

1. SUBJECT CLASSIFICATION	A. PRIMARY Agriculture	AK50-0000-G500
	B. SECONDARY Wood technology and industries--South America	

2. TITLE AND SUBTITLE
 Report on investigations in South America related to a projected AID program in the field of forest products utilization

3. AUTHOR(S)
 Kukachka, B.F.; Saeman, J.F.

4. DOCUMENT DATE 1962	5. NUMBER OF PAGES 78p.	6. ARC NUMBER ARC LAT634.9072.K96
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7. REFERENCE ORGANIZATION NAME AND ADDRESS
 USDA/FS

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publishers, Availability*)

9. ABSTRACT

10. CONTROL NUMBER PN-AAC-621	11. PRICE OF DOCUMENT
12. DESCRIPTORS Project planning South America	13. PROJECT NUMBER
	14. CONTRACT NUMBER AID-25 Res.
	15. TYPE OF DOCUMENT

LAT
334-1072
270

AID/25 R...
PN-AAC-621

REPORT ON INVESTIGATIONS IN SOUTH AMERICA RELATED TO A PROJECTED
AID PROGRAM IN THE FIELD OF FOREST PRODUCTS UTILIZATION

By

B. F. Kukachka, In Charge
Wood Identification Research
Division of Wood Quality
and
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October 1962

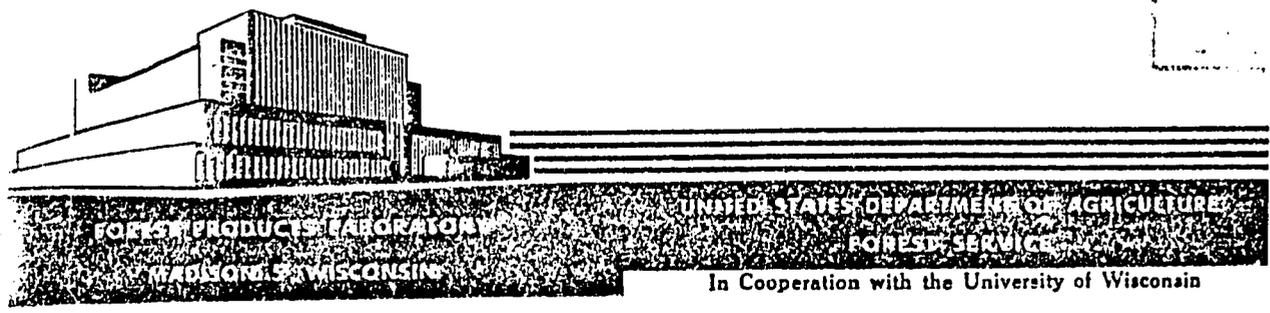
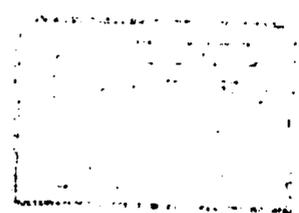
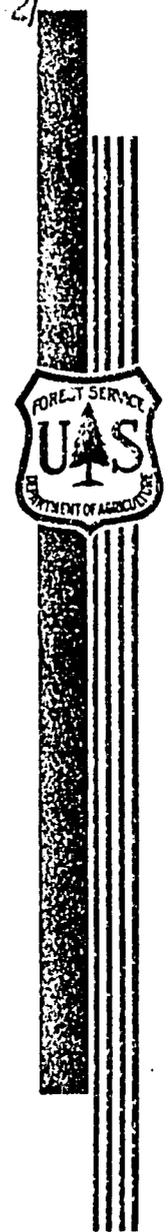


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ABSTRACT

In keeping with the aims and objectives of the Alliance for Progress program for Latin America, the Agency for International Development (AID) contracted with the Forest Service, U.S. Department of Agriculture, to conduct a field survey in Venezuela, Brazil, Chile, and Peru to obtain the following information:

- (a) Obtain local opinion regarding the species that are sufficiently important to warrant further study in this project.
- (b) Inspect laboratory facilities to determine to what extent and where forest products research can be undertaken in Latin American laboratories.
- (c) Meet and interview local scientists who may now, or with training, be capable of assisting with research to be undertaken.

This report covers the period May 20 to June 25, 1962. It includes a record of conferences, a listing of people and places visited, and

¹Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

it provides a key to major reference materials (at FPL) which have a bearing on the problem under investigation.

References relating to the initiation of this project are "Proposed Initial Program for Support of Science and Technology in Latin America," AID, October 30, 1961, Item 12, page 65, and "Characterization, In Relation to Potential Utilization of Latin American Woods," dated March 13, 1962.

The account of the investigation is presented in the following pages by country, or where suitable, by major topic.

INTRODUCTION

Latin America, with over 1,000 million hectares of forests represents one of the world's largest forest reserves, still unused to a great extent. This is traceable to slow economic and industrial development in the past, relatively low population and consequently plenty of forest in relation to population, and the fact that most of the region's forest wealth is totally inaccessible, in unexplored areas, or else still beyond the reach of economic utilization. Also, the fact that a large part of the forest consists of very heterogeneous stands with many species, which so far have not found their way to the world markets or industrial utilization, has further handicapped the economic utilization of these resources.

In recent years, however, a tendency toward considerably more dynamic economic and industrial development has been observed throughout Latin America. This development has also been linked with the aspirations for better social conditions and standards of living, better utilization of natural resources, more adequate distribution of land among the

populations, and even fundamental structural changes in the societies themselves.

The forestry program has gained considerable importance, particularly in the face of the increased human pressure on certain lands and the expansion of colonization activities and programs of agrarian reform all over the region.

The tasks which the Latin American foresters today confront in the face of the intensified economic, industrial, and social development are, in consequence, tremendous. They call for the establishment of adequate forest policies and management practices, proper legislation and means of their application, and, foremost, considerable efforts in the field of professional education and training at all levels in order to make available the personnel necessary to achieve these goals. Latin America has to achieve in less than one generation what Europe and North America have achieved in the course of many generations, if their forests are to attain the status which they deserve as one of the principal sources of raw materials and as the main protector of soils and watersheds.

PRELIMINARY SURVEY

It was suggested that for a preliminary survey of the problem it would be desirable to list the known characteristics of the Latin American tree species significant to their present or potential utilization. Properties to be considered were specific gravity, shrinkage, grain, mechanical properties, seasoning, machining, durability and treatability, veneer and plywood properties, chemical composition and suitability for pulp and paper.

Because over 400 species known in the literature would have to be surveyed to fulfill the above requirements, it is obvious that in the short space of time allotted to this survey it would be impossible to accomplish the task. It is conservatively estimated that a comprehensive survey would require two professional man-years. In lieu of this, about 200 of the specifically named species are tabulated alphabetically by their botanical names (see Appendix I), together with an indication of what properties are known specifically or by local reputation. The National Laboratory of Forest Products at Merida has compiled data from the available literature on 43 species native to Venezuela; this is in Appendix I. This is in their publication entitled "Descripcion y propiedades de algunas maderas Venezolanas," by H. J. von der Slooten and Pausolino Martinez, dated 1959. An attempt to categorize the woods of the Amazon Basin was initiated by FAO personnel at the Santarem Training Station located in the state of Para, Brazil. The Santarem information is partially covered in Appendix I.

The Santarem Unit classifies some 630 species according to the following scheme:

Group I - Woods of known economic value and currently utilized.

Group II - Woods not currently utilized but of sufficient size for lumber production.

Group III - Woods not utilized because of small size or poor form or those which are better known for products other than wood.

Within each of these major groups, further separation is made on the basis of specific gravity and three subdivisions are used: Woods with a specific gravity of less than 0.55 at a moisture of 15 percent;

those ranging between 0.55 and 0.75; and finally those over 0.75. The various species are finally separated according to color groups; that is, light colored, medium, and dark. This is the first attempt we have encountered where an effort has been made to categorize or screen a large number of species. With little additional equipment such as micrometers, balances, and permeability tester, this program could have been amplified to produce an appreciable body of valuable information.

The Latin American species problem may be summarized as follows:

1. The number of tree species in this area has been estimated to be anywhere from 5,000 to 12,000 species.
2. About 400 species have been investigated and reported in the literature. For the majority of these only the mechanical and physical properties were determined.
3. For the majority of the species listed three trees or less have been tested.
4. Available data on the mechanical and physical properties are not strictly comparable because of differences in testing equipment, testing procedures, and specimen size.
5. Of the 400 or so species reported on, about 50 are exotics, mostly species of Eucalyptus.
6. Another 75 species reported on are identified to genus only which makes these data appreciably less useful and perhaps of doubtful value as in the case of genera with a large number of species. In any investigative work on timber the specific identity of the material is of outstanding importance and this is particularly significant with respect to tropical genera which may contain a large number of species with marked

differences in their properties. If herbarium vouchers are not available for the species which have already been tested, then some doubt must be cast on the authenticity of the species identification as also on the value of the data collected.

7. The majority of the species tested are in the durable class with very little attention being given to those lacking in natural durability with respect to insect and fungus attack.

FIELD SURVEY

Species Utilization in South America

Out of the many thousands of species occurring in the forests of South America actually only a mere handful are utilized. This may appear rather astounding but in the tropics, where conditions favor the destruction of wood by insects and decay, it is necessary to use durable species if any degree of permanence is desired. Frame construction is practically unheard of because the cost of durable species would make such construction prohibitive and as a consequence the primary materials of construction are brick, tile, and concrete. Two examples of frame construction were examined; one in Rio de Janeiro which was constructed of peroba do campo (Paratecoma peroba) and another at Bataypora which utilized peroba (Aspidosperma peroba). The use of wood for housing was so rare as to make these examples unique.

The classic species encountered other than for structural purposes are mahogany (Swietenia macrophylla) and Spanish cedar (Cedrela spp.), which have been utilized for several hundred years. A very strong prejudice exists against using any other species which does not closely resemble

these two woods. Certain less costly species such as apamate (Tabebuia rosea), Cordia alliodora, and Carapa guianensis are also encountered, and these are all in the high-durability class but differ in color from mahogany and cedar. For exterior use, primarily as concrete forms, one meets with Bombacopsis guinatum and Anacardium excelsum. In southeastern Brazil the principal species for concrete forms and shuttering (temporary shields used during construction) and many minor uses is "Parana pine" (Araucaria angustifolia). Concrete poles are in evidence everywhere but the woods encountered for this particular use are Mora, Myroxylon, Piptadenia in the untreated condition, and Eucalyptus which has been creosote treated. Eucalyptus, the mainstay species in many areas where the forests have been destroyed by the "shifting-burning" agriculture, is used for fuelwood, charcoal, posts and poles, and as an important source of fiber for the pulp and paper industry of southeastern Brazil. In Chile the principal species from the standpoint of volume are coigue (Nothofagus dombeyi), rauli (Nothofagus procera), roble (Nothofagus obliqua), alerce (Fitzroya cupressoides), pino araucaria (Araucaria araucana), radiata pine (Pinus radiata), and eucalyptus. In Pacific Peru the principal construction timber is Douglas-fir imported from the west coast of the United States. Here, however, with the improvement of trans-Andean transportation, Amazonian species will be utilized to a very large extent.

Appreciable quantities of wood enter the flooring industry in South America although the number of species utilized is rather limited. Species commonly used are generally hard, heavy, and quite colorful such as ipe (Tabebuia spp.), acapu (Vouacapoua), sucupira (Bowdichia), pau marfim (Dalffourodendron), peroba (Aspidosperma), and several species of Nothofagus.

How long the prejudice toward the use of the above-mentioned species will continue is difficult to ascertain, but seemingly a change will have to occur within a relatively short time because of the ever-widening breach between the population centers and the forests. The education of the public by proof that there are many durable species that are the equal of those now being used will be one of the prime functions of the schools, laboratories, and governmental agencies of the various South American countries. It has been suggested that for this purpose an elementary type of "Wood Handbook" be developed for the wood-using industries and the general public that would carry the basic information on strength, durability with respect to decay and termite attack, good air seasoning practice, uses, and comparisons with the classic species so that the reader could tell at a glance the relative superiority or inferiority of an "unknown" wood with respect to mahogany, cedar, etc.

Much of the information that has been developed on Latin American species has been through investigations made in many institutions of the North Temperate Zone. While some of this is available in Latin American libraries a great deal is not accessible to researchers in that area. Perhaps it would be desirable to produce a publication similar to Agriculture Handbook No. 207, entitled "Present and Potential Commercial Timber of the Caribbean," which would bring together under one cover the known characteristics of all Latin American species. This would serve as a guideline for future research in their institutions and at the same time serve as an excellent source of information to importers, exporters, architects, and in fact all users of tropical American species.

One of the objectives of this mission was "to determine unknown characteristics of the wood species of Latin America that may have high

potentialities for contributing to the local economy." This would be an extremely difficult objective to attain in a short space of time because the forest resource of the Amazon is so poorly known. Granted there have been many expeditions to the region and hundreds of wood specimens have been collected, but the unfortunate part is that these collections are made from small trees where the leaves, flowers, or fruits are readily accessible and as a consequence such secondary species are better known, at least taxonomically, than the primary species of large dimensions. Numerous examples could be used to illustrate this point but perhaps the classic is the case of Brazilian tulipwood. This species was known in the Continental and American trade for many decades and its source was attributed as being Physocalymma scaberrimum of the family Lythraceae, but it was as late as 1945 that the true identity was determined by means of wood and herbarium material from the same tree that proved conclusively that Brazilian tulipwood was actually a species of Dalbergia of the family Leguminosae. A similar situation exists in the case of the wood being imported into the United States in very large quantities from Pacific Colombia under the common name "virola." There is difference of opinion as to whether this material actually belongs to the genus Virola or to the related genus Dialyanthera. Since these species are being logged it would be a simple matter to collect herbarium material and determine the exact species involved, but up to the present time this has not been accomplished. As was previously stated, the herbaceous flora, shrubs, and small trees are rather well known but the large forest trees present great difficulties for collection of herbarium specimens and for this reason are largely bypassed with the result that the primary forest flora

is least well known. Undoubtedly the Peruvian collections will bring to light a number of species new to science and perhaps a new genus or two.

Because we are dealing largely with unknowns it is very difficult to determine which species may produce the largest contribution to the local economy of a given country or area, aside from those now currently utilized or exported. This would have to be determined after the species are known and can be accomplished only in the manner which is now being followed in Peru under a PL-480 Project and the parallel project suggested later in this report. Projects of this type could be offered to all of the countries bordering the Amazon Basin and also in Pacific Colombia and Ecuador. A series of such projects would produce a tremendous amount of extremely valuable and usable information in a relatively short space of time, and the monetary outlay would be much less than that required for the establishment of a forest products laboratory. Once the primary species are specifically known and screened, then an established laboratory or laboratories can undertake the second step of concentrating their efforts on those species showing the greatest promise.

With the work already well advanced in Peru, personnel assigned to these projects could be trained by experienced collectors in Peru, which moreover is centrally located.

Pulp and Paper Activities in South America

In any consideration of increased commercial use of forest resources, major attention must be given to the field of pulp and paper. Many of the other aspects of forest industries are in the hands of people who

have little technical skill and minimal capital. Economic factors and lack of training and knowledge make it very difficult for them to appreciate the importance of resource management, sound marketing systems, and the importance of drying, treating, and quality control. It is a very slow and painful process to make progress with such groups.

In the United States, some of the best developments in sound forestry and conservation are traceable to the pulp industry. The very high investment and the necessary concentration of technical and management skills results in a proper appreciation of the resource and its management. For this reason, it is our belief that efforts put into the establishment of a healthy pulp and paper industry will rapidly have a favorable effect on all aspects of forestry, forest products utilization, and soil conservation. In Latin America, as in the United States, pulp and paper is now the fastest growing and most vigorous segment of the forest products industries. There is no question in our mind that its proper growth should be encouraged.

In 1955, the Food and Agriculture Organization of the United Nations published a 465 page report, "Pulp and Paper Prospects in Latin America" (1). The summary of recommendations of the responsible group is given on page 27 of the report. More recently, the economic commission for Latin America of the United Nations Economic and Social Council at its ninth session in Caracas, May 1961, made available a provisional text for "Pulp and Paper in Latin America: Present Situation and Future Trends of Demand, Production and Trade" (2). Particularly pertinent to the present discussion is their set of recommendations related to educational training and research aspects, pages 93-96, inclusive. This publication lists the following as institutions where "Research Work on Pulping Problems has Been or is

Being Conducted to Some Extent": (a) Mexican Technological Institute,
(b) University of the Andes, (c) University of Concepcion, (d) The Technological
Institute of Sao Paulo, and (e) The Technological Institute, Havana, Cuba.

Literature Cited

- (1) Food and Agriculture Organization
1955. Pulp and Paper Prospects in Latin America. United Nations,
New York, N. Y.
- (2) United Nations Economic and Social Council
1961. Pulp and Paper in Latin America: Present Situation and
Future Trends of Demand, Production and Trade. Economic
Commission for Latin America, Ninth Session, Caracas.

VENEZUELA

Investigations in Venezuela covered the period of May 20 to May 28, 1962. On arrival in Caracas May 20, contact was made with Mr. Patrick F. Morris, Acting AID representative, who advised us to proceed directly to Merida. This we did, then returned to Caracas, held conferences with representatives of the Department of Agriculture, and reported again to Mr. Morris.

The National Laboratory of Forest Products (NLFP)

The National Laboratory of Forest Products was visited on May 21-23 inclusive. The director and staff described the objectives and program of the institution.

The NLFP is located at Merida in the northwestern part of Venezuela, at an elevation of about 5,000 feet. The elevation and location give the town a pleasant climate. The population of Merida is about 30,000. Much of the employment in the city of Merida centers around the University of the Andes and other schools. It has the usual local trade activities, but little additional commerce or industry.

Descriptive material was obtained on the city of Merida (V1)² and the University, together with plans for expansion of the University and its forestry and forest products research organizations (V2).

The University of the Andes was established 180 years ago and has about 3,000 students in medicine, engineering, law, pharmacy, forestry, and other disciplines. Forestry presently has about 120 students and offers a 4-year course leading to the degree of forest engineer. Plans

²Underlined numbers in parentheses refer to literature cited by countries. Literature is retained in the files of B. F. Kukachka.

are completed to convert this to a 5-year course, and to establish a program leading to a master's degree. The forestry school is expected to become increasingly prominent in the University, and seems well on the way to becoming a training center serving Latin America.

In 1960, a report on the need for a forest products laboratory was prepared and submitted to the Government and the University of the Andes (V3). The Government apparently took immediate action, and on May 20, 1960, the Laboratory was established by Presidential decree. A statement of the objectives, organization, and program is included (V4). Additional information on the new laboratory was published in the Forest Products Journal (V5). The laboratory, drawing on the staff originally associated with the forestry school, and on the Instituto Forestal Latino Americano (IFLA) is in the process of development.

The course of studies offered in the forestry school is outlined in item (V6).

Instituto Forestal Latino Americano

The Latin American Forestry Institute came into existence on a temporary basis in 1956. It was created under the auspices of the Food and Agriculture Organization of the United Nations for the purpose of promoting the program of the organization in Latin America. An agreement was entered into with the Government of Venezuela to establish the Institute at the University of the Andes. Equipment was purchased and technical staff recruited.

The present Director of IFLA is Dr. E. Meijer Drees, who arrived at Merida about the middle of April 1962. In a conversation with him, he discussed the origin and activities of the Institute, and provided

a copy of an agreement dated March 1961, for the establishment of a permanent Latin American Forest Research and Training Institute (V7). He emphasized the role of the Institute in the establishment of the NLFP and pointed out that the latter is concerned with Venezuelan problems whereas the Institute is concerned with problems of tropical Latin America. He looks upon the Director of NLFP as a cooperator of the Institute. Van Slooten, in charge of plywood and laminating, is one of their staff who went from IFLA to NLFP about a year ago.

Reference (V7) outlines responsibilities of the Institute, and proposed contributions of participating countries. The future of the arrangement, however, seems uncertain at this time.

Participation of the Organization of American States

The Venezuelan Government has begun negotiations with the Organization of American States on the subject of its participation in an expanded forestry and forest products research program. It is considered likely that the construction of a new building devoted to photogrammetry will be financed by equal contributions of the Venezuelan Government and OAS. It was stated that present activities in this field in Brazil are being closed out, and Brazil will be happy to see the work picked up in Venezuela with the help of OAS. Photogrammetry, it was repeatedly emphasized, is a most important key to improved forestry in tropical areas.

Existing Staff, Facilities, and Program of the
National Laboratory of Forest Products

Staff

The administrative organization of the NLFP is given in reference (V4). A brief description of the staff members, their tenure, and background is given below:

The Section of Wood Anatomy is headed by Mr. Harry Corothie. Corothie is a Venezuelan who obtained his M.S. from the University of Michigan in recent years. He has teaching responsibilities, is a permanent staff member, and is presently preparing a comprehensive anatomical description of Venezuelan species.

The Section of Wood Chemistry is headed by (Dr.) Pierre Kiener, a Swiss who took his bachelor's and master's degrees from Eidgenössische Technische Hochschule at Zurich, and has completed or will shortly complete his Ph.D. at Illinois. He was employed by NLFP prior to his going to Illinois, and is expected to return in August 1962. In a later conversation with the Director of NLFP, the Rector of the University, and the Dean of the Forestry school, we urged that Kiener come from Urbana to Madison for a day or two. They said such arrangements would be made. Later conversation with other staff members, however, raised the possibility that Kiener might not return to Venezuela. This is a common experience with students sent off for training.

The Section of Mechanical and Physical Properties is headed by Juan J. Mara. Mr. Mara is a Venezuelan who did his work at the Universidad Los Andes (ULA) under Jorgensen and Van Slooten. He has been on the staff for four years, and plans are underway to send him to Madison for a master's degree.

The Section of Wood Seasoning is currently headed by the Director, Pausolino Martinez. Mr. Martinez is a Venezuelan, got his B.S. in 1953 at ULA and obtained his master's from Yale in 1954. He considers drying his specialty.

The Section of Preservation is headed by Ian S. Hunt, a New Zealander with specialized background in wood chemistry, tannin, and extractives. Because of foreign exchange complications, he is not listed as a permanent staff man, but functions as though he were. He seems quite capable and has been at Merida about 10 months.

The Division of Plywood and Laminating is headed by Harry Van der Slooten, a Dutch citizen who obtained his bachelor's and master's degree in his home country. He spent a few years at the Institute of Forestry and Forest Products in Indonesia, and came to Venezuela in 1955 as an FAO employee. In 1957 he returned to Holland and came back to Venezuela in 1961.

The Division of Pulp and Paper is headed by Roger W. Fairest, a British citizen who obtained his master's from Manchester in 1961. He had training experience in Germany and Sweden, but no previous full-time job.

Junior staff men of demonstrated ability include the following:

Jesus Conejos, specializing in wood processing and now studying in Sweden. Plans are being made to send him to Madison.

J. Rafael Rodriguez, specializing in pulp and paper is now completing three years in Manchester and will return to Venezuela in November 1962.

Enrique Vilelo, specializing in timber construction. Plans are being made through Garratt of Yale to continue his education in the United

States, and obtain some practical background at Timber Structures of Portland, and with the Timber Engineering Company.

Candidates for additional training include:

Adolfo Rivera, a Venezuelan employed for two years by the Forest Service, and about to be transferred to the NLFP. He wants to specialize in plywood, glue, and laminates. He was a superior student as an undergraduate, perhaps in the upper 10 percent of his class. He is single and has a good personality. It is hoped that he can be sent to the United States for two years to get a master's degree.

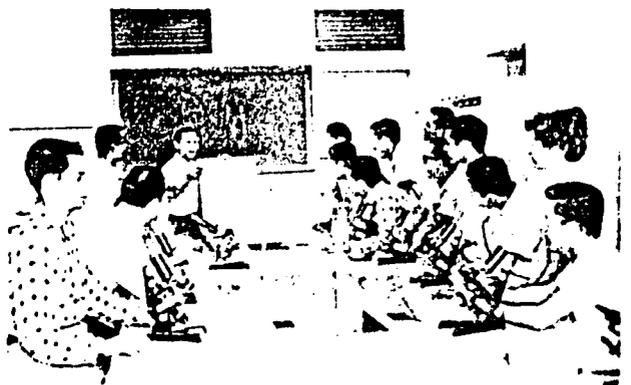
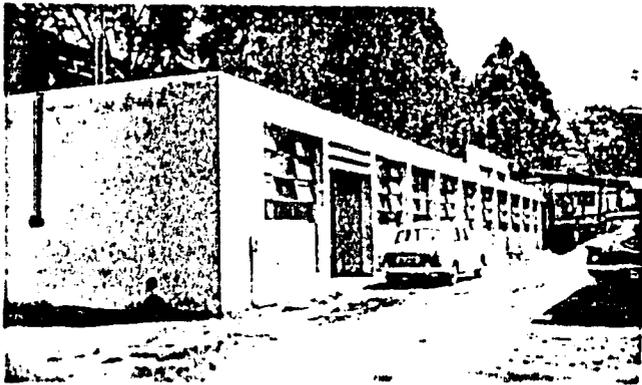
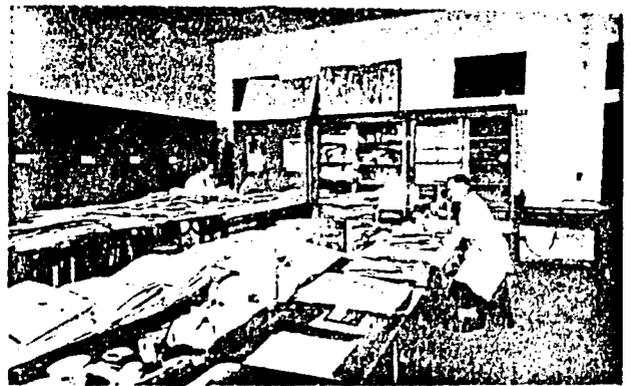
Jaime Pinzon is another Forest Service employee of similar qualifications who is being transferred to the NLFP. He obtained his B.S. in 1961, and is expected to take on leadership in fiber and particle board.

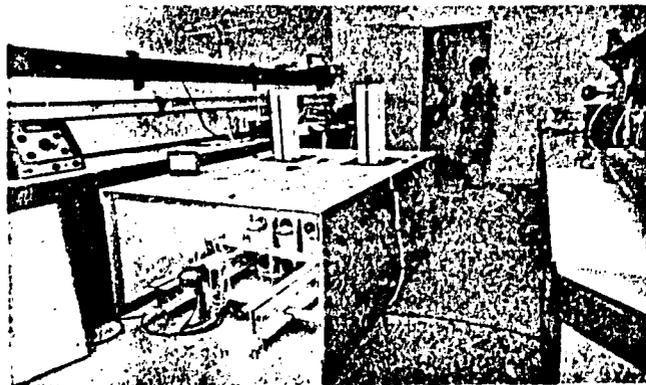
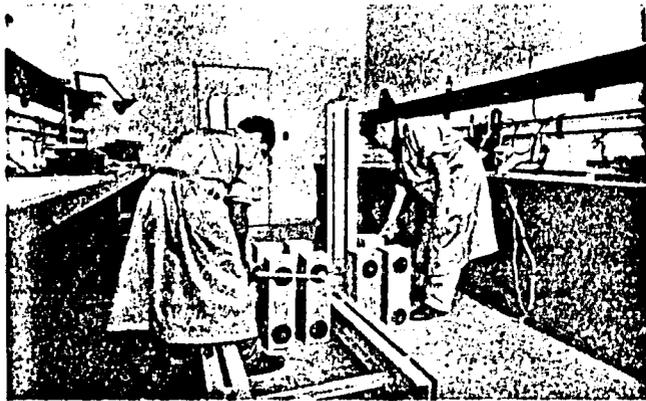
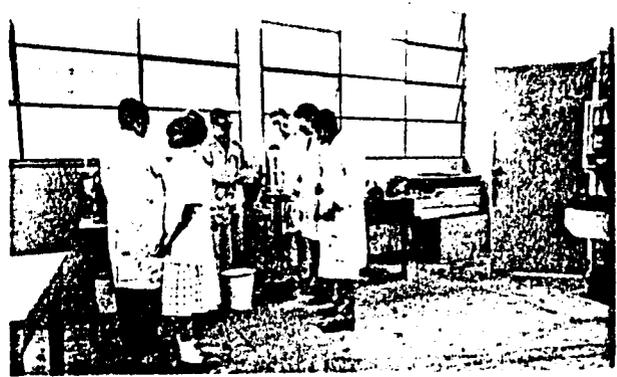
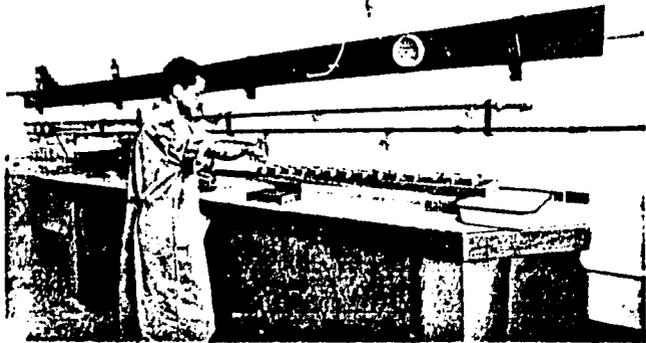
Facilities

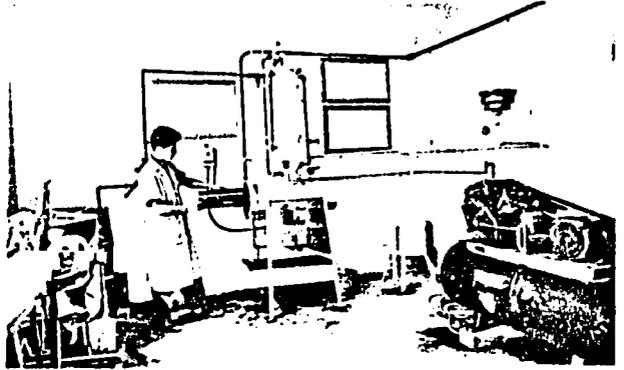
At the present time, the NLFP is located in the Civil Engineering and Forestry buildings. Pictures showing some of the installed equipment and activities of the group are reproduced in figures 1, 2, and 3. One of the photographs shows the site of the new laboratories, which will provide a 66- by 180-foot main building and a 6- by 210-foot shop. Construction is now well along and should provide more than adequate space. These buildings will be part of a well-planned forestry and forest products teaching and research center, including the following facilities:

1. Faculty of Forestry (10)
2. Forest Management and Engineering (8)
3. Institute of Geography and Conservation (8)
4. Anatomy Dendrology and Botany (4)
5. Institute of Silviculture (8)

**Figures 1, 2, and 3.--Views of equipment and facilities of the National
Forest Products Laboratory, and the Forestry
Department of the University of the Andes.**







6. National Laboratory of Forest Products (20)
7. Carpenter Shop
8. Latin American Forestry Institute (-)

The figures in parentheses are estimates of the staff members to be accommodated in each of the units.

A complete inventory of available equipment together with the staff and their salaries is given in (V8) and (V9). Reference (V8) consists of material submitted to the United Nations by the Ministry of Agriculture requesting "special fund" assistance for forestry activities.

Recently ordered equipment includes:

1. A complete veneer and plywood pilot plant with both slicing equipment and a rotary lathe.
2. A band mill.
3. A preservation pilot plant including two cylinders.

Photocopies of the orders and technical specifications for the new equipment are given in reference (V9).

Request for United Nations Assistance

An important amount of assistance has already been provided in the field of forest products by FAO. Initially this assistance was regional in nature, through the IFLA. Activities of IFLA, however, are tapering off. The Venezuelan Government, through the Ministry of Agriculture, has prepared a fairly elaborate statement of needs for assistance in the fields of forestry and forest products, and submitted a proposal for a project in this area to the United Nations special fund. This material, collected as reference (V8), provides important background material to those interested in assistance under the AID program.

Progress to Date in the Characterization and
Utilization of Venezuelan-Guayana Woods

At the National Laboratory of Forest Products we were provided with documents describing progress on the evaluation of species prominent in the area. Frequent mention was made of a list of 43 species that in the judgment of local foresters seemed to deserve priority in their studies. This list is given in (V10a). As of May 23, 1962, mechanical and physical properties were determined on 21 species from the list (V10b). In all cases, just one log was used per species. All test work is according to ASTM.

In addition to the above, the anatomical, mechanical, and physical properties of five Brazilian Amazon species were determined at the request of the FAO mission in Brazil (V11).

In the field of pulp and paper it was determined that about 30 of the prominent species mentioned previously have some promise as fiber sources. These are being divided into seven groups on the basis of morphology and specific gravity. Cooking tests are being made of the mixtures. Relatively little progress has been made because of lack of a chipper, air-conditioned test laboratory, and for other reasons. Test work is according to TAPPI standards.

Preservation

Preservation was recognized as a most important field, but the large cylinders had not yet been installed. Progress so far has been limited mainly to planning a program. Some preservation and durability samples have been prepared, but none have been placed in test sites. All test work will be according to ASTM and AWPA.

Seasoning

A solar drier and a Standard dry kiln were installed and had been used successfully.

Wood Anatomy

The Division of Wood Anatomy, under Mr. Harry Corothie, is the most advanced division of the laboratory, having all necessary equipment, a fairly well-developed collection, and adequate assistance to take care of current needs. A book on the Anatomy of Venezuelan Woods is in preparation.

Gluing and Laminating

In the field of gluing and laminating, a major effort is being directed toward a demonstration of the utility of glued-laminated construction. The new laboratory is to be built with monkey-pod (Samanea saman) laminated arches with a span of 80 feet or more. The maximum depth is to be of the order of 1 meter. Experimental work has been conducted to select the glue and establish the lay-up procedures best suited to local conditions. The staff of the NLFP feels that a successful demonstration of laminated arch construction would have great value in popularizing wood utilization and the work of the laboratory.

Conversation with Martinez Regarding

the Nature of the AID Program

Martinez is very interested in having any assistance that can be provided. As Director, he is much concerned about the fact that he has successfully recruited a skeleton staff, but there is no well-organized program. For this reason he is most interested in having a senior man

from Madison (or elsewhere) assist him in the establishment of good studies, experimental techniques, and research management procedures. He talked of sharing the cost of such a man on a 50-50 basis. Such a senior scientist would have perhaps four assistants and his major assignment would be to develop leadership. Martinez hopes that this can be done by having the expert assist in the selection of a man for future training, and laying out a training plan. The trainee would go to the United States after completion of the expert's stay in Venezuela.

Ian Hunt emphasized another need. He sees himself as providing the necessary leadership, and he feels that AID assistance could best be used in extending the education of newly graduated Venezuelan students. Hunt, in charge of preservation, feels that real progress in his area requires the addition of at least one mycologist, one entomologist, and one chemist. He feels that he cannot efficiently use newly graduated Venezuelans for this purpose.

This difference in point of view is understandable. Martinez is quite satisfied with the senior staff he has, but he knows that it is only a matter of time before the non-Venezuelans will leave. He knows he will not have a stable and effective organization till it is staffed by competent Venezuelans.

Martinez would like to have a senior man come to his new laboratory about Spring 1963 and stay for a year. He emphasized that the assistance of a senior scientist is particularly important in the first phases of the new laboratory's existence. He worries about the fact that everything stops when he sends good men away from his understaffed organization. He repeatedly asked about the availability of Mr. George Hunt. He seems

to feel that Hunt's experience in the Philippines would be of much value in the closely related situation at Merida.

Conversation with the Rector of the University, the Dean
of the Forestry School, and the Director of the NLFP

At the conclusion of our stay in Merida, Martinez arranged for us to visit with Dr. Pedro Rincon, Rector of the University, and Mr. Carlos Liscano, Dean of the Forestry School.

Dr. Rincon asked us about our reactions to what we have seen of the NLFP. We told him we were much impressed with the progress being made toward the creation of a Forest Products Research Center at Merida. As the conversation went on, it became apparent that Dr. Rincon was taking a strong personal interest in the growth and development of forestry and forest products research at ULA. He expects this to become one of the strong activities of the University. He has a personal interest also in seeing ULA and NLFP grow in importance to other Latin American nations. He specifically discussed the past and future participation of FAO and OAS in Venezuelan and regional forestry activities.

Dr. Rincon, at the invitation of the French, Italian, and German Governments, is leaving for a tour of their wood and forestry research institutions. A contract has been or will be completed for the training of a number of NLFP staff members at Grenoble. He said that he hopes to visit Madison in the near future. It was not clear how definite his plans are on this latter point.

The Rector, at one point, said that the Venezuelan Minister of Agriculture visited the Forest Products Laboratory at Madison and was given to understand

that we would train 10 of their men. He wanted to know what happened to those plans. We told him that we personally were not aware of the commitment, but that the AID program, over a period of years, could assist in accomplishing this aim. A few days later Mr. Sixto Pericchi raised the same point. We obtained the impression, however, that the training referred to was to have been financed by Venezuelan rather than American funds. In any case, they seem to feel that we are already committed to provide training assistance.

We repeatedly obtained the impression that the people we talked with were much more interested in our providing genuine help in the creation of scientific competence than in the funds which might become available to them.

Dr. Rincon, in his conversation, said that plans are underway for the creation of a Chemical Institute. He particularly wanted assistance in training men for this activity. Time did not permit the complete clarification of his ideas, but it appeared that chemical research of all kinds might be gathered into a single institute, with forest products chemistry strongly represented. It was at this point that we suggested he make arrangements for Kiener to visit us after the completion of his work at Illinois (see earlier section on staff).

Interview with Mr. Sixto Pericchi, Chief of the Division
of Resource Evaluation, Ministry of Agriculture

Following the visit to Merida, an appointment was made by Mr. Edward Quinones, Assistant Agriculture Attache, for our visit with Mr. Sixto Pericchi, responsible for forest survey activities and for the NLFP.

Mr. Pericchi had an extended training session at the United States Forest Products Laboratory. He is, of course, fully familiar with our program and the help we are capable of providing his country. He was most cooperative and even eager to see an effective program developed.

Mr. Pericchi talked initially about the forest products resource of Venezuela. This information, together with fragmentary bits acquired previously, is given below.

Resource and Industry

Information on the forest resource of Venezuela is scattered and poorly accessible. While visiting at the Ministry of Agriculture, we were provided with a very valuable document that represents an important step in putting this matter in order: "Atlas Forestal de Venezuela," Ministerio de Agricultura y Cria, Direccion de Recursos Naturales Renovables, Caracas, December 1961, by Professor J. P. Veillon and Ing. For. Sixto J. Pericchi.

The forest area of Venezuela comprises about 120,000,000 acres that represent approximately 53 percent of the total land area.

The State of Bolivar contains 71 percent of the forested area of the country but at the present time produces only about 4 percent of the total timber output. The principal producing states, Barinas, Portuguesa, and Zulia comprise 12.4 percent of the total forest area but produce 62 percent of the total national production. In 1960 the sawn timber was valued at 33,000,000 Bolivars compared to imported wood products valued at 28,000,000 Bolivars. The importation consists mainly of long-fibered pulp from the Scandanavian countries. In 1960 the production of sawn timber amounted to 275,000 cubic meters and was distributed among species

as follows: finas 64,000 cubic meters; duras 40,000 cubic meters; and blanda 172,000 cubic meters. The species classified as finas are mahogany and spanish cedar; the duras is mostly mora; and blanda consists of Bombacopsis, Virola, Anacardium, and Tabebuia.

Charcoal production has been declining rapidly and the 1961 production was computed at 9,715 metric tons. The production in 1943 was 30,650 metric tons. This decline is attributed to the increased use of kerosene for cooking and heating purposes, and is looked upon favorably by the Forest Service because it results in increased retention of the forest cover, particularly on the mountain sides where the population density is highest.

In 1959 there were 159 sawmills producing an average of about 1,800 cubic meters of sawn timber per mill. The seven veneer and plywood plants of the country had a total production of 6,590 cubic meters in 1959. The single particle board plant had a production of 1,860 cubic meters. The production of the single pulp and paper plant consisted of 34,000 metric tons of paper and 25,000 metric tons of carton papers.

In Venezuela there are 34,000 people employed in the wood industry and of this total 12,000 are employed in exploitation and sawmilling and 22,000 in wood-based industries.

The 1961 census gives the population of Venezuela as 7,556,000 people and the average annual increase is said to be about 3.5 percent. The percapita consumption of national and imported wood products is about 20 board feet per year.

The six Forest Reserves or National Forests comprise 4,875,000 acres and range in size from 422,000 acres to 1,125,000 acres. Three additional

reserves are currently contemplated with an estimated area of 3,250,000 acres.

Principal uses of wood in Venezuela (national production):

1. Fuelwood
2. Construction (primarily concrete forms)
3. Furniture and interior trim

Principal species:

1. Mahogany
2. Spanish cedar
3. Tabebuia
4. Anacardium
5. Cordia
6. Carapa
7. Bombacopsis
8. Mora
9. Podocarpus

Pericchi said that Venezuelans do not know how to use timber, let alone the forest. He feels that their laboratory should obtain data on properties and performance of the species, and his office should use this information to place the forest products in the internal and external markets. He feels that he needs the help of economists, but economists are not enough. He wants the assistance of specialists who know forest products and the marketing of forest products. Pericchi went on at some length on this subject and it became apparent that he was describing the service provided by the forest products utilization specialists attached to each of our forest and range experiment stations. Later discussions

with representatives of the Forest Service, Washington Office, led us to believe that the use of AID funds to provide such a man should be a prominent part of our recommendations.

Pericchi repeated Martinez' plea for a senior man, and George Hunt was his outstanding choice. He also reminded us, as did the Rector of the University of the Andes, that we had promised to train 10 of their technicians (this promise, of course, presumed that funds were to be supplied from Venezuelan or other sources).

Pericchi made the point that their laboratory is moving forward on a broad front, with representation in all major fields of forest products research. We had the impression that they went too far in attempting to reach this objective. Greater depth and less breadth would probably lead to more success. We did not argue the point, however.

The interview with Pericchi, as with all officials visited at Merida, was most cordial and seemed to provide all the information we hoped to acquire in regard to prospective AID programs. We were most impressed with the sincerity of these people in their drive toward an effective forestry organization and forest products laboratory. All of them emphasized their lack of skills, and that their most urgent need was for people who could teach their own nationals what they need to know in forest products research.

Report on Conversations with Mr. Patrick F. Morris,

Acting AID Representative, and Mr. Edward Quinones,

Assistant Agricultural Attache

Mr. Morris was informed by letter of our visit and on arrival we contacted him by telephone. He advised us to go directly to Merida.

On our return to Caracas, May 24, we visited him in his office. We described briefly the interviews we had had and the favorable outlook for cooperative training at the University of the Andes.

Mr. Morris was most concerned about the fact that he had not been briefed on the purpose of our trip. At his suggestion we prepared a statement of our assignment and approximate itinerary for transmission to Rio de Janeiro and Santiago. We also gave him a copy of our advance of funds agreement with its attached statement of our objectives and procedures.

The agricultural attache, Mr. George Day, was away from his office, so we talked to Mr. Edward Quinones, the assistant attache. Mr. Quinones was very interested in our trip and what we had found at Merida, but had little information on forestry or forest products.

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BRAZIL

Investigations in Brazil were conducted during the period May 29 to June 13, 1962. An account is given below of interviews and visits in the area of Belem, Rio de Janeiro, and Sao Paulo.

Instituto Agronomico de Norte.

Belem, Para, Brazil

The Instituto Agronomico do Norte in Belem was visited on May 29, 1962. This institute has many fields of activity in the general field of agriculture. The only one of direct interest to this project is in the section of botany headed by Dr. J. Murca Pires, who is concerned primarily with botanical exploration of the Amazon Basin and the collection of wood samples as an aid in the identification of herbarium material. The institute has a very good herbarium, consisting of over 115,000 sheets and a wood collection of about 1,500 specimens, all of which are backed by voucher sheets. The institute has no wood utilization projects in existence and none are contemplated. The visit was made primarily for the purpose of meeting Dr. Pires and learning more about his future plans. It was learned that he plans to leave the institute in September to join the staff of the Instituto Botanical in Sao Paulo. As a result of Dr. Pires' leaving, there would be little point in involving the Instituto Agronomico in any AID project, at least in the early stages of the program. General information on the Instituto Agronomico do Norte is presented in reference (B1).

Brazilian Embassy

We arrived at Rio de Janeiro, on Memorial Day, and the following day, May 31, was a Brazilian holiday. Our first contact at the Embassy, Mr. John Peabody, referred us to Mr. David Robertson, who worked with us as control officer. Robertson's assignment is with Escritorio Tecnico de Agricultura, the joint project arm of the Brazilian Government and AID. His project activities are in the fields of cacao and rubber.

On June 1 we had a brief conference with Mr. Tyson of Escritorio Tecnico de Agricultura, and an appointment was made with Dr. Altamiro Barbosa Pereira, Assistant Chief of the Brazilian Forest Service. His superior, Walter Xavier de Andrade, is located at the new capital, Brasilia. Mr. Tyson arranged for us to visit Mr. Edward Bash, Commercial Attache of the United States Embassy. He had little detailed information on forest products industries but he provided a useful book of statistics on the Brazilian economy (B2) and a review of the Brazilian iron and steel industry (B3). This latter is of interest because a large part of iron production is based on charcoal derived from wood.

Dr. Pereira described the forest service as having deteriorated badly. There is no forestry school in Brazil, and all technically trained foresters are in administrative work. No young foresters are entering the service. Nontechnical workers do what is done in national forests and parks.

Dr. Pereira said that the state of Sao Paulo provides a larger budget for its ministry of agriculture than does the federal government for the national ministry. The state of Sao Paulo, he said, has a billion planted eucalyptus trees. There are large hardboard plants based on

eucalyptus, producing "Zucatex" and "Duratex." Much of the Brazilian iron industry is based on charcoal derived from eucalyptus. (Reportedly 5m³ of charcoal are required for a ton of iron.) Extensive information on eucalyptus is in the hands of the Paulista Railroad Company, which was responsible for introduction of the species. Much of the steel industry and the pulp industry is in the Sao Paulo area, and based on the introduced eucalyptus.

Dr. Pereira described the laboratories maintained by the Forest Service and they were visited later during our stay. It appeared that the laboratories started fairly well some decades ago but in recent years lack of leadership and lack of technical competence have caused them to lose their effectiveness. The mechanical testing equipment is archaic but useable. A collection of wood specimens is available and identification services are used to some extent.

As a result of this and other conferences, it seemed clear that the Brazilian Forest Service, and indeed all federal service, was in a very sad state. Administrators were shifted rapidly and arbitrarily. Salaries were so low that civil servants required other jobs to maintain their families. As a result, offices were not manned on proper schedule, and all seemed quite chaotic. It would be difficult and perhaps all but impossible to set up and maintain a proper program of instruction or research with the Brazilian Federal Forest Service of the type contemplated under this portion of the AID program.

Through Dr. Pereira, contact was made with Mr. Paulo Ferreria de Souza, a retired Brazilian Forest Service man. Mr. Souza was educated as a forester at Yale, and was responsible for the creation of the Brazilian

Forest Service in 1925, serving as its head during 1925 and 1926. In 1937 he was responsible for the creation of the national forests, and very recently for the new forestry school at Vicosa. He seems to consider this latter his most significant achievement, and he provided publications, (B4) and (B5), outlining the need for the school and the program being followed. Mr. Souza said that 4 or 5 new schools were urgently needed to pick up special aspects of regional problems. A school for the Amazon is particularly important.

In 1964 Vicosa is expected to graduate 22 men, but 200 are needed immediately.

Mr. Souza was asked for some statistics on the forest industries that would serve to give some indication of their importance to the economy. He said that such statistics were not easily obtained, and there are frequently major discrepancies in numbers from different sources. He has been compiling such numbers for a publication, and was reluctant to release copies of what he had. He did, however, read off some numbers which are reported below:

In 1958 Brazil consumed 94 million cubic meters of fuelwood; this amounts to 90 percent of the energy consumed. Coal production in 1957 amounted to 997,000 tons and in 1958 to 1,073,000 tons.

There are 39 railroad companies in Brazil with 37,000 kilometers of track and 55 million sleepers. Those in the untreated condition have perhaps a 10-year life. Brazil had a total of 165,000 kilometers of telephone lines in 1958, 79,000 of which were main line. Only a negligible number of sleepers or poles have been treated up to the present time.

There were 64 mills in 1960 producing a total of 474,000 tons of paper. In 1958, 140,000 tons of paper and 163,000 tons of pulp were imported.

Brazil, in 1957, produced 32,000 tons of rubber and imported 18,000 tons. The world production of natural rubber was then 1,900,000 tons and synthetic 1,200,000 tons. In 1960 Brazilian consumption of rubber rose to 60,000 tons.

The number of lumber mills in Brazil was given as 7,381 in 1960. The mills are divided among states as follows:

Sao Paulo 1,085

Parana 1,669

St. Caterina 2,693

Rio Grande Do Sul 1,934

A large number of "Poachers"--perhaps 1,500--are also in operation.

In 1960, 650,000 tons of pine were exported with a value of \$46,000,000. In 1959, total production of wood was 3,320,000 M³.

Charcoal production in 1958 was 1,073,000 tons. It is not clear whether this includes charcoal produced in captive plants of the steel industry; presumably it does.

Mr. Souza impressed us as a very knowledgeable man. A series of publications (B6, B7, B8, and B9) attest to his role in research, reforestation, and other aspects of forestry and forest products utilization. He seems to have a real dedication to his profession, and takes very seriously his role in the national forestry and forest products picture. He seems to be looked upon as an "elder statesman" by others in the Brazilian Forest Service, and by AID personnel attached to the Embassy at Rio de

Janeiro. He would probably be a very useful source of advice in the development of future programs for Brazil.

Instituto de Botanica, Sao Paulo, Brazil

This is undoubtedly the best-organized and best-staffed botanical organization in Latin America. The Institute is under the direction of Dr. Alcides Ribeiro Teixeira. Dr. Teixeira is a very capable scientist, and by offering markedly better pay has been able to recruit a highly superior staff. He has a number of effective husband and wife teams working in his organization. No work is done in wood utilization aside from work in wood structure and identification. Principal efforts are directed toward the fields of taxonomy, physiology, ecology, and mycology. They are said to have the best fungus collection in Latin America.

Dr. Teixeira is considered a most important contact and a man who could be useful to us for our program. In the limited field in which he operates, his group is extremely effective and there is little we would be able to do to improve their work. Their concentration on the woods of the state of Sao Paulo limits their usefulness in a program directed toward solving the needs of Latin America.

Instituto Florestal, Sao Paulo

The Instituto Florestal is another of the forestry institutions of the state of Sao Paulo. Research is limited to the silviculture of eucalyptus and other exotics. They are known also for a wood museum that is very interesting but that has limited scientific value.

Electron Microscope Laboratory,

Jardim Botânico, Rio de Janeiro

This is a very recently completed laboratory under the direction of Dr. Raul D. Machado. At the time of our visit the scope had not been installed, but Dr. Machado was doing some research using the University scope. The building is devoted entirely to work of this type, is completely air-conditioned, and also has facilities for visiting scientists. They have a Siemens scope but we do not recall the exact type or power. The lab is completely equipped with the most modern equipment and presents quite a contrast with the other laboratories we visited. Dr. Machado, at the time of our visit, was investigating vestured pitting in several species of the Leguminosae family.

Mato Grosso Colonization Project,

Bataypora, Mato Grosso, Brazil

A visit was paid to this tract of 150,000 acres located on one of the higher terraces of the Parana River near the junction of the three states of Mato Grosso, Sao Paulo, and Parana. It is the objective of this project to clear 80 percent of the tract for agricultural purposes and to utilize as much as possible of the available wood. At the present time, a sawmill is in operation that provides all of the timber for construction and the principal species being cut is red peroba (Aspidosperma peroba). The houses are constructed entirely of this species which is similar in many respects to our native sugar maple except for the color. The wood is initially red but upon exposure to light assumes a yellow color.

For the nonmerchantable material they plan to erect a particle board plant, charcoal kiln, and a destructive distillation plant. The project is under the supervision of Dr. Jan A. Bata, one of the principal Brazilian industrialists and the largest shoe manufacturer in Latin America. This is a rather unique project in that nearly complete utilization of the forest is contemplated rather than resorting to the usual custom of cutting and burning. The progress of this project should be followed.

Instituto do Pesquisas Florestais
do Amazonia, Manaus, Brazil

The Institute at Manaus was not visited, but we had a conversation with the director, Dr. Djalma Batista, at Belem. He informed us that the work with wood was limited to identification, specific gravity determination, and some natural durability studies. In our opinion, there would be little point in involving this Institute in an AID program at the present time.

Training Center for Wood Industry
Workers, Santarem, Brazil

The training center at Santarem was not visited. The man formerly in charge of the center, Mr. V. C. Hasek, visited on two different occasions at the Forest Products Laboratory and informed us that their main concern was with sawing, machining, seasoning, grading, and natural durability studies.

Instituto de Pesquisas Tecnologicas,

Sao Paulo, Brazil

This Institute was officially organized in its present form in 1944 and is composed of 42 groups covering all technical fields. Its origins, however, extend some decades into the past. The Institute is headed by Francisco H. J. Maffei, and has four sections dealing with wood:

Pulp and Paper, Francisco de Matos Massai, Chief

Wood Anatomy and Identification, Calvino Mainieri, Chief

Wood Preservation, Edgard Ghilardi, Chief (currently in Sweden)

Wood Technology, Joao Cesar Hellmeister, Responsible Engineer

The Section of Wood Technology, up to 1956 (B10), had tested 300 logs representing 151 named species, 48 named to genus only, and 1 named to family only. The great majority of the species tested were from the states of southeastern Brazil (202 logs from state of Sao Paulo) and 4 logs from the Amazon Basin. Mechanical testing is done on the Amsler machine and the 2 cm. standard specimens are used. The Section of Wood Anatomy and Identification appears to be very well staffed and equipped and is now concerned with the development of "An Atlas of Brazilian Timbers." Their wood collection consists of about 8,200 specimens, of which about 20 percent are backed by herbarium vouchers.

This Institute issues certificates of analysis or inspection on products submitted, and it is of interest to note that the Annual Report (B11) for 1958 shows 87.2 percent of the certificates were issued for chemical analyses and tests of concrete. Wood apparently fell into the miscellaneous category which made up 1.8 percent of the issued certificates. The Institute appeared to be well organized, had good equipment, and

competent scientists. It offers an excellent basis on which to build a forest products research group.

The Chief of the Wood Preservation Section, Edgard Ghilardi, is currently in Sweden. A man from his group, Armando Russo, and Dr. Calvino Mainieri showed us the laboratories and pilot plant, and discussed their activities.

Wood preservation in Brazil was said by these men to be 100 years behind. There is literally a shortage of millions of ties, and 200,000 ties are required per year for replacement. Less than half of one percent of the ties are now treated. A number of plants are now in operation treating ties, posts, and utility poles. Most of these depend on soluble salts rather than creosote.

In the laboratories, studies were underway using the soil-block test, or rather a modification of the soil-block test in which the block is supported above liquid water.

The impression was gained that there was relatively little competence in the field of preservation and that there is an enormous job of educating the industry to the economies that might be realized by a proper program of wood preservation. There is little doubt that the proper encouragement of wood preservation research and wood preservation technology would pay large dividends.

Pulp and paper research at the Instituto de Pesquisas Tecnologicas was in the hands of an enthusiast, Francisco de Matos Massei, Chief of the section. Mr. Massei was trained as a chemist, and his background in pulp and paper is limited to what he learned himself and what he acquired during a period in the mills of the Klabin Company. Mr. Massei said

that the Institute became interested in pulp and paper in about 1956. The Laboratory as it exists now is about 2 to 3 years old. Their main assignment was to study the potential usefulness of Brazilian woods for pulp and paper production. They have worked also on bamboo, eucalyptus, Juncus, and such residues as carnauba leaf and bagasse. The Laboratory appears to be quite well equipped for the job to be done. They have a 20-liter digester, defibrator, screen, beaters, and a small paper machine (Kammerer). The small paper machine, we were told, is used to a relatively small extent.

The current activity of Mr. Massei demonstrated an interesting approach to the complicated problem of utilization of Amazonian woods for pulp and paper production. He said that he was asked some time ago to take on the appalling job of evaluating the Amazonian species for their pulp and paper potential. At his suggestion, he said, the job was modified to that of evaluating the fast-growing species which appear after the jungle area is clear cut. In this way, what was formerly an array of 3,000 species is reduced to an array of some 20 or 30 species. The fast-growing woods tend, in general, to be of low density and relatively light color, with much greater potential for fiber products.

Mr. Massei said that Brazil can look forward in the relatively near future to being an exporter of pulps. He says he sees no reason why they cannot take over some of the markets now enjoyed by the Scandinavian countries.

Massei said that he runs his section with two professional assistants, a chemist, an engineer, and two helpers. He is very much impressed with Brazil's needs for pulp and paper technologists. He said there would

be a place for 100 pulp and paper technicians per year in Brazil. This seems like a very high figure, but he did not elaborate on his concept of the term "technician." He, himself, has put some 15 or 20 trainees through 3- to 4-month training periods.

Massei said that much of the technical skills in existing Brazilian pulp and paper plants is provided by Europeans, primarily Germans and Czechs. He indicated that such foreigners are not particularly interested in transmitting their skills to the Brazilians with whom they are associated.

Massei appeared to have a great amount of energy and enthusiasm for his work. He suffers greatly from a lack of formal training in his specialty. We had the impression that great dividends would be gained by bringing him to the United States for an extended training period, and following this by training periods for his chief assistants.

Conference with Mr. Rene Gachot, Deputy Regional
FAO Representative for Latin America, and
Mr. G. G. Gray, FAO Project Manager and
Head of Forestry School, Vicosa

A rather brief conference with Mr. Gachot and Mr. Gray provided useful background information. Mr. Gachot was leaving his position in Latin America for a new assignment. Mr. Gray was rather recently assigned to his position as the counterpart of Lisboa, Head of the Forestry School at Vicosa.

Gachot said that lack of skill was the greatest problem, and only a few countries have financial resources to work effectively in training and research programs. These, in his opinion, are Colombia, Argentina,

Brazil, Venezuela, and Chile. There is a great need, he said, for determining the mechanical properties of timbers present in abundance. Work at Santarem has to do with seasoning, sawing, and preservation (durability). Santarem is expected to work into a national project. The forestry research center at Manaus presents a major problem in that foreigners will accept assignments to work there but Brazilians will not.

Gachot was asked about his views of the future of the Merida laboratory. He said he had some doubts about the wisdom of undertaking the project, but now that it has come as far as it has, he believes it deserves financial and technical support. He said that he hopes that it will become an effective coordinator of research in South America.

In regard to the effective research groups and coordinating groups in Brazil, he discounted the Instituto do Pinho as being only a sales organization. Some of the best work, he said, was in private hands and hence not available generally. He believed that in pulp and paper Klabin was an effective group. The Instituto de Pesquisas Tecnologicas at Sao Paulo has capable people and has in the past done good work on wood. They have increasing activities in the pulp and paper research field.

Gachot and Gray were asked how they thought we might proceed to use a rather modest amount of AID funds with maximum effectiveness in promoting forest products utilization. They were reluctant to offer specific advice but suggested that training local people to carry the job was the main task, and the proper selection of such men is of greatest importance. They said we should be careful about putting much stock in the recommendations of local officials. In their experience, such selections were not often on the basis of merit. Some officials use

it as a way to please the right people, and even to unload undesirables from their groups. They said that AID or UN programs operate through "Counterparts," and that when possible we should seek joint recommendations which force the technical expert to vouch for the suitability of a man for training. It is most important, Gachot said, to select serious young men who give some assurance of having dedicated their professional careers to the job for which they seek additional training. Many students will accept training in any field for the sake of foreign travel and education. After the completion of their training, they will work at whatever job pays the most (this is not likely to be in the field of forest products research).

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CHILE

Investigations in Chile were conducted during the period of June 14 to 20, 1962.

Resource and Wood Industry

Chile has a land area of 286,400 square miles of which about 77,000 or 27 percent is forest or bush. About 60 species of trees make up the natural forest and the majority are hardwood species of which 15 to 20 species are suitable for lumber. The report of two forestry missions to Chile estimate that the total volume of standing timber amounts to about 174,000 million board feet. Of this total almost 60 percent belong to two species, coigue and tepa. There are, however, important quantities of ulmo, tineo, manio, olivillo, rauli, roble, araucaria, and several other species. The important exotic species are radiata pine, eucalyptus, and Douglas-fir. Some 700,000 acres of these species are in plantations mostly in the provinces of Linares to Malleco.

At the present time, enterprises connected with the forestry resources employ about 80,000 persons directly or indirectly, and make an important contribution toward raising the standard of living of the rural workers.

There are about 300 sawmills in operation with an average annual output of 400 million board feet of sawn lumber. They also produce about 900,000 cross-ties annually and some 7,500 cubic meters of poles for transmission lines.

The sawn lumber is utilized by the following industries: 80 box factories, 40 door and window factories, 20 parquet plants, 140 furniture factories, and 50 miscellaneous plants turning out brushes, brooms, barrels,

etc. There are three plywood factories producing 10,000 cubic meters of product and one veneer mill devoted to the production of face veneers. There are three pulp and paper mills based primarily on radiata pine.

Exports amount to about 90 million board feet going primarily to Argentina and Peru with small quantities to Europe and the United States.

Past Reviews of the Forestry Situation in Chile

The first forest survey was made in Chile by the United States Mission headed by Irvine T. Haig in 1944-46, and a second mission in 1956 headed by Johannes Weck produced a similar forest and industrial survey.

Although the lumber industry in Chile is currently one of the nation's valuable resources, it has not been developed as it deserves, although it is more advanced than similar industries in other parts of Latin America. This may be attributed to the early interest developed in Chile with regard to their forests, and the Government's policy regarding facilities for investment and freedom of trade also assure a brighter future for the wood industry.

Chile has a strong and fairly well-developed lumber association, The Corporacion Chilena de la Madera (CORMA). They have been instrumental in the publication of the "Chilean Wood Handbook" which is entitled "Maderas" and contains the basic information on the principal Chilean woods.

Further impetus toward the improvement of forestry and forest industries of Chile is being promoted by the Instituto Forestal and their recently inaugurated 4-year program sponsored by the United Nations Special Fund. The executive and technical staff consists of 15 men, 8 of which are Technical Assistance FAO Experts (C2, C3). (Fred Simmons to be added.)

The Instituto Forestal does not do research directly but attempts to promote and coordinate research activities among the several universities of the country. In discussions with this group, it was indicated that it may be difficult to maintain these research activities among the various universities and that within 4 or 5 years it will be necessary to develop a Federal forest products laboratory.

A conference with Mr. Edwin Schmeisser, Chief of the Forest Service, and Mr. Lorenzo Garay, of the Forest Service staff, made it apparent that the picture of forests and forest products activities could be best developed through discussions with FAO representatives. They stated that there is much uncertainty of the magnitude and nature of the forest resource and that photogrammetry is now being employed for the purpose of increasing the efficiency and accuracy of the forest survey. They also indicated that there was only the beginning of forest products research in Chile and this was largely the result of recent activities of FAO.

Interview with Mr. Eero Kalkkinen, Regional Forestry
Officer of FAO for Latin America, Secretary General
of Latin American Forestry Commission

Mr. Kalkkinen was interviewed at his office in Santiago.

In the course of this trip and prior to making the trip, the important work of UN-FAO in the field of forestry in Latin America had become apparent. The interrelationships of the many groups involved, however, had not been clarified. Mr. Kalkkinen was asked to describe the scope of FAO activities in Latin America and the upper-level people involved in its direction. The following is his list of key personnel and the two major types of activities in which they are involved.

General

Dr. Hernan Santa Cruz, Assistant Director General of the FAO,
in charge of Latin American affairs, Latin American Regional
Office, Santiago

Mr. Adolfo Alarcon, Deputy Regional Representative, eastern zone,
Rio

Mr. Ian Kelton, Deputy Regional Representative, western zone,
Santiago

Mr. Thomas Borges, Deputy Regional Representative, northern zone,
Mexico

Forestry - Regional

Mr. Eero Kalkkinen, Regional Forestry Officer of FAO for Latin
America, Santiago, Secretary General of Latin American Forestry
Commission

Dr. M. A. Huberman, Regional Forestry Officer, northern zone,
Mexico, and liaison officer with North American Forestry Commission

Mr. Carlos Flinta, Forestry Officer, Santiago

Mr. Peter Grijpma, Forestry Officer, Santiago

Mr. Lucas Tortorelli, Chief, Latin American Advisory Group for
Forest Education and Research, Rio de Janeiro

Mr. Max Oberdorfer, Chief, Latin American Pulp and Paper Advisory
Group, CERAL/FAO, Santiago

Mr. Cesco Petrin, Adviser, forest colonization and agricultural
reform, Santiago

UN-FAO Activities

A. Expanded Technical Assistance Programme (1)

B. UN Special Fund Projects

Note: (1) Assisted also by junior experts from the Netherlands
and Germany, and probably from other European
countries in the future.

Mr. Kalkkinen was asked whether he had available any descriptive
brochures or annual reports describing the total effort in Latin American

Forestry and Forest Products by FAO. He said that he had no such report. Available reports are apparently limited to those produced by experts in the various programs. Our investigations would have been greatly facilitated if we'd had available to us a very brief statement on where work is being done, the nature of the program, and its status, together with names and addresses of responsible people. Such information can now be obtained only by a laborious process, and the information obtained is necessarily very incomplete. Thus, it wasn't until we talked with Mr. Kalkkinen that we heard about the fact that a Mr. Lucas Tortorelli is functioning in Rio de Janeiro as the Chief of the Latin American Advisory Group for Forest Education. When we were in Rio de Janeiro, we were not aware that such a position existed.

Mr. Kalkkinen was able to provide a copy of Information Document No. 14 in Spanish and English translation on "Present State of Higher Forestry Education in Latin America" (CI). This is a key document to service the investigation we have undertaken.

Mr. Kalkkinen went on to describe the nature of Latin American FAO forestry activities. There are, he explained, two types of country programs, ETAP (Expanded Technical Assistant Programs) and UN Special Funds Projects. ETAP's programs are in operation in Mexico, Salvador, Honduras, Nicaragua, Chile, and Brazil. The governments of Netherlands and Germany have agreed to supply young foresters to these groups. There are now about 12 such men in Latin America. Mr. Kalkkinen mentioned the fact that he has attempted to work with the Peace Corps, which has some forestry graduates in its ranks. It appears that the Peace Corps is not in forestry work, but there is some hope of detaching trained foresters or rangers to contribute what they can to forestry activities.

The other general class of activity, the FAO-UN Special Fund, is of two types: (1) Preinvestment survey of resources, now underway in Mexico, Honduras, Nicaragua, Guatemala, and Ecuador; and (2) the creation and strengthening of forest education and research. Such projects are in existence at Vicos, University of Mexico, Costa Rica (Inter-American Institute for Cultural Sciences in cooperation with OAS). A prominent program is underway in Chile on the creation of a general forestry development institute. This institute is under the direction of Lars A. Hartman, Chief of Projects for the United Nations Special Fund.

Conference with Mr. Lars Hartman, Project Chief,
United Nations Special Fund, and Staff Members
of Instituto Forestal, Santiago

Mr. Hartman described the makeup of his group and its assignment. The United Nations Special Fund for Chile consists of \$1,350,000, which is to pay for 44 expert years over a period of 4 years starting in 1961. A statement of the activities represented and the staffing level is given in reference (C2). Incumbents in the various positions are listed in reference (C3). It is quite apparent that this project represents an outstanding forestry and forest products research effort in South America. Answers to many of the questions we raised were handled by Dr. Kauman, Coordinator of Forest Products Research in Chile. Dr. Kauman has just completed a study of existing forest products research and research facilities in Chile and summarized his findings. Facilities for research are limited to the five major universities. The University of Chile has two major institutes--one dealing with the strength of materials in the Department

of Civil Engineering and the other in the field of forest engineering. Their attention is given to timber physics, preservation, and physical chemistry.

Catholic University has an institute on structural materials, and they deal with problems of wood connectors. At the University of Santa Maria in Valparaiso, Professor Rubens has work in progress on pulping. Additional work is in progress in wood chemistry and some work is being done on the conversion of lignin to detergents. At the end of four years, a technical degree can be obtained. Associated with the University is a School for Tradesmen. The University of Concepcion has a department of forest products with investigations underway in the fields of pulping, chemistry, and wood preservation. The University of Valdivia is a relatively new institution--only 6 to 7 years old. It has a School of Forest Engineering with some strength in the field of timber physics and laboratory drying investigations. Germany has provided funds and specialists to this school. The University of Santiago has work in the field of mechanical design, and, in addition, some 15 species are being investigated by fairly elaborate density surveys. Additional work on density surveys is being done at Valdivia.

Dr. Kauman felt that the major job ahead of him was coordinating the research program. He is attempting to get the various universities to cooperate in joint activities. The six major departments in the five universities, however, are widely separated, and he can give only a relatively small percentage of his time to each of them. He has two projects started--one on the drying of coigue at Valdivia and another at the University of Concepcion on relief of collapse in wood. Assistance is being given

to the University of Santa Maria at Valparaiso on a course for timber engineers. At Concepcion, pilot-plant tests are being made of preservative methods, particularly double diffusion and the use of borax in control of blue stain. Valdivia has a large impregnation plant, and an effort is being made to interest industry in cooperative studies. This plant at Valdivia was visited by McLean some years previously.

Dr. Kauman was assembling all of the information he acquired in the course of a 3-month study on the status and coordination of Chilean research in forest products. This report (C7) gives, in detail, the current situation in forest products research, necessary investigations, proposed program of research, and lists of scientific personnel and equipment available at the various Chilean universities for investigations in forest products research.

While Kauman is working toward a coordination of forest products research activities in Chile, Hartman said he is not very optimistic about making effective progress and he believes it will be necessary to create a laboratory research group under FAO or perhaps some other auspices.

Hartman and his group were asked for their opinion on the most effective way to use modest sums available in the AID forest products Cooperative Program. His answer was very positive. He suggested that we select young, professional men with some scientific achievement and perhaps two years or more of experience and give them intensive training in Madison or elsewhere in the United States. He believes a young, professional man on leave from a permanent position would feel enough loyalty to his group to return. The same cannot be said of newly graduated students.

Past experience has shown that many of them acquire an education, then leave their sponsoring group for work in another field. Hartman also feels that future forest products research in any of these countries requires fully trained career men of the country involved. Foreign experts have limited use.

Conference with Mr. Max Oberdorfer, Chief of the Advisory
Group on Pulp and Paper for Latin America

CERAL/FAO United Nations

While in Santiago, a conference was held with Mr. Max R. Oberdorfer whose previous position was that of Management Consultant, Sandwell International, Inc., Portland, Oreg. We explained our mission to Mr. Oberdorfer and found him very interested in our activities. It seems that Mr. Oberdorfer is relatively new to his job with FAO. What will be reported here will be mainly what he provided to fill gaps in our information.

He told us of a Mr. Enrique Scotto, c/o Celulosa Argentina, Avda. Pte., R.S., Pena 938, Buenos Aires, Rep., Argentina. Scotto, according to Oberdorfer, would be a good contact if we would ever wish to pick up any activities in Argentina. He seems to be functioning as a representative of the Argentina Pulp and Paper Association. He also told us of a Mr. Bruno Leuschner, Consultant Expert on Research and Training, Economic Commission for Latin America, c/o CEPAL, Providencia 871 or Casilla 179-D, Santiago, Chile. Neither of these men were contacted, but they should be kept in mind if future activities develop.

Mr. Oberdorfer said that he has very high regard for the work in progress and research capacity of the Instituto Mexicano de Investigaciones

Tecnologicas, A.C. He provided copies of a descriptive bulletin of the Institution (C4), a list of its publications (C5), and a reprint (C6) describing a new process for sulfite pulping of tropical woods.

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PERU

Introduction

Lima, Peru, was visited June 21 to June 23, 1962, for the purpose of determining what progress was being made in connection with the PL-480 program, Project No. S3-FS-1-Rev. Personnel contacted were Flavio Bazan, Chief of the Forest Service, Fernando Galvan, Assistant Chief of the Forest Service, and Adolfo Salazar, Coordinator, Forest Service, and in charge of the PL-480 project. Also contacted here was Torkel Holsoe, FAO Advisor in Silviculture.

The following pages summarize the progress to date and a suggested AID project for the rapid screening of Amazonian tree species.

Collection of Wood Samples and Herbarium Vouchers
from the Forest Trees of Peru (a Public Law 430
project), and a Suggested Parallel AID Project
for Rapid Screening of Amazonian Tree Species

The review of the collection project at Lima in June of 1962 was most gratifying and we were pleased with the amount of work that had been accomplished as well as with the quality of the materials so far collected. These collections are made from especially selected trees in eight different regions of the country. The individual trees are visited periodically and collections of flowering material or fruiting material are made as available. Upon collection of both flowering and fruiting specimens, the tree is felled and a 3-foot-long section is cut from the bole 16 feet above the ground line or buttress. Radial strips are cut from this section which are 4 inches wide, 1 foot in length, and the full radius of the tree, including the bark. Twelve sets of

herbarium material and wood specimens are collected from each tree. Five sets remain in Peru of which one set will establish the Peruvian Forest Service Herbarium, and the others will implement the collections of the Javier Prado Museum of Natural History at the University of San Marcos and the National Agricultural University. Seven sets will be sent to the United States where the herbarium specimens will be distributed by Dr. Little of the Washington Office, and the wood specimens will be further processed at the Forest Products Laboratory to provide material for exchange purposes and study.

This is a top-priority item in the Peruvian Forest Service and they are doing a fine job. They are very much aware of the fact that they must know their species and their properties in order to promote sales of Peruvian timber. Other benefits will be the establishment of an excellent herbarium as well as a wood collection which together will be the basis for future research, forest management, production and marketing, providing information for importers, and a very marked increase in the knowledge of Peruvian timber species. In Peru, timber production and secondary forest products do not meet the requirements of the domestic market and as a consequence about \$40,000,000 worth of these products are imported annually. In contrast, their 1961 export of timber amounted to \$2,300,000. This situation, they believe, is due to several reasons with the outstanding one being their lack of knowledge of the botanical identity of their tree species, and along with this the almost complete lack of knowledge of the technological features of the timbers.

As of March 31, 1962, they have selected and marked 175 trees, and from this number 26 trees have been collected in the flowering conditions and 23 trees in the fruiting conditions.

Suggested Species Screening Project

Wood specimens will be made available under the Peru FL-480 project and herein lies the opportunity for the screening of a large number of Amazonian species with relatively little effort and expense. This parallel project deserves sponsorship by AID because it would be of benefit to all of the countries bordering the Amazon Basin due to the fact that many of the same species found in the Peruvian Amazon occur as well in Bolivia, Ecuador, Venezuela, Brazil, and Paraguay.

Because a complete evaluation of the mechanical properties of a species involves a large number of tests of various kinds and is rather costly, it is usually not justified unless the species is likely to be used for purposes where strength plays an important part. In the place of detailed mechanical tests, preliminary evaluation should be undertaken to provide limited data that will indicate the need for or desirability of a more complete investigation of other properties. Since the Peruvian wood samples are of ample dimensions, the following information could be obtained: (1) Specific gravity; determination of this value permits estimates of its strength, weight, nail-holding power, ease of working with ordinary tools and woodworking machinery. It is also an index of resistance to wear and serves as a basis for estimating the yield of pulp per cord of wood; (2) Radial, tangential, and volumetric shrinkage measurements indicate how much a given species of wood is likely to change in dimensions when subjected to different moisture conditions; and would also dictate end use; (3) Hardness, representing the resistance of wood to wear and marring. The tests are easily and rapidly accomplished and are important when timber is used for such purposes as flooring, furniture,

bearing blocks, crossties, etc.; (4) FPL porosity test to indicate relative degree of treatability with preservatives; (5) Occurrence of silica; this can be obtained from sections or more readily from macerations of the wood during which materials are removed which might otherwise obscure its presence. The presence of silica plays an important part in the machinability of wood as well as in chipping wood for pulping purposes. It is also believed to have some degree of importance in assessing the value of a wood for marine borer resistance; (6) Fiber length is of value for pulping and paper characteristics and this value can be determined concurrently with item (5); (7) Material for soil-block tests to rapidly assess the durability of a species with respect to fungus attack; (8) Material for chemical analysis and perhaps initially limited to those species which show promise for pulp and paper; (9) Heartwood-sapwood percentage to indicate volume of durable heartwood in the case of a durable species or conversely the volume of sapwood that could be preservatively treated; (10) The color of heartwood, indicating possibilities for use as decorative woods or in the case of pulping, the necessity or degree of bleaching required; (11) Grain characteristics, whether straight or interlocked, are indicators of machining characteristics as also how the species might react in seasoning; and (12) Texture, whether fine or coarse and in the case of decorative species would dictate finishing characteristics.

Implementation of such a parallel project as outlined above would provide information of inestimable value which would become increasingly important in the future development of the Amazon Basin and other areas. Peru and the adjacent areas would be in the enviable position of possessing a large body of knowledge of their primary species before embarking on a more elaborate scale of testing. Furthermore, a tremendous saving

in time and money could be realized by this initial screening process because the more costly and more comprehensive testing could be limited to those species showing the most promise.

CONCLUSIONS

A. Forest Resource

South America has the largest single forested area in the world, most of it inaccessible and remote from population centers. Much of the forest consists of heterogeneous stands with many species that so far have not found their way into the world market or into local utilization. In populated areas the original forest disappeared generations ago because of the shifting-burning agricultural practices. As a result, the land has been seriously denuded and damaged, and erosion is a major problem. The native forests have been replaced to a small extent by exotics, which now play an important role. Much of South America will have to depend increasingly on plantation-grown trees. In areas where native species are used only a few have an important local market because of their reputation for durability. There are undoubtedly many other species with similar durability which could serve the same purposes but are not now used. Nondurable species could be treated and rendered equally useful for many purposes. Reforestation will provide increasing supplies of wood for long-fibered pulps and construction materials, and in addition will play an important part in watershed protection and soil conservation.

At the present time, South America is a net importer of wood products, primarily in the form of pulp. With improvement of forestry and forest products practices, the balance could shift in favor of their becoming a net exporter.

B. Utilization

The present utilization situation.--At the present time a mere handful of species are accepted by the wood-using industries of Latin America. The reasons for this, outlined above, are accounted for by durability factors made worse by a lack of technicians and lack of knowledge of wood properties. Per capita consumption of industrial wood in Latin America is lower by a factor of many fold than that in Europe or North America. Most of this is traceable to the fact that they prefer masonry construction for housing.

A recent FAO publication, "The Yearbook of Forest Products Statistics, 1959," presents data on the consumption of forest products in the major areas of the world. In total wood consumption, South America consumed 39 percent as much as North America, but most of this was accounted for by its low-grade use as a fuel, and less than 14 percent appeared as industrial wood products. The per capita consumption of sawn wood products in South America was 7 percent of that in North America; of plywood, 4 percent; and of paper, 6 percent.

C. Potential Utilization

In the field of housing there could be great opportunities for increased use of wood, but under no circumstances can we foresee such uses becoming very prominent in the next decades. Established prejudice in favor of masonry in tropical areas is attributed to the high cost of durable species. In the Andean region, where earthquakes are common, masonry is preferred because of lower fire hazard even though wood structures are better able to withstand the shock. Because of these facts, many South American builders are experts in the use of masonry but have relatively little

skill in the use of wood. Increased knowledge of the proper use of wood can ultimately lead to changes in these long-established practices. What has been said about housing applies equally to wooden structures generally, such as bridges, warehouses and docks, poles and piling.

It is our belief that the establishment of a healthy pulp and paper industry will have a favorable effect on all aspects of forestry, forest products utilization, and soil conservation. This view is endorsed by South Americans and by others from this country who have thoroughly reviewed the situation.

Since much of the prejudice against wood construction in Latin America derives from the limited availability and high cost of naturally durable species, great increase in the use of wood could undoubtedly be accomplished through an extension of simple but sound wood preservation practices applied to the readily available and less costly species.

D. Needs

1. It is very evident from the literature survey and the present field survey that there exists a tremendous gap in the knowledge of the properties of the vast majority of Latin American tree species. This is true not only from the taxonomic standpoint but also from the mechanical and physical point of view. All of the countries must move forward beginning first with determining what species are found in their forests and the volumes and availability of those which have potential in improving the economy of the individual country. A screening program is, therefore, essential before any large scale comprehensive testing program is inaugurated, by existing facilities or those yet to be established.

2. There is a tremendous need for trained technicians and researchers in all phases of wood utilization. There are some 11 universities offering curricula in forestry, but these are generally aimed in the direction of general forestry and not for training in wood technology. There is a marked shortage of foresters in the region and the number of trained industrial technicians and wood utilization research personnel is minute.

3. Along with these very apparent deficiencies it is also essential that all processes involving wood, from the tree to the finished product, be markedly improved.

4. Interest in forest utilization research appears to be highest in Venezuela which now has the best-equipped laboratory in Latin America. Interest is lowest in Brazil perhaps due to the low salary scale and because of the formidable problem posed by the large number of Amazonian species.

5. The wood-using public must be educated to the fact that many species can be used in place of the very expensive mahogany and Spanish cedar and other durable species.

RECOMMENDATIONS

Recommendations are offered below for an introductory or pilot AID program, involving the cooperation of the Forest Service and the Agency for International Development.

In the development of this proposed program, it was kept in mind that a maximum benefit should result to the region in the shortest possible time.

Funds, available personnel, and facilities make it impossible to have a fully balanced program. The suggestions take advantage of special situations in personnel and facilities. An effort was made to favor projects of broad regional applicability.

A. Wood Collection and Screening Program

1. It is recommended that an expanded wood and herbarium collection program be undertaken in the countries bordering the Amazon Basin, and that the wood samples collected be subjected to the standard laboratory wood technology evaluations outlined previously (see Peru).

2. An elaborate collection program is now underway in Peru, and an excellent set of wood samples has been accumulated. Plans should be developed and Peruvian technicians trained to evaluate these samples according to standardized procedures.

The program of work represented in the Peruvian collection can serve as a prototype for all tropical Latin America. Important skills have been learned which can be readily transmitted to other workers in the area. For this reason, we recommend that arrangements be made for other Latin American personnel to work with the experienced group in Peru.

B. Training

Arrangements should be made for training Latin American scientists and technicians in a variety of fields related to forest products utilization, with particular emphasis on wood technology and pulp and paper technology.

It is recommended that Francisco de Matos Massei, Chief of the Section of Pulp and Paper, Instituto de Pesquisas Tecnologicas, Sao Paulo, be offered specialized training in pulp and paper research at the Forest

Products Laboratory. This man, with desirable background, has an established staff position in a strong institution located in an area with a dynamic paper industry. His training and the subsequent training of others on his staff would have an important effect on the industry.

C. Program Development

It is recommended that a utilization and marketing specialist be attached to the Division of Renewable Natural Resources in the Ministry of Agriculture, Caracas, Venezuela. His duties, as those of comparable men in our Forest Utilization Research positions, will be to provide liaison between groups responsible for research, the resource, and marketing. George Englerth, with extensive experience in this very work both in the United States and in the tropics, is highly recommended for the position.

Particular emphasis should be placed on the training of Latin American specialists to serve on the staff of the National Forest Products Laboratory at Merida, Venezuela. Of much importance in this connection is the organizing of the program and the selection of participants. In conversation with Government and educational leaders, they repeatedly emphasized their need for a senior man to help in this task. A man of the experience and caliber of Mr. George M. Hunt should be recruited for this purpose (the people in the Venezuelan Forest Service feel this need so acutely that they are now considering the employment of Mr. Hunt without AID assistance).

ACKNOWLEDGEMENTS

The authors wish to express their gratitude to all of the individuals contacted during their tour of Venezuela, Brazil, Chile, and Peru. They

are especially grateful to the persomel of the various AID Missions for their very kind interest in our project and their help in providing accomodations, reservations, appointments, translations, and the many other things that made the mission possible. The authors are particularly grateful for the assistance of Mr. David Robertson, USAID, Control Officer, during their stay in Rio de Janeiro; to Mr. Douglas Knudson, Vicosia Project, Vicosia, Brazil, during their stay in Sao Paulo; and Mr. Edward E. Morris, USAID, Santiago, Chile.

APPENDIX I

Known Properties of Certain Latin American Timber Species

Species	: Specific gravity	: Shrinkage	: Mechanical properties	: Seasoning	: Machining	: Durability	: Pulp and paper	: Veneers and plywood	: Chemical composition
Acacia polyphylla	: + ¹	: +	: +	: :	: :	: :	: :	: :	: :
Aextoxicon punctatum	: +	: +	: +	: :	: :	: :	: +	: :	: :
Albizzia caribaea	: +	: +	: +	: +	: +	: +	: :	: :	: :
Aleurites moluccana	: +	: +	: +	: :	: :	: :	: :	: :	: :
Anacardium excelsum	: +	: +	: +	: +	: +	: +	: +	: :	: :
Anadenanthera macrocarpa	: +	: :	: +	: +	: +	: +	: :	: :	: :
Aniba duckei	: +	: +	: +	: +	: +	: +	: :	: :	: :
Apuleia molaris	: +	: +	: +	: +	: +	: +	: :	: :	: :
Apuleia praecox	: +	: +	: +	: :	: :	: :	: :	: :	: :
Araucaria augustifolia	: +	: +	: +	: +	: +	: +	: +	: +	: +
Araucaria araucana	: +	: +	: +	: +	: +	: +	: +	: :	: :
Aspidosperma desmanthum	: +	: +	: +	: :	: :	: :	: :	: :	: :
Aspidosperma duckei	: +	: +	: +	: :	: :	: :	: :	: :	: :
Aspidosperma olivaceum	: +	: +	: +	: :	: :	: :	: :	: :	: :
Aspidosperma peroba	: +	: +	: +	: +	: +	: +	: :	: +	: :
Aspidosperma ramiflorum	: +	: +	: +	: :	: :	: :	: :	: :	: :
Astronium fraxinifolium	: +	: +	: +	: :	: :	: :	: :	: +	: :
Astronium graveolens	: +	: +	: +	: +	: +	: +	: :	: +	: :
Astronium lecontei	: +	: +	: +	: :	: :	: :	: :	: :	: :
Astronium urundeuva	: +	: +	: +	: :	: :	: :	: :	: :	: :
Bagassa guianensis	: +	: +	: +	: +	: +	: +	: +	: :	: +
Balfourodendron riedelianum	: +	: +	: +	: :	: :	: :	: :	: :	: :
Bastardiopsis densiflora	: +	: +	: +	: :	: :	: :	: :	: :	: :
Belangera glabra	: +	: +	: +	: :	: :	: :	: :	: :	: :
Bertholetia excelsa	: +	: +	: +	: +	: +	: +	: +	: :	: :
Bombacopsis quinata	: +	: +	: +	: +	: +	: +	: +	: :	: :

APPENDIX I (Cont.)

Known Properties of Certain Latin American Timber Species

Species	: Specific gravity	: Shrinkage	: Mechanical properties	: Seasoning	: Machining	: Durability	: Pulp and paper	: Veneers and plywood	: Chemical composition
Bombax endecaphyllum	: +	: +	: +	: +	: +	: +	: +	: +	: +
Bowdichia brasiliensis	: +	: +	: +	: +	: +	: +	: +	: +	: +
Bowdichia virgilioides	: +	: +	: +	: +	: +	: +	: +	: +	: +
Buchenavia capitata	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cabrlea cangerana	: +	: +	: +	: +	: +	: +	: +	: +	: +
Calophyllum brasiliense	: +	: +	: +	: +	: +	: +	: +	: +	: +
Calycophyllum candidissimum	: +	: +	: +	: +	: +	: +	: +	: +	: +
Carapa guianensis	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cariniana brasiliensis	: +	: +	: +	: +	: +	: +	: +	: +	: +
Caryocar villosum	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cassia ferruginea	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cassia inaequilatera	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cedrela angustifolia	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cedrela fissilis	: +	: +	: +	: +	: +	: +	: +	: +	: +
Ceiba pentandra	: +	: +	: +	: +	: +	: +	: +	: +	: +
Celtis brasiliensis	: +	: +	: +	: +	: +	: +	: +	: +	: +
Chlorophora tinctoria	: +	: +	: +	: +	: +	: +	: +	: +	: +
Chorisia speciosa	: +	: +	: +	: +	: +	: +	: +	: +	: +
Copaifera langsdorffii	: +	: +	: +	: +	: +	: +	: +	: +	: +
Copaifera reticulata	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cordia alliodora	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cordia collococca	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cordia goeldiana	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cordia hypoleuca	: +	: +	: +	: +	: +	: +	: +	: +	: +
Cordia trichotoma	: +	: +	: +	: +	: +	: +	: +	: +	: +
Coumarouna odorata	: +	: +	: +	: +	: +	: +	: +	: +	: +

APPENDIX I (Cont.)

Known Properties of Certain Latin American Timber Species

Species	Specific gravity	Shrinkage	Mechanical properties	Seasoning	Machining	Durability	Pulp and paper	Veneers and plywood	Chemical composition
Coumarouna oleifera	+	+	+						
Couratari pulchra	+	+	+	+	+	+			
Croton echinocarpus	+	+	+						
Croton floribundus	+	+	+						
Cryptocarya mandioccana	+	+	+						
Cryptocarya moschata	+	+	+						
Dalbergia violacea	+	+	+						
Didymopanax navarroii	+	+	+						
Diplostropis purpurea	+	+	+	+	+	+			
Duguetia lancolata	+	+	+						
Enterolobium schomburgkii	+	+	+	+	+	+			+
Enterolobium timbouva	+	+	+	+		+		+	
Erismia uncinatum	+	+	+						
Eschweilera blanchetiana	+	+	+	+	+	+			
Eschweilera odora	+	+	+	+	+	+			
Eschweilera tenax	+	+	+	+	+	+			
Eucalyptus globulus	+	+	+	+					
Eucryphia cordifolia	+	+	+				+		
Eugenia pseudocaryophyllus	+	+	+						
Euxylophora paraensis	+	+	+						
Fagara monophylla	+	+	+						
Ficus pohliana	+	+	+						
Ferreirea spectabilis	+	+	+						
Fitzroya cupressoides	+	+	+		+	+		+	
Gallesia gorazema	+	+	+						

APPENDIX I (Cont.)

Known Properties of Certain Latin American Timber Species

Species	Specific gravity	Shrinkage	Mechanical properties	Seasoning	Machining	Durability	Pulp and paper	Veneers and plywood	Chemical composition
<i>Glycydendron amazonicum</i>	+	+	+						+
<i>Goupia glabra</i>	+	+	+	+	+	+			
<i>Grevillea robusta</i>	+	+	+	+	+	+		+	
<i>Guaiacum</i> spp.	+		+						
<i>Guarea trichilioides</i>	+	+	+	+	+	+			
<i>Hieronyma alchorneoides</i>	+	+	+	+	+	+			
<i>Hieronyma laxiflora</i>	+	+	+	+	+	+			
<i>Holopyxidium jarana</i>	+	+	+	+	+	+			
<i>Holopyxidium latifolium</i>	+	+	+	+	+	+			
<i>Humiria balsamifera</i>	+	+	+	+	+	+	+	+	
<i>Hura crepitans</i>	+	+	+	+	+	+			
<i>Hymenaea courbaril</i>	+	+	+	+	+	+			
<i>Hymenaea davisii</i>	+	+	+	+					
<i>Hymenaea oblongifolia</i>	+	+	+						
<i>Hymenaea parvifolia</i>	+	+	+						
<i>Hymenaea stilbocarpa</i>	+	+	+						
<i>Hymenolobium excelsum</i>	+	+	+	+	+	+			
<i>Iryanthera lancifolia</i>	+	+	+	+	+	+			
<i>Iryanthera sagotiana</i>	+	+	+	+	+	+			
<i>Jacaranda acutifolia</i>	+	+	+						
<i>Jacaranda copaia</i>	+	+	+	+	+	+			
<i>Jacaranda semiserrata</i>	+	+	+				+	+	
<i>Laurelia aromatica</i>	+	+	+	+	+	+			
<i>Lecythis paraensis</i>	+	+	+	+	+	+			
<i>Lecythis pisonis</i>	+	+	+						
<i>Lecythis usitata tenuifolia</i>	+	+	+	+	+	+			
<i>Licania hypoleuca</i>	+	+	+	+					

APPENDIX I (Cont.)

Known Properties of Certain Latin American Timber Species

Species	Specific gravity	Shrinkage	Mechanical properties	Seasoning	Machining	Durability	Pulp and paper	Veneers and plywood	Chemical composition
<i>Licania macrophylla</i>	+	+	+	+	+	+			
<i>Licaria cayennensis</i>	+	+	+	+	+	+			
<i>Loxopterygium sagotii</i>	+	+	+	+	+	+			
<i>Luehea divaricata</i>	+	+	+						
<i>Machaerium stipitatum</i>	+	+	+						
<i>Machaerium villosum</i>	+	+	+						
<i>Macoubea guianensis</i>	+	+	+	+	+	+			
<i>Manilkara bidentata</i>	+	+	+	+	+	+			+
<i>Manilkara huberi</i>	+	+	+	+	+	+			
<i>Melia azedarach</i>	+	+	+						
<i>Meliosma brasiliensis</i>	+	+	+						
<i>Mezilaurus itzuba</i>	+	+	+	+	+	+		+	
<i>Micropholis gardnerianum</i>	+	+	+						
<i>Micropholis guyanensis</i>	+	+	+	+	+	+			+
<i>Mimosa bracaatinga</i>	+	+	+						
<i>Mimquartia guianensis</i>	+	+	+	+	+	+			
<i>Moquinia polymorpha</i>	+	+	+						
<i>Mora excelsa</i>	+	+	+	+	+	+			
<i>Mouriria guianensis</i>	+	+	+						
<i>Myroxylon balsamum</i>	+	+	+						
<i>Nectandra concinna</i>	+	+	+	+	+	+			
<i>Nectandra mollis</i>	+	+	+						
<i>Nothofagus dombeiyi</i>	+	+	+	+	+		+	+	
<i>Nothofagus obliqua</i>	+	+	+				+	+	
<i>Nothofagus procera</i>	+	+	+	+	+	+	+	+	
<i>Ocotea pretiosa</i>	+	+	+						
<i>Ocotea rubra</i>	+	+	+	+	+	+		+	+

APPENDIX I (Cont.)

Known Properties of Certain Latin American Timber Species

Species	: Specific gravity :	: Shrinkage :	: Mechanical properties :	: Seasoning :	: Machining :	: Durability :	: Pulp and paper :	: Veneers and plywood :	: Chemical composition :
<i>Ocotea tenuiflora</i>	: +	: +	: +	:	:	:	:	:	:
<i>Ormosia paraensis</i>	: +	: +	: +	:	:	:	:	:	:
<i>Osteophloeum platyspermum</i>	: +	: +	: +	: +	: +	: +	:	:	:
<i>Paratecoma peroba</i>	: +	: +	: +	: +	: +	: +	:	: +	:
<i>Parinari campestris</i>	: +	: +	: +	: +	: +	: +	:	:	:
<i>Parinari rodolphii</i>	: +	: +	: +	: +	: +	: +	:	:	:
<i>Patagonula americana</i>	: +	: +	: +	: +	: +	: +	:	:	:
<i>Peltogyne confertiflora</i>	: +	: +	: +	:	:	:	:	:	:
<i>Peltogyne densiflora</i>	: +	: +	: +	:	:	:	:	:	:
<i>Peltogyne pubescens</i>	: +	: +	: +	: +	: +	: +	:	:	:
<i>Peltogyne venosa</i>	: +	: +	: +	: +	: +	: +	:	:	:
<i>Peltophorum vogelianum</i>	: +	: +	: +	:	:	:	:	:	:
<i>Persea lingue</i>	: +	: +	: +	: +	: +	: +	: +	: +	:
<i>Phoebe porosa</i>	: +	: +	: +	:	:	:	:	:	:
<i>Phyllanthus nobilis</i>	: +	: +	: +	:	:	:	:	:	:
<i>Pinus radiata</i>	: +	: +	: +	: +	: +	: +	: +	:	:
<i>Piptadenia communis</i>	: +	: +	: +	:	:	:	:	:	:
<i>Piptadenia macrocarpa</i>	: +	: +	: +	:	:	:	:	:	:
<i>Piptadenia peregrina</i>	: +	: +	: +	:	:	:	:	:	:
<i>Piptadenia pittierii</i>	: +	: +	: +	:	:	:	:	:	:
<i>Piptadenia rigida</i>	: +	: +	: +	:	:	:	:	:	:
<i>Platycyamus regnellii</i>	: +	: +	: +	:	:	:	:	:	:
<i>Platymiscium pinnatum</i>	: +	: +	: +	:	:	:	:	:	:
<i>Platymiscium polystachium</i>	: +	: +	: +	:	:	:	:	:	:
<i>Platymiscium trinitatis</i>	: +	: +	: +	:	:	:	:	:	:

APPENDIX I (Cont.)

Known Properties of Certain Latin American Timber Species

Species	Specific gravity	Shrinkage	Mechanical properties	Seasoning	Machining	Durability	Pulp and paper	Veneers and plywood	Chemical composition
<i>Platymiscium ulei</i>	+	+	+						
<i>Podocarpus nubigenus</i>									
<i>salignus</i>	+	+	+						
<i>Populus nigra</i>	+	+	+						
<i>Pouteria carabobensis</i>	+	+	+	+	+	+			
<i>Pradosia glycyphloea</i>	+	+	+						
<i>Frunus brassiliensis</i>	+	+	+						
<i>Pseudosamanea guachapele</i>	+	+	+	+	+	+			
<i>Pterocarpus vernalis</i>	+	+	+	+	+	+			
<i>Pterodon pubescens</i>	+	+	+						
<i>Pterogyne nitens</i>	+	+	+						
<i>Qualea albiflora</i>	+	+	+	+	+	+			+
<i>Qualea rosea</i>	+	+	+	+	+	+			+
<i>Quararibea guianensis</i>	+	+	+						
<i>Rauwolfia pentaphylla</i>	+	+	+						
<i>Roupala brasiliensis</i>	+	+	+						
<i>Sacoglottis uchi</i>	+	+	+						
<i>Samanea saman</i>	+	+	+	+	+	+			
<i>Sapium biglandulosum</i>	+	+	+	+	+	+			
<i>Schizolobium excelsum</i>	+	+	+				+		
<i>Securinega guarayuva</i>	+	+	+						
<i>Simaruba amara</i>	+	+	+	+	+	+			+
<i>Solanum inaequale</i>	+	+	+						
<i>Spondias mombin</i>	+	+	+	+	+	+	+		
<i>Sterculia apetala</i>	+	+	+						
<i>Sterculia chicha</i>	+	+	+						
<i>Swietenia macrophylla</i>	+	+	+	+	+	+		+	

APPENDIX I (Cont.)

Known Properties of Certain Latin American Timber Species

Species	Specific gravity	Shrinkage	Mechanical properties	Seasoning	Machining	Durability	Pulp and paper	Veneers and plywood	Chemical composition
<i>Symphonia globulifera</i>	+	+	+	+	+	+			
<i>Tabebuia cassinioides</i>	+	+	+					+	
<i>Tabebuia guayacan</i>	+	+	+	+	+	+			
<i>Tabebuia impetiginosa</i>	+	+	+						
<i>Tabebuia ochracea</i>	+	+	+						
<i>Tabebuia pentaphylla</i>	+	+	+	+	+	+			
<i>Tabebuia serratifolia</i>	+	+	+	+	+	+		+	
<i>Tabebuia spectabilis</i>	+	+	+						
<i>Talauma ovata</i>	+	+	+						
<i>Tapirira guianensis</i>	+	+	+						
<i>Terminalia amazonia</i>	+	+	+	+	+	+			
<i>Terminalia guyanensis</i>	+	+	+	+	+	+		+	
<i>Virola surinamensis</i>	+	+	+	+	+	+		+	
<i>Vitex orinocensis</i>	+	+	+						
<i>Vochysia guianensis</i>	+	+	+	+	+	+			
<i>Vochysia laurifolia</i>	+	+	+						
<i>Voacapoua americana</i>	+	+	+	+	+	+			+

¹Indicates property has been investigated.