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REPORT OF TRAVEL TO COLOMBIA (June 1973)

ROBERT C. KOEPPEN, Botanist
Forest Products Laboratory
Forest Service, U.S. Department of Agriculture
Madison, Wisconsin 53705

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REPORT OF TRAVEL TO COLOMBIA, MAY 6 - 20, 1973

CONCERNING UTILIZATION OF SECONDARY WOODS

By

ROBERT C. KOEPPEN, Botanist

Forest Products Laboratory,¹ Forest Service
U.S. Department of Agriculture

Introduction

Authority

The trip was made under a Participating Agency Service Agreement between the Agency for International Development and the Forest Service, U.S. Department of Agriculture. The PASA Control No. is TA(AJ)2-73. The PASA was approved for AID on November 29, 1972, and for U.S.D.A. on December 13, 1972.

Background

The demand for wood is rapidly increasing throughout the world, and in some areas is already in such short supply that mills are unable to operate at full capacity. Worldwide tropical forests are known to contain large volumes of wood, but their actual production is only a small fraction of the potential. With the tropical forests all located in lesser developed countries, it is likely that increased utilization of this vast potential would not only benefit world wood-using industries, but that considerable economic and social benefits to the LDC's would also result.

The Agency for International Development has, over an extended period, been concerned with the practice, in many tropical countries, of concentrating on a relatively limited number of species for exploitation. Such limited exploitation not only limits the resource base from which developing countries can enter into international commerce, but it also limits the possibilities for furnishing the amenities to their own populations.

An expanded resource base could, in addition, reduce the necessity for imports and thus ease the problems of balances of trade. For example, if newsprint is imported, establishment of newsprint manufacture from their own resources would be helpful.

Recognizing these problems, USAID asked the Forest Service in 1965 to look at this problem in Latin America, with emphasis on the Amazon area-- probably the greatest, relatively untapped forest resource in the world. This resulted in recommendations, contained in the report "Projected AID Research Program on Improved Forest Products Utilization in Latin America,"

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

for establishment of research programs in several locations. In large part, the recommendations were based on the concept that one of the principal deterrents to increased utilization was a lack of knowledge of the characteristics of many species in the resource and thus of their potential for utilization.

The proposals for Latin America were never implemented but, in 1971, a new proposal was developed, along the same lines, to cover the three principal tropical areas of the world--Latin America, Africa, and Southeast Asia. During the review of this proposal, questions were raised as to the validity of the basic concept. That is, is the lack of knowledge of characteristics the primary deterrent to increased use of "secondary" species, or are there other factors which are equally important or perhaps more important?

To get at the answer to this question, the PASA mentioned earlier was set up and the Forest Products Laboratory was given responsibility for the project. One phase of the project involved travel to selected countries for on-the-ground discussion of limiting factors. The 2-week trip to Colombia was taken under this phase. The country of Colombia was selected because (a) a large quantity of Colombian wood is imported to U.S. industry, (b) the government officials contacted readily agreed to cooperate by making the necessary arrangements, and (c) it was considered representative of the South American countries, at least of the Andean region. Travel to additional countries in the area was not possible because of limitations on time and funds.

Object of Travel

The basic objective of this travel was to gather information from knowledgeable people in Colombia as to the factors which control the choice of woody species presently being cut and utilized.

Itinerary

The Division of Forestry of the Instituto de Desarrollo de los Recursos Nacionales Renovables (INDERENA) was asked to prepare an itinerary which would include visits to wood testing laboratories, forestry schools, and businesses concerned with wood, such as manufacturing plants and exporters.

The itinerary developed by the staff of INDERENA, which included five cities and took me from one end of the country to the other, is shown in detail in Appendix A. Actually, most of the work on the itinerary, the necessary arrangements, and the coordination was done by Sr. Ramon Camargo of the Bogota office. For this he is to be commended because everything went smoothly and according to plan, which greatly contributed to whatever success this trip attained. For example, my knowledge of Spanish is quite limited and an interpreter is required in order to carry on a successful interview. At each city arrangements had been made to insure that an interpreter was available to provide such help during my visit.

Principal Contacts

As indicated in the Itinerary, a large number of contacts were made during this 2-week visit. The principal contacts are listed in Appendix B under the appropriate organization.

General Observations

Forests and Forest Inventory

The forests of Colombia reportedly contain more than 500 species (some estimates range as high as 700) of trees of commercial size. However, no good, comprehensive forest survey is available for the entire country. Forest inventory information of any sort is available for only 20 percent of the forested area in Colombia and, therefore, the potential timber supply is not known. This is one of the major problems confronting the Colombian forest service, INDERENA, as well as businessmen interested in exploiting the forests. At several different meetings, businessmen lamented the fact that even "ballpark" figures are not available on species densities and locations for a large percentage of the Colombian forests. Lack of such data, of course, stifles business interests that might strengthen the national economy. Also, INDERENA, which has the responsibility of managing the national forests for the continued benefit of all Colombians, cannot operate effectively because long-range plans are impossible without a reliable and complete forest survey. I was later informed that concessioners are required to inventory specific areas before permission to cut in them is granted.

Since I was told repeatedly by both businessmen and government officials that this lack of a good forest survey was a major problem to better forest utilization, why haven't such studies been initiated? The answer is simple--no money. Nevertheless, this serious information gap must be taken into account whenever a timber testing program for Colombia is under consideration. Such matters as order of priorities cannot be wisely regulated without first knowing what species and what volumes are present in a given area.

Forest Types

The timber-producing forests of Colombia range from sea-level swamp associations to upland mountain types. In addition, there are some areas of tropical scrub forest and savannah which contain trees, but are not considered here.

Lowland forests.--The swamp and lowland forests of the Pacific and Caribbean coastal lands produce most of the volume of timber and veneer products. From these forests come such well known woods as cuangare (Dialyanthera spp.), banak (Virola spp.), sajo (Camptosperma panamensis), and sande (Brosimum spp.). These forests are heavily exploited but, in spite of this, future shortages are not expected. Natural regeneration is good and the cut can be done on about a 15-year cycle. Within this time,

I was told, trees such as banak and cuangare would have attained a DBH of around 15 inches. Contrary to the general concept of a tropical rain forest, trees do not become very large in the areas of high rainfall within Colombia. In the Tumaco region, the combination of more than 3 meters of rainfall per year, together with a physically unstable soil type, results in large trees just falling over from their own crown weight. Consequently, most of the sawmill and veneer industry of Colombia is geared to logs in the 12- to 24-inch-diameter class. Incredible as it seems, failure to realize this fact was one of the main reasons that the several million dollar veneer mill installed by Potlatch at Tumaco was unsuccessful. High-speed, largely automatic lathes were installed that were designed to handle logs in the class of our West Coast Douglas-fir. With the much smaller diameter material that is available in that area, the machinery could not operate effectively and the plant continually lost money. When the present Colombian management took over, they installed several old lathes and these, together with the abundance of cheap hand labor available, have put the plant on a paying basis. The high-speed, modern lathes and veneer-handling equipment stand idle and are up for sale.

The number of species in the lowland forests ranges from around 20 in the continuously inundated areas to about 120 on the terrace or periodically inundated areas. The better drained the site, the more heterogeneous the forest growing there. However, relatively few species or kinds of trees are utilized from the lowland forests. In the Tumaco area, normally only six kinds are regularly cut, with another 12 occasionally cut or considered to have some market potential. The remaining tree species, of which there are more than 100, are listed as undesirable because the volume is too low or the characteristics are not good for current uses. It is significant to note here that most species taken from the lowland forests produce only utilitarian-type woods. They are not suitable as decorative veneers, nor do they qualify as expensive furniture woods. Consequently, one log is not worth much, especially with the small sizes, and it is necessary to have large volumes readily available for profitable exploitation.

Upland forests.--The hill or upland forests of Colombia contain valuable stands of timber. However, these hill associations are the most heterogeneous, with more than 120 species found and most of them having a presence factor of one per acre or less. I did not gain much information on this forest type; most business people visited were not interested in the upland forests because of the many problems, such as transportation, forest heterogeneity, etc., involved in their exploitation. In fact, one veneer and plywood company manager stated that they exploit only lowland forests and actually it was not necessary for them to use any other wood than virola. Such an attitude may be rather narrow, but it does reflect the present attitude of many people associated with the wood-using industries in Colombia, particularly those whose product is largely exported. On the other hand, sash and door plants, good furniture manufacturers, and others who are concerned with a supply of the more valuable or fancy woods get much of their supplies from the hilly regions. Most of these manufacturers are relatively small operations and market their product largely in Colombia or in neighboring tropical countries. These manufacturers often do not have the money or the ability to investigate the wood of little-known species

in their concessions, so they use mostly the traditional furniture or fancy woods, mostly of the mahogany type, from the upland forests: caoba or mahogany (Swietenia macrophylla), cedro (Cedrela odorata), abarco (Cariniana pyriformis), cedrillo (Guarea trichilioides), and cedro macho (Carapa guianensis). However, in the ARTECTO furniture plant in Bogota, some excellent and attractive pieces were being made from moho (Cordia alliodora) which has a dark, striped pattern on lighter yellows and browns. The manager of this plant said they often make their own trial runs on new species, often from sheer necessity because they are frequently running out of woods for their operation. This is said to result in part from competition with export and in part from overexploitation of presently used species. This was a recurrent theme from manufacturers concerned with species from the upland forest. They frequently have difficulty keeping an adequate supply of suitable wood types on hand. The Renacimiento sash and door plant at Medellin is operating at only 50 percent capacity because of lack of adequate raw materials. The plant manager felt that if he had more information on the properties of other woods available, he could run at least closer to capacity by using a greater range of species.

One of the major problems in Colombia concerned with more complete utilization of species in the heterogeneous tropical forest is that the present system of moving timber from forest to factory does not include a method by which low-volume species could be accumulated and adequate supplies built up. There are no wholesale lumber dealers supplying manufacturers. Each plant has its own concession in the forest from which it draws supplies. This present system does not adequately provide for stock piles of low-volume species to be built up.

Research on woods, such as we are concerned with, would undoubtedly be directed mainly toward species of the upland forests. However, in Colombia a considerable portion of this forest has already been destroyed for farming purposes. Except for Tumaco which is at sea level, the other cities I visited were once surrounded with the upland forest type. However, I was unable to see any of this forest, although we drove out of Medellin for several hours one day in search of some remnants. Evidently, only in the more remote and inaccessible areas of the country do considerable amounts of this forest still exist, notably in the largely unstudied Amazon and Middle Magdalena River Valley. Considerable forest exists on the coast.

Transportation

The transportation of the wood raw material to manufacturing centers is a great problem that results in short supplies and adds to costs largely for two reasons.

(1) The topographic features make it difficult for overland hauling. Colombia is mostly characterized by high, very rugged mountains, but along the coasts there also exist vast lowlands and swamps through which, I was told, it is impossible to construct roads in some areas. Over such diverse terrain transportation, either by road or railroad, is exceedingly difficult

and expensive. To emphasize this point, the Colombian airline Avianca is the oldest commercial airline in the world. It began when air transportation was very young simply because it was nearly impossible and very slow to get to some areas of Colombia any other way.

(2) The major cities and manufacturing centers are mostly located in the highlands or at least far removed from the existing forests. I have no explanation as to the reasons behind this fact, but, again, the transportation distance alone adds to the cost of the manufactured wood products. There is no question that the severe transportation problem in Colombia restricts more efficient use of their forest resource. However, I was told the situation is improving and, of course, would improve rapidly with any upswing in the economy. Also, Colombian businessmen consider the price of wood too low, which it probably is considering today's shortages. As the price goes up, roadways will be expanded and all forms of transportation can be expected to improve. On the other hand, extending the road system further into the forests can bring large social and land conservation problems to forest managers. The present laws in Colombia seem to favor "squatters rights," and once a road is put into the forest people move in rapidly and clear the forests for farms. This, of course, destroys the forest and in hilly country often creates serious soil-erosion problems. Better laws or more strict enforcement of existing ones are needed to keep farmers out of the forest reserves.

The railroads have problems getting crossties which certainly curtails development of this mode of transportation. Presently, 84 species are used for ties in Colombia, but one official thought around 200 species might be suitable if the properties of more species were better known. He claimed also to have trained personnel that can sort log to species, which would be important to the success of a system of grouping species with similar properties. The railroads do some wood property testing themselves. However, they complain that the government could do a better job of this but excessive red tape generally prevents their working together.

Logging Technology

I was unable to observe an actual logging operation, but through discussions at mills and with staff members of INDERENA, I gained the impression that the methods of felling trees and their removal from the forests are at an extremely primitive level. I was amazed to learn that in the upland forests pit sawing was still commonly practiced to remove sapwood and square up the logs before transporting them to a truck landing for shipment to a factory. The transportation out of the woods to the truck landing is two at a time by mule or donkey--one end of a squared timber tied to each side of a pack saddle, the other end dragging on the ground. Some of the timbers we saw stacked at a furniture plant had been dragged in this manner for such a distance that the edge to the ground was worn off to a considerable extent. I was later informed that attempts to use modern logging techniques had largely failed due to machinery cost and maintenance problems as well as such factors as difficult terrain.

I was also surprised that most of the logs in the ponds at Tumaco appeared to have been chopped down, rather than sawn. When it comes to debarking, I was told this operation is mostly done in the woods by hand labor.

Such primitive logging techniques indicate that much of the bottleneck in the flow of wood to manufacturing plants is in the forests at the beginning end. It seems strange that Colombian business interests have not remedied this illogical situation of trying to keep modern wood plants in full operation from a supply source that uses such ancient, inefficient, and time-consuming techniques. Considering the total situation, however, present practices may be the most effective.

Government Controls

The Division of Forestry of the Instituto de Desarrollo de los Recursos Nacionales Renovables (INDERENA) is the federal agency that has responsibility for management, protection, and development of the forests in Colombia. It is a young organization, having been created in 1969 to replace the previous state-controlled organizations in an effort to have a more uniform system of regulations and management. Perhaps it is because of this relatively new federal status that it does not seem to be a very strong organization. Part of this is undoubtedly due to their difficulty in getting sufficient funding from the Colombian government to operate effectively. I understand AID money has, in the past, supported a good percentage of INDERENA's operations. At any rate, whenever discussions turned to government controls, businessmen would complain about the excessive red tape involved to get permission to exploit an area of the forest. The average time to get a forest concession is 3 to 4 years, and too much red tape spoils business interests and incentives, I was told. Beyond this problem, the business sector does not suffer from heavy government controls or restrictions.

Business and Commerce

The Colombian businessmen in general seem to be quite conservative in their outlook. To many of them, the secure markets they have now are bringing a good income and they are not interested in further expansion. The present boom is considered to be a temporary situation by many businessmen and they fear that money spent on expanded facilities would be lost later.

On the other hand, some organizations such PROEXPO (a governmental agency) are developing plans to increase markets, especially the export markets. PROEXPO is a large organization that is interested in developing Colombian forests and forest resources. One of their main interests is to export more furniture woods. They have already published the book "Maderas Colombianas" in association with the government wood research institute at the university in Bogota. The book includes descriptions and possible uses for 69 woods. A colored plate of each of the woods, along with tables of their mechanical properties, should make the book very useful to potential wood buyers. The greatest limitation of this work is that it is printed in Spanish only. In their effort to promote Colombian woods on the world market, the manager of PROEXPO told me that one of their greatest problems

is a lack of technological information. Many times interested buyers ask technological questions about a wood species for which they have no information. There are no private wood testing laboratories in Colombia, so businesses concerned with wood must rely on information generated by the two government laboratories or from their own observations.

Wood Research Laboratories

There are two laboratories in Colombia doing research on wood. In Bogota, there is the Instituto de Investigaciones y Proyectos Forestales y Madereros de la Universidad Distrital "Francisco Jose de Caldas, which is headed by Dr. Alvaro Jimenez M. Dr. Jimenez received his degree in wood technology from Syracuse. In Medellin, at the Universidad Nacional, there is the Laboratorio Productos Forestales, of the Departamento de Recursos Forestales. This is a new laboratory and the testing group is presently being headed up by Hannes Hoheisel, an FAO consultant from Germany.

The Bogota institute has excellent facilities. Good equipment is available to do the full range of mechanical tests, a small kiln, a woodworking shop, a soils lab, small herbarium, and an entomology lab. All equipment can work to ASTM testing standards, but they presently use a combined standard called ECONTEC. However, they assured me it was based mostly on our ASTM standards and data generated could be used in this country. The staff members and their technicians seemed well trained and entirely capable, although specialists in certain areas are needed.

The Medellin Forest Products Laboratory is concentrating its testing more along the "practical" lines. A universal testing machine is available, but most research seemed to be directed towards gathering information on physical rather than mechanical properties. Hannes Hoheisel is actively seeking new uses for Colombian woods, especially those species that are not now being used. He showed me a section of an Aspidosperma trunk whose growth form is so deeply fluted that in cross section it looked more like a star than a circle. Naturally, the wood was not used for manufacture, but Hoheisel found that the very fine-textured wood in the flutes made excellent rulers.

Botanical Identification

The tree species of Colombia are not well known and botanical identification can be a problem when doing research on their woods. A case in point is the "Maderas Colombianas" referred to previously. Of the 69 woods listed, 13 of the scientific names were followed by a bracketed question mark (?) indicating that the names were questionable. One had no scientific binomial at all, only a common name. Another example is the packet of six wood samples that was given me at the INDERENA office in Tumaco. Of these, we found that four of the specimens were misidentified.

The leading botanist in Colombia, I was told, is Humberto Jimenez S., who is located at the University of Cali. The problem here is that when the flora of a region is not well known or completely described, a tree unknown to botanical science cannot be named by a botanist until properly described and given a name. Sometimes this can take a considerable period of time,

especially if the original collection was not complete, that is, did not contain both leaves and flowers, or fruits. In Latin America, in general, the botanical knowledge of the trees is not good. This was shown during a PL-480 project the U.S. Forest Products Laboratory had with Peru, which resulted in about 10 new species of trees being described from the herbarium material collected. It must be stressed that in any study of Latin American woods, it is very important that good botanical vouchers be collected along with the test material.

Traditions

Certain woods are traditionally preferred by the Colombian people for furniture and decorative purposes. This, of course, is not unlike the preference we have for such woods as walnut and cherry. However, the preferred species in Colombia, such as mahogany, Spanish cedar, etc., are (1) prime export woods that could bring much needed money into Colombia, and (2) are already in short supply and the continued heavy local demand just worsens the situation. Secondary species are not cut because there is no demand for them and their lumber is difficult to sell. There is no demand mostly because the technical properties are not known and, naturally, a manufacturer or some other potential user will not buy a species he is totally ignorant of. As a result, known good woods are over-used and many are continually in short supply. This results in cutbacks in production which, of course, causes job layoffs. All of the businessmen interviewed felt that if they had more information on more kinds of woods, broader industrial and market developments would certainly occur, making more and better jobs.

Plantations

There are about 40,000 hectares of plantations in Colombia. Most of these, I believe, are privately owned and are composed mostly of species of Eucalyptus, Pinus, and some Cupressus lusitanica, which they call cipres. A small treating plant visited in Medellin used only plantation material; the large poles were Eucalyptus and the smaller poles and posts were cipres. The pulp and paper plant visited at Cali, Carton de Colombia, has large plantations of pine and cipres. It is interesting to note that they interplanted their plantation trees with fast-yielding, fruit-bearing plants so as to get some profit before the pines are ready. They maintain their own seedling nurseries and are experimenting with seed sources. At no time did I get the impression that there was any sort of leadership or direction given by the government to encourage the establishment of plantations. It would seem to be a good idea to re-establishment of plantation forests on some of the denuded hillsides surrounding the major cities, but I saw no evidence of any efforts in this direction. Later information indicates that plantations are being established.

Summary and Conclusions

The problems surrounding more complete utilization of the woody species in the forests of Colombia, especially the heterogeneous upland forests, are complicated and varied. However, a mixture of the following conditions and situations are probably the main ingredients contributing to the present situation.

Lack of a Complete Forest Inventory

Although the forests in Colombia are varied and quite heterogeneous as to species content, an overall, long-range plan might be developed for their better utilization if an adequate forest survey and inventory were available. Connected with this is a similar need for more complete floristic studies so that Colombian botanists are better able to identify the entire tree flora present in their forests.

Lack of Capital

This, of course, is the real reason the above basic information has not been collected. The lack of money to carry on needed research is one of the main underlying factors for the present state of ignorance surrounding so many tree species in Colombia. Similarly, the limited amount of research data that is produced usually lacks effective publication and dissemination resulting from a shortage of funds by the testing institutions.

Lack of a Good System of Transportation

The natural topography of Colombia, which ranges from swamps to mountains, makes roadbuilding difficult and expensive. Overland transportation of the wood from forests to factory is also difficult and expensive. The present low prices on little-known species prevent their being transported very far for utilization. Of course, the transportation problem would probably be largely removed if there were an increase in the price of lumber in general, since this would provide more incentive to get the timber out as quickly as possible.

Lack of Technological Information

Ignorance of the physical and mechanical properties of many of the woods in Colombian forests shuts off any developing interest in their utilization. The lack of a broad base of species to choose from results in the over-utilization of the traditionally used or prime species, putting them in short supply. This in turn produces a shortage of wood in the plants which then slows industrial production and limits the number of jobs available.

Lack of a System to Accumulate Low-Volume Species

Colombian wood-using industries have not developed a system of wholesale yards or any method which would enable the accumulation of a supply of the low-volume species. With the great heterogeneity of the upland tropical forest, this is a major stumbling block to developing a market for species that have a low presence factor in the forests. If such yards were established, however, it would also be easier to develop the grouping concept which stresses the end uses for the wood groups rather than the properties of individual species.

General Conclusion

The basic reason for this mini-project was to determine if a lack of information on the technical and technological properties of the little-used, or secondary, species is the primary deterrent to their more general utilization. As has been shown here, it certainly is not the sole reason, but at the same time, it is unquestionably among the more important of the contributing factors. Considering then that in the expected course of development for Colombia most of the other factors will likely be remedied in the future, it seems wise to have the technological information available when needed. The present world situation of a general shortage of wood as a raw material, as well as the overall concern for conserving nonrenewable resources, reinforces the opinion that as much information as possible on all woody species of Colombia, or for that matter, the world, should be gathered as soon as possible and made available for use.

Appendix A

Itinerary

May 6, 1973 (Sunday)

9:20 pm Arrival in Bogota, Braniff flight 977.

May 7, 1973 (Monday)

8:30 am Conference with INDERENA--Division Forestal staff.

2:30 pm Conference with Universidad Distrital staff and tour of laboratories.

May 8, 1973 (Tuesday)

8:30 am Conference with members of the producers association, ADEMACOL.

2:30 pm Conference with management of export house, PROEXPO.

May 9, 1973 (Wednesday)

8:30 am Conference with Ferrocarriles Nacionales staff and tour laboratory and yards.

2:30 pm Visit furniture plant, Muebles Artecto; discussion with management and tour plant.

May 10, 1973 (Thursday)

10:15 am Departure for Medellin, SAM flight 100.

2:30 pm Conference with staff of Laboratorio Nacional and tour laboratories.

May 11, 1973 (Friday)

8:00 am Visit Osmose treating plant. Confer with manager and tour plant and yard.

10:00 am Visit barrel-producing plant, Protoneles, Ltd. Confer with manager and tour plant and yard.

2:00 pm Visit sash and door factory, Renacimiento, S.A. Conference with manager followed by a tour of the plant.

May 12, 1973 (Saturday)

9:00 am Field trip to see countryside around Medellin.

May 13, 1973 (Sunday)

12:05 pm Departure for Cali, SAM flight 601.

May 14, 1973 (Monday)

8:30 am Visit veneer and plywood plant, CODEMACO. Confer with manager and tour plant.

2:30 pm Visit pulp and paper plant, Carton de Colombia. Confer with several plant engineers and tour plant.

May 15, 1973 (Tuesday)

- 10:00 am Departure for Tumaco, Avianca flight 759.
- 1:30 pm Conference with general manager of MADENAR.
- 3:00 pm Conference with managers and staff members of the major
Tumaco lumber and veneer mills.
- 6:00 pm Tour of plant and yard of MADENAR.

May 16, 1973 (Wednesday)

- 8:30 am Visit plant and tour yard of sawmill, Asserrios Iberia.
- 2:30 pm Visit plant and tour yard of the sawmill, EXPORFIN.

May 17, 1973 (Thursday)

- 11:45 am Departure for Barranquilla via Cali Avianca flights 758 and 194.

May 18, 1973 (Friday)

- 8:30 am Visit veneer and particlewood plant, Pizano, SA. Confer with
manager and tour plant.
- 2:30 pm Visit hardboard plant, Laminas del Caribe. Confer with owner
and manager and tour plant.
- 4:30 pm Visit sawmill, Aserradero Covadonga. Tour plant and yard
with manager.

May 19, 1973 (Saturday)

Free Day

May 20, 1973 (Sunday)

- 11:45 am Departure for Miami and home.

Appendix B

Principal Contacts

Aserradero Covadonga Ltda.

Apartado Aereo No. 13-35, Barranquilla, Colombia
Ernesto Recaman, Manager
Javier Coro, Chief of Production

Aserraderos del Rio Mira, Ltda.

Apartado Aereo 266, Tumaco, Colombia
Jesus Alberto Salinas C., General Manager

Aserrios Iberia, Ltda. Tumaco, Colombia

Luis Martinez S.
Omar Valencia S.

Carton de Colombia, Apartado Aereo 219, Cali, Colombia

Millan Gutierrez, Reforestation Investigacion
Edgar Chacon P., Jefe, Departamento Forestal
Clara Gomez, In Charge of Test Laboratory

CODEMACO, Apartado Aereo 1445, Cali, Colombia

Luis Alfredo Restrepo R.

EXPORFIN

Raul M. Rotlewicz, Owner and General Manager
Apartado Aereo 5209, Bogota, Colombia
Alfredo Gonzalez G., Plant Manager
Tumaco, Colombia

Ferrocarriles Nacionales de Colombia

Calle 13, No. 18-24, Bogota, Colombia
Hernando Quintana R., Ing. Jefe Planta Piloto
Guillermo Albarracin, Ing.

INDERENA

Barranquilla, Carrera 44, No. 40-20
Dr. Corredor, Jefe
Carlos Pacheco, Programa Estadistica

Bogota, D. E. Carrera 14, No. 24A-66
Dr. Gerardo Lozano, Chief of Forestry Division
Ramon Camargo

Cali.

Hugo Guzman, Jefe Programa Forestal

Medellin, Calle 54, No. 45-81
Ernesto Villa G., Ingeniero Forestal
Armando Hernandez R., Coordinador Tecnico

Tumaco

Jorge Toledo, Jefe

Instituto de Investigaciones y Protectos Forestales y Madereros.
Universidad Distrital, Carrera 8, No. 40-78. Bogota, Colombia

Dr. Alvaro Jimenez M., Director
Dr. Jose Anatolio Lastra R., Ingeniero
Hector Rojas L., Section Anatomia Maderas
Philip Johnston, Peace Corps, Wood Technologist (on loan from INDERENA)

Laboratorio Productos Forestales, Dept. de Rec. Forestales,
Univ. Nacional, Apartado Aereo 25064, Medellin, Colombia

Hannes Hoheisel, Wood Technologist
Oscar Escobar C., Sawmill Expert
Luis Carlos Mejia M., Wood Anatomist
Hector Anaya, Professor of Logging Engineering

Laminas de Caribe, Barranquilla, Colombia

Augusto Malave, General Manager
Jaime Galindo, Forester

Maderas y Chapas de Narino S.A. (MADINAR), Bogota, Colombia
Olivero Phillips M., Presidente, Calle 17, No. 7-35, of .603

Tumaco. Apartado Aereo 151
Rogelio Villamizar, General Manager
Jaime Torres, Assistant Manager
Robert B. Peck, Silviculturista
Luis Alberto Casas J., Ingeniero Forestal

Pizano S.A. Carrera 10a, No. 19-65-Pizo 12, Bogota, Colombia

Dr. Bernardo Pizano, Owner and Manager
Eduardo Jimenez, Ing.

PROEXPO. Edificio Avianca, Piso 17, Bogota, Colombia

W. Landertinger, Senior Marketing Officer

Renacimiento S.A. Apartado Aereo 2054, Medellin, Colombia

Guillermo Montoya M.