wood of *T. grandis* proved to be the most resistant to several types of fungi.

Reyna–R., N. 1983. Control of blue stain on *Pinus caribaea* var. *hondurensis Barr.* & Golf. wood in Turrialba, Costa Rica (Control de mancha azul en madera de *Pinus caribaea* var. *hondurensis* Barr. et Golf. en Turrialba, Costa Rica. Turrialba. 33(4):387–392.

Describes the use of sodium pentachlorophenate to prevent and control blue stain in *Pinus caribaea* var. *hondurensis.* Various species of fungi may cause blue stain but *Ceratostomella* spp. are the most common.

Rodrigues, S. 1976. Creosote and coal tar as wood preservatives (O creosoto e o alcatrao da hulma como preservativos de madeira. Revista da Rede Ferrivuarua Federal: 24–28.

Romero, A.E. 1971. Contribution to the study of Aliso *(Alnus jorullens)*–preservation of the wood (Contribucion al estudio del Aliso *(Alnus jorullensis)*–preservacion de la madera). Manizales, Colombia: Seminario sobre Aliso.

Salinas–Q., R.; Echenique–M., R.; Galvez–C., L. 1971. Observations of the induction of resistance to the attack of fungi producing rot in wood treated with variable levels of gamma radiation (Observaciones de la induccion de resistencia al ataque de hongos productores de pudricion en maderas tratadas con niveles variables de radiaciones gamma). Parasitologia, Mexico: Revista Latino Americana de Microbiologia y. 13:45–58.

Santos, M.D.G.C. 1982. The susceptibility of 35 Amazon wood species to *Cryptotermes brevis* (Walker). International Research Group on Wood Preservation. Document IRG/WP/1160. 12 p.

Scheffer, T.C. 1979. Decay resistance of Angelique *(Dicorynia guianensis).* Forest Products Journal. 29(6)33–34.

Dicorynia guianensis has been imported to the U.S.A. and used where exposure to wood destroying organisms is probable. Tests were performed in which blocks of this wood were exposed to decay fungi. Results indicate that this wood is highly resistant to decay.

Schmutzenhofer, H. 1978. The pines of El Salvador and their injurious insects (Los pinos de El Salvador y sus insectos nocivos). In: International Union of Forestry Research Organisations (IUFRO): Meeting of IUFRO Working Parties S 2.06.12 and S 2.07.07, Pests and Diseases of Pines in the Tropics. Piedras Blancas. 1978 September 3–14; Medellin, Colombia. Bogota, Colombia: Instituto Nacional de los Recursos Naturales Renovables y del Ambiente. 9 + 5 p.

Provides information on the insects causing damage of economic importance to standing and felled pine trees and logs in El Salvador. The insect species are identified with the pine species on which they were observed, with indications of their abundance and the tree part attacked. The principal defoliators include *Atta* spp., *Neodiprion excitans* Rohw., and *Tropidacris dux* (Dru.); the main bark-borers include *Dendroctonus* spp., *Ips bonanseai* (Hopk.), and *Melanophila notata* (Lap. & Gory); and the principal species attacking felled trees and logs include termites, scolytids, buprestids, cerambycids, bostrichids, curculionids, and platypodids.

Schulz, G. 1979. The use of wooden railroad ties in tropical regions (Verwendung von Holzschwellen in tropischen Gebieten). Holz als Roh- und Werkstoff. 37(12):469–472.

Describes the conditions of moisture, temperature, insects, and decay fungi that effect problems with railroad ties and their protection. Discusses the need for suitable mechanical properties as well as durability.

Seesman, P.A.; Colwell, R.R.; Zachary, A. 1978. Biodegradation of creosote/naphthalene-treated wood in the marine environment. College Park, MD: Department of Microbiology, University of Maryland. Proceedings, American Wood-Preservers' Association. 73:54–63.

Describes the biodegradation of wood pilings, in a Puerto Rican harbor, by bacteria associated with *Limnoria tripunctata.* Naphthalene-treated creosote has a selective effect on the attachment microflora.

Serpa, F.G. 1978. Efficiency of wood treated with sodium silicate against attack from marine borers (Eficiencia de madeira tratada com silicato de sodio contra o ataque de zilofagos marinhos). Preservacao de Madeiras. 8/9(1): 61–64.

Samples of Araucaria angustifolia were preserved with sodium silicate and exposed to attack by marine borers. Samples were damaged primarily by *Bankia fimbriatula,* though preserved samples showed greater resistance than control specimens.

Serpa, F.G.; Karstedt, P. 1978. Natural resistance to marine borers of nine north and north-eastern Brazilian wood species. Floresta. 9(2):97–102.

Serpa, F.G. 1978. Eradication and control of subterranean termites (Erradicacao e controle de termitas subterraneos). Boletin Tecnico. ITEP 1(1):5–12.

Setliff, E. C.; Ryvarden, L. 1983. Fungi of Colombia VII. Some aphyllophoraceous wood-inhabiting fungi (Los hongos de Colombia VII.) Mycotaxon. 18(2):509–525.

Siemon, G.R. 1981. Effect of C.C.A.-preservative treatment on bending strength of small clear specimens of high-temperature-dried and air-dried Caribbean pine. Queensland, Australia: Department of Forestry. Tech. Pap. 27:4.

Describes static bending tests performed on samples of Pinus caribaea varieties *caribaea, hondurensis,* and *bahamensis* treated with CCA. The treatment resulted in a small but significant loss of strength and stiffness. High temperature drying of the specimens reduced MOR in CCA-treated

specimens. Appropriate grade classifications were assigned to the varieties based on strength according to the Standards Association of Australia.

Silva, D. de. 1979. Causes of wood durability under marine conditions. In: Tamolang, F.N., ed. Wood quality and utilization of tropical species. Proceedings, International Union of Forestry Research Organizations (IUFRO) conference, 1978 October 30–November 3; FORPRIDECOM, College, Laguna, Philippines: 91–95.

Discusses results from studies that suggest inorganic deposits, e.g. silica, do not contribute to natural durability. The toxic elements are believed to be secondary organic components which are thought toxic to juvenile marine borers, a susceptible stage, and thus are successful in protecting the wood.

Silva, L.E.; Gaeta, M.R. 1973. Study on wood preservatives and treatment processes (Estudo de preservativos de madeira e processos de tratamento). Sao Paulo, Brazil: Instituto Florestal. Boletin Tecnico. 7:8.

Eucalyptus saligna posts were impregnated with different preservatives and field tested for two years. Untreated posts lasted less than two years, and preservatives containing zinc were also quite ineffective.

Silva, S.M.K.; Assumpcao, R.M.V. 1970. Contribution to the study of anti-fungal substances obtained from Brazilian woods. Pub. 799. Sao Paulo, Brazil: Instituto de Pesquisas Tecnologicas. 120 p.

Silverborg, S.B.; Mayorca, L. de; Conejos, J. 1970. The relative durability of some Venezuelan timbers. Revista Forestal Venezolana. 13(19/20):61–72.

Describes 40 Venezuelan wood specimens which were inoculated with fungi. The most durable species found were among the following: *Bombacopsis quinata, Centrolobium paraense, Clarisia racemosa, Enterolobium schomburgkii, Hymenaea courbari, Platymiscium pinnatum, Swietenia macrophylla,* and *Tabebuia serratifolia.*

Slooten, H.J. van der; Lisboa, C.D.J.; Sobral Filho, M.; Pastore, F. 1976. Forest species of Amazonia: characteristics, properties, and wood engineering data (Especies florestais da Amazonia: charactericas, propiedades e dados de engenharia da madeira). PRODEPEF. Serie Tecnica. 6:90.

Explores the properties, as well as the drying and preservation properties of 10 species. Also lists recommended uses for each species.

Socorro–G., N.M. del; Echenique–M., R.; Salinas–&, R. 1978. Laboratory indexes on wood-decay resistance properties in eleven Mexican forest tree species (Indices de laboratorio sobre resistencia de la madera a la pudricion en once especies forestales mexicanas). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales, Direccion General de Investigacion y Capacitacion Forestales, Boletin Tecnico. 31.

Southwell, C.R.; Bultman, J.D. 1971. Marine borer resistance of untreated woods over long periods of immersion in tropical waters. Biotropica. 3(1):81–107.

Splawa–N., S. 1970. Attempts of preservation of coniferrous wood meant for utilization in a tropical climate (Proby zabezpieczania drewna iglastego przeznaczonego do uzytkowania w klimacie tropikalnym). (Warsaw Szkola Glowna Gosp Wiejsk Lesnictwo):134–145.

Stevenson, D.; Stevenson, N.S. 1925. Some secondary timbers of British Honduras. Tropical Woods. 4:12–16.

Myristica panamensis, Calophyllum calaba, Vochysia hondurensis, and the Tamerins are discussed. A description of the trees and woods is provided. General characteristics related to preservation, such as damage of the wood by insects, are presented.

Stillner, F.J. 1965. Railroad ties from white wood (Dormentes de Madeira Blanca). Relatorios do Servico de Madeiras do Ex–ITERS — Porto Alegre, Brazil, 1962, 964, e 1965.

Stillner, F.J. 1969. Wood durability (Durabilidade de madeiras). Boletin 48. Porto Alegre, Brazil: Instituto Tecnologico do Rio Grande do Sul. 11 p.

Stuardo, J.; Saelzer, H. 1972. Attack by *Bankia martensi* on some untreated Chilean timbers. Santiago, Chile: Instituto Forestal. Informe Tecnico. 36:79–88.

Superintendencia do Desenvolvimento da Amazonia. 1972. Report on the durability of 56 Amazonian timbers (Relatorio sobre durabilidade de 56 madeiras da Amazonia). SUDAM Documenta. 3(1/4):173–175.

Taylor, J.A. 1966. Treating plant feasibility in Peru. U.S. Rural Electrification Administration. REA Bull. 44-4 and 345–9, 1960. 10 p.

Taylor, J.A. 1978. Wood preservation in Latin America. In: Proceedings, American Wood-Preservers' Association. 73:26–29.

Describes the political structure in Latin America and the preference for small regional industries as opposed to large structured industries.

Teixeira, M.L.; Lima, J.T.; Couto, L.C. 1987. Preservation of wooden posts: sap substitution method (Preservacao de moiroes de madeira. Processo substituicao seiva). Boletin-Tecnico-da-Escola- Superior-de-Agricultura-de-Lavras. 9:14.

Presents a method of treating posts with a solution of boric acid, potassium dichromate, and $CuSO_4$.

Tinto, J. 1961. Primary results of the durability of impregnated posts and vine trellises (Primeros resultados sobre durabilidad de postes y rodrigones impregnados). Folletos Tecnicos Forestales. 15:12.

Gives data from dozens of different preservative treatments of wood and makes some recommendations as to preferred treatment.

Tinto, J.C. 1960. Study of the preservation of wood in Argentina (Estado actual de la preservacion de maderas en la republica Argentina). Notas Tecnologicas Forestales. 13:6.

The industrial plants in Argentina capable of wood preseva-tion, and methods employed to preserve wood in 1960, are noted.

Tinto, J.C. 1967. Present situation with regard to wood preservation in Argentina (Panorama actual de la preservacion de maderas en la Republica Argentina). Folletos Tecnicos Forestales. 29. Buenos Aires, Argentina: Forestal, Administracion Nacional de Bosques. 10 p.

Reviews the state of preservation plants and research institutions in Argentina.

Tinto, J.C. 1967. Permeability of wood of exotic species cultivated in Argentina. Nota Tecnologica. 25. Buenos Aires, Argentina: Forestal, Administracion Nacional de Bosques. 4 p.

Classifies 30 species on the basis of degree and type of permeability to liquids.

Tinto, J.C. 1978. Contribution of the forestry sector to the construction of housing (Aporte del sector forestal a la construccion de viviendas). Buenos Aires, Argentina: Instituto Forestal Nacional. Folleto Tecnico Forestal. 44:167.

Includes a section on wood preservation treatments and woods useable for housing.

Tinto, J.C. 1978. Timber preservation for the rural sector in Argentina (Preservacion de la madera para el sector rural en Argentina). In: Proceedings, 8th World Forestry Congress; 1978 October 16–28; Jakarta, Indonesia. FID–II/22–8. 4 p.

Tinto, J.C. 1960. Impregnation of posts for rural use (Impregnacion de postes para uso rural). Folletos Tecnicos Forestales. 5:28.

Presents data from many tests performed on a wide variety of species to determine the best methods of impregnating posts with preservatives.

Torres, L.; Silverborg, S. B. 1972. Study on the natural durability of teak *(Tectona grandis* L. f.) (Estudio sobre la durabilidad natural de la teca *(Tectona grandis* L. f.). Merida, Venezuela: National Forest Products Laboratory. Boletin, Instituto Forestal Latino-Americano. (41/42): 63–70.

The natural durability of teak heartwood and sapwood was tested in soil/block tests with *Ustulina deusta, Polyporus versicolor,* and *Lenzites trabea.*

Tuk–D., J.B. 1987. Evaluation and uses of two tree species for round posts treated with Xilocrom (CCB) by immersion (Evaluacion y usos de dos especies forestales aptas para postes rollizos tratados con Xilocrom (CCB) por inmersion). Tecnologia en Marcha. 8(2–3):59–70.

Poles of *Gmelina arborea* and *Casearia sylvestris* were treated with xilocrom, and information on the cost of treatment, penetration, appearance, and practical applications of treatment are noted.

Uribe–C., E. 1985. Preservative treatments of wood for use in home construction (Los tratamientos de preservacion de madera usada en la construccion de vivendas). In: Seminario interno sobre definicion de lineas de accion en el uso de la madera en vivendas. Concepcion, Chile: Intendencia region del Biobio. 8 p.

Uribe–C., E. 1986. Laboratory for the preservative treatment of wood. Concepcion, Chile: Universidad del Biobio. 69 p.

Vidal–P, R.; Diaz–V., J.E.; Poblete–W, H.; Poblete–W, H.F. 1981. Properties of Pinus radiata particleboards treated against termites (Propiedades de tableros de particulas de Pinus radiata (D. Don) preservados contra termitos). Bosque. 4(1):49–54.

Laboratory-made boards treated with Basileum SI, Basileum SPI, Xyligen CE 5046 TF, or Xyligen CE 5021 TF had reduced tensile strength and increased bending strength. All treated boards were highly resistant to attacks from *Kalotermes chilensis.*

Vilchis–A., M.B.; Pinzon–P., L.M. 1984. Micromorphological aspects of white rot caused by some wood-decomposing fungi on tropical woods under natural conditions (Aspectos micromorfologicos de la pudricion blanca causada por algunos hongos xilofagos en maderas tropicales bajo condiciones naturales.) Inst. Biol., Univ. Mexico, Mexico City, Mexico. Boletin de la Sociedad Mexicana de Micologia. 19:179–191.

Describes studies of the damage to wood by four wood rotting fungi, *Pleurotus roseopilatus, Polyporus occidentalis, Poria* sp., and *Trametes corrugata.* To study the action of the fungi, safranine-picroaniline blue and safranine fast green were used to follow the growth of hyphae and the extent of damage to the wood. Fibres had less hyphal growth and more deterioration, and vessel elements more hyphal growth and less deterioration, and parenchyma cells had hyphal growth in direct proportion to the deterioration.

Vital, B.R. 1982. Preservatives and wood preserving methods without pressure (Preservativos e metodos de preservacao de madeiras sem pressao.) Boletin Tecnico. SIF 2: 42 p.

Watanabe, L.Y. and others. 1973. Inspection on field plots from Sao Paulo State to evaluate the performance of wood preservatives and treatment processes (Inspecao aos campos de apodrecimento existentes em diversas regioes de Estado de Sao Paulo, para estudo comparativo de preservativos de madeira e processos de tratamento). Preservacao de Madeiras. 3/4(1):7–39.

Wiessel, C. 1983. Preservation of fence posts by the modified Boucherie method (Preservacion de postes para cerca por el metodo Boucherie modificado). Tecnologia-en-Marcha. 6(2):29–32.

Fence posts of *Alnus acuminata* were treated with a 2 percent concentration of copper acid chromate using the modified Boucherie method.

Wolcott, G.N. 1924. The comparative resistance of woods to the attack of the termite, *Cryptotermes brevis* (Walker). San Juan, Puerto Rico: Insular Experiment Station Bull. 33:15.

Wolcott, G.N. 1946. A list of woods arranged according to their resistance to the attack of the West Indian dry-wood termite, *Cryptotermes brevis* (Walker). Rio Piedras, Puerto Rico: Caribbean Forester. 7(4):329–336.

Wolcott, G.N. 1948. The resistance to dry-wood termite attack of some Central American woods. Rio Piedras, Puerto Rico: Caribbean Forester. 9(1):53–56.

Wolcott, G.N. 1950. An index to the termite-resistance of woods. Rio Piedras, Puerto Rico: University of Puerto Rico, Agricultural Experiment Station. Bull. 85:26.

A rating system is given for the resistance of about 200 species of wood to attack by the West Indian dry-wood termite Cryptotermes brevis (Walker).

Wright, J.E.; Blumenfeld, S.N. 1984. New South American species of *Phellinus* (Hymenochaetaceae). Buenos Aires, Argentina: University of Buenos Aires, Facultad Ciencias Exactas y Naturales. Mycotaxon. 21:413–425.

Describes six new species of Phellinus including *P. daedaliformis* found in decayed Tabebuia wood.

Wright, J.E.; Deschamps, J.R. 1976. Fungal deterioration of Salicaceae in the delta (Deterioro fungico de salicaceas en el Delta). Buenos Aires, Argentina: Fac. Nat. Sci., University, IDIA, 337/342:52–55.

Describes fungi causing decay in the wood of *Salix* and *Populus* spp. *Coriolellus malicola* caused the greatest wood decay. Other species causing decay were *Coriolus versicolor, Fomitopsis submurina, Ganoderma applanatum, Phellinus igniarius, Pycnoporus sanguineus, Trametes extenuata,* and *T. trogii.* On stored logs *Stereum* [Chondrostereum] *purpureum* had the highest incidence.

Wright, J.E.; Deschamps, J.R.; Rovetta, G.S. 1973. Wood-decomposing basidiomycetes of the Argentine Mesopotamia. I. Polyporus trametoides (Basidiomicetos xilofilos de la region mesopotamica. I. Poliporos trametoides). Buenos Aires, Argentina: University of Buenos Aires, Revista de Investigaciones Agropecuarias. 5,10(3): 117–179.

Describes with illustrations of fruiting bodies, 14 spp. found in the Mesopotamian region of Argentina. The fungi belong to *Coriolellus, Coriolopsis, Hexagona, Spongipellis, Trametes,* and Tyromyces. The descriptions include a new species, *T. delbustoi,* and *H. caperata,* a new combination.

Zachary, A.; Colwell, R.R. 1979. Gut-associated microflora of *Limnoria* tripunctata in marine creosote-treated wood pilings. Nature. 282(5740):716–717.

Although the marine isopod *Limnoria tripunctata* Menzies is unique among wood-borers in its ability to inhabit and severely damage creosote-treated wooden structures, little is known of the nature of its apparent resistance to creosote. When the animal is reared on untreated wood, its digestive tract appears to be free of microorganisms. In this paper, the authors report, in contrast, that microorganisms were readily observed in the digestive tract of examples of *L. tripunctata* found inhabiting creosote-preserved wooden pilings at Roosevelt Roads, Puerto Rico, in December 1976. Furthermore, isopods from such preserved wood apparently possessed a resident gut microflora, which was in close association with the lining of the intestinal tract and separated by a peritrophic membrane from other microorganisms ingested during wood boring.

Zubieta, G.J.; Gomez, C.E.; Bonanni, E.O. 1960. Durability of telephone posts (Durabilidad de posted de madera en lineas aereas telegraficas). Folletos Tecnicos Forestales. 8: 33.

Provides field observations on the durability of 1,600+ posts of 23 species.

Zubieta, G.J.; Masoni, S.L. 1980. Durability and biological decay of wooden posts for overhead lines (Durabilidad y anomalias biologicas de los postes de madera para lineas aereas). Buenos Aires, Argentina: Instituto Forestal Nacional. Folleto Tecnico Forestal. 61:90.

Veneer and Plywood Manufacture

Veneering properties of wood, veneering techniques, plywood manufacture, industry (characterized by country), bending, and laminating.

AIMA. 1985. Catalogo. Quito, Ecuador: AIMA (Asociacion de Industriales Madereros Ecuador). 62 p.

Primarily a catalog of information on the AIMA organization, information on plywood from Ecuador is also included.

Anon. 1970. Central and South America need development. World Wood. 11(8):59–61, 64–67.

Anon. 1971. Maderas y Chapas de Narino, S/A. World Wood. 12(4):5–9.

Anon. 1971. New [Brazilian] specifications for the standardization and grading of composite wood products. Brasil Florestal. 2(6):65–69.

Gives the text of a decree passed in May 1971, with a view to the export market, relating to plywood, door facings, blockboard, and packing containers of Araucaria angustifolia.

Anon. 1971. Some useful information on woods from Amazonia (Algumas informacoes uteis sobre madeiras Amazonicas). Belem, Para, Brazil: SUDAM (Superintendencia do Desenvolvimento da Amazonia) Documenta. 3(1/4): 133–177.

Presents summarized data on the use of a large number of species from the Amazon for rotary or sliced veneer production

Anon. 1971. Veneers for local markets sliced and peeled in Panama operation. World Wood. 12(12):2–3.

Anon. 1972. Corestock plant far up Amazon ships lupuna to U.S. East Coast. World Wood. 13(1):2–4.

Anon. 1975. Thinboard sells well in Mexico. World Wood. 16(4):17.

Anon. 1977. Brazilians slice precious veneers for export to world markets. World Wood. 18(5):11.

Anon. 1978. In Argentina: pulp group invests in solid wood products. World Wood. 19(10):46–47.

Anon. 1978. In Ecuador: wood products companies unite to install high quality plywood mill. World Wood. 19(12):22–23.

Anon. 1978. In Mexico's highlands: integrated mill centers on panels. World Wood. 19(8):12–13.

Anon. 1978. Jungle plymill has limitless log supply. World Wood. 19(7):12–13.

A highly automated plywood mill, costing $3 million, is nearing completion at Iquitos, Peru. Some 14 commercial hardwoods are available: lapuna and virola are the most heavily used. The mill is able to produce a variety of plywood dimensions, with an estimated production of 1,500 m^3/month.

Anon. 1982. Abundant peeler species supplies Colombian mill. World Wood. 23(2):24–25.

Anon. 1985. Ecuador–exports, wood products. UNCTAD/GATT. Quito, Ecuador: International Trade Center. 18 p.

Anon. 1985. Latin America: planting slows deforestation rates. World Wood. 26(6):23–29.

Anon. 1986. Economic problems stifle Latin America's industry. World Wood. 27(5):29–32.

Arroyo–P., J. 1985. Technical guide for the use of Venezuelan woods (Guia tecnologica para la utilizacion de maderas venezolanas). Merida, Venezuela: Facultad de Ciencias Forestales, Universidad de los Andes.

Azevedo–C., A. de. 1984. Papermaking study of a mixture of 'leftover log rolls' from plywood plants in the Amazonas State, Brazil. Papel. 45:48–58.

Describes the use of waste plywood cores from Calophyllum brasiliense, Copaifera multijuga, Hevea guianensis, and Virola surinamensis for the manufacture of corrugated board. The neutral sulphite high-yield process was used.

Beekman, W.B. 1958. A new veneer wood: Imbuia *(Phoebe pirosa).* La Revue du Bois et ses Applications. 13(2):19–21.

Notes the characteristics of this veneer wood, as well as providing information on the history of its export to Europe. The prospects for future use of this species are considered to be favorable.

Blackman, Ted. 1979. Ecuador's first plymill produces 15,000 m^3/yr. World Wood. 20(3):21–22.

Blackman, Ted. 1979. Mexico's largest plymill expands. World Wood. 20(3):22.

Blackman, Ted. 1980. Costa Rica board mill processes neighboring plymill's lathe cores. World Wood. 21(6): 18–19.

Blackman, Ted. 1980. Remote Amazon plymill to expand production, diversity. World Wood. 21(5):22–23.

Bruce, R.W. 1976. Production and distribution of Amazon timber (Producao e distribucicao de madeira amazonica). FO:DP/BRA/71/545. Field Doc. No. 21, Brasilia, Brazil. Rome, Italy: United Nations Development Program, Food and Agriculture Organization. 60 p.

Camara Argentina de la Industria de Maderas. 1972. Young plantations and the supply of raw material to the plywood industry (Las reforestaciones jovenes y la provision de materias primas para la industria de maderas compensadas). In: Proceedings, 7th World Forestry Congress, Centrol Cultural General san Martin 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: FAO–Instituto Forestal Nacional: 5:6346–6347.

Emphasized need for greater reforestation in Argentina to meet the needs of the plywood industry.

Davis, W.E. 1972. Efficient Mexican plywood mill peels 7 species of pine. World Wood. 13(13):6–7.

Davis, W.E. 1973. Smooth running plywood plant turns out 26,000 m^2 daily. World Wood. 14(5):4–5.

FAO. 1963. Plywood and other wood-based panels. In: International consultation on plywood and other wood based panel products. Rome, Italy: United Nations, Food and Agriculture Organization. Vol. 1–5. ca. 1400 p.

FAO. 1970. Development of the wood-based panel industry in Latin America. In: Proceedings, regional consultation on the development of the forest and pulp and paper industries in Latin America; 1970 May 19–26; Mexico, D.F., Mexico. ECLA/FAO/UNIDO. FORIND 70. Pap. 3. 98 p.

Covers the production, capacity, and end use of the veneer, plywood, fiberboard, and particleboard industry in Latin America.

Fernandez, C.C. 1974. Structures composed of solid wood and plywood (Estructuras compuestas de madera soida y madera contrachapada). Civil Engineering thesis. San Pedro, Costa Rica: Universidad de Costa Rica. Series T, No. 13.

Franklin, W.E. 1979. Steps to develop a lumber or plywood mill from an existing timber resource base. In: Economic commission for Europe, Timber Committee: Seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam (Netherlands). ECE Rep. TIM/SEM.8/R.13. 9 p.

Fraser, H.R., Jr. 1980. Quality milled products from "unwanted" Amazon sinker logs. World Wood. 21(7):16–18.

FUDECO. 1971. Preliminary information on the possible use of 17 woods, from the west central region of Venezuela for fabrication of packing crates (Informe preliminar de aptitud para la fabrication de embalajes de 17 maderas de la region centro–occidental de Venezuela). Plan FUDECO. Merida, Venezuela: Universidad de los Andes. 23 p.

Provides physical and mechanical data on woods, as well as information on veneering these species.

Gilmore, R.C.; Barefoot, A.C. 1974. Evaluation of some tropical woods imported into the United States from South America. Forest Products Journal. 24(2):24–28.

Describes machining, gluing, and strength tests on six groups of tropical woods, exported under the commercial names of Andiroba *(Carapa guianensis),* Azafran *(Zanthoxylum* sp.; *Cordia* sp.), Banak or Ucuuba *(Oteophloeum* sp.; *Virola* sp.), Hura *(Hura* sp.), Sajo *(Campnosperma panamensis),* and Virola *(Dialyanthera* sp.). Comparisons were made with *Liriodendron tulipifera.* In general, strength of glue bonds, static bending strength, and toughness decreased with decreasing specific gravity of the wood.

Harzmann, L.J. 1965. Development of the wood-based materials industry in tropical countries. (Entwicklungstrend der Holzwerkstoffindustrie in den tropischen Landern). In: Entwidtlung der Zellstoff-, Papier- und Plattenproduktion tropischer lander. German Democratic Republic, Technische Universitat Dresden, Sektion Forstwirtschaft: Study texts for further education: tropical forestry. (Studienmaterial fur die weiterbildung. Tropische). Forstwirtschaft. Dresden, German Democratic Republic, Technische Universitat. 55 p.

Describes tropical plywood, particleboard, and fibreboard production for the period 1950–1963, with projections to 1975 and further discussions of the future beyond 1975.

INFOR–CORFO. 1987. Technological vision of the Chilean forest industry (Vision tecnologica de la industria forestal chilena). Informe Tecnico. 105. Santiago, Chile: INFOR-CORFO (Instituto Nacional Forestal-Corporacion de Fomento de la Production).

IUFRO. 1976. Veneer species of the world. Printed on behalf of International Union of Forestry Research Organizations (IUFRO). Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 227 p.

A compilation of data on veneer species from ten forest products laboratories. One hundred and forty-one species are covered, including names, locality, estimated timber volume, physical characteristics, and suitability for veneer. Drying, cutting, and gluing are also covered for some species.

Jankowsky, I.P. 1979. Quality of veneer from *(Pinus strobus* (Martinez) var. *chiapensis)* obtained for peeling (Qualidades das laminas de *(Pinus strobus* (Martinez) var. *chiapensis)* obtidas pr desenrolamento). Brazil, Piracicaba. Instituto de Pesquisas e Estudos Florestais (IPEF). (16):50–59, June 1978.

Knife angles and nosebar pressure recommendations are made for peeling veneer and plywood manufacture.

Jankowsky, I.P. 1979. Rapidly developing (timber) species as raw material for the plywood industry (Especies de rapido desenvolvimento como materia-prima para a industria de paineis compensados). Revista da madeira, Sao Paulo: Editora Industrial Teco.

Jones, A. 1980. Duty-free tropical plywood imports get into another tangle. Woodworking Industry. London: Benn Publications.

Karstedt, P.; Simioni, A. 1979. Some aspects of the Brazilian timber industry (Einige Aspekte der brasilianischen Holzwirtschaft). Parana, Brazil: Forest Faculty, State University, Parana, Curitiba, Allgemeine Forstzeitschrift, (29):794–798.

Describes products from plantation species grown in Brazil. Product groups discussed include charcoal (for steel industry), poles (for electrification programs), sleepers, and fiberboard (for export) (principally of *Eucalyptus* spp.); lumber products (principally of *Araucaria angustifolia, Pinus elliottii,* and *P. taeda);* plywood and particleboard (Eucalyptus and Pine spp.); and finished furniture for export.

Koehler, A. 1928. Tests on six Argentine woods. Tropical Woods. 14:15–20. Tests determining the specific gravity, shrinkage, seasoning qualities, and suitability for veneer were performed. Six species from Argentina were tested, including *Torresia cearensis, Cedrela fissilis, Piptadenia macrocarpa, P. communis, Calycophyllum multiflorum,* and *Phyllostylon brasiliensis. Piptadenia macrocarpa* was noted as especially promising for veneer production.

Lella, E.F. di. 1947. The plywood making industry of Argentina (La industria de maderas conpensadas en la Republica Argentina). Buenos Aires, Argentina: Ministerio de Agricultura de la Nacion. Publicacion Tecnica. 10. 95 p.

Reports on the veneer and plywood situation in Argentina, including the history of manufacture, description of species, methods of manufacture, and production costs.

Lella, E.F. di. 1960. Characteristics of forest species suitable for plywood (Caracteristicas de las especies forestales aptas para compensados). Buenos Aires, Argentina: Notas Tecnologicas Forestales Administracion Nacional de Bosques. 9:7.

Provides physical and mechanical properties of 22 species used in Argentina for plywood and recommends another 13 for future trial.

Lella, E.F. di. 1966. Forest species suitable for the wood industries. Forest species suitable for the plywood industry. Mexico Forestal. 41(5; 6):22–24; 20.

Recommends five species for plywood after reviewing the properties of a number of species.

Lelles, J.G. de. 1977. Adaptability of the woods of four little-known species from southeastern Parana in the production of industrial plywood (Adapatabilidade das madeiras de quatro especies ocorrentes no sudeste do Parana, pouco conhecidas na prducao de compensados industrias). In: Postgraduate course in forestry. Curitiba, Parana, Brazil: Parana Federal University. M.Sc. thesis. Floresta. 8(1):33–60.

The results of laboratory trials that evaluated several species for their plywood-making potential are provided. Piptocarpha angustifolia produced sheets of quality suitable for face veneers.

Martinez–P., E. 1989. Bending-lamination of wood (Laminado-doblado de la madera). In: Boletin Tecnico, La Madera y Su Uso 24. Mexico, DF, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, INIREB. 19 p.

The bending-lamination wood technique, which facilitates the production of curved elements, constitutes an interesting option for the industry of wood-based products. Basic principles and procedures for the utilization of this technology are described, including a review of the appropriate raw material, the type of jigs, the spreading of adhesive, the fitting and pressing of layers into the molds. Some recommendations on how to obtain an adequate setting of the adhesive are offered.

Mason, D.C. 1974. Peruvian mill plans expansion. World Wood. 15(13):10-11.

Mason, D.C. 1975. Quality veneers aim of Masul S/A. World Wood. 16(1):23.

Mason, D.C. 1976. Brazil plymill makes houses. World Wood. 17(3):20.

Mason, D.C. 1977. Tough skin sells Brazil mill's plywood. World Wood. 18(7):13–14.

A brief account of the production of plywood with a 1-mm facing of impregnated kraft paper. It is used mainly for concrete formwork, and up to 60 reuses are claimed.

Mattos Filho, A. de.; Rizzini, C.T. 1960. Contributions on a study of *Vochysia thyrsoidea* Pohl (Vochysiaceae) (Contribuicao ao estudo de *Vochysia thyrsoidea* Pohl (Vochysiaceae). Rodriguesia. 23/24(35/36):83–97.

Describes anatomy of *Vochysia thyrsoidea* wood and the taxonomy of the species.

Maydell, H.J. von. 1974. Grading of tropical timbers. (Die Sortierung von Tropenholz). Holz als Roh- und Werkstoff. 32(1):30–34.

Discusses the complex existing regional and national grading rules, the differing requirements for internal and external markets, and the requirements for roundwood, sawn timber, and wood-based materials (veneers, plywood, pulping chips, fiberboard, particleboard). Some suggestions are made on the grading of tropical timbers, and it is pointed out that grading is only worth while if the value of the products is increased sufficiently to cover the costs involved.

Morales–V., A.; Johnston, P. 1974. Development of the wood panel producing industry (Sintesis de la industria productora de paneles de madera). Bogota, Colombia: Instituto de Desarrollo de los Recursos Naturales Renovables (INDERENA). 35 p.

The physical and mechanical properties of twelve species used for wood panels in Colombia are provided. Additionally, all aspects of the wood panel industry in Colombia, from wood resources and manufacture procedure to sales, are listed.

Ogle, P.L. 1980. Amazon plymill's marketing needs close quality control. World Wood. 21(9):9–10.

Ogle, P.L. 1980. Innovative Brazilian firm to slice tropical softwood. World Wood. 21(13):22–23.

Oktem, E. 1978. Comparison of the bond–degrade–accelerating systems of national plywood standards. In: Proceedings of the 7th world forestry congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 5:6397–6401.

Perez–G., V. Antonio. 1982. Mechanical and associated properties of plywood manufactured in Chile (Propiedades mecanicas y asociadas del contrachapado fabricado en Chile). Santiago de Chile: Instituto Forestal. Informe Tecnico 81:41.

Tests including static bending, compression, tension, toughness, shear, and impact were performed on plywood produced in Chile by five national manufacturers.

Rivera, Adolfo. 1969. Production and drying veneer of Guayanan woods (Maderas de Guayana produccion y secado de chapas). Merida, Venezuela. Universidad de los Andes, Laboratorio Nacional de Productos Forestales. 4:33.

Provides information on the conditioning and drying of 42 species of Guayanan woods used for veneer. Tables summarize working properties and drying times, and woods that will produce veneers for specific products, e.g., exterior plywood, are noted.

SARH (Secretaria de Agricultura Y Recursos Hidraulicos). 1982. The wood panel industry in Mexico (La industria de los tableros de madera en Mexico). Mexico, D.F., Mexico: SARH. 99 p.

Slooten, H.J. van der. 1970. Forest industries development survey, Guyana. Evaluation study of eighteen wood species from Guyana for veneer and plywood manufacture.

FAO, SF/GUY 9, Tech. Rep. No. 13. Rome, Italy: United Nations, Food and Agriculture Organization. 75 p.

Provides standard data for eight species that could be used for utility veneer and plywood, and on the suitablility of 10 species for decorative veneer (though three were rejected as unsuitable).

Tamm–J., G. 1972. Test of Chilean adhesives used in wood lamination. Santiago, Chile: Informe Tecnico, Instituto Forestal. 36:266–274.

Describes tests with neoprene, polyvinyl acetate, epoxy, urea formaldehyde, and casein adhesives. Data are given on adhesion to wood at different moisture contents, different wood species (Fitzroya cupressoides, Nothofagus dombeyi, and Pinus radiata), and to preservative-treated wood.

Valdes–S., H. 1983. Industries derived from wood (Industrias derivadas de la madera). Proceedings: Primer Congreso Nacional de Industria derivadas de la madera; 1983; Medellin, Colombia: 101-112.

Vidal–P., R.; Diaz–V. J.E.; Poblete–W., H. 1981. Properties of *Pinus radiata* particleboards treated against termites (Propiedades de tableros de particulas de Pinus radiata (D. Don) preservados contra termitos). Bosque. 4(1):49–54.

Particleboards prepared in the Valdivia laboratory were treated with the insecticides 'Basileum SI,' 'Basileum SPI,' 'Xyligen CE 5046 TF,' or 'Xyligen CE 5021 TF' (3 treatments each). The boards were then evaluated for tensile strength perpendicular to surface, bending strength, and swelling. Tensile strength was reduced, bending strength increased, and swelling was generally unchanged. The treatments were effective against the dry wood termite *Kalotermes chilensis.*

Welsh, G.S. 1963. A review of the existing manufacture and prospects for the further development of wood based panel products in Chile. Santiago, Chile: Instituto Forestal, Information Pap. 5:122.

Reconstituted Board Products

Particleboard, hardboard, and fiberboard; wood properties relative to board manufacture, manufacturing techniques, and board property evaluations.

Anon. 1971. Maderas y Chapas de Narino, S/A. World Wood. 12(4):5–9.

Anon. 1975. Thinboard sells well in Mexico. World Wood. 16(4):17.

Anon. 1977. Brazilian board mill has three lines. World Wood. 18(8):18–19.

Anon. 1977. Brazilian mill uses eucalyptus. World Wood. 18(4) :30–31.

Anon. 1977. Mexican board complex restarts. World Wood. 18(10): 12–13.

Anon. 1977. Wood complex has four lines. World Wood. 18(13)120–21.

Anon. 1978. In Argentina: pulp group invests in solid wood products. World Wood. 19(10):46–47.

Anon. 1978. In Mexico's highlands: integrated mill centers on panels. World Wood. 19(8):12–13.

Anon. 1978. Jungle plymill has limitless log supply. World Wood. 19(7):12–13.

Anon. 1978. Mexican plant features low resin usage. World Wood. 19(1):12–13.

Anon. 1980. Particleboard a rising star of Mexico. World Wood. 21(11):29.

Anon. 1981. Industry News: Chilean particleboard plant comes on stream. Wood Based Panels International. 1(6):4.

Anon. 1983. Focus on South America: Chilean hardboard for world markets. Wood Based Panels International. 3(2):41.

Anon. 1983. Industry News: Argentine MDF plant on variable raw material. Wood Based Panels International. 1(6):8.

Anon. 1984. News: fiberboard in Chile. Wood Based Panels International. 5(4):5.

Anon. 1984. News: Duratex buys two Brazilian particleboard producers. Wood Based Panels International. 5(3):3.

Anon. 1985. Ecuador-exports, wood products. UNCTAD/GATT. Quito, Ecuador: International Trade Center. 18 p.

Anon. 1985. New Panels 1985: MDF. Mexican MDF mill to install continuous press. Wood Based Panels International. 5(4):20.

Anon. 1986. Lamination & Surfacing: Laminates are big business for Brazil's CQIL (Companhia Quimica Industrial de Laminados). Wood Based Panels International. 6(1):40.

Asplund, A. 1978. Trends and developments in the manufacture of fiberboard. In: Proceedings, 7th World Forestry Congress, 1972 October 4–18; Centro Cultural General San Martin; Buenos Aires, Argentina: 5:6675–6685.

Auchter, R.J. 1978. Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 569 p.

Contains 23 papers on: harvesting, transport and storage, wood fibre, and reconstituted products research, industrial plans and practices, and investment considerations.

Blackman, Ted. 1979. Extensive modernization boosts production at hardboard plant. World Wood. 20(13):14.

Blackman, Ted. 1979. US $20 million particleboard plant will be Mexico's largest. World Wood. 20(5):39.

Blackman, Ted. 1980. Thinboard goes big in Mexico. World Wood. 21(3):10–11.

Cruz, A. 1980. Properties of experimental particleboard from three Costa Rican hardwoods (Procesamiento de maderas tropicales de alta densidad. Acta de la reunion de International Union of Forestry Research Organizations) In: Proceedings of an International Union of Forestry Research Organization (IUFRO) meeting; 1977 October 2–9; Merida, Venezuela. Merida, Venezuela: Laboratroio Nacional de Productos Forestales. 23 p.

Describes a study of three Costa Rican woods for use as particleboard furnish. Tests conducted on the boards included internal bond, static bending, screw withdrawal, and linear expansion. The species used in the experiment were ceiba *(Ceiba pentandra),* pilon *(Hieronyma alchorneoides),* and copal *(Protium costaricense).* Average board properties except longitudinal expansion exceeded U.S. Commercial Standard 236–66 for 1B2 grade particleboard. Board properties tested increased with higher density and resin content, and decreased with increasing wood density or a change from flake particles to a flake-shavings mixture.

Davis, W.E. 1973. Mexican particleboard plant uses mill residues plus tree tops/limbs. World Wood. 14(1):2–4.

FAO. 1970. Development of the wood-based panel industry in Latin America. In: Regional consultation on the development of the forest and pulp and paper industries in Latin America: 1970 May 19–26; Mexico D.F., Mexico. ECLA/FAO/UNIDO, FORIND 70, PAPER 3: 3–7.

Garcia, R.R. 1961. Particleboard: possibilities for its manufacture in Argentina. Buenos Aires, Argentina: Misc. For. Adm. Nac. Bosques. 4: 8 p.

Lists species that may be suitable for particleboard manufacture from a wide variety of Argentinian forests.

Gilmore, R.C.; Barefoot, A.C. 1974. Evaluation of some tropical woods imported into the United States from South America. Forest Products Journal. 24(2):24-28.

Describes machining, gluing, and strength tests on six groups of tropical woods, exported under the commercial names of Andiroba *(Carapa guianensis),* Azafran *(Zanthoxylum* sp.; Cordia sp.), Banak or Ucuuba *(Oteophloeum* sp.; *Virola* sp.), Hura *(Hura* sp.), Sajo *(Campnosperma panamensis),* and Virola *(Dialyanthera* sp.). Comparisons were made with *Liriodendron tulipifera.* In general,

strength of glue bonds, static bending strength, and toughness decreased with decreasing specific gravity of the wood.

INFOR–CORFO. 1987. Technology and perspectives on particle boards of the waferboard, flakeboard, and OSB type (Tecnologia y perspectivas de tableros de particulas tipo waferboards, flakeboards y OSB). Santiago, Chile: INFOR–CORFO (Instituto Forestal-Corporacion de Fomento de la Produccion. Informe Tecnico. 109:89.

A review of worldwide information on the manufacture and properties of specific types of particleboards not traditionally manufactured in Chile. Includes a bibliography of 114 citations and an annex of international standards.

Koljonen, K. 1977. Projection of demand for wood-based panels in Brazil, 1975–2000 (Projecoes de demanda de paineis a base de madeira no Brasil, 1975–2000). Brasilia, Brazil: Ministerio da Agricultura, Instituto Brasileiro de Desenvolvimento Florestal. Serie Tecnica. 1:72.

Labante. 1974. Technological study of the woods of the Llanos Occidentales (Expedited study, first part) (Estudio tecnologico de las maderas de los llanos occidentales (Estudio expeditivo, primera parte)). Merida, Venezuela: Laboratorio Nacional de Productos Forestales. 94 p.

Mason, D.C. 1975. Duratex achieves high production with single product board plant. World Wood. 16(9):7–8.

Mason, D.C. 1976. Eucatex makes largest hardboard panel. World Wood. 17(10):17–19.

Hardboard 8 by 20 ft is produced from *Eucalyptus saligna* by the Eucatex Co. of Salto, Brazil.

Myers, G.C. 1979. Hardboards from mixed tropical hardwoods. Forest Products Journal. 29(5):44–48.

Chip mixtures prepared from secondary hardwood species were collected in Colombia, Ghana, and the Philippine Islands. All chip mixtures readily fiberized in a presurized refiner, producing excellent fiber. All classes of hardboards had excellent dimensional stability with small linear and thickness movement. The surfaces of all hardboards were excellent and would be suitable for finishing operations.

Morales–V., A.; Johnston, P. 1974. Development of the wood panel producing industry (Sintesis de la industria productora de paneles de madera). Bogota, Colombia: Instituto de Desarrollo de los Recursos Naturales Renovables (INDERENA). 35 p.

Nakamura, R.M.; Sobral Filho, M. 1982. Particleboard of a mixture of tropical species from Amazonia (Aglomerado de mistura de especies tropicais da Amazonia). Brasilia, Brazil: Instituto Brasileiro de Desenvolvimento Florestal. De Serie Tecnica. 4:10.

Using a mixture of the wood of 36 species from Amazonia, particleboard was manufactured that met the strength and thickness stability requirements for structural panels.

Nico, R. 1957. Wood particles bonded with synthetic resins (Paneles de particulas de maderas ligadas con resinas sinteticas). La Plata, Argentina: Publicacion del Laboratorio de Ensayo de Materiales e Investigaciones Tecnologicas. 76(2):34.

Covers raw materials, types of particleboards, and their manufacturing process.

Peredo, M.; Poblete, H. 1979. Inclusion of forest biomass in the fabrication of particleboard (Inclusion de biomasa forestal en la fabricacion de tebleros de particulas). Bosque 7(1):9–16.

Pleydell, G.J. 1978. Increasing the utilization of secondary species through the manufacture of wood-based panels. In: Proceedings of the 7th world forestry congress; 1972 October 4–18; Ceritro Cultural General San Martin, Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 5:6279–6291.

Poblete, H. 1979. Inclusion of sawdust in particleboard (Inclusion de aserrin en tableros de particulas). Bosque. 3(1):39-46.

Poblete, H. 1985. Movement of formaldehyde during pressing of particleboard (Movimiento del formaldehido durante el prensado de tableros de particulas). Holzforschung. 39(3):187–188.

Poblete, H. 1986. Mechanical strength of particleboards produced with mixtures of Chilean species (Resistencias mecanicas de tableros de particlas producidos con mezclas de especies chilenas). Bosque. 7(1):38-45.

Poblete, H. 1988. Incorporation of board wastes in particleboards (Incorporacion de astillas de despuntes en tableros de particulas). Ciencia e Investigacion Forestal. 4:45-61.

The characteristics of particles produced with board wastes from *Pinus radiata* (D. Don) were analyzed. The effect of these particles, on physical and mechanical properties of the produced panels, was also studied. Specific weight, water absorption, particle geometry and specific area, pH-value, and buffer capacity of particles were determined. Particleboards containing 14 percent and 40 percent of board waste-particles in the middle layer were manufactured. Other process parameters were density at 608 Kg/m^3, board thickness of 19 mm, adhesive content of 7.0, 6.4, and 5.3 percent of ureaformaldehyde. Internal bond strength, bending strength (MOR), thickness swelling, and water absortion of the panels were also tested

Poblete, H. 1988. Joining of panels by their edges: Experiences at industrial scale (Uniones de tableros por sus cantos: Experiencias a escala industrial). Ciencia e Investigacion Forestal. 5:71–76.

Describes the testing of edge joints used to join panels of Particleboard. The combinations used included 4 different joints and 4 adhesives. Data are presented on the strength of joints.

Poblete, H.; Roffael, E. 1985. Chemical changes in particles during the production of panels with ureaformaldehyde (Cambios quimicos en particulas durante la produccion de tableros con ureaformaldehido). Holz als Roh–und Werkstoff. 43:57–62.

Poblete, H.; Roffael, E. 1985. Chemical changes in particles during the production of panels with phenolformaldehyde (Cambios quimicos en particulas durante la produccion de tableros con fenolformaldehido). Adhesion. 3:21–28.

Roffael, E.; May–A., H.; Poblete, H. 1985. Changes in particles during pressing and drying (Cambios en las particulas durante el prensado y secado). Valdivia, Chile:

Facultad de Ciencias Forestales, Universidad Austral de Chile.

SARH (Secretaria de Agricultura Y Recursos Hidraulicos). 1982. The wood panel industry in Mexico (La industria de los tableros de madera en Mexico). Mexico, D.F., Mexico: SARH. 99 p.

Schmidt–Hellerau, C. 1977. The suitability of some Latin American timbers for exterior quality particleboard (Die Eignung einiger lateinamerikanischer Holzer zur Herstellung von Aussenspanplatten). Holz– Zentralblatt. 103(71/72):1076–1077.

Describes laboratory tests of 13 hardwoods and 1 softwood (Pinus caribaea) from Costa Rica and Nicaragua, with densities ranging from 300 to 760 kg/m^3 and pH values from 3.8 to 8.9, to make particleboard glued with Kauramin 542 powder (a modified melamine urea resin). Properties of boards are given. The best strength properties were obtained with cedro maria *(Cedrela* sp.) and *P. caribaea.* Five other species, cativo *(Brosimum),* jobo *(Calophyllum* sp.) manga larga *(Vochysia* sp.) palo de agua *(Anacardium* sp.) and zapote mico *(Carapa* sp.) had good strength and dimensional stability. *Virola* spp. from the uplands were acceptable, but not material of swamp origin. Two others were marginally approved and the remainder were not considered suitable for exterior use.

Soto–U., G. 1975. Some basic aspects of the particleboard industry. Charlas y Conferencias. 3:21–32.

Describes important characteristics of the particleboard industry, with a general discussion of the process of manufacture and the relation to raw material, wood, and other materials. Specifics of the Chilean industry are given in an appendix.

Valdes–S., H. 1983. Industries derived from wood (Industrias derivadas de la madera). Proceedings: Primer Congreso Nacional de Industrias derivadas de la madera; 1983; Medellin, Colombia: 101–112.

Vidaurre–E., S. 1988. Characterization and needs of the Chilean wood panel industry (Caracterizacion y necesidades de la industria Chilena de paneles de madera). Ciencia e Investigacion Forestal. 3:90–102.

Describes the current wood-based panel industry, their location and installed capacity, as well as the installed capacity by company. The raw material and processing requirements for the full variety of wood-based panel products are discussed with comments on changes needed to meet internal and export demands. Suggestions are given for improving the industry.

Vidal, R.; Diaz–Vaz, J.E.; Poblete, H. 1981. Properties of *Pinus radiata* D. Don particleboards preserved against termites (Propiedades de tableros de particulas de Pinus radiata D.Don preservados contra termitos). Bosque. 4(1):49–54.

Vilela, E.; Pasquier, B.du. 1968. Determination of the coefficient of suitablilty in a collection of woods for their possible use in the manufacture of wood-wood/cement slabs. Revista Forestal Venezolana. 11(16):75–84.

Twenty-seven species were tested for suitability in wood/cement panels. The tabulated results show that *Couratari pulchra* was the highest ranking species.

Vital, B.R.; Lehmann, W.F; Boon, R.S. 1974. How species and board densities affect properties of exotic hardwood particleboards. Forest Products Journal. 24(12)137–45.

Hardwood species *Paulownia tomentosa, Virola* spp., Ter*minalia superba,* and *Pericopis elata* were used to make three-layer particleboards with one species and in combinations of equal parts of two, three, and four species. Mechanical properties of these boards were determined by static bending and IB tests.

Youngs, R.L.; Laundrie, J.F. 1979. Reconstituted products: A use for mixed tropical hardwoods. Journal of Forestry. 77(3):178–179, 198.

Research was conducted of the manufacture of reconstituted products from mixed tropical hardwoods, including kraft pulps, newsprint, papers, tissue, toweling, hardboards, particleboards, linerboard, and corrugating medium. Suitable products were produced showing the potential for use of mixed species.

Chemicals and Energy

Chemical: naval stores, destructive distillation, and other compounds. Energy: charcoal manufacture and gasification.

Alarcon A., C. 1988. Model for the evaluation of oleoresin production (Modelo para evaluar procuccion de oleorresina). Ciencia e Investigacion Forestal. 4:35–44.

Describes a computer model, Resin, for evaluating the technical and economical feasibility of obtaining resin from Pinus radiata plantations by an exudation process.

Alves, H.M.; Arndt, V.H., Ollis, W.D. [and others]. 1966. Triterpenoids isolated from *Machaerium incorruptible.* Phytochemistry. 5(6):1327–1330.

Amoros–Marin, L.; Torres, W.I.; Asenjo, C.F. 1959. Isolation of cycloeucalenol from West Indian mahogany wood *(Swietenia mahagoni).* Journal of Organic Chemistry. 24(3):411–413.

Anderegg, R.J.; Rowe, J.W. 1974. Lignans, the major component of resin from Araucaria angustifolia knots. Holzforschung. 28:171–175.

Anon. 1960. Pine oleoresin from British Honduras. London, U.K.: Report Tropical Products Institute. 1959:3–4.

Anon. 1963. Hercules dedicates new naval stores plant in British Honduras, C.A. Naval Stores Review. 72(11):4–5.

Anon. 1976. Roundup of naval stores activities in Mexico, Central and S. America. Naval Stores Review. 86(2):4–5.

Anon. 1978. The chemical composition of Amazonian plants. Acta Amazonica. 8(3):469–470.

Describes the structures of mirandin-A and 4 structurally related compounds from stem wood of *Endlicheria verticillata,* and of 5 compounds from leaves of *Virola surinamensis.*

Anon. 1979. The chemical composition of Amazonian plants. INDA, Manaus, Amazonas, Brazil. Acta Amazonica. 11(9):161-162.

Describes the chemical constituents of the wood of *Virola* divergens and *V. guggenheimii* and of the bark of *V. pavonis.*

Anon. 1989. Heliotropine favors ocotea; Brazil may gain market share. Chemical Marketing Reporter. 235(8):28–29.

Anon. 1989. Naval stores review—1988 international yearbook. New Orleans, LA: Naval Stores Review.

Asenjo, C.F. [and others.] 1958. Termite-repellent activity and chemical composition of West Indian mahogany wood *Swietenia mahagoni* Jacq. with special reference to P^2 fraction. Rio Piedras, Puerto Rico: Journal of Agriculture of the University of Puerto Rico. 42(3):185–195.

Assumpcao, R.M.V.; Jordao, M.C.S. 1978. Situation and perspectives of the industry of naval stores in Brazil. Naval Stores Review. 88(2):4-7.

Babicki, R. [and others]. 1973. Thermal decomposition of seven Chilean wood species in laboratory conditions. Prace Instytutu Technlogii Drewna. 20(2):3–16.

Describes the use of *Drimys winteri, Nothofagus dombeyi, Laurelia serrata, Eucalypt us globulus, Acacia me1anoxylon, Weinmannia trichosperma,* and Podocarpus chilinus [P. salignus] in destructive distillation studies. Data are provided on the yield of charcoal (ca. 30 percent in all cases), pyroligneous acid, tar, and other products. All of the seven species are deemed suitable destructive-distillation use.

Bangham, W.N. 1947. Plantation rubber in the New World. Economic Botany. 1:210–229.

Barrichelo, L.E.G.; Brito, J.O.; Bazanelli, A.V. 1983. Basic density and characteristics of *Eucalyptus grandis* wood fibers. In: Proceedings of ABCP 16th annual meeting, 3rd Latin–American cellulose and paper congress; 1983, November 21–26; Sao Paulo, Brazil. Technical Association of the Brazilian Pulp and Paper Industry (ABCP):113–125.

Barrineau, R.G. 1921. In: Naval stores–history, production, distribution, and consumption. Savannah, GA: Review Publishing & Printing Co.

Bastos, J.G. Filho; Valente, O.F.; Vital, B.R.; Della Lucia, R.M. 1986. Development and testing of a metallic kiln for wood carbonization (Desenvolvimento e teste de um forno metalico para carbonizacao de madeira). Revista Arvore. 10(1):44–59.

Beattie, W.D. 1979. Energy production from the Brazilian forestry sector. A report prepared for the World Bank. United Nations Development Program, FAO Project BRA/78/003. 178 p.

Beijer, J., de. 1982. Reforestation plan aims to make steel from trees. World Wood. 23(1):11–12.

Bonavia de Guth, E. 1985. Salix nigra: wood properties in relation to zone of establishment in the Parana delta (Salix nigra: caracteristicas del leno segun zona de implantacion en el Delta del Parana). Buenos Aires, Argentina: LAQUIGE–CONICET: 15.

Describes wood evaluations of 5 to 13 year old Salix nigra trees from plantations in the Parana delta region of Argentina. Data include tree diameter, alcohol/benzene extractives, density, and cell dimensions. The trees were selected from five sites based on suitability for pulpwood production. Principal differences in the sites were soil properties.

Booth, H.E. 1974. Long-term provision of charcoal for the Zapla blast furnaces. FAO Rep. FO:DP/ARG/70/536. Documento de Trabajo. 41 p.

A detailed report, recommending that ca. 3 million ha of chaco forest should be reserved to supply raw material and that the feasibility of establishing new plantations of Eucalypts for charcoal should be investigated. The rationalization of methods of charcoal manufacture and the economics of the industry are discussed in detail. New retorts should be installed in stages in Zapla, Tartagal, J.V. Gonzalez (Salta), and in Los Tigres (Santiago del Estero); each group should be capable of an annual production of 80,000 t.

Bracho, R.; Crowley, K.J. 1966. The essential oils of some Venezuelan Croton species. Phytochemistry. 5(5):921–926.

Braz Filho, R.; Magalhaes, A.F.; Gottlieb, O.R. 1972. Coumarins from [the heartwood of] *Brosimum rubescens:* Chemistry of Brazilian Moraceae, Part 3. Phytochemistry. 11(11):3307–3310.

Braz Filho, R.; Lette, M.F.F.; Gottlieb, O.R. 1973. Constitutions of diarylpropanoids from *Virola multinervia.* Phytochemistry. 12(2):417-419.

Braz Filho, R.; Lemos, M. de J.C.; Gottlieb, O.R. 1973. A new xanthone from Lorostemon species. Phytochemistry. 12(4):947–948.

Brito, J.O.; Barrichelo, L.E.G. 1982. Behavior of woods native to the State of Maranhao when processsed by destructive distillation (Comportamento de madeiras nativas do Maranhao frente as processo de destilacao seca). Brazil: Florestal. 11(45):47-56.

Provides results of analyses of the pyrolysis products of 67 woods grouped by wood density into 5 classes.

Bulow, M.V.von; Franca, N.C.; Gottlieb, O.R.; Suarez, A.M.P. 1973. Guianin: a neolignan from Aniba guianensis. Phytochemistry. 12(7):1805–1808.

Calvin, M. 1987. Fuel oils from euphorbs and other plants. Botanical Journal of the Linnean Society. 94:97–110.

Camara Argentino–Parsguayade Productores de Extracto de Quebracho. 1960. Some uses of quebracho extract not related to its principal use in tanning (Algunas utilizaciones del extracto de quebracho ajenas a su destino principal en la curtidura). In: Multiple use of forest lands: 5th World Forestry Congress; 1960 August 29–September 10; Seattle, WA. 3:1403–1405.

Campello, J.de P.; Fonesca, S.F.; Change, C.J.; Wenkert, E. 1975. Terpenes of *Podocarpus lambertii.* Phytochemistry. 14(1):243–248.

Carneiro, M.G.; Ferraz, E.S. de B.; Tomazello Filho, M. 1982. Polymerization of methyl metacrylate in the wood of *Schizolobium parahyba* (Vell.) Blake, by the thermal process (Polimerizacao de metacrilato de metila em madeira de Schizolobium parahyba (Vell.) Blake (guapuruvu) atraves de processo termico. Sao Paulo, Brazil: Instituto Florestal. Silvicultura em Sao Paulo.

Carreno, J.A. 1980. Naval stores industry in Central and South America. Naval Stores Review. 90(6):6–7.

Carter, F.L.; Beal, R.H.; Bultman, J.D. 1975. Extraction of antitermitic substances from 23 tropical hardwoods. Wood Science. 8(1):406–410.

Carter, F.L.; Jones, S.C.; Mauldin, J.K.; Camargo, C.R.R. 1983. Responses of *Coptotermes formosanus* Shiraki to extracts from five Brazilian hardwoods. Zeitschrift fur Angewandte Entomologie. 95(1):5–14.

Cascon, S.C.; Moura, L.L.; Lago, R.C.A. 1979. Chemical compounds of the wood of *Torresia [Torresea] acreana* (Componentes quimicos da madeira de Torresia acreana Ducke). Acta Amazonica. 9(4):787–789.

Coppen, J.J.W.; Greenhalgh, P.; Smith, A.E. 1984. Gum naval stores; an industrial profile of turpentine and rosin production from pine resin. Pub. (2187. London, U.K.: Tropical Development and Research Institute. 40 p.

Coppens, H. 1979. Tannin/resorcinol-based adhesives in laminated parana pine beams for exterior use (Adesivo a base de tanino resorcinol para laminados de pinheiro do parana uso exterior). Brasilia, Brazil: Laboratorio de Produtos Florestais, IBDF. Serie Tecnica. 3:13.

Couto, E.; Repetti, R.; Rique, T. 1980. Quebracho colorado sapwood—a forestry residue with possibilities of industrial exploitation (Albura de *quebracho colorado,* un desecho orestal con posibilidades de aprovechamiento industrial). Buenos Aires, Argentina: Folleto Tecnico Forestal, Instituto Forestal Nacional. 57:13.

Craveiro, A.; Corsano, S.; Proietti, G.; Strappaghetti, G. 1983. Constituents of essential oil of *Commiphora guidotti.* Fortaleza- Ceara, Brazil: Departamento de Quimica Organica e Inorganica, Universidade Federal de Ceara. Planta Medica. 48(2):97–98.

Cruz, A.; Silva, M.; Sammes, P.G. 1973. Further terpenoids and phenolics of *Drimys winteri.* Phytochemistry. 12(10):2549-2550.

CTFT. 1982. Woods of Guyana—Key promotions of l'amarante, Angelique, Coeur dehors, Courbaril, Gonfolo, Grignon franc, Jatoby, Saint-martin Rouge, Wacapou, Wapa (Bois de Guyane–Fiches promotionnelles de l'Amarante, Angelique, Coeur dehors, Courbaril, Gonfolo, Grignon franc, Jatoby, Saint-martin Rouge, Wacapou, Wapa). Nogent-sur-marne Cedex, France: Centre Technique Forestier Tropical.

Cunningham, A.; Martin, S.S.; Langenheim, J.H. 1973. Resin acids from two Amazonian species of Hymenaea. Phytochemistry. 12(3):633–635.

DeLucia, R.J.; Poole, A.D. 1984. Industrial fuel substitution via woody biomass: the case for Costa Rica. Biomass. 5(2):79–207.

Describes an evaluation of the possibilities for increased wood use in Costa Rica for industrial fuel. Benefits of the program would be especially in the rural sector through increased employment.

Diaz, A.M.P. de; Dias–D., P.; Ferreira, Z.S. [and others]. 1977. The chemistry of Brazilian Lauraceae. XLVII. Ferulic esters from Endlicheria and Ocotea species. Inst. Nacional de Pesquisas da Amazonia, Manaus, Amazonia, Brazil. Acta Amazonica. 7(2):292–293.

Doat, J. 1977. The calorific value of tropical woods (Le pouvoir calorifique des bois tropicaux). Nogent-sur-Marne, France: Centre Tech. For. Trop. Bois et Forets des Tropiques. 172:33–55.

Describes the calorific values of 111 tropical species, nearly all broadleaves (67 from Surinam and 22 from Indonesia, and 4 temperate species for comparison). No correlation between calorific value in cal/g and density was found.

Chemical composition accounts for most of the calorific value, being high for species high in lignin or resins or other extractives, and low for species with high cellulose and pentosan content.

Doat, J; Petroff, G. 1975. The destructive distillation of tropical woods. Laboratory trials and industrial prospects. Bois et Forets des Tropiques. 159:55–72.

Describes the pyrolysis of wood, the products and byproducts of the process, and gives results of tests on more than 100 tropical woods from Africa, Madagascar, and S. America. The relationship of the specific gravity of wood and the density of the charcoal produced was shown to be very strong. Difficulties in the production of charcoal for the metallurgy industry, and for gas to generate electricity, are discussed.

Duchene, G.F. 1987. What happened to Brazil's naval stores industry in 1985–7. Naval Stores Review. 97(5): 12–13.

Duke, J.A.; Maeglin, R.R.; Youngs, R.L. 1989. An initiative on underutilized tropical forest products. Washington, DC, USA. Report to USAID/FENR. 78 p.

Earl, D.E. 1974. Charcoal: An Andre' Mayer fellowship report. Rome, Italy: FAO, United Nations. 97 p.

Egler, F.E. 1947. The role of botanical research in the chicle industry. Economic Botany. 1:188–209.

Eslyn, W.E.; Bultman, J.D.; Jurd, L. 1981. Wood decay inhibition by tropical hardwood extractives and related compounds. Phytopathology. 71(5):521–524.

Describes the impregnation of sterilized pine blocks with extractives obtained from tropical hardwoods (obtusaquinone, obtusastyrene, or lapachol) and one synthetic compound (2-benzyl- 4,6-di-t-butylphenol). The treated blocks were exposed to the wood decay fungi, *Coriolus versicolor*, *Gloeophyllum trabeum*, or *Poria placenta.* Obtusastyrene and obtusaquinone were most effective against the brown rot fungi. Lapachol was effective at its highest concentration only against *P. placenta.* The synthetic compound reduced all decay-associated weight losses. Chemical sterilization resulted in increased decay by *G. trabeum* and *P. placenta* on treated wood, but no statistical difference was noted on the control blocks.

Farmer, R.H.; Campbell, W.G. 1952. Chemical utilization of tropical hardwoods. Tappi. 35:181.

Fengel, D.; Bocher, G. 1984. Study of polysaccharides from three tropical woods (Untersuchung der Polysaccharide von drei Tropenholzern). Holzforschung. 8(4):177–180.

Cold-water extract, 1 percent NaOH extract, polyoses, and alpha-cellulose were isolated from 3 tropical wood species: azobe *(Lophira alata);* balsa *(Ochroma lagopus);* and Parana pine (Araucaria angustifolia), and their percentages and their sugar and polysaccharide composition were determined. The percentages of xylan, mannan, and cellulose corresponded approximately to those of woods from temperate zones. Balsa contained about one third more polyoses than azobe and about two thirds more mannan. The polyoses of balsa are very accessible, thus the alpha-cellulose obtained during analysis consisted of a nearly pure cellulose.

Fengel, D.; Greune, A.; Wegener, G. 1983. Characterization of lignins from three tropical woods (Charakterisierung von drei Tropenholzligninen). Holzforschung. 37(3):121–124.

The lignins from three tropical wood species, azobe *(Lophira alata),* balsa *(Ochroma pyramidale),* and Parana pine *(Araucaria angustifolia),* were carefully isolated and characterized by elementary analysis, determination of methoxyl, sugar analysis, IR, and UV spectroscopy. A lower syringyl content of the lignins of tropical hardwoods compared with indigenous hardwoods (as found previously) was confirmed. All three lignins showed a higher degree of oxidation than lignins from woods of temperate zones. The high acid-lignin content of azobe is partly caused by polyphenols. Additionally, benzoic acid was found in the extract of azobe.

Fernandes, P. de S.; Coutinho, C.J.; Baena, E. de S. 1982. Use of residues from timber exploitation as an energy source (Aproveitamento dos residuos lenhosos do desmatamento para fins energeticos). In: Malvesi, I.T.O. [and others], eds. Proceedings of the national conference on native species; 1982 September 12–18; Campos do Jordao, Sao Paulo, Brazil. Sao Paulo, Brazil: Silvicultura em Sao Paulo. 16A(2):1390–1394.

Describes the fuelwood yields from 4 forest types in Minas Gerais, Brazil.

Ferreira, J.M. [and others]. 1963. The alkaloids of Aspidosperma discolor A.D.C. Experientia Basle. 19(11):585.

Franca, N.C.; Gottlieb, O.R.; Suarez, A.M.P. 1973. 6-phenylethyl- 5,6-dihydro- 2-pyrones from [stemwood of] Aniba gigan tiff ora. Phytochemistry. 12(5): 1182–1184.

Gabriel, S. J.; Gottlieb, O. R. 1972. Tovoxanthone from *Tovomita choisyana.* Chemistry of Brazilian Guttiferae. Part 30. Phytochemistry. 11(10):3035–3036.

Describes the isolation of betulinic acid, sitosterol, stigmasterol, and 1,6-dihydroxy-6',6' -dimethylpyrano- (2',3':7,8)-xanthone (tovoxanthone) from stemwood of T. choisyana, from the Amazon Basin.

Gabriel, S.J.; Gottlieb, O.R.; Lima, R.A. de; Mesquita, A.A.L. 1977. The chemistry of Brazilian Guttiferae. Part 36. Constituents of Amazonian species. Itaguai, Brazil: Inst. Ciencias Exatas, Univ. Federal Rural do Rio de Janeiro. Acta Amazonica. 7(2):289–291.

Presents data from chemical analyses of the wood of *Caraipa costata, C. grandifolia, C. psidifolia, C. valioi, Haploclathra verticillata, Mahurea tomentosa,* and *Platonia insignis.*

Garrido, L.M. do A.G.; Garrido, M.A. de O.; Silva, H.M. da; Carball, M.R. 1984. Mathematical study of some components of daily resin production (Estudo matematico de alguns componentes da produeao diaria de resina). Sao Paulo, Brazil: Boletin Tecnic o do Instituto Florestal. 38(1):47-71.

Gomide, J.L.; Vital, B.R.; Ribeiro, A.C. 1975. Forest tree species of the Zona da Mata as a source of pulp: their chemical properties. Revista Ceres. 22(119):74–79.

Gottlieb, O.R.; Loureiro, A.A.; Carlneiro, M.dos S.; Rocha, A.I.da. 1973. Distribution of diarylpropanoids in [the stemwood of] Amazonian Virola species. Phytochemistry. 12(7):1830.

Gottlieb, O.R.; Magalhaes, M.T. 1958. Isolation of piperonylic acid from *Ocotea pretiosa.* London, United Kingdom: Nature. 182 (4637) : 742–743.

Gottlieb, O.R.; Magalhaes, M.T. 1959. Occurrence of 1-nitro-2-phenylethane in *Ocotea pretiosa* and *Aniba calelilla.* Journal Organic Chemistry. 24(12):2070–2071,

Gottlieb, O.R.; Magalhaes, M.T. 1959. Essential oil of the wood of *Aniba firmula* Mez. London, United Kingdom: Perfumery and Essential Oil Record. 50(2):121–123.

Gottlieb, O.R.; Magalhaes, M.T. 1961. Chemistry of Brazilian Leguminosae. 2. Isolation and structure of caviunin from Dalbergia nigra. Journal of Organic Chemistry. 26(7):2449-2453.

Gottlieb, O.R.; Magalhaes, M.T.; Oliveira, G.G.de; Trainotti, A. 1977. The chemistry of Brazilian Quinaceae. I. Constituents of *Touroulia guianensis* and *Lacunaria jenmani*. Acta Amazonica. 7(2):291–292.

Describes analyses of the wood of *T. guianensis* and *L. jenmani,* no special constituents were isolated that are not of common occurrence in many other plants; there was nothing to specially identify the family.

Gottlieb, O.R.; Mors, W.B. 1958. The chemistry of rosewood. 2. Isolation and identification of cotoin and pinocembrin. Journal of American Chemistry Society. 80(9):2263–2265.

Gottlieb, O.R.; Mors, W.B. 1980. Potential utilization of Brazilian wood extractives. In: Symposium on extractives: Utilization problem or fine chemical resource; 1979; Honolulu, HI. Journal of Agricultural and Food Chemistry: 212–215.

Greenhalgh, P. 1982. The production, marketing and utilisation of naval stores. Pub. G170. London, U.K.: Tropical Products Institute. 117 p.

Guenther, E. 1948. 1948–1952. The essential oils. New York: D.VanNostrand Co. 6 Vols.

Guerra, F. 1973. Forestry projects. V. Wood charcoal (Projetos florestais. V. Carvao vegetal). Belem, Para, Brazil: Superintendencia do Desenvolvimento da Amazonia, SUDAM Documenta. 5(1/4)3–12. Data are presented on the industrial output of charcoal in Brazil and especially the Amazon region from both man-made and natural forests.

Guevara, M.R. 1981. Geographical and within-tree variation in heartwood pH of Pinus oocarpa from Honduras. Wood Science. 13(4):220–224.

Guillard, J. 1978. What is 'Panama wood' (Qu'est-ce que le bois de Panama)? Revue Forestiere Francaise. 30(1): 78–79.

Describes *Quillaja saponaria,* a rosaceous tree species found on poor soils in semi-arid northern Chile. Collection of the bark for soap products leads to the destruction of the trees. The small seeds of the species germinate erratically, but can easily be regenerated and the tree grows rapidly. The inner bark containing sodium oxalate and about 150 g/kg of saponins, is used for degreasing wool, shampoos, in photographic developers, and as an emulsifier of resins, gums, and coal-tar for the pharmaceutical industry. A large part of the present production is used in rocket fuels. Exports from Chile declined from 2270 t in 1965 to 1069 t in 1971.

Gutierrez-J., T. 1983. General aspects of turpentine production in Mexico (Aspectos generales de la resinacion en Mexico). From: First Spanish-Mexican forestry session; 1982 July 13–17; Mexico City/Toluca, Mexico. Mexico, DF, Mexico: Instituto Nacional de Investigaciones Forestales, Publicacion Especial.

Guzman M., J.A.; Jordan F., R. 1984. Study of the impact of efficiency increase in wood stoves. In: Egneus, H.; Ellegard, A., eds. In: Proceedings of Bioenergy 84 conference; 1984 June 15-21; Goteborg, Sweden. Vol. 4. Bioenergy utilization. Barking, UK: Elsevier Applied Science Publishers: 9–15.

Describes a Chilean Department of Energy survey showing that 48 percent of households use some wood for energy. A study using an adiabatic chamber evaluated the efficiency of typical wood stoves used in Chile. Under different operating conditions the average efficiency was 9.0 to 37.2 percent under standard test conditions, with an estimated 13.1 to 54.2 percent efficiency under real conditions. Energy savings are estimated if modern high efficiency stoves and catalytic stoves with 60 to 80 percent efficiency would be used.

Harris, A.C.; ,Arnold, J.E.M. 1973. Supply of wood charcoal to Altos Hornos Zapla. FAO Rep. Salta, Argentina: No. FO: DP/ARG/70/536, Documento de Trabajo. 11:91.

A report forming part of the UNDP forest inventory and development project for north-east Argentina. A technical and economical analysis is made of alternative ways of meeting the increasing demand for charcoal at the Alto Hornos Zapla steel plant in Jujuy Province. Detailed recommendations are made on the method of charcoal production (stressing the advantage of continuous vertical retorts) and on the supply of wood for charcoal production.

Harris, J.F.; Baker, A.J.; Conner, A.H.; Jeffries, T.W.; Minor, J.L.; Pettersen, R.C.; Scott, R.W.; Springer, E.L.; Wegner, T.H; and Zerbe, J.I. 1985. Two-stage, dilute sulfuric acid hydrolysis of wood: An investigation of fundamentals. Gen Tech. Rep. GTR–FPL–45. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 73 p.

Hausen, B.M.; Simatupang, M.H. 1979. Naturally occurring quinones in tropical woods as allergenic agents. In: Tamolang, F.N., ed. Wood quality and utilization of tropical species. Proceedings, International Union of Forestry Research Organization conference; 1978 October 30–November 3; FORPRIDECOM, College, Laguna, Philippines. Laguna, Philippines: International Union of Forestry Research Organization: 74–82.

Describes ten allergenic quinones, their effects, and the species in which they occur. A table listing tropical woods

known to contain quinones causing contact allergies is presented.

Hemingway, R.W. 1989. Recent developments in the use of tannins as specialty chemicals. TAPPI international symposium on wood and pulping chemistry: 377–386.

Hodge, W.H. 1948. Wartime cinchona procurement in Latin America. Economic Botany. 2:229–257.

Jones, S.C.; Carter, F.L.; Mauldin, J.K. 1983. *Reticulitermes flavipes* (Kollar) (Isoptera: Rhinotermitidae) responses to extracts from six Brazilian woods. Environmental Entomology. 12(2):458–462.

Describes tests of extractives from 6 Brasilian hardwoods as anti-termitic agents. The tests were conducted in Mississippi on the termite *Reticulitermes flavipes* (Koll.) over a 4-week period in no-choice tests. The success of the extracts varied with the species from which they were extracted and the solvent used for extraction. Termite feeding and survival was lowest on *Copaifera multijuga, Mezilaurus itauba,* and *Platymiscium ulei,* and highest on *Couroupita subsessilis* and on some extracts of *Micrandra siphonioides.* Where termites survived the no-choice test, protozoan numbers were reduced most on all extracts of *Carapa guianensis* and the hexane extracts of *Mezilaurus itaubi* and *P. ulei.* Termites exposed to choice tests generally consumed more untreated than treated paper pads. No significant difference occurred between pad weights of controls and those treated with some extracts of *Couroupita subsessilis* and *Micrandra siphonioides.* One to three extracts of each of the six woods were repellent to termites.

Lawrence, B.M. 1984. Progress in essential oils. Perfumer and Flavorist. 9(5):87–88.

Lawrence, B.M. 1985. A review of the world production of essential oils (1984). Perfumer and Flavorist. 10(5):1–15.

Lawrence, B.M. 1985. Progress in essential oils. Perfumer and Flavorist. 10(4):48–49.

Lawrence, B.M. 1987. Progress in essential oils. Perfumer and Flavorist. 12(4):58–59.

Lima, O.A.; Polonsky, J. 1973. Flavonoid constituents of *Cephalanthus spthelliferus.* Phytochemistry. 12(4):913-916.

Lindauer, G.D.; Krispin, T. 1981. A 4 to 6-MW wood gasification unit: scaling-up the gasification technology into an unknown size category (case study Guyana). In: Palz, W.; Chartier, P.; Hall, D.O., eds. Energy from biomass. 1st E.C. conference. London, UK: Applied Science Publishers Ltd: 782–788.

Describes a 4-6 Megawatt (MW) power plant based on wood gasification technology under construction in coujunction with a sawmill project in Guyana. Slated to start operation in 1981 at a capacity level of about 4MW, it is the first of its size. Technical performance will have to be monitored closely. Where steam is not needed gasification is the more economic solution. As long as the raw material (in this case wood wastes) is available free of cost, this technology is a financially viable proposition.

Lombardi, C.R.; Churin, D.Q. 1972. Test of a machine for debarking red quebracho logs (Ensayo de una maquina peladaora de rollizos dequebracho Colorado). In: Proceedings of the 7th World Forestry Congress; 1972 October 4–18; Buenos Aires, Argentina. 5:6377–6381.

Maldonado, E.D. 1983. Charcoal production: an opportunity for the Caribbean (Produccion de carbon vegetal: una aportunidad para el Caribe). Bull. R8–FB/U1. U.S. Department of Agriculture, Forest Service. 17 p.

McReynolds, R.D.; Kossuth, S.V.; Clements, R.W. 1989. Gum naval stores methodology. In: Zinkel, D.F.; Russell, J., eds. Naval Stores: Production, Chemistry, Utilization. New York: Pulp Chemicals Association. 83–122.

Mirov, N.T. 1961. Composition of gum turpentines of pines. Tech. Bull. 1239. Washington, DC: U.S. Department of Agriculture: 126–127.

Mirov, N.T.; Iloff, P.M., Jr. 1956. Composition of gum turpentines of pines. 28. A report on *Pinus edulis* from eastern Arizona, *P. tropicalis* from Cuba, and *P. elliottii* var. *densa* from Florida. Journal of American Pharmaceutical Association. 45(9) :629–634.

Moreira, J.R.; Goldemberg, J. 1981. Alcohols–its use, energy, and economics–a Brazilian outlook. Resource Management and Optimization. 1(3):231–279.

Describes the economics and energy balance comparisons between sugar cane, cassava, sorghum, and wood for alcohol production. The use of ethanol for engine fuel in Brazil is discussed, concluding that it has reached the breakeven point with oil.

Mors, W.B.; Magalhaes, M.T.; Gottlieb, O.R. 1959. Physiological varieties of *Ocotea pretiosa.* London, U.K.: Perfumery and Essential Oil Record. 50(1):26-27.

Oliveira, W. G. de; Gottlieb, O. R.; Mesquita, A. A. L. 1972. Xanthones from *Tovomita macrophylla.* Chemistry of Brazilian Guttiferae. Part 31. Phytochemistry. 11(11)13323-3325.

Reports the isolation from stemwood of BETA-amyrin, sitosterol, betulinic acid, and two novel compounds, tovophyllin-A and -B, for which structures are proposed.

Parameswaran, N.; Stamm, A. 1983. Structural and chemo-physical changes occurring during carbonisation of four tropical hardwoods (Strukturelle und chemo-physikalische veranderungen bei der verkohlung von vier tropischen laubholzern). Holzforschung. 37(6):309–320.

Describes the processing and final charcoal properties of four species: *Dicorynia guianensis, Erisma uncinatum, Nauclea trillesii,* and *Vochysia surinamensis.* Details of charcoal anatomy and physical properties are given, including changes in the wood structure due to carbonization. Yields of charcoal averaged 30 percent, and density was related to original wood density.

Pardo, L.L.; Ricci, E. 1956. Study of the tannin content of diverse native species (Estudio sistematico de la riqueza en taninos de diversas especies indigenas). Buenos Aires, Argentina: Anales Admistration Nacional de Bosques: 7–17.

Pardo, L.L.; Ricci, E. 1957. Identification of Schinopsis spp. by means of their tanstuffs (Identificacion de las especies de Schinopsis por sus materias tanantes). Buenos

Aires, Argentina: Revista Investigaciones Forestales. 1(1/2) 159–69.

Park, W.; Newman, L.C.; Ford, K. 1983. Fuelwood supply for Managua, Nicaragua: sustainable alternatives for the Las Maderas fuelwood supply region. Mitre Corp., CATIE, AID Research and Development Abstracts. 11(1/2):1-64.

Describes a study of the fuelwood supplies for Managua, Nicaragua, focusing on the region of Las Maderas to the northeast of Managua. Assessments of harvesting and active trade in fuelwood between Las Maderas and Managua are made, as well as estimates of supply and demand. Alternatives to fuelwood, such as charcoal are discussed as well as various forest management options. Conclusions are presented with some recommendations.

Paula, J.E. de. 1981. Internal structure of 16 species of the flora of Brazil in relation to their possible use for alcohol, charcoal, coke, and paper production (Estudo das estruturas internas das madeiras de dezesseis especies da flora brasileira, visando seu approveitamento para producao de alcool, carvao, coque e papel). Brasil Florestal. 11(47):23–50.

Describes the wood of 16 Brazilian species including: *Apuleia leiocarpa, Apuleia molaris, Caesalpinia ferrea, Calisthene major, Calophyllum brasiliense, Copaifera langsdorfii, Cordia goeldiana, Maprounea guyanensis, Mimosa artemisiana, Piptadenia macrocarpa, Qualea paraensis, Spondias lutea, Tapirira guianensis, Virola multinervia, Vochysia pyramidalis, Xylopia emarginata.* The use of these woods for alcohol, charcoal, coke, and paper is discussed.

Paula, J. E. de. 1982. Native species from the energy viewpoint (Especies nativas com perspectivas energeticas). In: Malvesi, I.T.O. [and others], eds. Proceedings of the national conference on native species; 1982 September 12–18; Campos do Jordao, Sao Paulo, Brazil. Sao Paulo, Brazil: Silvicultura em Sao Paulo. 16A(2):1259–1315.

Describes wood anatomy studies on 53 Brazilian species, in relation to their potential utilization for wood products, alcohol, charcoal, or coke production. Fruit and seed of 10 woody species, and nonwoody subterranean organs of five species were also examined.

Paz, J.; Ceballos, M.E. 1965. Study of the organic chemical composition of Pinus radiata wood. Informativo Tecnico. 21. Santiago, Chile: Instituto Forestal: 94–98.

Peterson, C. 1981. Biomass energy in the Caribbean Basin: a case study of the Dominican Republic. In: Klass, D.L; Emert, G.H., eds. Fuels from biomass and wastes. Ann Arbor, MI: Ann Arbor Science Publishers: 533–555.

The potential for the use of biomass (wood and bagasse–sugarcane residue) in the Caribbean Basin is reviewed. The commercial energy use of these countries, biomass resources, and actions to develop biomass energy in the Dominican Republic are covered.

Petroff, G.; Doat, J. 1978. Destructive distillation of tropical timbers. Influence of the chemical composition of wood on the products of distillation (Pyrolyse des bois tropicaux. Influence de la composition chimique des bois sur les produits de distillation). Bois et Forets des Tropiques. 177: 51–64.

Describes the destructive distillation of several mixtures of wood for comparison. Mixtures included six samples of *Gmelina arborea* and Eucalyptus saligna X E. '12 ABL', 3 mixtures of other tropical woods high in lignin, alcohol-benzene extractives, celluloses and hemicelluloses, and a mixture of French hardwoods. Distillation was at 500°C for 4 h. Data on the physico-chemical properties of the wood, charcoal and distillation products are shown, as are the chemical analyses of the distillates. The mixture of tropical woods yielded more charcoal and less distillate than the French hardwoods. High lignin woods gave more charcoal, high cellulose woods more methanol, and high pentosan woods more acetate. Woods with high levels of alcohol-benzene extractives may cause tarry deposits in the stills.

Picot, F.; Boiteau, P.; Das, B.C.; Potier, P. 1973. Alkaloids of *Pandaca [Tabernaemontana] retusa.* Phytochemistry. 12(9):2517–2519.

Potma, H.L.; Kengen, S.; Alves Alpande, M.R. 1976. A statistical analysis of the present forestry situation in Brazil (Uma analise estatistica da atual situacao florestal Brasileira). PRODEPEF, Brasilia, Brazil. FAO Rep. No. PNUD/FAO/IBDF/BRA–45. Serie Tecnica. 9:72.

Pozzi, H.; Sanchez, E.; Comin, J. 1967. Studies on Argentine plants—22. Helietin, a new fuocoumarin from *Helietta longifoliata* Britt. Tetrahedron. 23(3) : 1129-1137.

Reicher, F.; Odebrecht, S.; Correa, J.B.C. 1978. Carbohydrate composition of some Amazonian forest species (Composicao em carboidratos de algumas especies florestais da Amazonia). Acta Amazonica. 8(3):471–475.

Describes the lignin and carbohydrate content of 24 species of native Brazilian hardwoods as a measure to estimate the capacity for ethanol production from the woods by fermentation of sugars. Estimated production per ton of wood varied between 189 and 325 liters, the highest for *Protium* spp.

Ribas, C.; Garrido, L.M. do A.G.; Garrido, M.A. de O.; Assini, J.L.; Rocha, A.D. da. 1984. Resin production in *Pinus*–comparison between operational techniques and chemical stimulants (Resin agem de *Pinus*–comparacao entre tecnicas operacionais e estimulantes quimicos. San .Paulo, Brazi. Boletin Tecnico do Instituto Florestal. 38(1):35–46.

Ribeiro Filho, F.A. 1979. The ethanol-based chemical industry in Brazil. United Nations Industrial Development Organization. ID/WG.293/4. Presented at workshop on fermentation alcohol for use as fuel and chemical seedstock in developing countries. 68 p.

Rique, T. 1978. The industrialists and the search for new extractive forest products with a view to obtaining a positive contribution to man's social and economic development. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 5:6577–6595.

Rodriguez–V., F. 1975. A short study of the parameters of processing and formulation for carrying out the impregnation of woods with vinyl monomers at the pilot plant of the Chemical Engineering Laboratory (Breve estudio de los parametros de procesamiento y de formulacion para llevar a

cabo la impregnacion de maderas con monomeros vinilicos en la planta piloto del Laboratorio de Ingenieria Quimica). Mexico City, Mexico: Universidad Nacional Autonoma de Mexico. Thesis. 226 p.

Reviews the physical and mechanical properties of wood and of methyl methacrylate, analyses the market for wood products in Mexico in the context of potential demand for improved wood, and describes in detail pilot-plant experiments on the production of improved wood from a Mexican softwood *(Pinus ayacahuite)* and a hardwood *(Swietenia macrophylla).* The results of the experiments are given, and it is concluded that the properties of the improved wood produced from both species are very satisfactory and that there should be excellent opportunities for developing a demand for them for various uses.

Rubbo, R.; Milans, J. 1980. Making of charcoal from wood in an open kiln (Fabricacion de carbon de lena en horno abierto). Montevideo, Uruguay: Ministerio de Agricultura y Pesca, Direccion Forestal, Parques, y Fauna. Reproduction del publicacion 44, 1939, por la Direccion de Agronomia. 15 p.

Sanz, J.A. 1989. Naval stores status in South America with a focus on Brazil. Naval Stores Review. 99(5):6–9.

Senyszyn, P. 1980. Charcoal and the wood of Eucalyptus, which material is premium for its manufacture (El carbon vegetal y la madera de eucalipto como materia prima para su fabricacion). Montevideo, Uruguay: Ministerio de Agricultura y Pesca, Direccion Forestal, Parques y Fauna. 15 p.

Serrano, B. 1960. The Argentine extract producing industry—a reliable source of tanning products (Sequridad en el abastecimiento de productos curientes por la industria extractiva Argentina). In: Multiple use of forest lands: 5th world forestry congress; 1960 August 29–September 10; Seattle, WA: 3:1406–1409.

Shimizu, J.Y. 1978. Juvenile growth of *Pinus elliottii* Engelm of high and low output of resin from the south of Sao Paulo (Crescimento juvenil do *Pinus elliottii* Engelm. de alto e baixo rendimento em resina no sul de Sao Paulo). Brazil Florestal. 9(33):24–27.

Silva, M.; Bittner, M.; Sammes, P.G. 1973. Diterpenoids of Podocarpus nubigena. Phytochemistry. 12(4) :883–886.

Silva, M.L.da; Maia, J.G.S.; Rezende, C.M.A.da; Gottlieb, O.R. 1973. Arylpropanoids from Licaria puchury-major. Phytochemistry. 12(2):471–472.

Silva, O.M. da; Pereira, A.R. 1981. Seasonal variation in the price of charcoal in the State of Minas Gerais (Variacao estacional dos precos de carvao vegetal no estado de Minas Gerais). Revista Arvore. 5(2):125–134.

Prices from 1975 to 1980 are analysed. The seasonal variation ranged approximately 8 percent below and above the annual mean.

Silva S., M.K.; Assumpcao R., M.V. 1970. Contribution to the study of anti-fungal substances obtained from Brazilian woods. Sao Paulo, Brazil: Publicacao, Instituto de Pesquisas Tecnologicas: 799:120.

Describes the chemical extraction of five naturally durable woods of Brazil *(Aspidosperma polyneuron, Astronium urundeuva, Dalbergia nigra, Myroxylon balsamum, Poecilanthe parvifolia)* to test the inhibiting properties of the extracts on fungal attack of *Coniophora cerebella, Fomes connatus, Lenzites trabea,* and *Polyporus fumosus.* The most promising extract was from *P. parvifolia,* and was identified as sakuranetin (5,4'-dihydroxy-7- methoxy flavone).

Simmons, F.C. 1963. Charcoal from portable kilns and fixed installations. Unasylva. 17(4): 199–211.

Smith, G.C. 1982. Development of naval stores in South America. Naval Stores Review. 92(6):13–15.

Stephan, G. 1978. The utilization of living tropical trees for the production of industrial raw materials (Die Nutzung lebender Baume in den Tropen zur Gewinnung von Industrierohstoffen). Sekt. Forstwirtschaft Tharandt, TU Dresden, German Democratic Republic. Beitrage fur die Forstwirtschaft. 12(1):45–48.

The products discussed are resin, rubber, and shellac.

Szczerbakow, K. 1978. New methods of stimulating resin flow. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin.; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 5:6433–6437.

Tapia, C. 1986. The naval stores in Mexico. Naval Stores Review. 96(6):11–14.

Taylor, M.B. 1985. Naval stores in Brazil. Naval Stores Review. 95(5): 11–13.

Torres–Z., M. 1981. Test for producing charcoal using a portable steel kiln (Ensayo para producir carbon vegetal usando um homo portatil de hierro). Conocoto, Ecuador: Centro de Capacitacion e Investigacion Forestal de Conocoto. 30 p.

Uhart, E. 1976. The Amazonian forest: a source of energy (A floresta Amazonica: fonte de energia). Superintendencia do desenvolvimento da Amazonia; Departamento de Recursos Naturais, Ministerio do Interior Belem, Brazil, and For. Econ. Div., Centre Technique Forestier Tropical, Nogent-sur-Marne, France. 144 p.

Describes a joint study by SUDAM (Superintendencia do desenvolvimento da Amazonia) and the CTFT (Centre Technique Forestier Tropical) to evaluate possibilities for establishment of wood distilling industries in cattle raising areas. Analyses were made by CTFT, of the average and the densest wood samples as a source of products of distillation or as fuel for burning. The total volume of wood for processing in the areas was estimated at 200 t/ha, with a calorific value of about 3,000 cal per kg of dried wood. The possibility of using wood to produce electricity for the SUDAM livestock projects is also discussed. Production costs for electricity using different methods are compared, and investment costs for plant are given.

Valente, H.M.; Montes, A.L.; Venesch, E.E. 1968. Chemical composition of oil of turpentine from *Pinus elliottii* grown in Argentina. Revista Forestal Argentina. 12(4):111–114.

Valente, H.M.; Rique, T. 1960. Chemical analysis of the wood of "pino de cerro" *Podocarpus parlatorei* Pilg. and "aliso del cerro" *Alnus jorullensis* var *spachii* (Regal) (Winkler) and their possibilities for making pulp (Estudio quimico de la madera del "pino de cerro" *Podocarpus parlatorei* Pilg. y ''aliso del cerro" *Alnus jorullensis* var *spachii* (Regal) (Winkler) y sus posibilidades para la fabricacion de pulpas). Notas Tecnologicas Forestales. Buenos Aires, Argentina: Administracion Nacional de Bosques. 12:5.

Valente, O.F.; Almeida, J.M. de; Vital, B.R.; Della Lucia, R.M. 1985. The effect of carbonization temperature on the yield and properties of wood charcoal (Efeito da temperatura de carbonizacao nos rendimentos e propriedades do carvao vegetal produzido). Revista Arvore. 9(1):28-39.

Vital, B.R.; Bastos Filho, J.C.; Valente, O.F. 1985. The effect of tree age on charcoal production quantity, charcoal carbon content, and carbon yield from Eucalyptus (Efeito da idade da arvore sobre o rendimento gravimetrico e teor de carbono fixo de carvao de *Eucalyptus).* Revista Arvore. 9(2):180–185.

Vital, B.R.; Della Lucia, R.M.; Valente, O.F. 1985. Estimation of humidity in wood destined for charcoal, in function of drying time: (Estimativa do teor de umidade de lenha para cavao em funcao do tempo de secagem). Revista Arvore. 9(1): 10–27.

Wartluft, J.L.; White, S. 1984. Comparing simple charcoal production technologies for the Caribbean. Arlington, VA.: Volunteers in Technical Assistance (VITA). 22 p.

Weissmann, G.; Ayla, C. 1982. Thermosetting wood glues from bark extracts of Chilean *Pinus radiata* D. Don. Adhesion. 26(6/7):18–23.

Describes bark extraction, preparation of extractive adhesives, and the testing of the adhesives from Pinus radiata in Chile. Both water and alkaline methods were used for extraction, viscosity of the extracts was reduced by reaction with sulphite or bisulphite or by the addition of phenol.

Weissmann, G.; Vorker, W. 1975. The oleoresins of Cuban Pines. Holz als Roh– und Werkstoff. 33(1):21–25.

Oleoresins from one or more trees of each of the four Cuban Pines *Pinus tropicalis, P. occidentalis, P. cubensis,* and *P. caribaea* var. *caribaea* were separated into turpentine and resin acids, which were analyzed by gas chromatography. Differences between the four species were noted. The principal component of all the turpentines was alpha-pinene, while a relatively high content of limonene was found in *P. cubensis* and of beta-phellandrene in *P. caribaea.* In the resin acids, differences were found in the components of the pimaric and isopimaric acid type. Rosin obtained from the oleoresins corresponds in properties to commercial grades.

Wrann H., J. 1988. Tannin content in bark of pine (Pinus radiata D.Don) according to location and distinct ages (Contenido de taninos en corteza de pino (Pinus radiata D.Don) segun procedencias y edades distintas). Ciencia e Investigacion Forestal. 4:69–73.

Describes a study of radiata pine to evaluate the tannin content in bark of trees. Trees of different ages from various locations were evaluated, as was position in the tree. Data are given on the variation found.

Zabkiewicz, J.A.; Allan, P.A. 1975. Monoterpenes of young cortical tissue of Pinus radiata. Phytochemistry. 14(1):211–212.

Zinkel, D.F. 1985. Lightwood from the fire. Naval Stores Review. 94(8):15.

Zinkel, D.F.; Russell, J., eds. 1989. Naval stores — production, chemistry, utilization. New York, NY: Pulp Chemicals Association. 1,060 p.

Pulping

Pulping characteristics and manufacture (papermaking included only incidentally).

ABCP. 1982. ABCP annual meeting during Paper Week; 1982 November 22–26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry: 679 p.

Forty-one papers describe all aspects of the pulp and paper industry and, in particular, the use of home-grown Brazilian resources.

ABCP. 1983. Proceedings of the Technical Association of the Brazilian Pulp and Paper Industry 16th annual meeting/3rd Latin-American Cellulose and Paper Congress; 1983 Nov. 21–26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry: 1,276 p.

The proceedings consist of four volumes containing 93 papers about pulping Latin American woods, especially eucalyptus and pines.

Albin, R.; Jaramillo, R. 1960. Observations on the variation of moisture content in industrial wood chips of Pinus radiata D. Don (Observaciones sobre la variacion de contenido de humedad en madera industrial astillable de Pinus radiata D.Don). Valdivia, Chile: Facultad de Ciencias Forestales, Universidad Austral de Chile.

Alcalde–Melendez, H. 1979. Experiences on the use of hardwoods in paper manufacture (Experiencias sobre el uso de maderas duras en la fabricacion de papel). Durango, Mexico: Publicacion especial. Instituto Nacional de Investigationes Forestales.

Anon. 1958. Summary of pulping and papermaking experiments on eucalyptus. FPL Rep. 2126. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 6 p.

Anon. 1971. Some useful information on woods from Amazonia (Algunas informacoes uteis sobre Amazonia). Belem, Brazil: SUDAM (Superintendencia do Desenvolvimento da Amazonia) Documenta. 3(4):133–177.

Anon. 1973. Amazonian timbers. Industrial experience in the production of pulp and paper (Madeiras da Amazonia. Experiencia em escala industrial para producao de celulose e papel). Belem, Brazil: SUDAM (Superintendencia do Desenvolvimento da Amazonia). 14 p.

Anon. 1977. Changes in the prices of forest products during the last twelve years (Variaciones de precios de productos forestales en los doce ultimos anos). Chile Forestal. 2(22):12.

Provides information on domestic and export prices of roundwood, chips, sawn wood of *Pinus radiata* and rauli *(Nothofagus procera)*, particle and fibre boards, plywood, veneer, and paper in Chile for the years 1966 to 1977. Data are presented in tables and graphs, and the changes during the period are discussed.

Anon. 1977. Prices per cubic meter for the pulp and paper industry: at roadside or at the mill? (Precios del metro ruma para la industria de la celulosa y papel: a orilla de camino o puesto en planta?). Chile Forestal. 2(22):9-11.

A pulpwood supplier, two paper manufacturers, and an economist present their arguments for or against calculating the price of pulpwood in Chile at roadside vs. at the mill.

Anon. 1978. Basralocus (Angelique). Bois et Forets des Tropiques. 178: 17–28.

Describes Dicorynia guianensis which is found in Brazil, French Guiana, and Surinam. Logs, lumber, wood anatomy, and physical, mechanical, and chemical properties are detailed. The wood has a high shrinkage, is medium heavy, and hard to medium hard, with a high content of silica which makes it very abrasive. The logs are durable in marine use but are not durable in soil contact, and are not treatable with preservatives for prevention of decay. Pulping trials indicate that though the silica content is a disadvantage, it is suitable for pulp.

Anon. 1978. In Argentina: pulp group invests in solid wood products. World Wood. 19(10):46–47.

Describes the investment of $50 million by an Argentinian pulp firm for the development of a sawmill, plywood mill, and particleboard line.

Anon. 1978. The forest industries of Latin America. Sawmilling, wood-based panels, and pulp and paper. In: Proceedings of the 7th World Forestry Congress, 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires: Centro Cultural General San Martin. 1:1021–1103.

Anon. 1979. Eucalyptus market pulps from Brazil pose threat to U.S. hardwood pulp. Pulp and Paper 53(9):71–74.

Reports on new pulp sources from Portugal, Spain, the U.S. South, and Brazil. Emphasis is placed on the properties of Brazilian Eucalyptus and Brazil's mills.

Anon. 1985. Chilean forest-product exports in the first three months of the year. Chilean Forestry News. 88:4–5

Describes the exports of timber and pulp and paper products from Chile in the period January to March 1985. The value in US dollars for all products was $77,076,790. The most important commodity was bleached pulp followed by radiata pine sawn wood. The largest importers were S. Korea and Japan. A total of about 50 countries bought Chilean wood products.

Anon. 1985. Favourable forest-products foreign trade balance. Chilean Forestry News. 85:2–4.

Describes the import and export of forest products by Chile in 1983. Data are given in US dollars. Pulp and paper products were the principal imports. A positive balance of trade in forest products was shown for the year, totalling $263,900,000. Exports of forest products amounted to 8.5 percent of total trade while imports were 2 percent. Exports went, in order of importance, to West Germany, Japan, Brazil, USA, and Indonesia. The imports were mostly from Brazil and the USA.

Anon. 1985. Port expansion inaugurated at Lirquen. Chilean Forestry News. 87:2–3.

Describes activities of the 2nd most important port in Chile. The port, in Region 8, had incoming and outgoing cargo including 68,166 m^3 of sawn wood and 70,268 m^3 of roundwood in 1984. Logs and sawnwood comprised 40 percent of all shipments while pulp and paper accounted for another 30 percent. The handling capacity of the port was recently doubled to 2,250,000 tons per yr.

Anon. 1985. Rising forest-products output in 1984. Chilean Forestry News. 86:6–7.

Describes changes in production levels for logs, sawnwood, panels, veneer, and pulp and paper in Chile. Statistical data show the official forestry production index for 1984 was 8 percent higher than in 1980.

Area, M.C.; Fretes, R.M. 1988. Study of the cell elements of Guaica *(Ocotea puberula).* ATIPCA. 27(2):46–53.

Describes the fiber and pulping characteristics of *Ocotea puberula,* detailing fiber length and fiber content of early and latewood.

Asenjo–G., P. 1975. Pulp from native Chilean woods. Some general considerations. Charlas y Conferencias. 3:1–11.

Presents a brief history of the use of wood for production of pulp and paper, and discusses the present situation and future prospects of the pulp and paper industry in Chile. Up to this time the industry has been based on *Pinus radiata* wood from plantations which were planted in the late 19th century. Demand for *P. radiata* wood for sawtimber and pulp is expected to exceed output within the next 4 to 5 years. Tests of *Drimys winteri, Eucryphia cordifolia,* and *Nothofagus dombeyi* for pulp have proven feasible. Pilot studies of these species and other Chilean hardwoods should be made for industrial application.

Baker, D.L.; Sepall, O.; Cornforth, E.; Siedlak, E.R. 1977. TMP–key to development of mechanical book papers from a tropical hardwood–*Gmelina arborea.* In: Proceedings EUCEPA International Mechanical Pulping Conference. (Helsinki) Paper No. 6B. 1:21.

Describes paper making study where bleached *Gmelina* thermomechanical pulp was mixed with 35 percent softwood kraft pulp to give the best furnish for book papers.

Barrichelo, L.E.G.; Foelkel, C.E.B. 1975. Utilization of native forest trees for pulp: *Mimosa bracatinga, Cecropia* sp., *Tabebuia cassinoides,* and *Joannesia princeps.* Sao Paulo, Brazil: Instituto de Pesquisas e Estudos Florestais. 10:43–56.

Describes tests on the pulping characteristics of four native Brazilian hardwoods. Data show that the species produce sulphate pulps of quality inferior to Eucalyptus saligna pulp, but suitable for manufacture of printing and writing paper.

Barrichelo, L.E.G.; Brito, J.O. 1976. Eucalyptus as raw material for pulp in Brazil. Investigacion y Tecnica del Papel. 13(50): 927–949.

Barrichelo, L.E.G.; Brito, J.O. 1976. Potential of tropical eucalypt species for production of bleached sulfate pulp (Potencialade de especies tropicais de Eucalipto para a producao de celulose sulfato branqueada). Piricicaba, Brazil: IPEF (Instituto de Pesquisas e Estudos Florestais) Publicao Semestral. 13:9–37.

Barrichelo, L.E.G.; Brito, J.O. 1976. The wood of Eucalyptus spp. as raw material for the pulp and paper industry (A madeira das especies de eucalipto como materia-prima para a industria de celulose e papel). Piracicaba, S.P., Brazil: University de Sao Paulo. FAO Rep. PNUD/FAO/IBDF/BRA–45. Serie Divulgacao 13.

Barrichelo, L.E.G.; Kageyama, P.Y.; Speltz, R.M.; Bonish, H.J.; Brito, J.O.; Ferreira, M. 1977. Trials of provenances of **Pinus taeda** from the point of view of their industrial use (Estudos de procedencias de *Pinus taeda* visando seu aproveitamento industrial). Sao Paulo, Brazil: Instituto de Pesquisas e Estudos Florestais, Piracicaba. 15:1-14.

Describes a trial of 20 provenances of *Pinus taeda* established in Telemaco Borba district, Parana, Brazil. After 9 years the genetic variations between provenances in height, diameter at breast height, volume, survival percent, and wood density showed that the best growth was by provenances from the SE part of the natural range in the United States. The best provenances for optimum production of sulphate pulp per ha were: Jackson, Florida; Berkeley, S. Carolina; South Coastal, S. Carolina; Forest Service, S. Carolina; and the local introduced strain at Telemaco Borba (control).

Barrichelo, L.E.G.; Brito, J.O. 1979. Utilization of native wood species in the state of Santa Catarina for the production of pulp. Papel. 40:49–54.

Describes fibre dimensions, chemical and physical properties, and suitability for kraft pulping of hardwood species native to Santa Catarina and compares them with properties of *Eucalyptus grandis.* The native woods mixture had high density, high lignin content, and bleached pulps with relatively low yield, viscosity, brightness, and strength properties. Tearing strength, opacity, and porosity were high. The pulps would appear to be suitable in mixtures with long-fibre kraft pulps for writing and printing papers.

Barrichelo, L.E.G.; Foelkel, C.E.B. 1975. Utilization of native forest trees for pulp: bracatinga *(Mimosa bracatinga),* embauba *(Cecropia* sp), caixeta *(Tabebuia cassinoides)* and boleira *(Joannesia princeps)* (Utilizacao de madeiras de essencias florestais nativas na obtencao de celulose: bracatinga (Mimosa bracatinga), embauba *(Cecropia sp),* caixeta *(Tabebuia cassinoides)* e boleira *(Joannesia princeps)).* Piricicaba, Brazil: IPEF (Instituto de Pesquisas e Estudos Florestais) Publicao Semestral. 10:43–56.

Barrichelo, L.E.G; Brito, J.O.; Couto, H.T.Z. do. 1979. Kraft pulping characteristics of Pinus caribaea var. hondurensis growing in Brazil. In: Proceedings of 1st IUFRO conference on wood quality and utilization of tropical species; 1978 October 30–November 3; Laguna, Phillippines. Laguna, Philippines: FORPRIDECOM College: 236–255.

Barrichelo, L.E.G.; and others. 1982. Utilization of native Brazilian timbers. In: Malvesi, I.T.O. and others, eds. Proceedings of the national conference on native species, 1982 September 12–18; Campos do Jordao, Sao Paulo, Brazil. Sao Paulo, Brazil: Silvicultura. 16A(2):1235–1382.

Lists five papers by title: Barrichelo, L.E.G.; Brito, J.O. Wood of native species and the production of pulp (As madeiras de essencias nativas e a producao de celulose). p. 1235-1244; Freitas, A.R. de; Chimelo, J.P. Utilization of Amazonian woods for production of railroad ties for the Carajas Iron Project (Utilizacao de madeiras amazonicas para a producao de dormentes para o projeto Ferro Carajas). p. 1316-1327; Pontinha, A. de A.S.; Freire Neto, A.O. da L.; Giannotti, E. Study of the quality of charcoal produced at laboratory scale using ten cerrado species (Estudo da qualidade do carvao vegetal produzido em escala de laboratorio de dez especies de cerrado). p. 1345-1349. Carneiro, M.G.; Ferraz, E.S. de B.; Tomazello Filho, M. Polymerization of methyl methacrylate in Schizolobium parahyba wood using thermal processing (Polimerizacao de metacrilato de metila em madeira de Schizolobium parahyba (Vell.) Black atraves de processo termico). p. 1367-1372. Carneiro, M.G.; Ferraz, E.S. de B.; Tomazello Filho, M. Polymerization of methyl methacrylate in Schizolobium parahyba wood using gamma radiation (Polimerizacao de metacrilato de metila em madeira de Schizolobium parahyba (Vell.) Blake atraves de radiacao gama). p. 1373-1382.

Barrichelo, L.E.G.; Foelkel, C.E.B.; Gonzaga, J.V.; Busnardo, C.A. 1983. Basic density and characteristics of Eucalyptus grandis wood fibers. In: Proceedings of ABCP 16th annual meeting, 3d Latin American cellulose and paper congress: 1983 November 21-26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry: 113-125.

Describes the variation of basic density at eight locations from pith to bark on samples of Eucalyptus grandis grown in Brazil. Density was strongly correlated with fiber wall thickness, lumen diameter, and fiber length.

Becerra-M., J. 1977. Quality of forest products for use in the cellulose and paper industry (Calidad de troceria para uso en la industria de la celulosa y del papel). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Ciencia Forestal. 2(9):59-64.

Becker, S.E.; Caldwell, H.G. 1974. An evaluation of NSSC and kraft pulping of Ecuadorian hardwoods for corrugating medium. Tappi. 57(12): 117-1 19.

Describes results of laboratory experiments to evaluate eight samples of tropical hardwoods from Ecuador, including sande, Virola, sajo, mangrove, mixed hardwoods, sawmill waste, veneer waste, and sawdust. All of the furnishes, except that of mangrove, were suitable for making corrugating medium, but quality and yield varied considerably. In furnishes of mixed hardwoods, it is suggested that species with a high wood density could be separated by a flotation technique.

Boone, R.S.; Chudnoff, M. 1972. Compression wood formation and other characteristics of plantation-grown Pinus caribaea. Res. Pap. ITF-13. Rio Piedras, Puerto Rico: U.S. Department of Agriculture, Forest Service, Institute of Tropical Forestry. 16 p.

Seventy-one trees from four plantations located in two life zones were sampled to determine amount, orientation, and effect of compression wood on some physical and mechanical properties of 8 to 10 year old Pinus caribaea grown in Puerto Rico.

Bowers, R. 1974. Report to the Government of Surinam on the technical and economical appraisal of an export market pulp industry or export chip industry. Rep. SIS 14. Forest Industries and Trade Division of FAO, Rome-Development Program.

Boyhan, G. 1975. Tropical hardwoods-a fiber bonanza. Pulp and Paper International. 17(1):4346.

Describes the potential use of tropical hardwoods from Latin America and the Pacific Basin for pulpwood. Forest conversion to plantations of fast-growing species is considered best economically. Data on costs of clear cutting and planting are presented with a list of suitable species and pulping characteristics of the mixed hardwoods.

Breithaupt, G. 1975. The wood industry of Cuba (Die Holzwirtschaft der Republik Kuba). Holzindustrie. 28(12):373-376.

Describes current statistics from Cuba on the wood industry including sawmilling, plywood, pulping, and minor forest product industries. Plans to develop forestry and forest products industries and bagasse utilization are discussed. The supply of industrial roundwood is very low in Cuba, due to a high amount of coppice and poorly tended stands, also a high demand for poles and firewood.

Bueno-Z., J. 1979. Correlation between chlorine factor, kappa index, and lignin residue in sulfate pulp (Correlaciones entre indice de cloro, indice kappa y lignina residual en pulpa quimica al sulfato). Peru: Revista Forestal. 9(2) :59-67.

The linear relations of these three factors are noted for pulp from the wood of 53 Peruvian forest species.

Bueno-Z., J.; Trujillo-G., C. 1980. Sulfate pulp from *Eucalyptus globulus* labill from Cuzco, Cajamarca, and Junin [Peru] (Pulpa qhimica a1 sulfato de Eucalyptus globulus Labill en Cuzco, Cajamarca y Junin). Peru: Revista Forestal. 9(2):139-157.

Compares pulp produced from three regions in Peru, taking into account factors such as break length, burst index, and ease of desalignification.

Busnardo, C.A.; Gonzaga, J.V.; Foelkel, C.E.B.; Vesz, B.V. 1983. In search of ideal quality of eucalypt wood for producing pulp. Proceedings, ABCP 16th annual meeting, 3d Latin American cellulose and paper congress; 1983 November 21-26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry: 55-72.

Describes a study of the basic density of a commercial stand of Eucalyptus saligna, sampling was done at the tree base, breast height, and at 3.5, 14, 25, 50, 75, and 100 percent of the tree height. Best estimates of basic density came from the 25 percent sampling location. The suggestion was made to use trees felled for collection of vegetative material to do the 25 percent of height sampling.

Busnardo, C.A.; Gonzaga, J.V.; Benites, E.P.; Dias, C.; Menochelli, S.; Schmidt, C. 1983. Comparative study of the quality of Eucalyptus saligna wood from Coff's harbour and wood of hybrid origin from Canela, introduced in the Guaiba-RS region. In: Proceedings of the Technical

Association of the Brazilian Pulp and Paper Industry 16th annual meeting/3rd Latin-American Cellulose and Paper Congress; 1983 November 21–26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry: 1073–1091.

Busnardo, C.A.; Gonzaga, J .V.; Foelkel, C.E.B.; Vesz, B.V. 1983. In search of ideal quality of eucalypt wood for producing pulp. (2). Interrelationships between the properties of trees and their woods. In: Proceedings of the Technical Association of the Brazilian Pulp and Paper Industry 16th annual meeting/3rd Latin-American Cellulose and Paper Congress; 1983 November 21–26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry: 31–53.

Describes the use of linear models to predict wood quality (basic density) of Eucalyptus saligna wood based on the following parameters: diameter at breast height (inside and outside bark), and tree height.

Caceres–Rojas, H.; Gonzalez, S.G.; Rangel Murcia, N. 1977. Evaluation of sulfate pulps obtained from new species of the forest area of Caqueta, Colombia. Revista. Ion. 4(14):35–73.

Describes sulphate pulp studies on nine tropical species.

Carderias, P.R. 1978. Practical experiences in the manufacture of pulp with tropical hardwoods (Experiencias practicas en la fabricacion de la pulpa a partir de maderas duras de bosque tropical). In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 5:6114–6127.

Carpim, M.A.; Barrichelo, L.E.G. 1983. Wood density variability in Eucalyptus species. In: Proceedings of the Technical Association of the Brazilian Pulp and Paper Industry 16th annual meeting, 3rd Latin-American cellulose and paper congress; 1983 November 21–26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry: 127–137.

Describes a study of the basic density of *Eucalyptus deanei, E. dunnii, E. grandis,* and *E. saligna* of different growth rates and age, and from different provenances. Radial density variation was determined for *E. grandis* and *E. saligna.* Variation between provenances in density was sufficient to suggest tree improvement studies.

Carpim, M.A.; Barrichelo, L.E.G. 1984. Effect of seed source and diameter class on the characteristics of wood from Eucalyptus grandis. In: Proceedings of the ABCP 16th annual meeting, 3rd Latin American cellulose and paper congress; 1983 November 21–26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry: 411–422.

Samples of wood grown from sesed of three distinct sources exhibited different relationships between wood density and diameter.

Carvalho, O.F. 1979. Microbiological deterioration in Eucalyptus logs, chip piles and pulp. In: Proceedings of the Technical Association of the Brazilian Pulp and Paper Industry; 12th annual meeting (congresso anual) during paper week; 1979 November 26–30; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry: 167–170.

Casals, J.M.; Melo, R. 1969. Pulping the wood of insigne pine by bisulfite of magnesium. Magnefite process (Pulpaje al bisulfito de magnesio de madera de pino insigne. Proceso magnefite). Informe Tecnico. 36. Santiago, Chile: Instituto Forestal: 277–282.

Casessa–A, E. 1980. Anatomical aspects of wood in relation to paper production (Aspectos anatomicos de la madera en relacion con la fabricacion de papel). Tecnologia-en-Marcha. 3(2):33–37.

Groups 13 Costa Rican species into five catagories of paper quality, based upon their Runkel factor values.

Chidester, G.H.; Brown, K.J. 1954. Use of bleached cold soda pulps from certain mixtures of Latin American hardwoods in newsprint. FPL Rep. 2013. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 14 p.

Chidester, G.H.; Schafer, E.R. 1954. Pulping of Latin American woods. FPL Rep. 2012. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 22 p.

Chidester, G.H.; Schafer, E.R. 1961. Pulping and papermaking experiments on certain pines of Mexico and Central America;. FPL Rep. 2217. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 34 p.

Chilean Forestry News. 1988. CMPC goes into partnership to erect a new wood-pulp factory. Santiago, Chile: Chilean Forestry News. 11(121):6.

Chilean Forestry News. 1988. Shell: an important newcomer to Chilean forestry. Santiago, Chile: Chilean Forestry News. 11(121):5.

Chirinos, D.N. 1970. Economic aspects of programs for wood production. Venezuela: Revista Forestal Venezolana. 13(19/20):11–26.

Describes forestry and forest products in Venezuela from a national point of view. Includes information on resource management for sawlogs, and the potential for pulp and paper using plantations.

Contreras, A.H. 1980. Evolution of requirements for forest products in Latin America. Development and investment outlook. Forest Products Journal. 30(10):70-74

Following a summary of relevant FAO statistics it is concluded that there are opportunities for investment in forest industry in Latin America, particularly in the pulp and paper industry. It is suggested that an increase in the involvement of governments in forestry development is necessary.

Correira, A. de A.; Ribeiro, E.B.P.; Luz, C.N.R. 1974. Pulp and paper study of Amazonian forests. 1. Forest along the Manaus-Itacoatiara route. Acta Amazonica. 4(2):23-46.

Reviews the production and consumption of pulp and paper in Brazil, and various trials in using mixed tropical species

as a source of pulpwood. Details are given of an inventory of an area of Amazonian forest near Manaus, showing the amounts of 43 named species present (388 other species present were not considered). Data are given on fibre dimensions and chemical analyses of each of these 43 species, and results are presented from sulphate pulping of these species in individual cooks and in representative mixtures, easy mixtures, and difficult mixtures. The results indicate that the average dry wood density is high (0.94) but that any mixture can be pulped satisfactorily (22 percent NaOH and 2.2 percent S). Estimates are made of the amount of bleached pulp that could be manufactured from this forest resource.

Correa, A. de A.; Luz, C.N.R.; Frazao, F.J.L. 1977. Papermaking characteristics of the bamboos of the State of Acre (Caracteristicas papeleiras dos bambus do estado do Acre). Act a Amazonica. 7(4) :529-550.

Describes the bamboos: *Guadua angustifolia, G. glomerata, G. morim, G. superba,* and *Nastus [Cenchrus] amazonicus* with physical characteristics of the woods and properties of chemical, semichemical, chemimechanical, and mechanical pulps derived from them. These species may be used to make pulp and paper, especially paperboard.

Correa, A. 1983. Pulpwood tree for reforestation. III. *Pinus oocarpa* Shiede introduced into the Amazon region, Brazil (Essencia papeleira de reflorestamento. III. O *Pinus oocarpa* Shiede, introduzido na Amazonia). Acta Amazonica. 13(3/4):547–582.

The pulping characteristics of *Pinus oocarpa* were examined to determine its suitability for future reforestation programs. The chemical analysis of wood samples, density, classification of pulp fibers, pulping assays, testing of bleaching processes, and analysis of physiomechanical properties of pulps are reported. Author concludes that this species produces suitable pulps and should be considered for future Amazon reforestation projects.

Correa, A. 1984. Papermaking study of a mixture of leftover log rolls from plywood plants in the Amazonas State, Brazil. Papel. 45:48–58.

Couto, E.; Repetti, R.; Rique, T. 1980. Red quebracho sapwood–a forestry residue with possibilities of industrial exploitation (Albura de quebracho Colorado, un desecho forestal con posibilidades de aprovechamiento industrial). Buenos Aires, Argentina: Instituto Forestal Nacional. Folleto Tecnico Forestal. 57:13.

Reports data for the period up to 1976/78, on difficulties in Argentina's quebracho tannin extraction industry. The industry, since 1937 has been in a decline in production, due to competitive tanning materials. The suggestion is made to use the sapwood of quebracho *(Schinopsis)* for pulp furnish based on pulping studies with Kraft pulp. Where high physico-mechanical resistance is not required papers may be suitable, and could supply about 15 percent of Argentina's pulpwood requirements.

Cruz, G.C. da; Soares, M.I.; Fulgencio, C.M. 1978. Bibliographical survey on Eucalyptus species, suitable principally for the production of pulp and charcoal (1947–1977) (Levantamento bibliografica sobre especies de eucaliptos, aptas principalamente para producao de celuluse e carvao vegetal (Periodo 1947–1977)). Santa Barbara, Brazil: Companhia Agricola e Florestal. 2 vols.

Cubillos, J. 1978. Practical experiences in pulping tropical hardwoods [from Colombia's Pacific Coast forest]. In: Auchter, R. J. (coordinator): Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 493–500.

D'Adamo, O. 1972. The evolution of the forest products industry in Latin America. World Wood. 13(11):32–34.

A review of the state of the forest products industry (sawn timber, panel products–i.e., plywood and veneer, particleboard and fibreboard–and pulp products) and its development potential.

David–B., E., ed. 1971. A study of the trade and marketing of the forest products of Peru (Estudio de mercado y comercializacion de productos forestales del Peru). La Molina, Peru: Departamento de Industrias Forestales, Universidad Nacional Agraria. 326 p.

Describes data from a comprehensive survey by nine contributors. Part 1: forest resources of Peru; roundwood production, marketing, imports and exports; time and costs in timber extraction operations; the lumber industry, production, prices, transport costs, marketing, imports and exports; the flooring industry; the plywood industry, exports; the particleboard industry; the pulp, paper, and fiberboard industry, production, imports, exports; mining timbers and properties of the woods used; and the matchwood industry. Part 2: a listing of commercial species from Peru by common and scientific names, with data on the physical and mechanical properties, air-drying schedules, natural durability, preservation, nailing properties, suitability for decorative veneers, possibilities for pulping, and extractive contents. Conclusions and recommendations are also provided.

Dias, J.L.F. da S. 1972. Study of the technological characteristics of pulps produced industrially from wood of Eucalypts. Estudos, Ensaios, Documentos, Junta Invest. Ultramar. 128:101.

Fahey, D.J.; Laundrie, J.F. 1978. Market pulp and white papers from mixed tropical hardwoods. In: Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 355–370.

Fairest, R. W. 1964. Pulp for making paper, from three woods typical of the forest of the state of Bolivar (Pulpa para papel a partir de tres maderas tipicas de la selva del estado Bolivar). Venezuela: Revista Forestal. 10/11: 121–141.

FAO. 1955. Pulp and paper prospects in Latin America. Report of the Latin American meeting of experts on the pulp and paper industry; 1954 October 18–November 2; Buenos Aires, Argentina. p. 169–177.

FAO. 1975. Pulping and papermaking properties of fast-growing plantation wood species. FO:MISC/75/31. Rome, Italy: FAO.

FAO. 1977. Projections of demand for paper in Brazil 1975–2000 (Projecoes de demanda de papel no Brasil

1975-2000). FAO Rep. Brasilia, Brazil: Colecao Desenvolvimento e Planej amento Florest al. PNUD/FAO/BRA-76/027, Serie Tecnica. 2:83.

Part 1 contains a description of the procedure adopted in determining the demand projections. Part 2 presents in tables and graphs the statistical data on population growth, etc. on which the demand projections are based, together with the actual estimates of future demand.

Fiano, E.N. 1976. Summary of studies conducted in Argentina on willows and poplars. Investigacion y Tecnica del Papel. 13(50):1073–1085.

Fleming, P.; Melo, R. 1969. Pulping the heartwood of insigne pine with bisulphite of soda (Pulpaje de duramen de pino insigne con bisulfito de sodio). Informe Tecnico No. 36. Santiago, Chile: Instituto Forestal: 295–298.

Foelkel, C.E.B.; Barrichelo, L.E.G.; Molanzez, A.F. 1975. Comparative study of the woods of *Eucalyptus saligna, E. citriodora, E. maculata, E. tereticornis* and *E. paniculata* for production of sulfate pulp. Piricicaba, Brazil. IPEF (Instituto de Pesquisas e Estudos Forestais). Publicao Semestral. 10:17–34.

Describes tests of E. citriodora (7 and 13 year old), *E. maculata* (7 year), *E. paniculata* (6 and 10 year), *E. saligna* (8 and 13 year) and *E. tereticornis* (7 year) from Brazilian plantations. Wood characteristics and properties of unbleached sulphate pulps were studied. For *E. citriodora, E. paniculata,* and *E. maculata. E. paniculata* (10 year) specific gravity was higher, and fibres had thicker walls and were stiffer. *E. saligna* (8 year) gave the highest pulp yields, *E. citriodora* pulps had the highest tearing strength, while pulps of *E. saligna* (8 year), *E. tereticornis* (7 year) and *E. maculata* (7 year) had better burst and tensile strengths. Denser sheets were obtained from *E. maculata, E. saligna,* and *E. tereticornis.* Pulp blending studies are advocated.

Foelkel, C.E.B.; Barrichelo, L.E. 1976. Evaluation of the wood of Joannesia princeps for production of paper pulp (Avaliacao de madeira Joannesia princeps para producao de celulose para papel). Brasil Florestal. 7(25):24–34.

Foelkel, C.E.B.; Busnardo, C.A.; Zvinakevicius, C.; Borssatto, M. de F.B. 1981. In search of ideal quality of eucalypt wood for producing pulp. (1). Tropical eucalypts. Papel. 42:52–56.

Describes the Kraft pulping of 13 Eucalyptus species and their physical, chemical, and anatomical properties. Best pulp production results from woods with high basic density, thick cell walls, long fibers, high proportions of long and thick-walled fibers, and low lignin content.

Foelkel, C.E.B.; Zvinakevicius, C. 1980. Hardwood pulping in Brazil. Tappi. 63(3):39–42.

Describes wood and fiber properties, pulping and bleaching techniques, and qualities of pulps made. The species used are *Eucalyptus* spp. and Gmelina arborea.

Fuller, W.S.; Fussell, O.; King, R.E.; Nordquist, H. 1974. Alkaline pulping conference; 1974 Sept. 16–18; Seattle, WA.. Atlanta, GA: TAPPI: 207 p.

A collection of 27 individual papers, including: Extracting bark and dirt from forest residual chips (W.S. Fuller); Factors to consider in handling and pulping whole-tree chips (O. Fussell); New drumbarker design for small diameter pulpwood and sawlogs (R.E. King); Efficient extraction of large diameter bolts from drumbarker and chipping line (H. Nordquist); Whole-tree chips as a source of papermaking fiber (L.N. Powell; J.D. Shoemaker; R. Lazar; R.G. Barker); Pulping characteristics of Douglas Fir sawdusts (W. J. Bublitz; T.Y. Yang); and Evaluation of NSSC and kraft pulping of Ecuadorian hardwoods for corrugating medium (E.S. Becker; H.G. Caldwell) [all eight samples of Ecuador hardwoods evaluated proved suitable for the production of corrugating medium, except for mangrove].

Gallo Neto, C. 1979. The use of Eucalyptus pulp for packaging papers and boards in Brazil. In: Haas, L.E., ed. Proceedings of the symposium on new pulps for the paper industry; 1979 May; Brussels, Belgium. San Francisco, CA: Miller Freeman Publications.

Gomez, G. 1978. Case history of a South American papermill (Carton de Colombia). Unasylva. 30(122):7–13.

Gomez, C.H.; Mondragon, I. 1974. The pulping of tropical hardwoods for linerboard. Tappi. 57(5):140–142.

Describes laboratory studies and mill trials in Colombia in which the contribution of tropical hardwoods to the furnish for corrugated board was increased from 40 percent to 80 percent. Manufacturing characteristics and tear properties were maintained although there was some loss of burst strength and related properties. Further trials to improve these factors are planned.

Gomide, J.L.; Kutsha, N.P.; Shottafer, J.E.; Zabel, L.W. 1972. Kraft pulping and fiber characteristics of five Brazilian woods. Wood and Fiber. 4(3):158–169.

Describes the pulping properties of *Annona sericea, Luehea divaricata, Piptadenia rigida,* and *P. communis,* using the kraft process. *Eucalyptus saligna* pulp was used for comparison. Good pulp quality was achieved from all species, but correlations between fiber characteristics and pulp quality were poor. *A. sericea* wood is anatomically described for the first time.

Gomide, J.L.; Vital, B.R.; Ribeiro, A.C. 1975. Forest tree species of the Zona da Mata as a source of pulp. Revista Ceres. 22(119):74–79.

Describes the chemical properties and specific gravity for 20 of the most common woods from the Zona da Mata, Minas Gerais. Data were determined from wood samples of two trees per species. Tabulated results are discussed, with recommendations for further studies on the pulping of selected species having good technical characteristics and sufficient volumes, e.g. Annona sericea, *Apuleia leiocarpa, Cassia verrucosa, Mabea fistulifera, Piptadenia colubrina, P. communis,* and *Tapirira peckoltiana.*

Goncalez, J.C.; Gomide, J.L.; Vital, B.R. 1986. Technical evaluation of kraft pulps produced from *Eucalyptus grandis* wood grown from sprouts (Estudos technologicos da madeira de brotacoes de *Eucalyptus grandis* para producao de celulose kraft). Revista Arvore. 10(1):1–15.

Gonzaga, J.V.; Busnardo, C.A.; Dias, C.; Menochelli, S.; Foelkel, C.E.B. 1983. Characterization

of the quality of wood from Eucalyptus viminalis introduced in the Guaiba–RS region. In: Proceedings of the Technical Association of the Brazilian Pulp and Paper Industry 16th annual meeting, 3rd Latin–American Cellulose and Paper Congress; 1983 Nov. 21–26; Sao Paulo, Brazil: 1053–1071.

A study of an experimental stand of E. viminalis, planted in the Guaiba-Rio Grande do Sul region of Brazil with seed from Canela, sampled four representative trees at the base, breast height, and at 25, 50, 75, and 100 percent of the tree height. Amounts of bark, heartwood, and sapwood were determined, as were their basic densities and axial and radial variations. Data are presented on the chemical and anatomical characteristics of fibers and vessel elements. E. viminalis was shown to be inferior to other species of Eucalyptus normally used in the pulp industry. A case for improvement of the species is made.

Gonzaga, J.V.; Foelkel, C.E.B.; Busnardo, C.A.; Gomide, J.L; Schmid, T.C. 1983. Quality of wood and bleached kraft pulp from thirteen eucalyptus species. In: Proceedings of the ABCP 16th annual meeting, 3d Latin American cellulose and paper congress; 1983 November 21–26; Sao Paulo, Brazil. Technical Association of the Brazilian Pulp and Paper Industry: 7–29.

Describes a study of the wood and pulp properties of young (4 1/2 year-old) samples of *Eucalyptus andrewsii, E. camaldulensis, E. cloeziana, E. deanei, E. grandis, E. microcorys, E. pellita, E. pilularis, E. propinqua, E. quadrangulata, E. saligna, E. tereticornis,* and *E. urophylla.* All the species were grown in Minas Gervais, Brazil. The study showed that *E. grandis* and *E. saligna* were best for pulping because of their higher average biomass production and lower bark content. *E. andrewsii, E. microcorys, E. pellita, E. pilularis,* and *E. quadrangulata* also were indicated to be good for pulp.

Goto, T.; Furuno, T. 1974. Bibliography of publication[s] on tropical woods I. Wood qualities and utilization. Res. Rep. of Foreign Wood, Japan: Shimane University. 3:1–37.

A bibliography arranged in sections including information on pulping. Within each section the references are cited chronologically in two groups: references to world literature and Japanese literature.

Grant, J. 1971. Practical experiences in the use of mixed tropical hardwoods for the production of pulp and paper. Vienna, Austria: United Nations Industrial Development Organization, ID/WG.102/17: 39 p.

Describes the use of mixed tropical woods for pulp and paper, presenting information on the forests and their diversity, wood properties of some tropical hardwoods, pulping methods used, uses of the pulps, and other data.

Guth, E. 1968. Variation of the length of fibers in timber of Pinus elliottii (Variacion del largo de fibra en el leno de Pinus elliottii). Buenos Aires, Argentina: Informativo de Investigaciones Agricolas, Centro de Investigaciones y Experiencias Forestales. Suplemento Forestales. 5:31.

Guth, E. B. de. 1983. Variation in wood density of *Pinus elliottii* in relation to locality in Misiones and Corrientes provinces (Variacion de densidad en *P. elliottii* segun localidad de implantacion en las provincias de Misiones y Corrientes). In: Technical workshop of the 19th technical congress on pulp and paper Trabajos Tecnicos, 19deg Congreso Tecnico sobre Celulosa y Papel. Buenos Aires, Argentina: ATIPCA. 1:79–91

Describes a study of Pinus elliottii grown at 13 locations in Argentina. Evaluations of basic density were made on 7 to 12 year-old trees. Significant differences in density were noted between locations. The better sites yielded 6 t/ha in 10 years. Recommendations for selection to improve yield are made. Yields of alcohol-benzene extractives are also noted.

Guth, E.B. de. 1984. Laboratory evaluation of the suitability of six Eucalyptus species for paper manufacture (Evaluacion en laboratorio de la calidid papelera de seis especies de eucaliptus). Revista ATIPCA (Associacion de Tecnicos de la Industria Papelera y Celulosica Argentina). 23(1):55–59.

Describes the study of the wood of six eucalypts for use in paper manufacture. Tests included alcohol-benzene extractives content, wood density, fibre morphology, and general paper quality. The materials tested were from 11-year-old *Eucalyptus angophoroides, E. fastigata, E. globulus, E. nitens, E. regnans,* and *E. saligna* from Buenos Aires province, Argentina. The most promising species were *E. regnans, E. fastigata,* and *E. nitens.*

Guth, E.B. de; Ragonese, A.E. 1980. Evaluation of the characteristics of the timber in relation to the quality of the paper of some willow hybrids obtained in Castelar (Evaluacion de las caracteristicas del leno en relacion a la calidad del papel de algunos hibridos de sauces obtenidos en Castelar). IDIA (Informativo de Investigaciones Agricolas). Buenos Aires, Argentina: 393/394:25–30.

Describes an evaluation of six clones of *Salix babylonica* X *S. alba* and one clone of *S. babylonica* X *S. humboldtiana* compared with *Salix* spp. of known paper-producing qualities. Relationships were positive between wood density and fiber length (r=0.92), wood density and fiber length/diam. ratio (r=0.78), and between paper quality and fiber length. Paper quality and fiber diameter or wood density showed no relationship.

Haage, S. 1983. Forestry in Brazil: the Jari project. Raw Materials Report. 2(1):39–42.

For centuries the Amazon–the largest area of virgin forest in the world—has attracted foreign exploiters. The latest example is the so called Jari project, initiated by the American shipping magnate D.K. Ludwig, reportedly the richest man in the world. In 1967 he purchased an area as large as Northern Ireland in order to manufacture pulp for the world market. However, it proved considerably more difficult than he had calculated to construct a profitable forest industry in the jungle. The Jari project became a losing project and in early 1983 Ludwig had to withdraw. Today the plant has Brazilian owners supported by the Brazilian government, which had to step in to keep the project going.

Haas, L.E. 1979. New pulps for the paper industry. In: Proceedings of the symposium on new pulps for the paper industry; 1979 May; Brussels, Belgium.

Harzmann, L.J. 1979. The development of wood properties in fast-growing tropical broadleaves (Zur

Entwicklung von Holzeigenschaften bei raschwachsenden tropischen Laubholzarten). Beitrage fur die Forstwirtschaft. 13(3):123–125.

Describes research on the effects of short-rotation forestry, with fast-growing tropical timbers, on timber quality. Information is given on juvenile wood which is usually less dense and has shorter fibers than mature wood; the effects of these properties on lumber, veneer, pulp, and board properties are discussed.

Higgins, H G. 1973. Pulping of tropical hardwoods; individual and mixed species, wood and paper properties, resource assessment. Tech. Pap. 70. Melbourne, Australia: Commonwealth Scientific and Industrial Research Organization, Forest Products Laboratory: 21–22.

Horiike, K. 1977. Chemical properties of tropical woods. In: More effective use of tropical woods. Mokuzai Kogyo. 32(11):41-46.

A review article describing chemical composition and pulping properties, health hazards to machinists, the effect of wood extractives on the hardening of paints and cement, and staining, discoloration, and odor characteristics.

Hunter, D. 1978. Papermaking: The history and techniques of an ancient craft. New York: Dover Publications.

INFOR–CORFO. 1987. Availability of the wood of radiata pine in Chile (Disponibilidad de madera de pino radiata en Chile). Santiago, Chile: INFOR–CORFO (Instituto Forestal) (Corporacion de Fomento de la Produccion). Informe Tecnico. 103: 54 p.

INFOR–CORFO. 1988. Chilean forest exports (January–December 1987) Exportaciones forestales Chilenas (Enero–Diciembre 1987). Santiago, Chile: INFOR–CORFO (Instituto Forestal–Corporacion de Fomento de la Produccion. Boletin Estadistico. 5: 16 1.

Describes the exports of wood products from Chile in 1987. Product categories include raw, bleached, and semi-bleached pulp, sawn wood, logs, newsprint, peeled poles, secondary products, and fiberboard. Data include volumes by species, product, month, and region.

INFOR–CORFO. 1988. Operation and capital costs of forestry activities in Chile 1987. Costos operacionales y de capital de las actividades forestales en Chile 1987). Santiago, Chile: INFOR–CORFO (Instituto Forestal–Corporacion de Fomento de la Produccion. Informe Tecnico. 113:81.

Describes the operation and costs associated with plantations, timber harvest, fabrication of panel products, and pulp and paper.

Inoue, H.; Moriya, M.; Akiyama, T. 1982. Bleached kraft pulps from Costa Rican woods. Japan Tappi. 26(6):256–262.

Describes studies of the morphology, fibre and vessel dimensions, chemical characteristics, kraft pulping characteristics, and characteristics of bleached pulps of 24 Central American woods.

Janssonius, H.H. 1929. On the suitability of certain Euphorbiaceous woods for paper pulp. Tropical Woods. 18:1-3.

Members of the Euphorbiaceae are widely distributed throughout the tropics of Latin America. Though they are not of any value for their timber, they show great promise for use as pulp.

Kayama, T. 1972. Practical experiences in the use of mixed tropical hardwoods for production of pulp and paper. Japan Tappi. 26(6):300–307.

Describes the use of nearly 100 tropical hardwood species for pulping and papermaking.

Kayama, T. 1979. Pulping and papermaking properties and wood properties of tropical hardwoods. In: Tamolang, F.N., ed. Wood quality and utilization of tropical species. Proceedings, International Union of Forestry Research Organizations (IUFRO) conference; 1978 October 30–November 3; College, Laguna, Philippines. Laguna, Philippines: FORPRIDECOM: 197–209.

Describes pulping trials with 60 species of tropcial woods. Relationships between chemical properties of the wood and pulping and morphological characters and paper properties are discussed.

Keller, E.L.; Kingsbury, R.M.; Fahey, D.J. 1958. NSSC pulping of guaba, yagrumo hembra, and eucalyptus from Puerto Rico. FPL Rep. 2127. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 7 p.

Koning, J.W. Jr.; Laundrie, J.F.; Fahey, D.J.; Bormett, D. 1978. Linerboard, corrugating medium, and corrugated containers from mixed tropical hardwoods. In: Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 371–386.

Kubes, G.J.; Garner, BE.; Bolker, H.I. 1978. Bleached kraft pulp from mixed hardwoods from Ivory Coast forests. In: Auchter, R. J., coordinator. Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26; Madison, WI. Madison, WI : U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 279–294.

Data are presented on kappa number, viscosity, total yield, breaking length, burst index, and tear index of bleached kraft pulps from a mixture of 77 hardwood species. Under optimum conditions in the laboratory good quality pulp was obtained.

Kyrklund, B. 1978. Use of mixed tropical hardwoods for pulp manufacture. In: Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 308–312.

Lacerda, L.D. de 1981. Mangrove wood pulp, an alternative food source for the tree-crab *Aratus pisonii.* Biotropica. 13(4):317.

Describes the feeding of the tree-crab *(Aratus pisonii)* on three mangrove species *(Rhizophora mangle, Avicennia ger*minans, and *Laguncularia* racemosa) in Brazil.

Laundrie, J.F. 1978. Kraft and NSSC pulping of mixed tropical hardwoods. In: Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26;

Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 332–354.

Laundrie, J.F. 1977. Exploratory kraft and NSSC pulping and production of a bleached market-grade kraft pulp from Colombian hardwood mixtures. Rep. 8. Agency for International Development. 17 p.

Quality of kraft pulps made from 3 mixtures of 17 Colombian hardwood species was equal to or better than that from N. American hardwoods. Using a high-yield kraft process it was feasible to produce 25 to 30 percent screenings for making corrugating medium and screened pulp for linerboard. NSSC pulps made from all 3 mixtures were suitable for corrugating medium.

Lehmann, H.R. 1983. Panorama of the forestry situation in Misiones. Argentina: ATIPCA, Asociacion de Tecnicos de la Industria Papelera y Celulosica Argentina. 22(4): 51–54.

Describes the forest industry in the Province of Misiones, Argentina. Economics and problems of production and relevant factors that effect production are discussed. Crop and trees species are listed and forecasts provided as to supply and demand for pulp and paper resource materials.

Lonnberg, B. 1979. Wood quality aspects of tropical hardwoods used for pulp and paper. In: Tamolang, F.N., ed. Wood quality and utilization of tropical species. Proceedings, International Union of Forestry Research Organizations (IUFRO) conference; 1978 October 30–November 3; College, Laguna, Philippines. Laguna, Philippines: FORPRIDECOM: 189-196.

Describes pulping trials of about 20 tropical hardwoods, as well as, other hardwoods and softwoods. Study results indicate that suitability can be assessed from wood density, lignin content, and fiber length.

Losoda, O.; Baisi, A.A.I.; Kuhl, L.G.; Kleiman, R.C. 1973. Salicaceae: an Argentine experiment for the newsprint industry. ATIPCA (Asociacion de Tecnicos de la Industria Papelera y Celulosica Argentina). 12(5):24–47.

Describes laboratory and pilot-plant experiments with stone- groundwood and chemi-mechanical pulps made from different species of Salicaceae. The work was done to predict the capacity of Argentinian forests to meet pulpwood quantity and quality demands for newsprint manufacture.

Mainieri, C, ed. 1978. Notes on characteristics of Brazilian woods (Fichas de caracteristicas das madeiras brasileiras). Instituto de Pesquisas Tecnologicas. Publicacao: 966.

Loose-leaf notes published from 1971 and 1978, giving a description of 120 species noting species distribution, general appearance of the wood, anatomy, natural durability, preservative treatment, pulping properties, extractives, physical and mechanical properties, and uses. Species are listed by scientific and common names.

Mason, D.U. 1977. Tough skin sells Brazil mill's plywood. World Wood. 18(7):13–14.

A brief account of the production of plywood with a 1-mm facing of impregnated kraft paper. It is used mainly for concrete formwork, and up to 60 re-uses are claimed.

Matsuno, H.; Akino, S. 1972. Kraft pulping of some species in Guatemala. Japan Tappi. 26(6):308–313.

Abies guatemalensis, Pinus ayacahuite, and *P. rudis* were used to produce bleached Kraft pulps. Compared to Japanese pine pulps, the pulps had somewhat higher burst factor and percent elongation but slightly lower tear resistance and ring crush factor. Pulps from *Alnus ovalifolia* and *Quercus candicans* had strength properties nearly equal or slightly inferior to those of typical Japanese hardwood pulps.

Maydell, H.J. von. 1974. Grading of tropical timbers. (Die Sortierung von Tropenholz). Holz als Roh- und Werkstoff. 32(1):30–34.

Discusses the complex existing regional and national grading rules, the differing requirements for internal and external markets, and the requirements for roundwood, sawn timber, and wood-based materials (veneers, plywood, pulping chips, fiberboard, particleboard). Some suggestions are made on the grading of tropical timbers, and it is pointed out that grading is only worth while if the value of the products is increased sufficiently to cover the costs involved.

McGaughey, S.E.; Gregersen, H.M., eds. 1983. Forest-based development in Latin America. In: Proceedings of a regional conference sponsored by the Inter-American Development Bank; 1982 June 22–25; Washington, DC. 215 p.

The purpose of this book is to explore the prospects for accelerating the economic development of forestry and forest industry in Latin America, including the Caribbean subregion, in member countries of the Inter-American Development Bank (IDB). The book's central theme is to ascertain the many future opportunities as well as factors that will limit or stimulate the growth of public and private sector investments in the forest-based sector in years ahead. The sector is viewed in broad terms to encompass activities from forest management and timber extraction through the stages of primary processing, including energy, sawnwood, wood panels, and pulp and paper production. It also incorporates social and protection forestry such as watershed management and resource preservation.

Melo, C.F.M. de; Alves, S. de. 1974. Papermaking potential of some species from the Amazon region. Boletim Technico do IPEAN (Instituto de Pesquisas do Experimentacao Agropecuario do Nordeste). 63:35–79.

Describes seven Amazonian hardwoods from Brazil that were evaluated for pulp and papermaking. They included *Allantoma lineata, Carapa guianensis, Ochroma lagopus,* and *Schizolobium amazonicum,* which could be used singly or in mixture, and *Micropholis guianensis, Symphonia globulifera,* and *Syzygiopsis oppositifolia,* which are suitable for use only in mixture.

Melo, C.F.M.de; Huhn, S. 1974. Bleached pulps of woods from Amazonia. Boletim Tecnico do IPEAN (Instituto de Pesquisas do Experimentacao Agropecuario do Nordeste). 61:l–23.

Describes a study of the suitability of *Croton matourensis, Eschweilera odora, Jacaranda copaia, Parahancornia amapa, Pentaclethra macroloba,* and *Virola surinamensis* as raw materials for the production of bleached pulps and papers. Using similar bleaching conditions, the woods of

V. surinamensis and *J. copaia* showed the most promise because of their strength properties (bursting strength, breaking length, and resistance to tear and folding). Data are presented in both tabular and graphic form.

Melo–S., R.; Paz, J. 1980. Bleaching capacity of eucalypts grown in Chile. Investigacion y Tecnica del Papel. 17(63):62–73.

Describes pulping tests of 7 eucalypts, ranging in age from 11 to 15 years. The physical and chemical properties were compared to pulps made using the Kraft process using a CEDED sequence and subsequent bleaching. The species tested were: *Eucalyptus bicostata [E. globulus bicostata], E. delegatensis, E. globulus, E. grandis, E. maidenii, E. obliqua,* and *E. regnans.* Wood density differences did not significantly affect pulp yield.

Melo–S., R.; Madsen, P.E. 1966. Pulps from sawmill waste and thinnings. Tappi. 49(9):54A–55A.

Misra, N.D. 1973. A method for grading tropical hardwood. Pulp and Paper International. 15(6):48–49.

Describes and proposes a method for grading the suitability of tropical hardwoods for pulping, and gives tabulated data obtained by applying it to 18 hardwoods, bamboo *(Dendrocalamus strictus),* and kenaf *(Hisbiscus cannabinus).*

Molina–C., E.; Bueno–Z., J. 1979. Sulfate pulp from seven mixtures of 39 woods from Iquitos [Peru] (Pulpa al sulfato de mezclas de 39 maderas de la zona de Iquitos). Revista Forstal del Peru. 9(2):26–37.

Moreno, L.; Melo–S., R. 1969. Pulping the wood of insigne pine by means of the acid-neutral process. Concepcion, Chile: Facultad de Ingenieria, Universidad de Concepcion. M.S. thesis.

Muner, T.S.; Barrichelo, L.E.G. 1983. Effect of thinning on the quality of wood from *Pinus taeda* used for producing kraft pulp. In: Proceedings, 16th annual ABCP Meeting, 3rd Latin American cellulose and paper congress; 1983 November 21–26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry (ABCP): 93–112.

Describes the effects of three different thinning intensities on the wood of 17 year-old Pinus taeda grown in Brazil. Stands were thinned to 25, 50, and 75 percent of original. Two years after thinning 80 trees were sampled. Data show that wood formed after thinning had higher lignin content, lumen diameter, and ring width, and lower basic density. Alcohol/benzene and warm water extractives tended to increase, while holocellulose, pulp yield, kappa number, and viscosity tended to decrease. Pulps produced from the wood formed after thinning had better tensile strength, specific weight, and porosity, but poorer tear strength.

Mussi, F.; Mussi, F.H.; Castano, A.D. 1977. History of paper: homage to the centennial of paper manufacturing in Argentina. Trabajos Tec. 13th Congreso Tecnico sobre Celulosa y Papel, Buenos Aires, Argentina. Associacion de Tecnicos de la Industria Papelera y Celulosica Argentina: 1–18.

Nikles, D.G.; Burley, J.; Barnes, R.D., eds. 1978. Progress and problems of genetic improvement of tropical forest trees. In: Proceedings of a joint workshop; IUFRO working parties S2.02-08 and S2.03-01; 1977; Brisbane, Queensland, Australia. Oxford, UK: Commonwealth Forestry Institute. 2 vols., 1,066 p.

Proceedings of a joint workshop held in Brisbane, Queensland, Australia, April 4–7, 1977 by IUFRO working parties S2.02-08 (Tropical species provenances) and S2.03-01 (Breeding tropical species). The 110 papers covered five topics: 1. Wood quality of tropical species in relation to provenance and tree breeding; 2. Pulp, paper, and timber properties of plantation-grown tropical pines; 3. Selection and genetics; 4. Population-environment interactions; and 5. Provenance trials and breeding programs.

Nock, H.P. 1979. Brazil's paper and cellulose program. (Brasiliens Papier- und Zellstoffprogramm). State Tech. Sch., Hamburg, German Federal Republic. Allgemeine Forstzeitschrift. 29:800–803.

Describes the National Paper and Cellulose Program that is designed to develop self-sufficiency in paper manufacture for Brazil and produce a favorable balance of trade in pulp and paper. The author predicts an annual pulp production increase from 0.4 million t in 1977 to 3.0 million t in 1982. Dependence on foreign investment and large-scale afforestation schemes (in Eucalyptus and Pinus spp.) is required to accomplish the goals. The greatest growth is expected in bleached sulphate pulp derived from Eucalyptus plantations in southeastern Brazil.

Pacini, P. 1978. Kraft pulping of Brazilian eucalypt Papel. 39:35–40.

Describes the pulping of eucalyptus species in Brazil, noting optimum chip dimensions and cooking conditions. Problems with bark and extractives are discussed. Data on the kraft pulping of Eucalyptus saligna showed that delignification was relatively easy due to its low lignin content.

Palmer, E.R. 1974. Pulping characteristics of *Gmelina arborea* and *Bursea simaruba* from Belize. Rep. L 36. London, United Kingdom: Tropical Products Institute. 27 p.

Describes the chemical composition, fiber dimensions, and pulping characteristics of 5 trees each of *G. arborea* and *B. simaruba* (8 to 9 year). Both species were easily pulped by the sulphate process, and yields were similar to those for US southern hardwoods pulped under the same conditions. The strength characteristics of the unbleached pulps showed that *G. arborea* yield stronger pulps than *B. simaruba* and that both yielded denser pulps, with better bonding but poorer tearing strength, than US southern hardwoods. Pulps of both species could be bleached by a 4-stage sequence of chlorination, alkali extraction, hypochlorite, and chlorine dioxide to a good brightness. The bleached pulps had strength characteristics similar to those of a commercial birch pulp. Both species yielded bleached pulps satisfactory for writing and printing papers and also unbleached pulps suitable for the manufacture of packaging materials, except where a high tearing strength is required. G. arborea is preferred for its higher growth rate, higher density, greater yield of pulp, and better pulp strength characteristics.

Palmer, E.R. 1978. Investigations at Tropical Products Institute of fibrous materials for use in pulp and papermaking. In: Auchter, R. J., coordinator. Proceedings of conference on improved utilization of tropical forests;

1978 May 21–26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 413–425.

A review is presented of work carried out at the Tropical Products Institute on: the evaluation of plantation-grown coniferous species, plantation-grown hardwoods, and potential seed trees. A bibliography of recent TPI publications is included.

Palmer, E.R.; Gibbs, J.A. 1973. Pulping characteristics of three trees of *Pinus caribaea* with different densities grown in Jamaica. Indian Pulp and Paper. 28(4/6): 25–30/6–14.

Palmer, E.R.; Gibbs, J.A. 1973. Pulping characteristics of three trees of *Pinus caribaea* with different densities grown in Jamaica. Rep. L 30. London, United Kingdom: Tropical Products Institute. 24 p.

Three 10-year-old trees of *P. caribaea* var. *hondurensis* with wood densities of 325, 390, and 480 kg/m^3 were pulped under two alkali conditions (17.5 and 20 percent), resulting in increased sulphate pulp yield, and decreased breaking length and bursting strength, with increasing wood density. Pulp Kappa numbers from the medium-density tree were higher than those of the pulps from the trees with higher density. No firm conclusions can be drawn from the small test as to the potential value of such material for pulpwood, but it seems that a pulp approaching the strength characteristics of Southern Pine pulp could be made.

Palmer, E.R.; Gibbs, J.A. 1975. The pulping characteristics of two samples of *Pinus caribaea* var. *caribaea* from Cuba. Rep. L–41. London, United Kingdom: Tropical Products Institute. 25 p.

Describes studies on the sulphate pulping of *Pinus caribaea* var. *caribaea.* Ten samples each were used from a natural forest about 20 years and a plantation of 12 years. Extreme variability in density was noted within and between trees. Mean density was 607 kg/m^3 for the natural stand and 433 kg/m3 for the plantation. The natural stand had longer and narrower fibers with thicker cell walls than those of the plantation. Cooking by the sulphate process was slightly more difficult for the natural material than for plantation wood and produced a bulkier pulp with higher tearing strength and lower bonding properties. Both samples yielded less unbleached and bleached pulp, with lower strength values than established coniferous pulpwoods. The samples of *P. caribaea* var. *caribaea* tested were not very promising as pulpwood.

Palmer, E.R.; Gibbs, J.A. 1976. Pulping characteristics of Pinus caribaea from Belize. Rep. L–43. London, United Kingdom: Tropical Products Institute. 43 p.

Palmer, E.R.; Gibbs, J.A. 1976. Pulping characteristics of Pinus oocarpa grown on Mountain Pine Ridge, Belize. Rep. L–44. London, United Kingdom: Tropical Products Institute. 21 p.

Palmer, E.R.; Gibbs, J.A. 1978. Pulping characteristics of six hardwoods from Guyana. Rep. L 50. London, United Kingdom: Tropical Products Institute. 43 p.

Catostemma spp., *Eperua falcata, Eschweilera sagotiana, Licania venosa,* Mora excelsa, and *Pentaclethra macroloba* were pulped separately by the sulphate process, and mixed in different proportions. At kappa number 18, pulp yields were about 43 percent. Pulps were bulky, and had poor bonding strength. Tearing strength was comparable with or better than that from commercially used hardwoods. Bleaching (CEHD) produced pulps with brightness of about 80 percent. Bleached pulps had strength characteristics similar to unbleached pulps. Limited trials with NSSC pulping yielded 70 percent with very poor strength properties. Data on bark/wood ratios, density, chemical composition, and fiber dimensions are shown.

Palmer, E.R.; Gibbs, J.A. 1978. Pulping characteristics of *Dicymbe altsoni* from Guyana. Rep. L 51. London, United Kingdom: Tropical Products Institute. 8 p.

Describes pulping results from one tree of *D. altsoni.* The kraft pulp yield was 48.1 percent (kappa number 33.1) to 44.3 percent (kappa number 22.9). Bleaching (CEHD) produced pulp with a brightness of 83 percent. Data on bark content, wood density, chemical analyses, and fiber dimensions are presented.

Paula, J.E. de. 1977. Anatomy of woods from Amazonia with a view to pulp and paper (Anatomia de madeiras da Amazonia com vistas a polpa e papel). Acta Amazonica. 7(2):273–288.

Describes the morphology (fibre length, wall thickness, diameter, and Runkel ratio) of the wood of 20 species. Seventeen species were found to be suitable for papermaking.

Paula, J.E. de. 1980. Amazonian timbers in relation to their use for pulp and paper (Estudo de madeiras da Amazonia visando o seu aproveitamento para polpa e papel). Brasil Florestal. 10(42):25, 35–52.

Describes the physical and anatomical properties of 41 Brazilian woods for their pulp and paper potential. Among the species examined are: *Cassia grandis, Cassia reticulata, Cordia goeldiana, Erism a bicolor, Goupia glabra, Parkia ulei, Protium araguense, Schizolobium amazonicum, Simaba cedron, Virola duckei, Virola flexuosa, Vochysia mariziana, Virola multicostata, Virola multinervia, Virola oleifera, Virola surinamensis.*

Paula, J.E. de. 1981. Internal structure of 16 species of the flora of Brazil in relation to their possible use for alcohol, charcoal, coke, and paper production (Estudo das estruturas internas das madeiras de dezesseis especies da flora brasileira, visando seu approveitamento para producao de alcool, carvao, coque e papel). Brasil Florestal. 11(47):23–50.

Describes the wood of 16 Brazilian species including: *Apuleia leiocarpa, Apuleia molaris, Caesalpinia ferrea, Callisthene major, Calophyllum brasiliense, Copaifera langsdorfii, Cordia goeldiana, Maprounea guyanensis, Mimosa artemisiana, Piptadenia macrocarpa, Qualea paraensis, Spondias lutea, Tapirira guianensis, Virola multinervia, Vochysia pyramidalis, Xylopia emarginata.* The use of these woods for alcohol, charcoal, coke, and paper is discussed.

Paz, J.; Rueda, F. 1981. Effect of the addition of anthroquinone in the soda and kraft processes, using insigne pine wood (Efecto de la adicion de antraqinona en procesos a la soda y kraft, usando madera de pino insigne). Torremolino, Spain: 2d Congreso Latinoamericano de Celulosa y Papel: 2:83–95.

Pereira, A.P.; Melo, C.F.M. de; Alves, S. de M. 1982. Schizolobium amazonicum: general characteristics of the species and its suitability for use in pulp and paper manufacture (O parica *(Schizolobium amazonicum),* characteristicas gerias da especie e suas possibilidades de aproveitamento na industria de celulose e papel). In: Proceedings of the national conference on native species, Campos do Jordao; 1982 September 12–18; Sao Paulo, Brazil. Silvicultura em Sao Paulo. 16A(2):1340–1344.

Pereira, J.C.D.; Barrichelo, L.E.G.; Couto, H.T.Z. do; Jankowsky, I.P.; Timoni, J.L. 1983. Effect of growth rate on the density of wood from *Pinus elliottii* var. *elliottii.* In: Proceedings of the Technical Association of the Brazilian Pulp and Paper Industry (ABCP) 16th annual meeting, 3rd Latin-American Cellulose and Paper Congress; 1983 November 21–26, 1983; Sao Paulo, Brazil: 139–146.

Describes a wood density evaluation of 15 year-old Pinus elliottii trees grown in Brazil. Cross sections taken at breast height were sampled from 24 trees of differing heights and diameters. Through multiple regression, basic density was correlated to both tree height and diameter at breast height.

Perez–Olvera, C. de la P. 1974. Wood anatomy of five species of oak from Durango. Mexico, D.F.: Instituto Nacional de Investigaciones Forestales, Boletin Tecnico. 43:35.

Describes the macroscopic characteristics of *Quercus crassifolia, Q. convallata, Q. obtusata, Q. potosina,* and *Q. sideroxyla.* The locality of collection is for each wood, anatomical characteristics are described, tabulated, and illustrated by photomicrographs, and the general appearance and density of the woods are listed. The suitability of the five species for various purposes, including pulp are discussed. Recommendations include a forest inventory and habitat description of the Oaks of Mexico, as well as basic studies of wood anatomy for each species.

Petroff, G. 1978. Tropical hardwood pulps. In: Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 427–450.

A review of research conducted at the Centre Technique Forestier Tropical on general characteristics of tropical woods; pulping of mixtures; kraft pulping of woods from 9 different forests in the Ivory Coast, Gabon, Cameroon, Guyana, Indonesia, Ecuador, Colombia, Surinam, and New Guinea; and semi-chemical and mechanical pulping for the manufacture of corrugated paper. Some results of industrial-scale tests are given.

Petroff, G.; Doat, J.; Tissot, M. 1977. Experimental use of tropical woods for the manufacture of corrugated board. Mixed forest–*Gmelina arborea–Eucalyptus* (Essais d'utilisation de bois tropicaux pour la fabrication de carton ondul). Nogent-sur-Marne, France: Centre Technique Forestier Tropical: 90.

Corrugating board was made from five different species or mixtures: *G. arborea; E. tereticornis* 12 ABL X *E. saligna;* an all-species mixture from the forest of Kango, Gabon, mean oven-dry relative density 0.57 (range 0.25-1.1); a similar mixture with a higher proportion of hard, dense species, mean 0.72; and a similar mixture without the hard dense species, mean 0.52. Laboratory and commercial sulphite pulping trials are described, and laboratory-scale paperboard manufacture and corrugating trials. All the pulps gave apparently satisfactory board, but the Eucalypt pulp and the light-weight mixture were difficult to corrugate. The heavy mixture, which was the least satisfactory for pulping, gave a board which was exceptionally good for corrugating. Theoretical considerations, including fiber length, have not been able to explain these results.

Porres, C.; Valladares, J. 1979. Production of pulp and paper with native Central American raw materials. 1. Production of pulp with 17 tropical woods from El Peten, Guatemala, employing the "kraft" and "sulfate" processes (Produccion de pulpa y papel con materias primas autoctonas centroamericanas. 1. Produccion de pulpa con 17 maderas tropicales de el peten, guatemala, empleando el proceso "kraft" o "a1 sulfato"). Division de Investigacion Aplicada, Instituto Centroamericano de Investigacion y Tecnologia Industrial (ICAITI). Guatemala City, Guatemala. 28 p.

Rance, H.F.T. 1976. Aracruz: the shape of things to come. Pulp and Paper Canada. 77(3):20–21, 23–25.

Describes the planning and development of a 200 square mile eucalyptus plantation in Brazil. The selection of the site, strains, and facilities to harvest and process the trees are noted.

Record, S.J. 1925. Jacaranda copaia in British Guiana. Tropical Woods. 3:6–8.

Provides an overview of this tree, its locality, characteristics of the wood, and its uses. Recommends that it be investigated for possible use in the pulp industry.

Record, S.J. 1925. Schizolbium: a promising source of pulpwood. Tropical Woods. 2:2–5.

Discusses general observation on the wood of *Schizolbium* and presents a more complete description of *S. kellermanii.* Recommends that more investigation be undertaken to determine the practicality of using *Schizolbium* as pulpwood.

Redko, B.V.P. 1983. Vessels of hardwoods: *Eucalyptus deglupta, E. urophylla,* and *Gmelina arborea.* In: Proceedings of the ABCP 16th annual meeting, 3d Latin American cellulose and paper congress; 1983 November 21–26; Sao Paulo, Brazil. Sao Paulo, Brazil: Technical Association of the Brazilian Pulp and Paper Industry (ABCP): 1169–1194.

Describes the characteristics of vessels in two eucalypts and gmelina. The largest number of vessels occurred in *Eucalyptus deglupta, E. urophylla* and *Gmelina arborea* having a similar but smaller number of vessels. The vessels of *G. arborea* contain tyloses that reduce penetrability during pulping. All three species are anatomically suitable for pulp use.

Reitter, F.J. 1974. A new process for the utilization of mixed tropical hardwoods for pulp and paper production. In: Symposium Internacional EU CE PA, Madrid. Pap. 4: 33 p.

Describes a new method of pulping (MM) developed in Argentina for mixed tropical nonconiferous species. The wood is flaked (0.3-0.5 mm thick) and dried to 3 to 5 percent

moisture content before cooking in a continuous rapid digester (20 to 40 min) at 60°C to 70°C without pressure. Quality of pulp is similar to that of pulp from a conventional sulphate process, yield is higher and energy consumption lower.

Ribeiro, E.B.P.; Luz, C.N.R. 1973. *Trema micrantha* as a raw material for pulp (A trema micrantha como materia-prima para a producao de celulose). Acta Amazonica. 3(3):45–50.

Sulfate pulping and bleaching trial results, fiber dimensions, and the chemical composition of *Trema micrantha* are given.

Rique, T.; Repetti, R.; Angelinetti, A.R. 1979. Integration of the quebracho extraction industry with the manufacture of cellulose pulp (Integracion de la industria del extracto de quebracho con la fabricacion de pastas celulosicas). Instituto Forestal Nacional, Buenos Aires, Argentina. Folleto Tecnico Forestal. 54:21.

Describes a study evaluating the use of *Schinopsis balansae* and *S. quebracho–colorado* for tannin extraction and pulp production, using combined or separate treatments of bark and wood. One scenario is to use sulphate or sulphite treatment of quebracho logs followed by separate processing of tannin-containing liquor and pulp. Results of an initial trial were encouraging. The quebracho tannin industry in Argentina is discussed.

Roda, A.W.; Lopes, C.H. 1978. Babassu–the wonderful palm. In: USA, TAPPI (Technical Association of the Pulp and Paper Industry), Atlanta, GA. Nonwood Plant Fiber Committee: Nonwood plant fiber pulping. Progress Rep. 9:41–45.

Describes the manufacture of NSSC pulp from the Babassu palm tree, which is satisfactory for use as corrugating medium. The palm *Orbygnia speciosa* was pulped at Industria de Sacos de Papel SA in Brazil. Chipping, depithing, and recovery of spent pulping liquors are discussed.

Rodrigues, W. A. 1972. Virola surinamensis and its uses. Acta Amazonica. 2(2):29–47.

Describes Virola surinamensis giving taxonomy; general botanical features; phenology; ecology; distribution; silvical characters; phytopathology; leaf histology; wood anatomy; traditional uses of seeds, bark, etc. for medicine, tallow, and cattle fodder; and the physical, mechanical, and chemical properties; and uses of the wood including suitability for pulp and paper.

Rodriguez, C.B. 1978. The world pulp and paper crisis and its solution (La crisis mundial de la celulosa y el papel y su solucion). Mexico D.F., Mexico: Instituto Nacional de Investigaciones Forestales, Ciencia Forestal. 3(15):36-43.

Suggests that tropical areas planted to fast-growing tropical species may be the best way to meet the needs for pulp and paper. Calls for appropriate means to manage such forests and encourages development and use of oxidation pulping to handle these potential species rather than the sulphate or sulphite methods used for temperate softwoods.

Rodriguez–Romero, F. 1975. The nature of wood as raw material for pulp. Mexico y sus Bosques. 14(4):23–26.

Describes the wood anatomy and fiber morphology (including data on length and diameter of fibers, both early and late wood) for seven Mexican conifers, in relation to the pulping characteristics of wood.

Rodriquez–S., J.R. 1965. The production of pulp for paper from Venezuelan broadleaved species. Revista Forestal Venezolana. 8(12/13) : 19–37.

The characteristics, including fiber length and chemical constituents, of 77 broadleaved woods from Venezuelan Guayana are given,

Sandermann, W. 1979. The wood and paper industry of Mexico. (Die Holz- und Papierwirtschaft Mexikos). Holz als Roh- und Werkstoff. 37(2):41–51.

Describes the forest industries in Mexico in relation to population, forest area, production of timber and other wood-based materials, timber usage, imports and exports, and pulp and paper production. Based on the data, future potentials are discussed for industry and the need for reforestation, and for more technically trained personnel.

Schweers, W.; Wiebecke, C. 1978. The Wood, Pulp, and Paper Institute of Guadalajara University. An example of bilateral cooperation in wood technology and forestry between Mexico and the German Federal Republic (Das Institut fur Holz, Zellstoff und Papier an der Universitat Guadalajara. Ein Beispiel bilateraler Zusammenarbeit fur Holztechnologie und Forstwirtschaft zwischen den Vereinigten Staaten von Mexico und der Bundesrepublik Deutschland). Forstarchiv. 49(8): 149–152.

Describes the function of teaching and research at the Institute, established in 1971. The principal research conducted is in chemical wood technology; evaluation of new timber species for pulping; forest exploitation; reforestation; and land-use problems. The active cooperation with the Federal Institute for Forestry and Timber at Hamburg-Reinbek, Germany is noted.

Setubal Filho, L. 1978. The role of forestry activity in the utilization of wastes in Brazil. In: Proceedings of the Eighth World Forestry Congress; 1978 October 16–28; Jakarta, Indonesia. FQL/29–9. 6:31.

Describes the waste or misuse of the forest resource in Brazil in relation to the development of agriculture, forestry and pasture; metallurgical uses of charcoal; and flooding from hydroelectric projects. Also discusses plantations; difficulties of marketing new products; forest fires; and wood processing technology from sawmills to pulp mills.

Shand, E.A.; Bezerra, R.N.; Nascimento, P.R. 1978. Diagnosis of the market for wood and its derivatives. Vol. 2. Analysis of the domestic marketing system (Diagnostico do mercado de madeira e derivados. Vol. 2 Analise do sistema de comerciali tacao interna de madeira e derivados). In: Forestry development and planning: projections for the period 1979–1985. Diagnosis of the forestry subsector of Brazil (Colecao: Desenvolvimento e planejamento florestal. Serie: Estudos perspectivos para o periodo 1979 a 1985. Diagnostico do subsetor florestal do Brasil. Brasilia, Brazil, Secretario Nacional de Planejamento Agricola, Subsistema de Planejamento Florestal. Barasilia, Brazil: Instituto Brasileiro de Desenvolvimento Florestal: 387 p.

Describes the classification of Brazil into two sections: the north/northeast, (mostly natural forests, particularly the Amazon basin) and the south/southeast with mostly plantation forests. The marketing systems of these two units are considered separately. From the north, the timber is used principally for sawnwood and plywood, as sales of sawlogs diminish. In the south, more processing is common making panels, laminates, pulp and paper, and charcoal for the steel industry. Classification of timber, prices, market structure, distribution channels, and transport are discussed for both geographical units. Recommendations are made for both areas, covering fiscal regulation, products, and social factors.

Shand, E.A.; Nascimento, P.R.; Bezerra, R.N.; Reis, F.D.V.; Ribeiro, H.; Souza, A.L.P.M. de. 1978. Diagnosis of the market for wood and wood derivitives. Vol. 3. Analysis of the international market (Diagnostico do mercado do madeira e derivados. Vol. 3. Analise do mercado internacional). Forestry development and planning: projections for the period 1979-1985. Appraisal of the forest sector of Brazil. Colecao: Desenvolvimento e planejamento florestal. Serie: Estudos perspectivos para o periodo 1979 a 1985. Diagnostico do subsetor florestal do Brasil. Secretario Nacional de Planejamento Agricola, Subsistema de Planejamento Florestal. Brasilia, Brazil: Instituto Brasileiro de Desenvolvimento Florestal: 310 p.

Describes an analysis of the trends in the international timber markets during the 1970s, to be used in planning of forestry activities during the period from 1979 to 1985. Hardwood sawlogs, lumber, panels, and pulp and paper were the products studied. Supply and demand for these products was considered in the analysis as were market situations within the main importers of Brazil's wood products (UK, USA, W. Germany). Seventy six tables of statistical data are presented. Brazil's competitive position, with respect to forest ownership, production capacity, marketing organization, product classification, and transport is also discussed. Fourteen recommendations are presented for the improvement of Brazil's position as a world supplier. Several of the recommendations relate to marketing of Amazonian lumber.

Silitonga, T.; McGovern, J.N. 1975. Experimental holopulping of several temperate and tropical hardwoods. Tappi. 58(7): 125–128.

Describes laboratory trials with low- and high-density temperate and tropical hardwoods *(Cryptocarya* sp., *Populus trernuloides, Quercus rubra,* and *Schirna* sp.) and compares the properties of pulps made by various procedures yielding holocellulose pulps with those of unbleached sulphate pulps from the same species.

Silva, C.F. 1983. Bark from *Eucalyptus globulus*–pulping versus burning. In: Proceedings of the Technical Association of the Brazilian Pulp and Paper Industry (ABCP) 16th annual meeting, 3rd Latin-American Cellulose and Paper Congress; 1983 November 21–26; Sao Paulo, Brazil: 855–863.

Simmonds, F.A.; Kingsbury, R,M. 1951. Viscose-rayon pulps from Chilean hardwoods, coigue, tepa, and ulmo. FPL Rep. R1906. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 15 p.

Sosanwo, O. 1976. Studies on *Gmelina arborea.* Pt 5. Pulping characteristics of a tropical hardwood, *Gmelina arborea.* Helsinki, Finland: Department of Wood and Polymer Chemistry, University. Paperi ja Puu. 58(11):791–792, 794–796.

Describes evaluations of soda/oxygen pulping on *Gmelina arborea* wood. Soda/oxygen pulps were comparable in yield to kraft pulps; pretreatment with H2S did not increase the yield of kraft pulps; and high yield pulps were obtained by NSSC pulping. Soda/O2 and NSSC pulps were brighter than kraft pulps. It is suggested that NSSC pulps could be used for corrugating medium.

Staepelaere, R.L.; Ginsburger, P.L. 1978. Utilisation of bleached sulfate tropical hardwood pulp. In: Auchter, R. J., coordinator. Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 451–485.

Describes a full-scale experiment in forest inventory, logging, and evaluation of mixed Guyanese woods for pulping and general properties. The Guyanese woods were of higher density, had longer fibers, and higher lignin content than the European and North American wood with which they were compared. They were similar to woods from Gabon in Africa. It was concluded that mixed Guyanese hardwood pulp is commercially acceptable on international markets for the manufacture of a large range of white paper and boards.

SUDAM. 1972. Feasibility study of the industrial exploitation of the Amazonian forest in the Curua-Una region (Estudo de viabilidade da exploracao industrial da mata amazonica na regiao do Curua-Una). Brazil: Superintendencia do Desenvolvimento da Amazonia: 135 p.

Describes the mostly natural forests of about 900,000 ha. The use of the mixed hardwood forests and plantations of Pinus caribaea, is discussed. Development of a pulp and paper industry, and details of investments, costs, and profitability, are discussed. Appendices include data on the growth of *P. caribaea* var. *hondurensis* plantations, areas and amounts of pine required to supply a pulpmill having a capacity of 500· t/day, timber transport costs, notes on the suitability for pulp and paper of 46 different native Amazonian species, and details of equipment for a woodworking industry and pulpmill.

SUDAM. 1971. Some useful information on woods from Amazonia (Algumas informacoes uteis sobre madeiras Amazonicas). Brazil: Superintendencia do Desenvolvimento da Amazonia. SUDAM Documenta: 3(1/4):133–177.

Summarized data are presented on the suitability of a large number of tropical species from the Amazon region for sulphate pulping and production of sliced or peeled veneer, and on the natural durability of the woods. Tables are also given showing, by forest types and regions, the estimated volumes (obtained from FAO inventories) of available standing timber of the more important species.

Teixeira, L.L.; Moreschi, J.C.; Lelles, J.G. de; Tomaselli, I. 1977. Post-graduate course in Forest Engineering, Parana Federal University, Curitiba, Parana, Brazil. M.Sc. degree theses (Curso de Pos-graduacao em Engenharia Florestal, Universidade Federal do Parana.

Dissertacao de grau de Mestre em Ciencias). Floresta. 8(1):33–60.

Presents three condensed theses with English summaries. 1.Teixeira, L. L. Botanical, dendrological, and anatomical identification of the wood of six woody species from southwest Parana. (Identificacao botanico-dendrologica e anatomica da madeira de seis especies euxiloforas do sudoeste Paranaense). Describes the potential of the following species for solid wood and paper making: *Casearia inaequilatera, Ilex brevicuspis, Piptocarpha angustifolia, Lamanonia speciosa, Sloanea lasiocoma,* and *Vernonia discolor.*

Teles, A.A.; Paula, J.E. de. 1980. Wood anatomy of *Virola sebifera* Aubl. and Pseudobombax tomentosum (Mart. and Zucc.) A. Robyns in relation to their technological utilization (Estudo anatomico das madeiras de Virola sebifera Aubl. e Pseudobombax tomentosum (Mart. et Zucc.) A. Robyns visando o seu aprovietamento technologico. Brasil Florestal. 10(42):25–34, 35.

Describes a study of the wood anatomy of Virola sebifera and Pseudobombax tomentosum in relation to their use for pulp and paper.

Valente, H.M.; Rique, T. 1960. Chemical analysis of the wood of "pino de cerro" *Podocarpus parlatorei* Pilg. and 'aliso del cerro' *Alnus jorullensis* var *spachii* (Regal) (Winkler) and their possibilities for making pulp (Estudio quimico de la madera del "pino de cerro" *Podocarpus parlatorei* Pilg. y 'aliso del cerro' *Alnus jorullensis* var *spachii* (Regal) (Winkler) y sus posibilidades para la fabricacion de pulpas). Buenos Aires, Argentina: Administracion Nacional de Bosques. Notas Tecnologicas Forestales. 12:5.

Wandel, E. 1984. Firing of rotary kiln with wood powder. In: Egneus, H.; Ellegard, A., eds. Bioenergy 84. Proceedings of a conference; 1984 June 15–21; Goteborg, Sweden. Vol. 4. Bioenergy utilization. Goteborg, Sweden: Elsevier Applied Science Publishers: 101–108.

Describes the use of wood powder fuel, in Brazil, for lime reburning kilns at pulp mills and for cement kilns in Brazil. Wood waste, bark, and low quality wood chips are used for the powder. The processes from grinding the powder through drying and burning it are discussed, including equipment, power consumption, safety measures, and computer control. A best method of production and burning is discussed, as is a rotary burning unit.

Wisdom, H.W.; Granskog, J.E.; Blatner, K.A. 1983. Wood shipments to Puerto Rico. Res. Pap. SO–201. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 11 p.

Describes timber trade to Puerto Rico from mainland USA for the ten-year period 1971 to 1981.

Worrall, J.; Burley, J.; Palmer, E.R.; Hughes, J.F. 1977. The properties of some Caribbean pine pulps, and their relationship to wood specific gravity variables. Wood and Fiber. 8(4):228–234.

Describes average yields, burst factor, tear factor, and tentative overall values for *Pinus caribaea* pulps. *P. caribaea* pulps were generally better than those for *P. patula, P. sylvestris, P. taeda,* and southern pine, and inferior to those of *Pseudotsuga menziesii.* The pulp properties of *Pinus caribbaea* varied considerably between trees, and the variation was not significantly related to density variation. Density and fiber length together accounted for approximately 67 percent of the between-tree variation in pulp properties in *P. caribaea.*

Yoda, M. 1975. Bleached sulfate pulps from Brazilian eucalyptus. Japan Tappi. 2:53–57.

Youngs, R.L. 1978. Research in tropical wood utilization. Unasylva. 29(117):9-11.

Describes a cooperative research project by the Forest Products Laboratory, Madison, Wisconsin, aimed at full-scale production of forest products in the lesser developed areas of the tropics. The program was designed for the development of economic processes for making pulp, paper, and related products from naturally occurring mixtures of tropical hardwoods. Results were presented at an international conference on improved utilization of tropical woods held at Madison, Wisconsin on May 21–26, 1978.

Zabe, R.N.; Albert, R.J. 1978. Utilization of tropical hardwoods for manufacture of pulp, generation of steam, and electrical energy—a preliminary industrial survey. In: Auchter, R. J., coordinator. Proceedings of conference on improved utilization of tropical forests; 1978 May 21–26; Madison, WI. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 542–569.

Describes an economic analysis of the increased use of tropical woods for pulp and paper, based on results from currently operating pulp and paper mills, laboratory trials, and pilot studies.

Zobel, B.; Campinhos, E. Jr.; Ikemori, Y. 1983. Selecting and breeding for desirable wood. Tappi. 66(1): 70–74.

Describes the variability of wood properties and their causes, while emphasizing the desirability for uniform wood properties in structural and pulping use. Discusses the tree improvement work being done in Brazil on eucalypts.

Furniture Manufacture and Miscellaneous Products

Furniture, musical instruments, pencils, boxes and crates, and crafts.

Anon. 1985. Problems in the use of tropical timbers for moulding manufacture (Probleme des Einsatzes von Tropenholz fur die Leistenfertigung). Holz–Zentralblatt. 111(52/53):759–760.

Describes the wood requirements necessary for the manufacture of mouldings, and presents a number of woods from Latin America, North America, SE Asia, Africa, Oceana, and Europe that are suitable for mouldings.

Becerra–M., J. 1977. Probable uses of the wood of two oaks from the state of Durango (Usos probables de la madera de dos encinos de estado de Durango). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Ciencial Forestal. 5(2):3–13.

Bueno–Z., J. 1975. A study of 161 Peruvian woods for pencil manufacture (Estudio de 161 maderas Peruanas para fabricacion de lapices). Lima, Peru: Univaersidad Nacional Agraria, La Molina. Revista Forestal del Peru. 6(1/2):3–11.

Describes wood from 161 native Peruvian trees by common and scientific names for potenial use in pencil making. Three species and species groups were shown to be suitable for pencil-making: *Ceiba* sp. (Chahuano), *Cedrela odorata,* and *Virola* sp. (Cumala de Altura). Six more species are suitable if waxed for pencil production, including: *Chorisia integrifolia, Guazuma ulmifolia, Nectandra* sp. (Moera negra), *Spondias mombin, Sterculia* sp. (Punga), and *Trichilia* sp. *(Cedro mullaca).*

Clark, H.S. 1931. Use of Amaranth for interior trim and flooring. Tropical Woods. 25:1–3.

Describes the utilization of *Peltogyne pubescens* from British Guiana.

Coetzee, S.E. 1984. Pau marfim–a furniture timber from South America. South African Forestry Journal. 131:72–74.

Presents the distribution, properties, and uses of *(Balfourodendron riedelianum).*

Compean–G., F.J.; Perez–M., F. J.; Avila–S., J.A.; Murguia–G., D.A. 1984. Assessment of the wood-and-wire box industry of the State of Durango (Diagnostico de la industria de caja alambrada de estado de Durango). Durango, Mexico: Instituto Nacional de Investigaciones Forestales. Boletin Divulgativo. 66:90.

Describes a major industry in the state of Durango, Mexico.

De Medinacelli, A. and others. 1975. Materials that can be used in the manufacturing of crates for perishable agricultural products (fruits and vegetables), and specific designs for each of them (Materiales susceptibles de ser usados en la construccion de embalatas para productos agricolas perecederos (frutas y hortalizas) y diseno especifico para cada uno de ellos). Barquisimeto, Venezuela: FUDECO. 238 p.

Covers all types of crates for produce, but emphasizes wood. Sixty-four species are mentioned as being suitable for use, though at that time only six species were widely used for crates.

Enriquez–Q., M. 1980. The wire-bound timber packing crate industry in the State of Durango (La industria de cajas de madera alambradas del Estado de Durango). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales, Ciencia Forestal. 5(23):37–50.

Describes production, production costs, merchandise turnover, type of equipment used, and number of employees for nine box factories in Durango state, Mexico.

Fritz, E. 1926. "Amapa" for interior trim and flooring. Tropical Woods. 8:8–9.

Describes the use of *Tecoma pentaphylla* for interior use. This wood is described as having a pleasing appearance and being easy to work with.

Guridi–G., L.I. 1980. Woods used by craftsmen in the state of Michoacan [Mexico] (La Madera en las artesanias del estuado de Michoacan). Boletin Divulgativo. **50: 129** p.

Seventy-three craftsmen were interviewed regarding the woods they utilize in their trade. From this, 40 species were identified as being commonly utilized in the manufacture of crafts. The aesthetic characteristics of these woods are described; photographs of some of the wood samples and crafts are included.

Herrera–B., A. 1981. Progress in the determination of the machining characteristics of five oak species growing in Mexico (Avance en la determinacion de las caracteristicas de maquinado de cinco especies de encino que vegetan en Mexico). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales, Ciencia Forestal. 34(6):45–63.

Describes machining properties (planing, sanding, drilling, moulding, and turning) of the wood of *Quercus candicans, Q. Castanea, Q. resinosa, Q. obtusata,* and *Q. sideroxyla.* For all five species, machining properties were generally good, except for turning quality. Sanding was poor for Q. candicans. Best results in planing were with a knife angle of 20 degrees and a feed velocity producing 19.7 knife marks per centimeter.

Longwood, F.R. 1961. Puerto Rican woods: their machining, seasoning, and related characteristics. Agric. Handb. 205. Washington, DC: U.S. Department of Agriculture. 98 p.

Longwood, F.R. 1962. Present and potential commercial timbers of the Caribbean—with special reference to the West Indies, the Guianas, and British Honduras. Agric. Handb. 207. Washington, DC: U.S. Department of Agriculture. 167 p.

Moure, D. 1978. Use of hard and semihard woods in construction of houses and furniture (Uso de maderas duras y semiduras en la construccion de vivendas y mobilario). Serie Tecnologia. Argentina: Direccion de Bosques. 1:1–15.

Describes the physical and mechanical properties and uses for furniture-making and other wood products from two woods characteristic of Cliaqueno Seco National Park,

viz. *Schinopsis lorentzii (Quebracho colorado)* and *Aspidosperma* sp. *(Quebracho blanco).*

Record, S.J. 1927. Panama "Orey" wood and related species. Tropical Woods. 12:6–12.

Discusses uses of the Campnosperma, found in Panama, as well as in Brazil and the West Indies. Concludes that the wood is not well suited for the production of pulp and is easily damaged by insects and decay, but is useful in the construction of boxes and food containers.

Saldarriaga, J. 1979. Machining characteristics of ten species from the Uraba region (Caracteristicas de trabajabilidad de diez especies de la region de Uraba). Medellin, Colombia: Facultad Nacional de Agronomia Medellin. Revista.

Describes the machining characteristics of 10 tropical woods from Colombia.

Schmieg, K. 1926. Notes on new cabinet woods from Brazil. Tropical Woods. 5:1–4.

Briefly discusses the use of *Myroxylon toluiferum, Astronium fraxinifolium, Nectandra* sp., and *Cordia* in the manufacture of fine furniture.

Souza, M.R. de. 1983. Classification of wood for musical instruments (Classificacao de madeiras para instrumentos musicais). Brasilia, Brazil: Departamento de Economia, Instituto Brasileiro de Desenvolvimento Florestal (IBDF). Serie Tecnica. 6: 21 p.

Describes the testing of 100 Amazonian woods for possible use in musical instruments. Three different approaches to the testing were used; acoustic properties, Principal Component Analysis, and practical knowledge or empirical selection. Twenty species were selected as having potential for stringed and woodwind instrument making.

Sternadt, G.H. 1983. Small wooden objects (Pequenos objetos de madeira–POM–1983. Brasilia, Brazil: Laboratorio de Produtos Florestais, DPq/IBDF: 83 p.

Describes a wide variety (40) of small wooden objects, their export to other countries, and their value in Brazil and the importing countrie. Data are provided in tabular and graphic form.

Engineered Uses

Design properties of wood in housing and other construction, including stress grading.

ABNT (Asociacao Brasileira de Normas Tecnicas). 1951. Design and construction of wood structures (Calculo e execucao de estruturas de madeira). Sao Paulo, Brazil: Standard ABNT NB11–1951. 22 p.

ABNT (Asociacao Brasileira de Normas Tecnicas). 1953. Tests of small clear specimens in the green condition. Sao Paulo, Brazil: ABNT MB 26–1953.

Ahn, Won–Young; Moslemi, A.A. 1980. SEM examination of wood-portland cement bonds. Wood Science. 13(2):77–82.

Anon. 1965. A standard wooden house. Santiago, Chile: Maderero. 14: 9–15,18.

Describes the design and construction of a one-story wooden house, suitable for conditions in Chile.

Anon. 1986. Caribbean wood homes big hit. Market News. New Orleans, LA: Southern Forest Products Association. April–May: 1–2.

Anon. 1986. Caribbean wood homes: wood is winner. Market News. New Orleans, La: Southern Forest Products Association. August. 4 p.

Anon. 1989. Five SP demo homes built in Jamaica. Market News. New Orleans, La: Southern Pine Marketing Council. February. 14 p.

Arostegui, V.A. 1978. Integrated study of wood for construction (Estudio integral de la madera para contruccion). Lima, Peru: Universidad Nacional de la Amazonica, Ministerio de Agricultura. 184 p.

Arroyo–P., J. 1971. Classification of uses and working strengths for Venezuelan woods (Clasificacion de usos y esfuerzos de trabajo de madera venezolana). Merida, Venezuela: Laboratorio Nacional de Productos Forestales.

Arroyo–P., J. 1985. Technical characteristics of 37 Venezuelan woods (Caracteristicas tecnologicas de 37 maderas venezolanas). Merida, Venezuela: Laboratorio Nacional de Productos Forestales.

Barajas–M., M. en C.J.; Echenique–M., R.; Carmana–V., T. F. 1979. Wood and its use in construction. No. 3. Structure and identification (La madera y su uso en la construccion. No. 3. Estructura e identificacion). Veracruz, Mexico: Instituto Nacional de Investigacions sobre Recursos Bioticos. 70 p.

Describes wood characteristics and defects in relation to reliability in construction use. Discusses the appearance and how to identify 15 woods commonly used in Mexico for construction with a key. Some exotic woods are included. For each species the characteristics are given along with uses.

Barghoorn, A.W.; Reyes–M., E.; Rojas–L., H.; Cabrera–D., H.; Aloarado–P., J. 1967. Oriented study of some anatomical, physical and mechanical properties of 41 timber species from the Carare–Opon region (Estiudio orientativo de algunas propiedades anatomicos y fisico–mecanicas de 41 especies maderables de la region Carare–Opon). Bogota, Colombia: Instituto de Investigaciones y Proyectos Forestales y Madereros de la Universidad Distrial Francisco Jose de Caldes. 228 p.

Berhane, Z. 1986. Problems faced by the homeless in developing countries. In: Proceedings of the 10th triennial congress of the International Council for Building Research (CB); 1986 September 22–26; Washington, DC. 1,133 p. Vol. 4.

Brealey, T.B. 1975. Low cost timber housing in Venezuela, FAO Rep. VEN/72/019, Consultants Rep. 3. Rome, Italy: United Nations, Food and Agriculture Organizations. 23 p.

A review is given of the size of the house-building program in Venezuela, the nature of the building industry, the availability and cost of timber, and the possibility of introducing timber for house construction rather than the traditional masonry or concrete. The attitudes of the authorities and the public are examined particularly in relation to doubts about durability, fire risk, appearance, security, and structural safety of timber houses. Recommendations are made for the design and erection of experimental and prototype timber houses and for the promotion of timber as a construction material for houses.

Campos– B., A. 1987. Determination of the strength of radiata pine poles (Determinacion de la resistencia de postes de pino radiata). Ciencia e Investigacion Forestal. 2:93-107.

Describes the increase in use of wood poles in Chile and the interest of the industry in the market for both internal and export markets. To provide strength data for the industry, American Standard ANSI 05.1-1979 and ASTM D 103-83 were applied to use with radiata pine.

Carabias–J., R.; Karsulovic–C., T. 1978. Density and mechanical properties of the wood of rauli *Nothofagus alpina* (Poepp et Endl.) Oerst. (Densidad y Propiedades Mecanicas de Madera de Renovales de Rauli). Santiago, Chile: Universidad de Chile. Boletin Tecnico. 51:36.

Chudnoff, M. 1984. Tropical timbers of the world. Agric. Handb. 607. Washington, DC: U.S. Department of Agriculture. 206 p.

This handbook contains descriptions of 370 species or generic groupings of tropical trees and their timbers grouped by regional origin. Standardized descriptions emphasize physical and mechanical properties, processing characteristics, and uses. Data have been compiled, evaluated, and synthesized from the world literature.

Costa, C.L.C. 1973. Utilization of *Pinus elliottii* wood in construction (Emprego de madeira de *Pinus elliottii* na construcao civil). Sao Paulo, Brazil: Instituto Forestal. Boletin Tecnico. 6:23.

The use of this wood for prefabricated constructions is suggested, as it proves to be economical if adequate care is taken to insure its proper drying and preservation.

Crane, J.L. 1949. Huts and houses in the tropics. Unasylva. 5(3): 100–105.

Davalos–S., R. 1984. Design of wooden structures, general information (Diseno de estructuras en madera, informacion general). Nota Technica 1, 2nd ed. Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio De Ciencia Y Technologia De La Madera.

General discussion of wood design considerations, including grading characteristics, lumber standard dimensions, and allowable stresses.

Davalos–S., R.; Wangaard, F.F.; Echenique–M., R. 1977. Classification of the wood of Mexican pines (Clasificacion de la madera de pinos Mexicanos). Inst. Investig. sobre Recursos Biologicos. Xalapa, Veracruz, Mexico: Madera y su Uso en la Construccion. 2:26.

Drawing from limited data on the mechanical properties of Mexican pines, and a study of correlations between the density and mechanical strength of Mexican and foreign pines, a provisional classification of Mexican pine wood for structural purposes is derived. Four quality classes, and the limits of the defects (number, size, type, and position of knots, extent of splits or cracks, etc.) permissible for each class are provided. Suggestions are made for the application of the structural classes.

Davalos–S., R.; Wangaard, F.F.; Echenique–M., R. 1980. Classification of the wood of Mexican pines, the wood and its uses in construction No. 2 (Clasificacion de la Madera de Pinos Mexicanos, La Madera y su Uso en la Construccion) No. **2.** Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Technologia de la Madera.

This report discusses the grading and mechanical properties of seven species of pine found in Mexico. Discussions include adjustments for use in redundant assemblies.

Della Lucia, R.M. 1975. Strength grading of construction lumber for Brazil. Lafayette, In: Purdue University. Ph.D. dissertation. 152 p.

Echenique–Manrique, R.; Becerra–M., J. 1972. Some physical–mechanical characteristics of the wood of three species from the Neovolcanica mountain range (Algunas caracteristicas fisico–mecanicas de la madera de tres especies de la Cordillera Neovolcanica). Mexico, DF, Mexico: Instituto Nacional Investigaciones Forestales. Notas Tecnicas. 6:7.

Falconer, J.P.R. 1971. Design and production of tropical timber housing. Unasylva. 25(1):15–21

Fox, T.H.; Cortes, T.M. 1984. The use of wood in house building in Chile with a case study in the city of Concepcion. Vol. 1. Timber Construction. In: Hutchison, J.D., ed. Proceedings of the Pacific Timber Engineering conference; 1984 May; Auckland, New Zealand. Wellington, New Zealand: Institution of Professional Engineers: 283–298.

Describes the use of wood in the building of homes, churches, and other structures in the area around Concepcion, Chile. Some house designs are shown. Discusses current use of wood in construction and refers to a case study on modern wood house construction in Concepcion.

Freitas, Amantino Ramos de. 1978. Probabilistic approach in the design of wood structures in Brazil based on the variability of 23 species. Bull. 159. Sao Paulo, Brazil: Instituto Pesquisas de Tecnologicas (IPT).

Fullerton, R.L. 1977. Building construction in warm climates. Oxford, UK: Oxford University Press. 3:269.

A reference book of construction techniques and materials, illustrated by many diagrams, and of particular interest to students of architecture, building, surveying, and structural engineering. A section is included on the properties of wood in relation to its suitability for use in warm, humid and hot, dry climates. The properties of 22 species are tabulated. Mention is made of most aspects of the use of timber in houses and multipurpose buildings for administration and recreation.

Hallett, Robert M. 1984. Timber structures in developing countries. In: Supplementary proceedings of Pacific timber engineering conference; 1984; Aukland, New Zealand. Wellington, New Zealand: Institution of Professional Engineers: s1–s7.

Hellmeister, J.C. 1984. Structures of wood (Estruturas de madeira). Sao Paulo, Brazil: Universidad e de Sao Paulo, Escola De Engenharia De Sao Carlos, Departamento Estructuras, Laboratorio de Madeiras e de Estruturas de Madeira.

HHFA (International Housing and Home Finance). 1959. Manual on design for low-cost and aided self help housing. Ideas and methods exchange No. 37. Washington, DC: International Housing and Home Finance. 45 p.

Hoyle, R.J., Jr. 1979. Visual stress grading of structural lumber for Costa Rican wood. Unpublished rep. Pullman, WA: Washington State University, Instituto Tecnologico de Costa Rica. 18 p.

Hoyle, R.J., Jr. 1979. Theory and practice of machine stress grading of structural timber. Unpublished rep. Pullman, WA: Washington State University, Instituto Tecnologico de Costa Rica. 12 p.

IBDF (Instituto Brasiliero de Desenvolvimento Florestal). 1983. Brazilian grading rules for sawn hardwood timber. Brasilia, Brazil: Ministry of Agriculture, Brazilian Institute of Forestry Development. 67 p.

IPT. 1982. Popular manual for wooden house construction (Cartiha para construcao de casas de madeira). Relatoario No. 17.464. Sao Paulo, Brazil: UNIDO (United Nations Industrial Development Organization) and IPT (Instituto Pesquisas de Tecnologicas) Building Technology Division. 101 p.

IPT. 1984. Alternative technologies for construction of habitations of social interest (Alternativas tecnologicas para construcao de habitacoes de interesse social). Sao Paulo, Brazil: Secretaria de Industria, Comercio, Ciencia e Tecnologia do estado de Sao Paulo. Instituto de Pesquisas Tecnologicas (IPT).

IPT. 1985. Manual of orientation for construction by mutual-help [self-help] (Manual de orientacao por construcao por ajuda-mutua). IPT Division of Buildings (Divisao de Edificacoes). Publication No. 1610. Sao Paulo, Brazil: Instituto de Pesquisas Tecnologicas (IPT). 69 p.

ITCT. 1980. Structural grading rules for Costa Rican wood. Cartago, Costa Rica: Instituto Tecnologico de Costa Rica. Draftcopy. January, 1980.

Johnston, P. 1975. Characteristics of wooden parts for houses (Caracteristicas de partes de madera para viviendas). Bogota, Colombia: INDERENA. Bosques de Colombia: Jan.–June:68-82.

Joseph, A.; Sharma, A.K. 1984. Physical examination and evaluation of residential and light timber buildings. Vol. 1. Timber construction. In: Hutchison, J.D., ed. Proceedings of the Pacific timber engineering conference; 1984 May; Auckland, New Zealand. Wellington, New Zealand: Institution of Professional Engineers. 167:299–308.

Describes a simple method for evaluating building safety based on tests of 1,000 buildings in Trinidad. Factors evaluated to establish probabilities for failure included design, random hazards, and human errors. Risk factors are derived for each component of the buildings. An example is given as to how the results can be used.

JUNAC. 1984. Manual of design for woods of the Andean Group. (Manual de diseno para maderes del Grupo Andino). Lima, Peru: Junta del Acuerdo de Cartegena. 567 p.

A complete manual for designing engineered structures using woods from the countries of the Andean Pact. A glossary of terms is included.

Karsulovic–C., T.; Navarrette–M., Randolfo. 1977. I. Mechanical properties of commercial Chilean woods. 11. Basic strengths of some Chilean woods (I. Propiedades mechanias de maderas comericiales chileanas. II. Tensiones basicas de algunas maderas chilenas). Buletin Tecnico 46. Santiago, Chile: Department of Wood Science and Technology–University of Chile. 60 p.

Keenan, F.J.; Tejada, M. 1984. Tropical timber for building materials in the Andean group countries of South America. IDRC–TS49. Ottawa, Canada: International Develoment Research Centre. 151 p.

Includes information on the selection and cutting of trees in the forest, wood anatomy, species identification, drying, preservation, workability, mechanical properties, grading, derivation of allowable stresses, establishing standard sizes of lumber, the strength of joints and fastenings, the design and testing of structural components, building design, long duration load tests, dynamic testing, the construction of prototype housing, technology transfer, education, and training.

Knowles, O.H. 1971. Research on the utilization of woods from Amazonia (Pesquisas sobre utilizacao de madeiras da Amazonia). Belem, Brazil: SUDAM Superintendencia do Desenvolvimeanto da Amazonia) Documenta. 3(1/4): 83–116.

Describes the machining and bending properties of 20 Brazilian woods. Tests included drilling, mortising, moulding, planing, sanding, steam bending, and turning. Eight other hardwoods and a palm were tested partially.

Longwood, F.R. 1962. Present and potential commercial timbers of the Caribbean. Agric. Handb. 207. Washington, DC: U.S. Department of Agriculture. 167 p.

Martinez, Jorge Becerra. 1977. Probable uses of the wood of two oak species from the state of Durango (Usos probables de la madera de dos encinos del estado de Durango). Mexico, DF, Mexico: Ciencia Forestal. 5(2):3–12.

Maydell, H.J. von. 1974. Grading of tropical timbers (Die sortierung von tropenholz). Holz als Roh- und Werkstoff. 32(1):30–34.

Discusses the complex existing regional and national grading rules, the differing requirements for internal and external markets, and the requirements for roundwood, sawn timber, and wood-based materials (veneers, plywood, pulping chips, fiberboard, particleboard). Some suggestions are made on the grading of tropical timbers, and it is pointed out that grading is only worth while if the value of the products is increased sufficiently to cover the costs involved.

Mendes, A. de S. 1977. Some tree species from Amazonia recommended for production of railway sleepers (Algumas especies florestais da Amazonia indicadas para producao de dormentes). Brasilia, Brazil: Laboratorio de Productos Florestais. FAO\0 Rep. DNUD/FAO/IBDF/BRA–45. Comunicacao Tecnica. 14:5.

Mora, J.J. 1974. Technical characteristics of 37 Venezuelan woods (Caracteristicas tecnologicas de 37 maderas venezolanas). Merida, Venezuela: Facultad de Ciencias Forestales, Universidad de los Andes. 224 p.

Morales, A.; Jaramillo, A.; Covarrubias, S. 1965. Assemblies of *Pinus radiata* timber made with nails or connectors as structural units. Santiago, Chile: Informe Technico. Instituto Forestal: 21:69-72.

NBS (National Bureau of Standards). 1974. Design, siting and construction of low-income housing and community building to better withstand earthquakes and wind storms. Building Science Series 48. Washington, DC: U.S. Department of Commerce, Center for Building Technology, Institute of Applied Technology. 132 p.

Nnabuife, E.L.C. 1984. A research programme on the development of building materials composed of Amazon timbers and cement. Field document No. 32. Brasilian Institute for Forestry Development United Nations Development Programme. IBDF/UNDP/FAO/BRA–32. Rome, Italy: United Nations, Food and Agriculture Organization.

Ordonez–Candelaria, V.R.; Davalos–Sotelo, R. 1985. Manual of visual classification for pine structural lumber (Manual de classificacion Visual Para Madera Estructural De Pino). Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos.

This manual is a guideline for the visual inspection and grading of pine lumber to be used in structural applications.

Ordonez, V.G.; Barcenas, A. 1986. Physical-mechanical characteristics of the wood of ten species of San Pablo Macuiltianguis Oaxaca (Characteristicas Fisico-Mecanicas de la Madera de Diez Especies de San Pablo Macuiltianguis Oaxaca). La Madera Y su Uso 21, Technical Bull. Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Technologia de la Madera.

Ortega–E., F.; Ricalde–C., M. 1987–90. Design manual for wood structures. Biological structure of wood (Manual para diseno de estructuras de madera. Estructura biologica de la madera). Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Technologia de la Madera.

Perez, Ary R. 1985. System for construction with wood: Sistema construtivo em madeira. Tecnologia de Edificacoes. IPT/DEd 39. August. p. 69–74.

Perez-G., V.A. 1971. Design stresses for Chilean structural timber (Fatigas de diseno para maderas estructurales chilenas). Santiago, Chile: Instituto Forestal. Informe Tecnico. 37:61–62.

Perez–G., V.A. 1982. Determination of strength and toughness of some species of wood grown in Chile (Determination de la resistencia a la tenacidad de algunas especies maderas que crecen en Chile). Santiago, Chile: Instituto Forestal.

Perez–G., V.A. 1983. Mechanical and associated properties of tepa (Laurelia philippiana Looser (Propiedades mecanicas y asociada de la tepa (Laurelia philippiana Looser). Informe Tecnico. 96. Santiago, Chile: Instituto Forestal. 22 p.

Perez–G., Vicente A. 1983. Physical–mechanical characteristics of *Eucalyptus fastigata, Eucalyptus nitens,* and *Pinus muricata* grown in Chile (Characteristicas fisico–mecanicas de Eucalyptus fastigata, Eucalyptus nitens and *Pinus muricata* crecidos en Chile). Informe Tecnico. 97. Santiago, Chile: Instituto Forestal. 71 p.

Perez–G., V.A. 1987. Allowable stresses for structural wood (Tensiones admisibles para madera estructural). Ciencia e Investigacion Forestal. 2:75–91.

The system adopted in the Chilean standard NCh 1990 "Timber Allowable Stresses for Structural Timber" was conceived in Australia and defines 12 structural grades for which flexural allowable stresses, parallel compression, parallel tension, shearing, and flexural elasticity module are provided. The present work analyzes in detail the process just as is done in Australia. It explains the modifications needed to adopt it to the physical and mechanical properties of Chilean woods, and gives the procedure to be followed for its practical application.

Perez–G., V.A.; Martinez B., L.; Rio E., E del. 1973. Stress grading of Pinus radiata. Santiago, Chile: Informe Tecnico, Instituto Forestal. 45:19.

Describes the stress grading of Chilean *P. radiata,* and gives the results of the application of the proposed national standard grading rules to commercial samples of lumber in Chile. According to these rules, 70.7 percent of the sawn timber would be rejected. It is concluded that *P. radiata* sawn timber should not be used for important structural elements. If, however, it is desired to use *P. radiata* for structural purposes at the moment, it is recommended that a single grade be used, with a stress ratio of 50 percent, which would include ca. 30 percent of the total production; details are given of the specifications and permissible stresses of this grade.

Perez–G., V.A.; Zuniga–A,, R.: Hidalgo–S., H. 1971. Mechanical and associated properties of lenga *(Nothofagus pumilio* (Poepp et Endl.) Krasser) grown in Aisen province (Propiedades mecanicas y asociades de la lenga (Nothofagus purnilio (Poepp et Endl.) Krasser) proveniente de la provincia de Aisen). Santiago, Chile: Instituto Forestal. Informe Tecnico. 35:27.

Perez–G., V.A.; Zuniga–A., R.; Hidalgo–S., H. 1971. Mechanical and associated properties of lenga *(Northofagus pumilio* (poepp et Endl.) Krasser) grown in Aisen province (Propiedades mecanicas y asociades de la lenga *(Nothofagus pumilio* (Poepp et Endl.) Krasser) proveniente de la provincia de Aisen). Santiago, Chile: Instituto Forestal. Informe Tecnico. 42:29.

Perez–G., V.A.: Zuniga–A., R.; Hidalgo–S., H. 1975. Mechanical and associated properties of lenga from Magallanes (Propiedades mecanicas y asociades de la lenga de Magallanes). Santiago, Chile: Instituto Forestal. Informe Tecnico. 50:27.

Perez, J.A. 1973. Venezuelan woods that can be used as substitutes for American elm (Maderas Venezolanas que podrian Utilizarse como Substitutos del Haya Americana (American elm)). Merida, Venezuela: Laboratorio Nacional de Productos Forestales. 18 p.

Pfeil, Walter. 1980. Wood structures (Estruturas de madeira). Livros tecnicos e cientificos. 2d ed. Editora, Rio De Janeiro, S.A.

Pleydell, G. 1979. Using mixed tropical timbers for structural purposes. In: Tamolang, F.N., ed. Proceedings of 1st International Union of Forestry Research Organizations (IUFRO) conference on wood quality and utilization of tropical species; 1978 October 30–November 3; Laguna, Philippines. Laguna, Philippines: FORPRIDECOM, College: 108–14.

Quintana, M.E.; Enriquez, B.E.; Martinez–B., A.E. 1978. Supply of wooden sleepers for Mexican railways (Abastecimiento en durmientes de madera para ferrocarriles de Mexico). Instituto Nacional de Investigaciones Forestales. Mexico 17, D.F., Mexico: Ciencia Forestal. 3:3–19.

Quiroz, A.; Davalos, R. 1988. Resistence to compression of pine timbers (Resistencia a compresion de polines de pino). Mexico City, Mexcico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Boletin Tecnico. La Madera y Su Uso. 18:14.

A series of 87 by 87 mm members was tested in specially designed equipment with the purpose of determining appropriate compression design stresses for such members. The results obtained agreed reasonably well with the values proposed in the limit states design rules recently issued by the Department of the Federal District (Mexico).

Ricalde–C., M. 1990. Design manual for wood structures. Wood in Mexico (Manual para diseno de estructuras de madera. La madera en Mexico). Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Technologia de la Madera.

Ricalde–C., M.; Barcenas–P., G.) 1990. Design manual for wood structures. Physical properties of wood (Manual para diseno de estructuras de madera. Propiedades fisicas de la madera). Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Technologia de la Madera.

Ricalde–C.; Barcenas–P., G.) 1990. Design manual for wood structures. Mechanical properties of wood (Manual para diseno de estructuras de madera. Propiedades mecanicas de la madera). Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Technologia de la Madera.

Rivoli, G.; Koljonen, K.; Nascimento, P.R.; Samanez–M., R. 1978. The application of wood and its derivatives in housing (A aplicacao da madeira e seus derivados na construcao habitacional). Brasilia, Brazil: Instituto Brasileiro de Desenvolvimento Florestal: 129.

Robledo, E.; Robledo, F. 1934. Tests of construction materials (Ensayo de materiales de construction). Medellin, Colombia: Anales de la Escuela de Minas. 33:217.

Robles–F., F. 1984. Structural uses of wood in Mexico, wood and its use in construction (Diseno de Estructuras en Madera, Informacion General). Nota Tecnica 1, 2nd ed. Xalapa, Veracruz, Mexico: Instituto Nacional De Investigaciones Sobre Recursos Bioticos, Laboratorio De Ciencia Y Tecnologia De La Madera.

This report discusses structural applications of wood. It includes structural wood products such as I-beams, stress skin panels, arches, etc., as well as mechanical properties for a number of structural species native to Mexico.

Robles–F., F. 1990. Design manual for wood Structures. Method of design (Manual para diseno de estructuras de madera. Metodo de diseno). Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Technologia de la Madera.

Robles, F.; Davalos, R.; Ricalde, M.O. 1988. Comments on technical standards related to the design and construction of wooden structures, version 1987.(Comentarios a las normas tecnicas compementarias para diseno y contruccion de estructuras de madera, version 1987). Mexico, DF, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Boletin Tecnico. La Madera y Su Uso. 15:125.

Commentary on the technical standards related to the design and construction of wood structures.

Robles, F.; Romo, F. 1988. Nailed joints for wooden structures (Uniones clavadas para estructuras de madera). Mexico, DF, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Boletin Tecnico, La Madera y Su Uso. 16:131.

An overview of the structural applications of nails is provided. The characteristics of nails and nailed joints are described. The principal theories that have been suggested for the prediction of the behavior of nailed joints are reviewed. Rules for the design of nailed joints contained in some of the most important codes are discussed. Various testing procedures are described. Suggestions are offered for the development of limit states rules for the design of nailed joints appropriate for Mexican conditions. Research projects aimed at improving the efficiency of nails as connecting elements are recommended.

Rosende–B., R. 1978. Deterioration of wooden houses (Deterioro de la vivienda de madera). Santiago, Chile: Facultad de Ciencias Forestales, University de Chile, Ciencias Forestales. 1 (1) :3–12.

Describes the main problems with the deterioration of wood houses, including moisture and construction factors. Advice is given on the proper use of wood in house construction such as wood selection, use of treated wood, sound building practices, fire avoidance, exterior finishes, and basic maintenance.

Salinas, J.J. 1982. Box beams (Vigas en cajon). Nota Technica 2. Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Tchnologia de La Madera.

Salinas, J.J. 1982. Structural elements of wood in bending: component, analysis, and design (Elementos estructurales de madera en flexion: comportamiento, analisis y diseno). Nota Tecnica 6. Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Technologia de la Madera.

Salinas, J.J. 1983. Connections with nails, bolts, and lag screws (Conexiones con clavos, pernos y pijas). Nota Tecnica 8. Xalapa, Veracruz, Mexico: Instituto Nacional de Investigaciones Sobre Recursos Bioticos, Laboratorio de Ciencia y Technologia de la Madera.

Serrano–M., J.R. 1981. The effect of time on the strength of laurel beams (El efecto del tiempo sobre la resistencia en vigas de laurel). Cartago, Costa Rica: Instituto Technologico de Costa Rica Centro de Investigacion de Ingenieria en Maderas.

Sherwood, G.; Wilkinson, T. 1977. Fasteners for timber construction in high wind areas. NBS Building Science Series 100. National Bureau of Standards. 3:27–46.

Describes construction techniques for tropical areas including Jamaica, Bangladesh, and the Philippines.

Slooten, H. J. van der. 1972. Report to the government of Costa Rica on timber technology. FAO Rep. AT 3066:12.

Describes 8 upland species and 18 lowland species, from Costa Rica, suitable for the construction of prefabricated houses, with details on density, working properties, drying, nailing, etc.

Stillinger, J.R.; Wentworth, I.W. 1977. Products, process and economics of producing wood–cement panels by the Bison–Werke System. In: Proceedings, 11th Washington State University symposium on particleboard; Pullman, WA: 383–410.

Tejada–V., M. 1980. Primer of construction with wood (Cartilla de construccion con madera). Lima, Peru: Junta del Acuerdo de Cartagena. PADT- REFORT, JUNAC.

A wood construction manual with many drawings. Many topics covered including forest resource in 5 Andean Pact countries, wood properties, drying, and preservation prior to construction, wood engineering of structures, and equipment needed for constructing with wood.

Teng, I. 1970. Forestry and forest industries development program. Paraguay. Report on the use of timber for house construction. FAO Rep. FAO:SF/PAR 15. Tech. Rep. 9:8.

Briefly reviews (on the basis of two short study tours) problems of initiating plans for building cheap, wooden

houses for rural areas in Paraguay, and presents and discusses plans for a prefabricated wooden house.

Tinto, J.C. 1978. Contribution of the forestry sector to the construction of housing (Aporte del sector forestal a la construccion de viviendas). Buenos Aires, Argentina: Instituto Forestal Nacional. Folleto Tecnico Forestal. 44:(2):167.

Describes, for Argentina, the timber resources by region and species, general properties of available species, wood properties needed for wood housing, technical wood properties of native trees (listed by common names) including species mixes available, workability, and preservative treatability. Species are grouped by possible uses. A discussion of supporting infrastructure, precautionary measures during construction, and Argentinian standards for housing construction is presented.

Universidad del Biobio. 1985. Internal seminar on the definition of a line of action in the use of wood in houses (Seminario interno sobre definicion de lineas de accion en el use de la madera en vivendas). Concepcion, Chile: Intendencia Region del Biobio: 155.

A seminar of 21 presentations on using wood in housing. Both legal and technical considerations are considered.

University of Sao Paulo. 1983. Brazilian experience in wood and wood structures. (O encontro brasileiro em madeiras e em estructuras de madeira. Characteristics (Caracteristicas). Vol. 1. 391 p.; Connections (Ligacoes). Vol. 2. 284 p.; Housing (Habitacao). Vol. 3. 141 p.; Trusses (Telhados). Vol. 4. 290 p.; Bridges (Pontes). Vol. 5. 463 p.; Special Topics (Topicos especiais). Vol. 6. 340 p. Sao Carlos School of Engineering, Department of Structures, coordinated by Joa Cesar Hellmeister.

Vilela, J.E. 1969. Physical and mechanical properties of 137 woods from Venezuelan Guayana (Propiedades fisicas y mechanicas de 137 maderas de Guayana Venezolana). Merida, Venezuela: Laboratorio Nacional de Productos Forestales. 88 p.

Waggaman, W.C. 1967. Manual on design for low-cost and aided self-help housing. PB 177 385. Washington, DC: U.S. Department of Housing and Urban Development. 45 p.

Weatherwax, R.C.; Tarkow, H. 1964. Effect of wood on setting of portland cement. Forest Products Journal. 14(12):567–570.

Miscellaneous Topics

Economics, forest resources, education, training, and technology transfer.

Acosta–S., M. 1968. Forest management, transport, trade, and wood industries in Ecuador (Explotacion forestal, transporte, comercio e industria maderera en el Ecuador). World Forest Congress Proceedings. 1:788-799.

Discusses the primitive state of the forest industries in Ecuador, noting the problems caused by poor transportation systems and lack of qualified technicians. Notes that if properly managed, Ecuador would have enough wood for its domestic use and would be able to export several species. Twelve species listed as having potential for international exploitation include *Ochroma lagopus, Myroxylon balsamun, Dialyanthera gordoniaefolia, Carapa guianensis, Tabebuia chrysantha, Centrolobium ochroxylon, Cordia alliodora, Rhizophora mangle, Chlorophora tinctoria, Geoffroea spinosa, Cedrela fissilis, C. rosei, Juglans neotropica, Podocarpus oleifolius,* and *P. glomeratus.*

Ahern, G.P.; Newton, H.K. 1928. A bibliography on woods of the world: exclusive of the temperate region of North America and with emphasis on tropical woods. New York, NY: American Society of Mechanical Engineers. 127 p.

Lists 1,530 citations covering properties and utilization of wood. The bibliography is divided into geographic regions; 617 citations are given for Latin America.

Albin, R.H. 1978. Report on survey of education and training needs and staff requirements for the primary mechanical wood industries in selected countries in Latin America (Informe sobre el estudio de los requisitos de la ensenanza y capacitacion y de las necesidades de personal para las industrias mecanicas primarias de la madera en algunos paises de America Latina). Rome, Italy: Food and Agriculture Organization. FAO Rep. TF–INT 286 (SWE). 93 p.

Describes educational needs in Mexico, Colombia, Brazil, Chile, and Peru.

Alves, A.A.M. 1978. Marginal approach to financial maturity of timber. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 4/5:5407–5409.

Anon. 1974. Mexican imports and exports of wood and its derivatives. Mexico y sus Bosques. 13(6):25–39.

An analysis of statistics of imports and exports of wood and wood-based products for Mexico in recent years and with estimates of 1976. Recommendations are made with a view to reducing imports and increasing exports.

Anon. 1974. List of publications of the National Forest Products Laboratory (of Venezuela) (Lista de publicaciones del Laboratorio Nacional de Productos Forestales). Revista Forestal Venezolana. 17(24):92-93.

Lists alphabetically by authors 37 papers published by the Laboratory at Merida between 1963 and 1974.

Anon. 1975. Economic supplement on forest exports. Chile Forestal. 1(4):8.

Gives statistical data on various aspects of the marketing of forest products in Chile, and discusses the importance of exports of forest products in the national economy.

Anon. 1976. Catalog of forest products. (Catalogo de Productos Forestales). Publicacion, Direccion General del Inventario Nacional Forestal, Mexico. 38:30.

A catalog of all types of forest products (woody, nonwoody, or animal) in Mexico. A classification system using a code number consisting of two letters and five figures lists each product and places it in an appropriate category relative to its physical characteristics, and the conversion stage to which it belongs (roundwood, primary conversion, or secondary conversion product).

Anon. 1977. Forestal Arauco: first exporter of logs (Forestal Arauco: primera exportadora de rollizos). Chile Forestal. 2(19):10–11.

Describes with illustrations a 19,000 m^3 shipment of logs from Chile to Japan, by Forestal Arauco. Discusses the financial advantages of exporting logs, and some problems involved.

Anon. 1977. The Alerce declared a national monument (El Alerce declarado monumento natural). Chile Forestal. 3(25):4-5.

Fitzroya cupressoides (Alerce or Lahuen) is one of the most valuable large forest trees of Chile, yielding a high-quality durable softwood timber. This conifer is one of the few trees capable of growing on poor, swampy sites in southern Chile where its range includes both the coastal and inland ranges. In recent years it has been seriously over-exploited, and under government decree No. 490 of September 5, 1977, felling will in future be prohibited except where authorized by the National Forest Service for strictly limited and defined purposes.

Anon. 1978. The radiata pine market. Chilean Forestry News. 1(10):2-5.

Describes the volume and value of Chilean Pinus radiata timber marketed at home and abroad during 1970 to 1977, especially the increased trade with S. Korea, Japan, and the Arab countries. Trends for future markets are discussed.

Anon. 1978. Training for the use of timber in construction (Capacitacion para el uso de la madera en la construccion). In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 5:6348–6352.

Anon. 1978. Outlook for Argentinian industrial timber (Panorama maderero industrial argentino). In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 4/5:5792–5806.

Anon. 1978. National consumption of forest products (Consumo nacional de productos forestales). Mexico, D.F.,

Mexico: Departamento de Economia Forestal, Direccion General de Investigacion y Capacitacion Forestales. Ciencia Forestal. 3(11):41-50.

Describes consumption, production, import, and export of forest products by Mexico in 1971 to 1976 with statistics. The main trends during the period are discussed.

Anon. 1978. Future availability of raw material from the forests, 1978-1987. Region VIII including Malleco (Disponibilidad futura de materia prima forestal, periodo 1978–1987. VIII Region incluyendo Malleco). Chile Forestal. 4(37):16.

Predicts the types and quantities of forest products that should become available in this region of Chile and the adjoining Malleco province in the ensuing ten year period.

Anon. 1978. Pinus radiata on the world market (El pino insigne en el mercado mundial). Chile Forestal. 4(39):8.

Describes recent exports of Pinus radiata round timber to Korea and southern Japan, and sawn timber to the Arab countries, from Chile, which have increased. Data are shown for the prices of pulpwood and roundwood and lumber from various parts of the world from 1970 to 1977. The data are used to predict the profit margins that should be obtainable by the producer in Chile.

Anon. 1980. Processing high density tropical wood (Procesamiento de maderas tropicales de alta densidad). In: Proceedings of an International Union of Forestry Research organizations (IUFRO) meeting, Laboratorio Nacional de Productos Forestales; 1977 October 2–9; Merida, Venezuela. 441 p.

Proceedings containing 29 papers on the processing of high density tropical woods.

Anon. 1981. Aspects of the production and processing of tropical hardwoods in countries of origin. In: Annual report, The Netherlands Investmentbank for Developing Countries: 22–30.

Discusses supply and demand for tropical woods in the world market, the present situation and possible future developments, and obstacles to development of increased local processing in developing countries.

Anon. 1982. Brazilian forestry in the year 2000: strategic directions for the forestry sector in Brazil (Brasil Florestal, ano 2000: diretrizes estrategicas para o setor florestal brasiliero) . Brasil Florestal. 12(50):7-33.

Describes the outlook of the Group for Strategic Planning in Forestry in Brazil. The group, formed in 1981, is composed of both industrial and academic organizations. Planning for the year 2000, discussions include government forestry structure, regional development for the northeast Amazon area, increased production and profitability, reforestation, nature protection, public relations, ensuring the supply of timber, marketing, forestry professionalism, and other subjects. Some data are presented on timber volume, types of timber available, reforestation requirements, and new employment expected.

Anon. 1983. Availability and costs of logs from selected forest regions of Europe and North and South America (Verfugbarkeit und Kosten von Rundholz in ausgewahlten Waldregionen Europas, Nord- und Sudamerikas). Allgemeine Forstzeitschrift. 43: 1169–1170.

Summarizes parts of a report by the Jaakko-Poyry Group. Standing timber volumes, log prices, and other factors from three countries are shown, and estimates of these up to the year 1990 are given. The estimate for the southern USA indicates an adequate log supply, but higher costs for pine logs, felling, and transport. For Brazil the estimate is for an adequate log supply, increasing labor costs, and stable prices for standing timber. For Finland, the estimate indicates some restriction on timber supply, but no major changes in costs.

Anon. 1984. Radiata pine supplies and options for industrial expansion. Chilean Forestry News. 83:2–4.

Describes a study of Chilean forestry expansion from 1985 to 2004. Two models are presented: one showing a four fold increase in processing capacity and doubling of forest area, and a second showing minimal expansion and complete use of existing forest area only.

Auchter, R.J. 1978. Proceedings of conference on improved utilization of tropical forests; U.S. Department of Agriculture, Forest Service, Forest Products Laboratory; 1978 May 21–26; Madison, WI. 569 p.

Contains twenty three papers on: harvesting, transport and storage, wood fibre and reconstituted products research, industrial plans and practices, and investment considerations.

Barghoorn, A.W. 1972. Development and actual state of professional education and research in forestry and the wood-based economy in Latin America and ideas and proposals concerning their further development (Entwicklung und Stand der forst- und holzwirtschaftlichen akademischen Ausbildung und Forschung in Lateinamerika und Vorschlage zu deren kunftiger Weiterentwicklung). Reinbek, Germany: Bundesforschungsanstalt fur Forst- und Holzwirtschaft. Mitteilungen. 90:339–350.

Barghoorn, A.W. 1978. Professional training and research in forestry and wood industries in Latin America: a review of their beginnings, the present situation and proposals for their continued development (La formacion profesional y la investigacion en los campos forestales y madereros en America Latina: analisis del desarrollo y de la situacion actual y propuestas para la continuacion del desarrollo. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 3:3129–3140.

Bassili, A.V. 1979. Cooperation of importers and users of tropical timber products with manufacturing industries in exporting countries. In: Economic commission for Europe, timber committee: seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam, Netherlands. Rome, Italy: Food and Agriculture Organization, FO: TIM/SEM.8/R.18. 4 p.

Beltranena–M., E. 1966. Evaluation test for timber quality (Pruebas de evaluacion de calidad de madera). Guatemala, Guatemala: Universidad de San Carlos. Informe Parcial. 1:12.

Beltranena–M., E. 1967. Evaluation test for timber quality (Pruebas de evaluacion de calidad de madera). Guatemala, Guatemala: Universidad de San Carlos. Informe Parcial. 2:19.

Beltranena–M., E. 1968. Evaluation test for timber quality (Pruebas de evaluacion de calidad de madera). Guatemala, Guatemala: Universidad de San Carlos. Informe Parcial. 3:21.

Berb,erich, K. 1970. Prerequisites and possibilities of development of lumber industry in Guyana, Surinam, and French Guiana (Voraussetzungen und Entwicklungsmoglichkeiten der Holzwirtschaft in Guayana, Surinam und Franzosisch-Guayana). Bundesforschungsanstalt fur Forst- und Holzwirtschaft. Mitteilungen. 78:108–114.

Bezerra, R.N.; Nascimento, P.R. 1978. Contributions of the forest sector to the projections for the period 1979–85. Analysis of the internal system of marketing wood and wood products. Part 1: Northern and north-eastern regions. Part 2: Southern and south-eastern regions (Subsidios do sub-setor florestal aos estudos perspectivos para o periodo 1979/85. Analise do sistema de commercializacao interna de madeiras e derivados. Parte I - Regioes norte/nordeste. Parte II - Regioes sul/sudeste). Brasilia, Brazil: Ministerio da Agricultura: COPLAN/IBDF. 228 p.

Blanco, O.E. 1982. Forestry bibliography of Venezuela. Vol. 1 (Bibliografia forestal de Venezuela. Vol. 1). Merida, Venezuela: Instituto Forestal Latinoamericano, Laboratorio Nacional de Productos Forestales. IFLA. 119 p.

An annotated bibliography of the publications of the Instituto Forestal Latinoamericano, the Laboratorio Nacional de Productos Forestales, and degree theses of the Centro de Estudios Forestales de Postgrado of the Universidad de Los Andes, all in Merida, Venezuela.

Booth, H.E. 1978. Secondary species development. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 5:6324–6332.

Boutelje, J.B. 1979. Information on a wood dictionary with technical literature references. In: Tamolang, F.N., ed. Wood quality and utilization of tropical species. Proceedings, International Union of Forestry Research Organizations (IUFRO) Conference, FORPRIDECOM, College; 1978 October 30–November 3; Laguna, Philippines: 347–350.

Brown, G. A. (Moderator). 1981. Part II. Economic and sociopolitical aspects of tropical forest resource management. In: Mergen, F., ed. International symposium on tropical forests. Utilization and conservation. Ecological, sociopolitical, and economic problems and potentials; 1980 April 15–16; New Haven, CT. New Haven, CT: Yale University School of Forestry and Environmental Studies: 93–153.

Five papers listed by title include: Popkin, A.B. State responsibility for protection and preservation of forestry resources; Brewer, G.D. The state's responsibilities for the protection and preservation of forestry resources; Gregerson, H.M. Environmental constraints versus economic gains in tropical forestry; Evenson, R.E. Tropical forests in economic development; Smith, M.G. Forest and forestry programs in tropical countries: some observations and comments. Discussions in the papers include deforestation, international legal implications, international policies and alternatives, production and trade of forest products from tropical countries, guide to efficient exploitation of tropical woods, and comments on the symposium.

Burger, L.M.; Richter, H.G. 1979. Utilization of secondary tree species in south Brazil (Zur Verwendung von Sekundarholzarten in Sudbrasilien). Allgemeine Forstzeitschrift. 29:798–799.

Describes wood identification, standardization of nomenclature, anatomical investigation, and timber properties testing done in cooperative research between the University of Freiburg (Institute of Wood Anatomy and Technology) in Germany and the University of Curitiba (Forestry Faculty) in Brazil. *Schizolobium parahybum* and *Mimosa scabrella* are species described as having particular promise.

Caldevilla, G.M. 1978. Other forest products (conservation, recreation, wildlife, etc.): a source of foreign exchange. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina: Instituto Forestal Nacional. 3:3879–3896.

Describes the forests and other areas of natural beauty which have potential for world enjoyment and use, and the problems that countries have to resolve before they can take advantage of these values. Economic assistance agencies could make a significant contribution by using their own resources to protect these areas, to promote development, and generate foreign exchange with managed forest production as well as offering recreational opportunities and enjoyment of magnificent landscapes.

Cardoso, L. 1953. Causes of discoloration in wood (Causas da coloracao anormal da madeira). Sao Paulo, Brazil: Edio. Prop. Serv. Flor. Est. S. Paulo. 33:15.

Castro, R. de F.; Nascimento, J.R. 1978. Appraisal of the market for wood and wood products. Vol. 1. Analysis of supply and demand (Diagnostico do mercado de madeira e derivados. Vol. I. Analise de oferta e demanda). In: Brazil, Instituto Brasileiro de Desenvolvimento Florestal: Forestry development and planning: projections for the period 1979-1985. Appraisal of the forest sector of Brazil (Desenvolvimento e planejamento florestal. Serie: Estudos perspectivos para o periodo 1979 a 1985). Secretario Nacional de Planejamento Agricola, Subsistema de Planejamento Florestal. Brasilia, Brazil.

A three part report on: (1) Internal demand for timber and wood products with analysis, and forecasts of demand made on the basis of projected increases in population and GNP (based on the assumption that Brazil will follow the trends of developed countries). (2) Output predictions to 1985 are made for output from natural forests, plantations, and National Parks, by region and timber type. Output of plantation pine and eucalypts is predicted for a period of 15 to 20 years. (3) Required further reforestation is calculated by considering total production and demand forecasts by region, including balances of supply and demand between regions. Projected costs required for the period to 1985 are given.

Ceccatto, J.N. 1978. Analysis of the internal system of marketing wood and wood products. Part 3: Information

document (Analise do sistema de comercializacao interna de madeira e derivados. Parte III - Documento informativo). Brasilia, Brazil: Ministerio da Agricultura, IBDF: 54 p.

Describes activities of the Department of Industrialization and Commercialization (Ministry of Agriculture), with particular reference to legislation.

Cerda–V., I.; Contreras–D., V. 1979. Exports of Chilean forest products, 1978 (Exportaciones forestales Chilenas 1978). Santiago, Chile: Instituto Forestal. Informe Tecnico. 71:119.

The value of forest products exported by Chile in 1978 was US $236.9 million, $56 million more than in the previous year. The growing importance of exports of forest products in the national economy is noted, and detailed statistical data for 1978 are presented on the types of products exported, markets, prices, and ports used. The volumes of round timber, pulpwood, and sawn timber exported by Chile are compared with the total world exports of these products.

Chardin, A.; Bege, P. 1984. Measurement of the longitudinal component of growth stresses in native (French) and French Guianese species (Determination de la composante longitudinale du champ des contraintes de croissance dans essences metropolitaines et guyanaises). In: Groupe de travail no. 1. La matiere premiere. Sous-groupe 1.4 - Contraintes de croissance. Colloque sciences et industries du bois. Grenoble du 20 au 22 septembre 1982. Paris, France: Centre Technique Forestier Tropical: 159–173.

Chen, C.M. 1975. Relationship of wettability to water of hydration of selected tropical woods. Wood Science. 7(3):198–200.

The contact angles (theta) for distilled water were measured on 13 tropical hardwoods. Cos theta decreased with an increase in the average molecular weight of wood substance (M) required to absorb one molecular weight of water of hydration. Regression analysis showed that the dependence of cos theta on M was significant at the 5 percent level. No significant relation existed between theta and fibre saturation point or the water of solution.

Chudnoff, M.; Youngs, R.L. 1980. Evaluating concepts for the improved utilization of tropical timber resources. Unasylva. 32(128):27–28.

Unlike temperate regions, tropical forests have a tremendous number of tree species, which complicates their utilization. The need for better use of these resources, and several general methods of accomplishing this, is discussed.

Cliff, E.P. 1973. Utilization of tropical forests. Washington, DC: Agency for International Development Reference Center. TA/OST 73–20. 26 p.

Summarizes the results of a review of forestry literature published since 1946 (mostly by employees of the Agency for International Development) and available at the Centre. Forestry and land use problems in tropical forests are listed and discussed, and measures recommended to improve forestry programmes and the utilization of unused and little-used species are examined.

Collardet, J. 1979. Grading and standardization of tropical timbers (Le classement et la normalisation des bois tropicaux). In: Economic Commission for Europe, Timber Committee: Seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam, Netherlands. ECE Rep. TIM/SEM.8/R.16.

Commonwealth Science Council. 1978. Report of a Caribbean meeting on utilization of natural products; 1978 June 6–8; Georgetown, Guyana. London, UK: Commonwealth Science Council. Commonwealth Secretariat. Rep. CSC(78)NP 1. 23 p.

Describes research on: medicinal and toxic plant products; forest products; waste products from agriculture-based industries; marine natural products; and plant-derived industrial products.

Commonwealth Science Council. 1979. Report of the second Caribbean meeting on utilization of natural products; 1979 April 23–27; Port of Spain, Trinidad. London, UK: Commonwealth Science Council. Commonwealth Secretariat. Rep. CSC(79)NP 2. 59 p.

CORMA. 1960. Wood, properties, classification, averages, and applications. 2d ed. (Maderas, propiedades, clasificacion, medicion y aplicaciones 2d ed.). Santiago, Chile: Corporacion Chilena de la Madera, Departamento Tecnico. 79 p.

Cortes–S., H.; Contreras–S., M. 1977. Determination of the value of standing timber (Determinacion del valor de la madera en pie). Santiago, Chile: Facultad de Ciencias Forestales, Universidad de Chile. Boletin Tecnico. 40:36.

A study of different approaches to the valuation of standing timber in the context of forestry in the indigenous forests of the Panguipulli region of Chile, and of the present and probable future development of forest industry in the area. Direct and indirect methods of valuation are discussed, and it is concluded that the indirect method based on determining the residual value of standing timber (defined as the sale value of the final product less the total cost of conversion) is the only practicable approach to the problem under the conditions described.

CTFT. 1973. Investigations and tests carried out on tropical timber by several research laboratories (Recherches et essais effectues sur les bois tropicaux par divers organismes de recherches). Nogent-sur- Marne, France. Centre Technique Forestier Tropical. 291 p.

Describes in tabular form, information on the tests used and species tested at the following laboratories: Australia - Forest Products Laboratory, CSIRO, Melbourne; Belgium - Station de Technologie Forestiere, Ministere d'Agriculture, Gembloux, and Laboratoire Forestier de l'Universite de Louvain, Louvain; France - Centre Technique Forestier Tropical, Nogent-sur-Marne; Madagascar - Centre Technique Forestier Tropical, Tananarive; Germany Bundesforschungsanstalt fur Forst- und Holzwirtschaft, Reinbek; Netherlands - Houtinstituut TNO, Delft; Portugal - Laboratorio Nacional de Engenharia Civil, and Laboratorio de Histologia e Tecnologia de Madeiras, Lisbon; Spain - Instituto Forestal de Investigaciones y Experiencias, Madrid; and UK - Forest Products Research Laboratory, Princes Risborough. Within these laboratories are 1068 research files on tropical woods, covering 732 species.

Cueva–G., L. de la. 1978. Analysis of forest production in Mexico 1971–1976 (Analisis de la produccion forestal

en Mexico 1971–1976). Mexico, D.F., Mexico: Direccion General de Investigacion y Capacitacion Forestales. Ciencia Forestal. 12(3):22–39.

Describes recent trends in timber production, and other forest products in Mexico, and probable future trends. Data show a continuing rise in both volume and value of forest products.

Cunha, S.R.P. 1982. Importance of the utilization of native species in the State of Rondonia (A importancia do aproveitamento das essencias nativas em Rondonia). In: Malvesi, I.T.O. [and others], eds. Proceedings of the National conference on native species; 1982 September 12–18; Campos do Jordao, Sao Paulo, Brazil. Sao Paulo, Brazil: Silvicultura em Sao Paulo. 16A(3):1506–1511

Dahms, K.G. 1982. Imports of tropical timbers to W. Germany in relation to botany and dendrology (Der Tropenholzimport der Bundesrepublik Deutschland und seine Verbindung zur Botanik und Dendrologie). Holz-Zentralblatt. 108(54):781, 784–785.

Describes the origin, principal timber types, uses for the wood, and demand for tropical woods. West and central Africa supply over 90 percent in the form of logs, while SE Asia supplies over 70 percent of sawn timber, and Latin America has little impact. Reasons for this are discussed. The availability of woods for the export trade of primary forests and woods in m^3/ha is: SE Asia, 20–25; Africa, 3–7; central and S. America, 2–3. Problems of reforestation are discussed.

Dahms, K.G. 1985. Nomenclatural problems as a restraint on international trade in South American timber exports (Probleme der Nomenklatur als internationales Handelshemmnis in sudamerikanischen Holzexport). Holz-Zentralblatt. 111(47):681-682.

Describes problems in the market with trade names for woods of South America. Multiple names cause most of the problems, especially where one name is used for several different woods. In other cases exporters use local trade names not known in the world markets. Other items discussed are the use of prefixes and designations that are too common. The increasing use of tropical woods as substitutes for other woods requires the detailed information on properties and suggests further studies be conducted on wood characteristics. South American wood imports to Europe in 1983 accounted for only 0.4 percent of logs, and only 5.3 percent of sawnwood. These figures are expected to change in the future.

David–B., E., ed. 1971. A study of the trade and marketing of the forest products of Peru (Estudio de mercado y comercializacion de produtos forestales del Peru). La Molina, Peru: Departmento de Industries Forestales, Universidad Nacional Agraria. 326 p.

Delgado–F., A.; Vallejo–R., D. 1977. Forest use in Colombia (El aprovechamiento forestal en Colombia). Bogota, Colombia: CONIF, Corporacion Nacional de Investigacion y Fomento Forestal. Serie Tecnica. 4:41.

Describes forest use as all operations in the removal and transport of forest products to locations of processessing or consumption. Included in processing were some in situ processes, e.g. extraction of gum elastic, balata, and wood blocks. The removal of timber for domestic and export markets, up to this point, has been the main use of the forest. The authors analyze past history, current conditions, and future prospects of forest use in Colombia, emphasizing technical, social, institutional, and commercial aspects of use.

Delmarco, O.; Pollini, C. 1982. Chile. Instituto per la Tecnologia del Legno, Quaderni: 3:110.

Describes the forest situation in Chile in two articles: Forestry and forest products industries in the Chilean province of Valdivia. (Situazione forestale e delle industrie del legno in provincia di Valdivia). p.5–57; and Characteristics, growing stock and a utilization hypothesis for a natural forest in southern Chile (Caratteristiche, disponibilita e ipotesi di utilizzazione di una foresta naturale del Cile meridionale). p. 59–110.

Detienne, P. 1979. Errors in the trade names of tropical woods (Les erreurs dans les denominations commerciales des bois tropicaux). Bois et Forets des Tropiques. 186: 61–64.

Describes the causes of errors in trade names. A list is shown, with correct and incorrect trade names, providing the correct name and its genus and family name as well.

Durgnat, P.A. 1973. Trinidad's lumber. Trinidad and Tobago Forester. 8(1):15–20.

Describes the supply and consumption of lumber, equipment used by the local industry, and the labor force in 1971, and suggests lumber production improvements that could be made.

ECE. 1979. Characteristic features of individual markets for tropical hardwoods in Europe. In: Economic commission for Europe. Proceedings, timber committee: seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam, Netherlands. Union pour le Commerce des Bois Tropicaux dans la CEE. TIM/SEM.8/R.15. 23 p.

Reports and discusses trends in imports of hardwood logs and sawn timber into Belgium, France, German Federal Republic, Italy, the Netherlands, and the UK, from tropical Asia, Africa, and America.

ECE. 1979. Economic Commission for Europe, Timber Committee. In: Proceedings, seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam, Netherlands. Rome, Italy: Food and Agriculture Organization, FO: TIM/SEM. 8 p.

Proceedings of meeting with 19 papers printed.

ECE. 1978. Study on the trade and utilization of tropical hardwoods. Economic Commission for Europe, Timber Committee. Timber Bulletin for Europe. 30(10):94.

Describes trends in imports, processing, consumption, end-uses, and factors influencing the utilization of tropical hardwoods in Europe.

ECE. 1979. Tropical hardwood resources. In: Economic Commission for Europe. Proceedings, timber committee: seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam, Netherlands. Rome, Italy: Food and Agriculture Organization, FO: TIM/SEM.8/R.G. 5 p.

Describes tropical forest areas in natural stands and industrial plantations in tabular form. Discusses the net removals of industrial roundwood in Africa, America, and Asia- Oceania and projects data from 1975 to 2000.

Eisenhauer, G. 1982. Chile: on the road to forests with a future. Plant Research and Development. 15:111-116.

Eremeev, A.G. 1979. Classification of the forests of Cuba (Klassifikatsiya lesov Kuby). Lesnoe Khozyaistvo. 434-76.

Presents data on wood properties of several native tree species in Cuba. A table of density and hardness is shown for eight species. Another table lists the distribution of the main tree species, by economic value, by the main forest types.

Escarpita–H., A.; Ramirez–M., J. G.; Zerecero–L., G. 1981. Forest resources of Chihuahua (Los recursos forestales de Chihuahua). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Ciencia Forestal. 6(34):3–29.

Describes the resource situation in relation to the forest products industry in Chihuahua, Mexico. The forestry administration in the state is discussed.

FAO. 1982. Assistance for forestry and forest industries development, Jamaica: project findings and recommendations. Rome, Italy: Food and Agriculture Organization of the United Nations. FAO Rep. FO:DP/JAM/77/006.

FAO. 1974. Committee on forest development in the tropics. In: Proceedings, Report of the 3rd session; 1974 May 14–17; Rome, Italy: Food and Agriculture Organization of the United Nations. FAO Rep. FO:FDT/74/Rep. 65 p.

Includes recommendations and sections on: The contribution of forestry to the development and management of dry zones in the tropics; FAO studies on forest working techniques in tropical forestry; Potential use of remote sensing techniques for monitoring tropical forests; Properties and uses of tropical woods in relation to national and international action for promoting less-known species; and Pioneer studies for the utilization of mixed tropical hardwoods.

FAO. 1982. Country tables of production, trade and consumption of forest products: North, Central and South America 1970–1980. Rome, Italy: Food and Agriculture Organization. FAO Rep. FO/MISC/82/18. 113 p.

FAO. 1977. General aspects of the benefits of forest research by a company (Aspectos gerais dos beneficios da pesquisa florestal para uma empresa). Brasilia, Brazil: PRODEPEF. FAO Rep. PNUD/FAO/IBDF/BRA-45. Comunicacao Tecnjca. 9:8.

Describes research efforts by the Forestry Division of Champion Papele Celulose S/A at Mogi Guacu, Sao Paulo state, Brazil. The company has large pulpwood plantations near Mogi Guacu. Information is provided of provenance trials for several eucalyptus species recently re-introduced from Australia. Special emphasis is given to the provenance of *E. grandis* from Coff's Harbour, New South Wales; progeny from this provenance are being used in a genetic improvement program.

FAO. 1970. Pre-investment study for forestry development in northwest Ecuador. Final report. Vol. 1. General. Vol. 2. Forest engineering, industries, and surveying. Vol. 3. Forest management. FAO Rep. FAO/SF: 76/ECU/13: Vol.1, 79 p.; Vol.2, 221 p.; Vol.3, 154 p.

The three volumes cover an intense study of Ecuador's forest resources and potential for timber production. Volume I describes the studies, conducted from 1964 to 1969, showing where efforts should be put (NW part of country). It also discusses concessions let to the industry that could result in immediate and long-term benefits. Volume 2 describes recommendations for logging and forest operations. Volume 3 describes the biological aspects including dendrology, wood property analysis, silvicultural studies, etc. Discussions of using domestic and exotic species are made. Information is provided for developing management plans including a suggested plan.

FAO. 1963. Proceedings of the 5th conference on wood technology; 1963 September 16–27; Madison, Wisconsin. Rome, Italy: United Nations, Food and Agriculture Organization. 77 p.

FAO. 1977. Projections of demand for sawn timbers in Brazil 1975–2000 (Projecoes de demanda de madeira serrada no Brasil 1975- 2000). Brasilia, Brazil: Colecao Desenvolvimento e Planejamento Florestal. FAO Rep. PNUD/FAO/BRA-76/027. Serie Tecnica. 3:67.

Describes the procedure used and presents data on the estimated future demand for sawn timbers (in roundwood equivalents), presented in tables and graphs.

FAO. 1977. Prospects and trends in the Brazilian forestry sector, 1975 to 2000 (Vol. 1) (Perspectivas e tendencias do setor florestal Brasileiro, 1975 a 2000 (Vol. 1)). Brasilia, Brazil. Colecao Desenvolvimento e Planejamento Florestal. FAO Rep. PNUD/FAO/BRA-76/027. Serie Tecnica. 8:183.

Describes the forestry sector in Brazil and its contribution to the gross national product, exports and imports, output, investment, effect on conservation of the environment, etc. Discusses the estimated future demand for sawn timber, national and regional timber resources, the relation between supply and demand, and future prospects and difficulties.

FAO. 1985. Tropical forestry action plan. Committee on Forest Development in the Tropics. Rome, Italy: Food and Agriculture Organization of the United Nations. FAO. 159 p.

Describes an action program for the tropical areas of the world in five priority areas: Forestry in land use; Forest-based industrial development; Fuelwood and energy; Conservation of tropical forest ecosystems; and Institutions (administration, research, extension, education, and training). Action proposals for each area include: justifications for priorities; identification of principal activities; Principal problems and probable solutions; action program goals, strategies, program structures, etc.; and development assistance needs. Sample project profiles are provided in appendices.

Fontes, P.J.P. de.; Quirino, W.F.; Peixoto, R.C.D. 1982. Survey of the timber supply from agricultural and colonization projects in the states of Rondonia, Mato Grosso, and northern Goias. (Levantamento da oferta madeireira derivada de projetos agropecuarios e de colonizacao nos Estados de Rondonia, Mato Grosso e norte de Goias). Brasil Florestal. 52:19–26.

Predicts the amount of wood expected to be cut due to deforestation in the near future. Notes that the wood processing industry is incapable of dealing with more than 10 percent of this unless this industry is better developed and managed.

Franco, M.A.B. 1982. Utilization of wood from areas cleared for reforestation for intensive silviculture by the Companhia Florestal Monte Dourado (A utilizacao da madeira de areas desmatadas para o reflorestamento com especies de rapido crescimento, pela Companhia Florestal Monte Dourado). In: Malvesi, I.T.O. [and others], eds. Proceedings of the national conference on native species; 1982 September 12–18; Campos do Jordao, Sao Paulo, Brazil. Silvicultura em Sao Paulo. 16A(2):1328–1331.

Franklin, E.C. 1978. Juvenile-mature correlations. In: Nikles, D.G.; Burley, J.; Barnes, R.D., eds. Progress and problems of genetic improvement of tropical forest trees. Proceedings of a joint workshop, IUFRO working parties S2.02–08 and S2.03–01; 1977; Brisbane. III. Selection and genetics. Oxford, UK: Commonwealth Forestry Institute: 205–212.

Describes breeding strategies necessary for the success of early selection in relation to physical and chemical properties, and the influence of genetic and environmental characteristics; a quantitative model is included.

Freas, A.D.; Chudnoff, M.; Koeppen, R.C.; Hutchinson, S.B. 1973. Factors influencing the utilization of tropical wood species. Washington, DC: Agency for International Development. TA/OST 73–22, 31 p.

Reports an investigation of reasons for the under-utilization of a large number of secondary timber species in tropical countries where relatively few species enter the trade, with particular reference to Colombia, Ghana, Nigeria, and the Philippines. It is concluded that the immediate problem is a lack of readily available information on the properties of these species, since the existing data are scattered and difficult to evaluate. This has given rise to problems of inventory, marketing, and processing. Several recommendations are made for a program of international aid to tropical timber producers.

Garduno, G.R. 1959. Notes on the utilization of forest products of arid zones (Nota sobre explotacion de productos forestales de zonas aridas). Durango, Mexico: Mensajero Forestal. 17(176):8–9.

Giordano, G. 1979. Knowledge of tropical hardwoods and information needs; market research, marketing, and promotion (Connaissances des bois feuillus tropicaux et besoins d'information; etudes de marche, commercialisation et promotion). In: Proceedings: Economic Commission for Europe, Timber Committee, seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam, Netherlands. ECE Rep. TIM/SEM.8/R.3. 6 p.

Goto, T.; Furuno, T. 1974. Bibliography of publication[s] on tropical woods I. Wood qualities and utilization. Matsue, Japan: Shimane University. Res. Rep. of Foreign Wood. 3:1–37.

A bibliography arranged in sections covering wood anatomy, physical and mechanical properties, working properties, gluing, durability and preservation, plywood manufacture, pulping, and trade and marketing. Within each section the references are cited chronologically in two groups: references to world literature and Japanese literature.

Goto, T.; Onishi, H. 1981. Bibliography of publications on tropical woods. [III]. Wood-producing areas (2). Matsue, Japan: Shimane University. Res. Rep. of Foreign Wood. 9:100.

Graaf, N.R. de. 1982. Sustained timber production in the tropical rainforest of Suriname. In: Wienk, J.F.; Wit, H.A. de., eds. Proceedings of management of low fertility acid soils of the American humid tropics; 1981 November 23–26; Paramaribo, Suriname. Vaco Press N.V.: 175–189.

Grainger, A. 1980. The state of the world's tropical forests. Ecologist. 10(1/2):6–54.

Describes the launching of the World Ecological Areas Programme (WEAP) proposal to save the world's tropical rainforests. The author notes major threats to the forests by shifting cultivation, logging, and the wildlife trade are considered and the world trade in tropical timbers is described. The effects of continued forest destruction on local populations, local and global climate, and genetic resources are discussed.

Grayson, A.J. 1978. The valuation of nonwood benefits. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina; Instituto Forestal Nacional. 4/5:5634–5657.

Grayum, G.H. 1971. Forest industries development survey, Guyana, logging and forest management. Rome, Italy: Food and Agriculture Organization, United Nations Development Program. Tech. Rep. 12. FO:SF/GUY 9. 73 p.

Gregersen, H.M. 1978. Export development programs for forestry. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina; Instituto Forestal Nacional. 4: 5883–5912.

Gregersen, H.M.; Contreras, A. 1975. U.S. investment in the forest-based sector in Latin America: Problems and potentials. Baltimore, Maryland: Published for Resources for the Future by Johns Hopkins University Press: 101–105.

Harris, J.M. 1971. FAO project on tropical pines. Report of Forest Research Institute for 1970. New Zealand: New Zealand Forest Service: 78–79.

Describes the density variation, determined by beta-ray densitometry, in *Pinus caribaea, P. merkusii,* and *P. oocarpa* from Malaya. Characteristics of the pines were different than those of temperate areas in that they had multiple bands of very dense wood in the mature zone. Juvenile wood was typically low on denser latewood.

Hartwig, F.; Wiebecke, C. 1981. Forestry and the forest products industry in Central America—with special reference to Honduras (Die Forst- und Holzwirtschaft Mittelamerikas unter besonderer Berucksichtigung von Honduras). Forstarchiv. 52(2;3):64-72; 97–102.

A comprehensive review; the following main subjects are discussed on a country-by-country basis: economic-geographic foundations; forest distribution; forest utilization; forestry policy and law; forestry administration; training of forestry personnel; and research. The need is stressed for a clear separation between agricultural and forestry requirements, and a halt to the expansion of agricultural development at the expense of actual/potential forest land. Recommendations include: intensified training of forest workers and technologists; and increased research in silviculture and work science. Caribbean countries constitute an important potential export market for Central American timber. Honduras is cited as the Central American country with the most clearly developed forestry policy, and there is a discussion of the activities of the Honduran Corporation for Forest Development (COHDEFOR), which has exclusive rights to harvesting of forests in Honduras.

Hederstrom, T. 1972. Commercial aspects of the forest products industries (Apuntes sobre comercializacion de productos forestales). Medellin, Colombia: Centro de Publicaciones, Universidad Nacional. Proyecto UNDP-FAO COL/65/516. p. 72.

Describes a study of the economics of the forest products industries in Colombia.

Herrera−S., V.J. 1980. Marketing of valuable and common tropical timbers in Mexico City (Comercializacion de maderas tropicales preciosas y corrientes en la Ciudad de Mexico). Ciencia Forestal. 5(28):32−56.

Presents results of a questionnaire survey study relating market conditions in the late 1970s, using supply and demand, and 1980 prices to make an evaluation of the situation.

Hilmi, H.A. 1986. World compendium of forestry and forest products research institutions. Rome, Italy: United Nations, Food and Agriculture Organization. FAO Forestry Pap. 71:611.

Holdridge, L.R., [and others]. 1947. The forests of western and central Ecuador. Washington, DC: U.S. Department of Agriculture, Forest Service. Special Report for Office of Interamerican Affairs: 134.

Describes about 70 species, giving tree description, range, and general wood description and uses. Keys to identification are also provided.

Hummel, F.C.; Davidson, J.L. 1978. The planning and development of markets for man-made forests. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4−18; Buenos Aires, Argentina. Buenos Aires, Argentina; Instituto Forestal Nacional. 4/5:5493−5515.

Husch, B. 1982. Forestry in Chile. Journal of Forestry. 80(11):735−737.

Describes the forestry situation in Chile using data on forestry up to 1981 and on forest industries up to 1980.

IBDF. 1983. Brazilian grading rules for sawn hardwood timber. Ministry of Agriculture, Brazilian Institute for Forestry Development. IBDF (Instituto Brasileiro de Desenvolvimento Florestal). Brasilia, Brazil: Forest Products Laboratory: 67.

Presents the first official lumber grading rules produced by Brazilian government. Items included are: Introduction; Generalities, Preparation of the timber, Sizes, Grading methods. Specifications for the general market; Rules defining the grade types, Grading some commercial species commonly having certain defects. Specifications for special markets; Grading by the better face, Grading by four faces, Shorts. Appendices.

IBDF. 1978. Study of the international wood and wood products market. Vol. 2. Statistical tables (Estudo do mercado internacional da madeira e derivados. Volume 2. Quadros estatisticos). Ministerio da Agricultura; Brasilia, Brazil: Instituto Brasileiro de Desenvolvimento Florestal: 109.

INFOR-CORFO. 1987. International markets and Chilean forest products exportation (El mercado internatcional y las exportaciones forestales Chilenas). Santiago, Chile: INFOR-CORFO (Instituto Forestal-Corporacion de Fomento de la Produccion. Informe Tecnico. 110:216.

Describes the development of international markets for Chilean forest products and the recent status of trade for specific classes of products. Data is provided on the volume and value of products traded, in mass and by specific country.

INFOR-CORFO. 1987. The internal forest market (El mercado forestal interno). Santiago, Chile: INFOR-CORFO (Instituto Forestal-Corporacion de Fomento de la Produccion. Informe Tecnico. 106:138.

Describes the internal market situation in Chile for 12 distinct products, providing information on the supply and demand and the expected future demand situation.

Karstedt, P.; Tomaselli, I. 1979. Training of wood science and technology researchers in Latin America (Formacao de pesquisadores no ramo da pesquisa da madeira na America Latina). Curitiba, Brazil. Floresta. 10(1):63−68.

Describes wood technology training in several countries of Latin America including Chile, Colombia, Mexico, and Peru. Details are given for Brazil with special emphasis on the Federal University of Parana at Curitiba.

King, K.F.S. 1978. The utilization of low-quality tropical timber. Unasylva. 29(118):18-24.

Knowles, O.H. 1969. Investment and business opportunities in forest industrial development of the Brazilian Amazon. Curitiba, Brazil: National Forestry School. FAO Rep. FO: SF/BRA 4. Tech. Rep. 1:56.

Describes conditions in the Amazon basin from human, industrial, and natural standpoints. Includes governmental structures that will assist with development projects. Reviews past history of the area concerning the industrial situation and the potential for the future (both positive and negative) regarding siting of forest products industries. Appendices list 150 species by common and scientific name.

Koch, P. 1978. Changing raw material supplies and their effect upon wood processing technology. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4−18; Buenos Aires, Argentina. Buenos Aires, Argentina; Instituto Forestal Nacional. 5:6240−6254.

Kumar, R. 1982. World tropical wood trade. Economic overview. Resources Policy. September: 177–192.

A general overview of world wide trade in tropical woods. Developments over a 30 year period are reviewed and considered in light of recent changes. Discusses trade in different parts of the world in relation to other factors, and predicts price changes due to them. Notes the need for large investments to renew the tropical forest resource.

Lembke, H.H. 1980. Problems of the world tropical timber market. Economics. 21:116–135.

Data are presented illustrating fluctuations in demand, price, and returns for tropical roundwood. It is suggested that these fluctuations could be compensated by reducing the dependence of individual supplying countries on specific foreign markets, by the setting-up of marketing boards to supervise trade, supply market information, and open up new markets, and by increasing the flexibility of supply, through a world-wide information system.

Lewis, N.B. 1972. Forestry development, Surinam, forest-based industry development Surinam. Rome, Italy: Food and Agriculture Organization of the United Nations. United Nations Development Program Rome: 27.

Lima, J.P.C. de; Mercado, R.S. 1985. The Brazilian Amazon region; forestry industry opportunities and aspirations. Commonwealth Forestry Review. 64(2):151–156.

Describes the region of the Amazon and its potential for development of further forest products industries.

Lopes, J.P.I. 1973. Amazonia tomorrow. In: Lopes, J.P.I. Amazonia [area strategy, and physical, economic, and psycho-social study for the development plan for Amazonia]: A Amazonia. Revue du Bois et de ses Applications. 28(4/5):33–39, 47–54.

Describes a study tour of about 20 French primary and secondary manufacturers of wood products and wood merchants, made in Feb. 1973. Discusses the economy of the Amazonian region (Colombia and Brazil), its geography, timber, and other natural resources, and the governmental methods and forest policies employed in the region. Also discussed are possibilities for establishing commercial ties between the region and Europe, especially France.

Loschau, M. 1984. College education in forestry and forest products industry of tropical countries (Hochschulausbildung fur die Forst- und Holzwirtschaft tropischer Lander). Beitrage fur die Forstwirtschaft. 18(4):151–157.

Describes the conditions and need for improved technical training in tropical countries.

Lupatelli, S.C.; Siqueira, J.D.P.; Terezo, E.F.M. 1982. Trade in Brazilian forest products. In: Malvesi, I.T.O. [and others], eds. Proceedings of the national conference on native species; 1982 September 12–18; Campos do Jordao, Sao Paulo, Brazil. Silvicultura em Sao Paulo. 16A(3):1421–1464, 1491–1505.

Lists three papers by title: Lupatelli, S.C. Integration of research and practice for the development of foreign trade in tropical woods (Integracao da pesquisa a pratica para desenvolver o comercio exterior de madeiras tropicais): 1421–1443; Siqueira, J.D.P. Expression of the social and economic importance of native species (Expressao economica e social das essencias nativas): 1444–1464; Terezo, E.F.M. Trade in forest products (Comercio de produtos e sub-produtos florestais): 1491–1505.

Madas, A. 1978. What will 2000 bring in changed patterns of production trade and consumption? In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina; Instituto Forestal Nacional. 4/5:5707–5741.

Maydell, H.J. von. 1974. The importance of the timber trade in developing tropical forest zones. Institute for Scientific Cooperation. Economics. 8:42–54.

McGaughey, S.E.; Gregersen, H.M., eds. 1983. Forest-based development in Latin America. An analysis of investment opportunities and financing needs. In: Proceedings, regional conference of the Inter-American development Bank at the bank's headquarters; 1982 June 22–25; Washington, DC: 215.

The purpose of this book is to explore the prospects for accelerating the economic development of forestry and forest industry in Latin America, including the Caribbean subregion, in member countries of the Inter-American Development Bank (IDB). The book's central theme is to ascertain the many future opportunities as well as factors that will limit or stimulate the growth of public and private sector investments in the forest-based sector in years ahead. The sector is viewed in broad terms to encompass activities from forest management and timber extraction through the stages of primary processing, including energy, sawnwood, wood panels, and pulp and paper production. It also incorporates social and protection forestry such as watershed management and resource preservation.

McNeil, D.L. 1981. Tropical forest industries: a transnational corporation view. Commonwealth Forestry Review. 60(2): 105–112.

Abstracted parts from a paper, presented at the workshop, Negotiations with transnational corporations in the tropical hardwoods section; 1980 August; Pattaya, Thailand. Organized by the United Nations Centre on Transnational Corporation (TNCs). Subjects covered are: the aims and economics constraints of TNCs; negotiation of terms under which logging concessions are granted by national governments; costs of developing local wood industries; and problems of reforestation.

Melo–H., R. 1988. Analysis of the heating process for radiata pine (Analisis del proceso de maceracion para el pino radiata). Ciencia e Investigacion Forestal. 5:31–44.

This article presents the most relevant results of a study about heating times of Radiata pine logs, using water as an agent of heat transfer. The process, called melting, is done previously to the rotary lathe. The results show that the heating times at different diameters are short and do not exceed 23 hours in any of the cases studied. The only variable which is statistically correlated with the wood temperature is the log diameter. Finally, regression models are established for calculating internal temperatures in the log at different diameters on the melting time.

Morgan, H.E. 1978. An industrialist looks at multiple forest uses. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina; Instituto Forestal Nacional. 5:6799–6821.

Mujica, F.D. 1978. Analysis of the variation in prices of willow in the Tigre produce market, Province of Buenos Aires, Argentina (Analisis de la variacion del precio de los sauces en el mercado de frutos del Tigre (Prov. de Buenos Aires, Argentina)). In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina; Instituto Forestal Nacional. 4/5:5410–5421.

Napier, I.A. 1973. A brief history of the development of the hardwood industry in Belize. Coedwigwr. 26:36–43.

Describes the history of the hardwood industry in Belize (British Honduras) from the 16th century to the present, with special reference to the importance of Logwood (Haematoxylon campechianum) and Mahogany (Swietenia macrophylla).

Netherlands Royal Tropical Institute. 1979. An analysis of the constituent elements of functions and their costs in the international tropical timber trade. In: Economic Commission for Europe. Proceedings, Timber committee: seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam, Netherlands. Royal Tropical Institute. TIM/SEM.8/R.2. 3 p.

Nikles, D.G.; Burley, J.; Barnes, R.D., eds. 1978. Progress and problems of genetic improvement of tropical forest trees. In: Proceedings of a joint workshop; IUFRO working parties S2.02–08 and S2.03–01; 1977 April 4–7, Queensland, Australia. Oxford, UK: Commonwealth Forestry Institute. 2 vols. 1066 p.

Proceedings of a joint workshop held in Brisbane, Queensland, Australia, April 4–7, 1977, by IUFRO working parties S2.02–08 (tropical species provenances) and S2.03–01 (Breeding tropical species). The 110 papers covered five topics: 1. Wood quality of tropical species in relation to provenance and tree breeding; 2. Pulp, paper, and timber properties of plantation-grown tropical pines; 3. Selection and genetics; 4. Population-environment interactions; and 5. Provenance trials and breeding programs.

Ninin–S.,L. 1974. Some important aspects of the production of sawn wood in the country (Algunos aspectos relevantes de la produccion de madera aserrada en el pais). Merida, Venezuela: Lab. Nac. de Productos Forestales. Revista Forestal Venezolana. 17(24):21–28.

Describes the main reasons why little progress has been made in developing the production of sawn timber in Venezuela in spite of publicized work by the National Forest Products Laboratory on the properties and potential uses of tree species previously considered as marginal, and in spite of government insistence that a greater range of timbers should be used. Recommendations are given to aid this situation.

Nock, H.P. 1979. Brazil's paper and cellulose program. (Brasiliens Papier- und Zellstoffprogramm). State Tech. Sch., Hamburg, German Federal Republic. Allgemeine Forstzeitschrift. 29:800–803.

Describes the National Paper and Cellulose Program that is designed to develop self-sufficiency in paper manufacture for Brazil and produce a favorable balance of trade in pulp and paper. The author predicts an annual pulp production increase from 0.4 million t in 1977 to 3.0 million t in 1982. Dependence on foreign investment and large-scale afforestation schemes (in Eucalyptus and Pinus spp.) is required to accomplish the goals. The greatest growth is expected in bleached sulphate pulp derived from Eucalyptus plantations in southeastern Brazil.

Oldeman, R.; Boerboom, J. 1979. A life-insurance policy on tropical timber resources (Vers une assurance-vie des ressources en bois tropicaux). In: Economic Commission for Europe. Proceedings, Timber committee: seminar on the utilization of tropical hardwoods, 1979 May 15–18; Amsterdam, Netherlands. ECE Rep. TIM/SEM.8/R.7. 6 p.

Oldeman, R.A.A., ed. 1982. Tropical hardwood utilization: practice and prospects. The Hague, Netherlands: Martinus Nijhoff/Dr. W. Junk Publishers. Forest Sciences Series. 584 p.

A book based on a seminar organized by the Timber Committee of the United Nations Economic Commission for Europe in 1979. The 40 chapters are arranged under 5 section headings listed by editor, title, and page. Fontaine, R.G. Section I. Tropical hardwood resources: 19–142; Guillard, J. Section II. Tropical hardwood markets and marketing: 143–323; Brazier, J.D. Section III. End-uses of tropical hardwoods: 325–433; Menon, K.D. Section IV. Grading and standardization: 435–526; Overbeek, A. Section V. Tropical hardwood expertise—international cooperation: 527-574.

Osgood, J.R. 1979. Tropical timber: an importer's point of view. Unasylva. 31(124):26–28.

Pan American Union. 1967. Study of agricultural education, investigation, and extension, 1965: Inter-American Committee for Agricultural Development; United Nations Development Program, Ecuador; Junta Nacional de Planificacion y Coordinacion Economica. Washington, DC: Pan American Union: 47.

Pandolfo, Clara. 1978. The Brazilian Amazaon forest (A floresta Amazonica brasileira) Superintendencia do Desenvolvimento da Amazonia). Departamento de Recursos Naturais Belem, SUDAM. 69 p.

Ponce, R.H. 1982. Review of the wood and wood products industry in selected countries in Latin America. A paper prepared in advance of the 1st UNIDO consultation on the wood and wood products industry; 1982 October 4–8; Sao Paulo, Brazil. Geneva, Switzerland: United Nations Industrial Development Organization. ID/WG.380/1. 138 p.

Describes market and trade for: Brazil, Chile, Colombia, Guyana, Mexico, Paraguay, and Peru.

Potma, H.L. 1977. Projections of demand for sawn wood in Brazil, 1975–2000 (Projecoes de demanda de madeira serrada no Brasil, 1975-2000). Brasilia, Brazil: Instituto Brasileiro de Desenvolvimento Florestal. Serie Tecnica. 3.

Preston, S.B. 1978. Information requirements for expanding markets for tropical woods. In: Proceedings of

the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina; Instituto Forestal Nacional. 5:6420–6425.

Pringle, S.L. 1979. The outlook for tropical wood imports. Rome, Italy: Food and Agriculture Organization. Unasylva. 31 (125): 10–18.

Examines tropical wood imports into the USA by type of product and source, projecting future prospects in relation to source country policies and domestic markets.

Quinonez–O., J.; Zerecero–L., G. 1981. Forest resources of Durango (Recursos forestales de Durango). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Ciencia Forestal. 6(31):43–55.

Describes, primarily for 1980, the statistics on the forest products industry in the state of Durango in NW Mexico.

Quintana, M.E.; Enriquez, B.E.; Martinez-B., A.E. 1978. Supply of wooden sleepers for Mexican railways (Abastecimiento en durmientes de madera para ferrocarriles de Mexico). Mexico, D.F., Mexico: Instituto Nacional de Investigaciones Forestales. Ciencia Forestal. 3(14):3-19.

Data up to 1978 are given on the availability of wooden sleepers for the Mexican State Railways. Sufficient timber is believed to be available in the country to meet the annual requirement of about 4.6 million sleepers. It is concluded that wooden sleepers are more economical than cement sleepers. Suggestions are made for improving sleeper production.

Reitz, R.; Klein, R.M.; Reis, A. 1978. Santa Catarina woods — survey of native forest species in Santa Catarina with the potential for growth and development. (Projeto madeiro de Santa Catarina - Levantamento das especies florestais nativas em Santa Catarina com a possibilidade de incremento e desenvolvimento). Itajai, Santa Catarina, Brazil. Herbario Barbosa Rodriques. 320 p.

The special commemorative issue describes the original forest vegetation of the state of Santa Catarina and lists the 72 families and 713 species of trees and shrubs held in the herbarium. Descriptions and illustrations of the plants are given with information on growth habitat, economic uses, and potential.

Rendel, B.J. 1969. World Timbers, Vol. 2, North and South America (including Central America and the West Indies). London, United Kingdom: Ernest Benn Ltd. and Toronto, ON, Canada: University of Toronto Press. 150 p.

Ribeiro, H.; Machado, L.M.G. 1981. Contribution of the forestry sector to the Brazilian export market (Contribuicao do setor florestal ao comercio exterior Brasileiro). Brasilia, Brazil: Instituto Brasileiro de Desenvolvimento Florestal: 55.

Describes the volume of exports and imports of wood and wood products for the period 1975–1980 for Brazil and discusses trends.

Ribeiro, H.; Machado, L.M.G. 1982. Contribution of the forestry sector to Brazilian foreign trade (Contribucao do setor florestal ao comercio exterior brasileiro). Brasilia, Brazil: IBDF. Brad Florestal. 12(49):7–22.

Describes, with statistics, the contribution of various segments of the forest products industry to foreign trade by Brazil. Most of the data are from 1975 to 1982. The figures show that in 1980 the balance of trade was a positive $650,000.

Ribeiro, J., De R. 1971. Maranhao and its vegetation. Brasil Florestal. 2(5):9–20.

Describes the vegetation types and the most important tree species in seven physiographic regions of the state of Maranhao, Brazil. The species most commonly used for wood products are listed, and the timber resource situation is discussed.

Riedesel, B.H. 1976. Utilization of forests in Venezuela (Utilizacion de bosques en Venezuela). Merida, Venezuela: FAO Rep. VEN/72/019, Documento de Trabajo. 1:48.

Describes the present state of forest exploitation in Venezuela, under the main headings: supply of raw materials for forest products; basic methods of forest administration; the forest law; rules under the forest law for the provision of sawmills; permits for short-term exploitation; contracts for long-term exploitation; rules regarding minimum diameters; and taxing of transport of forest products. Recommendations are made for improving and simplifying the system of permits and contracts, rationalizing the application of minimum diameter limits and replacing the existing multiple checks on exploitation by one effective check.

Rojas-C., V. 1979. Some aspects of wood utilization in Costa Rica (Algunos aspectos sobre la utilizacion de la madera en Costa Rica). In: Chavarria, M., ed. Proceedings, International symposium on forest science and its contribution to the development of tropical America (Simposio internacional sobre las Ciencias Forestales y su Contribucion al Desarrollo de la America Tropical); 1979 October 11–17; San Jose, Costa Rica.

Describes different species of Costa Rica and their uses.

Saelzer, B.F. 1974. International treaties of Chile regarding forest and timber policy. In: Charlas y Conferencias 2. Valdivia, Chile: Instituto de Manejo y Economica Forestal: 35–48.

A general account of various international agreements or treaties (bilateral and multilateral) entered into by Chile, that relate directly or indirectly to forest policy and the wood industry, conservation, labor matters, etc.

Sandermann, H. W. 1970. National Forestry School, Curitiba, Brazil: Laboratory for wood technology. FAO Rep. FOI: SF/BRA 4. Tech. Rep. 2:33.

Describes the Brazilian National Forestry School at Curitiba in the context of the state of forestry and forest products in the country. The facilities for forestry education and research for Brazil are discussed with recommendations for improved education in forestry and forest products.

Santos-V., J.E. de los. 1982. Training requirements for personnel in the forest products industry: Progress, limitations, and perspectives (Determinacion de necesidades de capacitacion de productores forestales: avances, limitaciones

y perspectivas). Mexico D.F., Mexico: Institute Nacional de Investigaciones Forestales. Ciencia Forestal. 7(36):30–64.

Describes a study of industries in the state of Chihuahua, Mexico.

Schrewe, H. 1975. Strengthening the national forestry program, Chile: the primary transformation of wood (current situation and future prospects) (Fortalecimiento del Programa forestal nacional, Chile: la transformacion primaria de la madera (situacion actual y futuras perspectivas). Rome, Italy: Food and Agriculture Organization. FAO Rep. Development Program 197.

Shand, E.A.; Bezerra, R.N.; Nascimento, P.R. 1978. Diagnosis of the market for wood and its derivatives. Vol. 2. Analysis of the domestic marketing system (Diagnostico do mercado de madeira e derivados. Vol. 2 Analise do sistema de comerciali tacao interna de madeira e derivados). In: Forestry development and planning: projections for the period 1979–1985. Diagnosis of the forestry subsector of Brazil (Colecao: Desenvolvimento e planejamento florestal. Serie: Estudos perspectivos para o periodo 1979 a 1985. Diagnostico do subsetor florestal do Brasil. Brasilia, Brazil, Secretario Nacional de Planejamento Agricola, Subsistema de Planejamento Florestal. Barasilia, Brazil: Instituto Brasileiro de Desenvolvimento Florestal: 387 p.

Describes the classification of Brazil into two sections: the north/northeast, (mostly natural forests, particularly the Amazon basin) and the south/southeast with mostly plantation forests. The marketing systems of these two units are considered separately. From the north, the timber is used principally for sawnwood and plywood, as sales of sawlogs diminish. In the south, more processing is common making panels, laminates, pulp and paper, and charcoal for the steel industry. Classification of timber, prices, market structure, distribution channels, and transport are discussed for both geographical units. Recommendations are made for both areas, covering fiscal regulation, products, and social factors.

Shand, E.A.; Nascimento, P.R.; Bezerra, R.N. [and others]. 1978. Diagnosis of the market for wood and wood derivitives. Vol. 3. Analysis of the international market (Diagnostico do mercado do madeira e derivados, Vol. 3. Analise do mercado internacional). In: Brazil, Instituto Brasileiro de Desenvolvimento Florestal: Forestry development and planning: projections for the period 1979 to 1985. Appraisal of the forest sector of Brazil. (Colecao: Desenvolvimento e planejamento florestal. Serie: Estudos perspectivos para o periodo 1979 a 1985. Diagnostico do subsetor florestal do Brasil.) Brasilia, Brazil: Secretario Nacional de Planejamento Agricola, Subsistema de Planejamento Florestal. 310 p.

Describes an analysis of the trends in the international timber markets during the 1970s, to be used in planning of forestry activities during the period from 1979 to 1985. Hardwood sawlogs, lumber, panels, and pulp and paper were the products studied. Supply and demand for these products was considered in the analysis as were market situations within the main importers of Brazil's wood products (UK, USA, W. Germany). Seventy six tables of statistical data are presented. Brazil's competitive position, with respect to forest ownership, production capacity, marketing organization, product classification, and transport is also discussed. Fourteen recommendations are presented for the improvement of Brazil's position as a world supplier. Several of the recommendations relate to marketing of Amazonian lumber.

Shand, E.A.; Nascimento, P.R.; Bezerra, R.N. [and others]. 1978. Study of the international wood and wood derivatives market. Vol.1 (Estudo do mercado internacional da madeira e derivados. Vol. 1). Brasilia, Brazil: Ministerio da Agricultura. 207 p.

First of three volumes examining the status of Brazil in the world wood products market senerio.

Simioni, A.; Keiner, S., Jr. 1975. Development of wood exploitation in Brazil (Evolucao da exploracao madereira no Brasil). Florest a. 6(2): 39–45.

A chronological survey, based on the literature, of the development of exploitation and the wood industries in Brazil since 1500.

Slooten, H. van der. 1977. The importance of wood density in forest productivity (A importancia da densidade da madeira na produtividade florestal). Rome, Italy: Food and Agriculture Organization. FAO Rep. PNUD/FAO/IBDF/BRA–45, Communicacao Tecnica. 13:8.

Describes the wood density variation from plantations of *Pinus elliottii* in different parts of southern Brazil. The cost per 1000 kg, of wood delivered at the factory, from a plantation of low wood density, was compared to the cost of wood from a plantation of high wood density. The greater volume yield of the low-density stand did not compensate for the loss of weight, and thus cost more than that from the high-density stand. It is noted that the producer and consumer must integrate needs and meet end requirements.

Slooten, H.J. van der. 1978. Utilization of Amazon tropical hardwood forests through technological research. In: Proceedings of the 8th World Forestry Congress; 1978 October 16–28; Jakarta, Indonesia. World Forestry Congress: Forestry for industrial development. FID-II/20–6. 15 p.

Soares, F. de A. J. 1972. Aspects of the commercialization of Amazonian timbers (Aspectos da comercializacao das madeiras amazonicas). Belem, Brazil: Divisao Desenvolvimento da Amazonia. 109 p.

Describes a survey of the timber industry in Amazonia, the principal characters of the most important forest types, with estimates of the standing volume of commercial species, and the domestic and export markets. Recommendations for improvements in the industry are made, with particular reference to the work of SUDAM. 703 Amazonian species are listed in an appendix, with common and scientific names.

Sobral Filho, M. 1982. Wood technology in Amazonia (Tecnologia de madeiras da Amazonia). In: Malvesi, I.T.O. [and others], eds. In: Proceedings of the national conference on native species; 1982 September 12–18; Campos do Jordao, Sao Paulo, Brazil. Sao Paulo, Brazil: Silvicultura em Sao Paulo. 16A(2):1245–1252.

Stadelman, R.C. 1979. The United States market for tropical hardwoods. In: Economic Commission for Europe,

Timber Committee: In: Proceedings, seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam, Netherlands. TIM/SEM.S/R.l. 8 p.

Stahelin, R.; Everard, W.P. 1964. Forests and forest industries of Brazil. Res. Rep. 16. Washington, DC: U.S. Department of Agriculture, Forest Service. 50 p.

Tinto, J.C. 1974. Utilization of woods of inferior quality. Buenos Aires, Argentina: Instituto Forestal Nacional. Notas Tecnologicas. 27:5.

Describes items to be considered in planning the exploitation of native forests in Argentina including large volumes of low-quality trees. Properties that result in a wood being classified as low-quality are identified, and suggestions made for marketing the various low-quality timbers for profitable use of the forests.

Tinto, J.C. 1979. Utilization of the forest resources of Argentina (Utilizacion de los recursos forestales argentinos). Buenos Aires, Argentina; Instituto Forestal Nacional. Folleto Tecnico Forestal. 41:99.

Describes the forest resources of Argentina, by vegetation type and region; native and exotic timber species, by common and scientific names; area under forest plantation, by region; uses of various woods; and specific wood properties for given species.

Towler, R.W. 1975. The possibilities of increased consumption of the lesser-known tropical hardwood species. Commonwealth Forestry Review. 54(3/4):243–249.

Describes the importation of tropical hardwoods into the UK, noting wood properties of species imported, total volume, and the need to include other species to meet demands.

UNDP/FAO. 1968: Survey of pine forests: Honduras. Rome, Italy: United Nations Development Program/Food and Agriculture Organization: 80 p.

Velay, L. 1978. The future of forestry administration. In: Proceedings of the 7th World Forestry Congress, Centro Cultural General San Martin; 1972 October 4–18; Buenos Aires, Argentina. Buenos Aires, Argentina; Instituto Forestal Nacional. 4/5:5859–5877.

Villegas, C., ed. 1978. Bibliography of plants of economic interest from the Amazon area (Bibliografia sobre plantas de interes economico de la region amazonica). Turrialba, Costa Rica: Biblioteca y Terminal de Servicios, CIDIA. Documentacion e Informacion Agricola. 26:167.

A revised and enlarged edition of the bibliography first published in 1974. The plant species, including *Carapa guianensis, Ocotea* spp., *Swietenia macrophylla, Virola* spp., *Annona* spp., *Bertholletia excelsa, Guilielma [Bactris] gasipaes, Passiflora edulis, Psidium guajava, Bixa orellana,* and *Cephaelis ipecacuanha,* are divided into 3 groups according to their use (wood production, fruit production, medical purposes, and dye production), and the references are arranged alphabetically by authors within each species. An author index is included.

Volatron, B. 1976. The exploitation of the forestry resources of Brazilian Amazon and in Colombia, and the medium-term outlook for imports of logs and sawn timber from these countries on the French tropical wood market (La mise en valeur des richesses foresti res en Amazonie br silienne et en Colombie. Perspectives, a moyen terme, d'importations en provenance de ces pays de bois en grumes et scies sur le marche francais des bois tropicaux). [Part I]. Bois Forets Tropicaux. 165:59–76.

Introduces the forest resources of the Amazon. The political efforts to increase the development of the timber industry and accounts of silviculture experiments are noted.

Wassink, J.T. 1979. Criteria for the choice of tropical timber species with emphasis on nontechnical and noneconomic aspects (i.e., appearance, texture, etc.). In: Economic Commission for Europe, Timber Committee. Proceedings: seminar on the utilization of tropical hardwoods; 1979 May 15–18; Amsterdam, Netherlands. Rome, Italy: Food and Agriculture Organization. FO: TIM/SEM.8/R.4. 3 p.

Wassink, J.T.; Wiselius, S.I. 1980. Aspects of marketing of tropical timber: a practical guide. Amsterdam, Netherlands: Royal Tropical Institute, Department of Agricultural Research. Bull. 30 5: 63–64.

Wicki, C. 1981. Forests, forest-management and wood production in Chile (Wlder, Forstwirtschaft und Holzproduktion in Chile). Schweizerische Zeitschrift fur Forstwesen 132(1):33-46.

Sections provide a brief overview of the land, an introduction to the forests of Chile, problems facing Chilean forestry, its wood industry and markets, and forest improvement.

Zechmistrenko, A.F.; Feofilow, W.A. 1984. Forestry in Communist countries (Die Fmstwirtschaft in den RGW-Mitgliedslandern). Beitrage fur die Forstwirtschaft. 18(2):95-99.

Describes the forestry and forest products industries of many Communist countries, including Cuba, using statistics up to 1979.

Zeeuw, C. de. 1971. Wood technical studies. Part I - The work programme. FAO Rep. FO:ST/ARG 36. Tech. Rep. 2. 31 p.

Describes research program for sampling 70 species of trees in the northwest provinces of Argentina. Information includes a list of trees to be sampled, directions for collection of herbarium and wood samples, recording of data on trees, and the wood testing methods.

Zobel, B.J. 1980. Imbalance in the world's conifer timber supply. Tappi. 63(2):95–98.

Describes the state of the pine resource in the world, discussing the plantations in the tropical and subtropical areas of the world. The major problem in South America is large acreages of young plantations, but little old timber, Chile is an exception, with many young and old plantations, but few intermediate ones.

☆ U.S. GOVERNMENT PRINTING OFFICE 1993 – 748-543