

RESUMEN DEL TRABAJO REALIZADO EN RELACION CON EL CONTROL DEL BARRENADOR DE LAS MELIACEAS, HYPSSIPYLA GRANDSELLA (ZELLER)

El problema del barrenador de las Meliáceas (cedro, caoba, etc.) Hypsipyla grandella (Zeller) es muy conocido en el trópico americano. A partir de aproximadamente 1967, el interés del Departamento de Ciencias Forestales del entonces IICA-CTEI, actualmente CATIE, en este problema creció gradualmente hasta que se estableció el 25 de setiembre de 1970 el 'Grupo Interamericano de Trabajo sobre Hypsipyla' con los siguientes objetivos:

1. Ejecutar y estimular investigación intensiva para lograr una solución económica y práctica al problema de Hypsipyla.
2. Comunicar e intercambiar información sobre investigaciones con científicos interesados de los países de América Latina y otros continentes.
3. Publicar y divulgar los resultados obtenidos a fin de promover lo más pronto posible una solución al problema del barrenador.

El Grupo Interamericano de Trabajo sobre Hypsipyla ya tiene unos 72 miembros en 26 países.

Entre los resultados logrados hasta la fecha se pueden mencionar los siguientes:

1. Introducción del cedro australiano (Toona ciliata var. australis) resistente al ataque de Hypsipyla grandella, y distribución gratuita de semillas de esta especie a más de 20 países de América Latina.
2. Estudios sobre nuevos métodos de control químico por medio de una combinación de un polímero con un insecticida sistémico, resultando la liberación gradual

del insecticida. Ya se obtuvo protección durante un año con una sola aplicación.

3. Desarrollo de un sistema de cría artificial de Hypsipyla grandella.
4. Investigaciones de las posibilidades de control biológico del barrenador por medio de hongos patógenos, parásitos y predadores.
5. Colección de datos sobre la dinámica de población, el comportamiento de vuelo la selección del árbol hospedante y sobre atrayentes sexuales del barrenador.
6. Realización del "Primer Simposio sobre Control Integral de Hypsipyla", del 5 al 12 de marzo de 1973 en el IICA-CTEI, Turrialba, con asistencia de 54 personas de 22 nacionalidades.
7. Publicación de: Grijpma, P. y Styles, B.T., comps. Bibliografía Selectiva sobre Meliáceas. Turrialba, Costa Rica, IICA-CIDIA, 1973. 143 p. (IICA-CIDIA Bibliografía n° 14).

Los resultados de las investigaciones de miembros del Grupo de Trabajo han sido publicados en unos 24 artículos en la revista 'Turrialba' a partir del número 19(4) del año 1969. Una parte de estas 24 publicaciones se publicó también en:

- Grijpma, P., ed. Studies on the shootborer Hypsipyla grandella (Zeller). Vol. I. Turrialba, Costa Rica, IICA. Miscellaneous Publication n° 101. 1973. 91 p.
- Proceedings of the First Symposium on Integrated Control of Hypsipyla. Turrialba, Costa Rica, 5-12 March 1973, Turrialba, Costa Rica, IICA-CTEI. 1973. pag. irr.

#### EL FUTURO DEL PROYECTO DE HYPSIPYLA

El Primer Simposio sobre Control Integral de Hypsipyla, llevado a cabo del 5 al 12 de marzo de 1973 en Turrialba, en la parte b. de la resolución n° 1 dice

así: "Se autorizará al actual coordinador presentar un proyecto a las organizaciones internacionales como el IICA, la FAO y la Oficina de Cooperación para el Desarrollo de los Países Bajos, a fin de asegurar la asignación de un futuro coordinador y la continuación de este proyecto".

A base de esta resolución se solicitó la asignación de un experto entomólogo forestal al Departamento de Ciencias Forestales del CATIE por parte de FAO/PNUD. Este experto debería continuar las labores iniciadas por el primer coordinador del 'Grupo Interamericano de Trabajo sobre Control Integral de Hypsipyla' quien salió de Turrialba en setiembre de 1973.

Después de algunas negociaciones la FAO propuso en febrero de 1974 al PNUD un proyecto de asistencia técnica para su financiación. En este proyecto, se propone nombrar, en un principio, a dos coordinadores, un silvicultor y un entomólogo forestal, quienes en Turrialba, durante un año, resumirían los logros hasta la fecha en el control de Hypsipyla grandella, y formularían los pasos a seguir hacia la solución al problema durante los tres años siguientes. Luego, después del primer año de evaluación y preparación, se nombraría a cuatro expertos más: dos silvicultores y dos entomólogos forestales. Los dos silvicultores trabajarían uno en Venezuela y el otro en Perú; los dos entomólogos forestales trabajarían uno en Trinidad y el otro en Brasil. Así se propone un esfuerzo combinado entre tres silvicultores y tres entomólogos forestales para lograr una solución económica y práctica al problema de Hypsipyla grandella, bajo la coordinación del silvicultor y entomólogo forestal en Turrialba.

Este proyecto propuesto por la FAO al PNUD tendría un costo de US\$659,000.00 incluyendo a los expertos, entrenamiento, equipo y costos directos, a partir de octubre de 1974 y por 4 años.

Actualmente, el PNUD tiene el proyecto en estudio.

RESUMEN DEL PROYECTO FORESTAL BAJO ESTUDIO DEL GOBIERNO DE  
LA REPUBLICA FEDERAL DE ALEMANIA

Los recursos forestales de América Central y del Caribe se explotan actualmente sin miras hacia el futuro. Existe la necesidad de aumentar la disponibilidad de los productos forestales, a costos más bajos, para satisfacer una creciente demanda.

Las especies nativas y las introducidas de rápido crecimiento, utilizadas en plantaciones puras con producciones económicas provisorias, deben proveer el estímulo necesario, tanto para las industrias privadas, como para las agencias gubernamentales, con el fin de incrementar programas de investigación forestal y entrenar especialistas en diversas ramas de las ciencias forestales.

Costa Rica, como los demás países de Centro América y del Caribe, se puede caracterizar como un país de gran necesidad de programas de investigación forestal, y entrenamiento de personal, con el objeto de coordinar sus planes de desarrollo de los recursos forestales sobre una base de rendimiento sostenido.

Se observan esfuerzos aislados, tanto en el sector privado como en el gubernamental y en oficinas permanentes de actividad forestal, pero en casos de emergencia en los que se requieren esfuerzos oportunos de mayor ejecución forestal, se tropieza con la falta de suficiente personal forestal y organización del mismo. Un caso actual es el del control de explotaciones forestales en Costa Rica, así como en toda América Central, situación que exige amplísimos trabajos forestales de emergencia y personal capacitado, pero éstos no pueden efectuarse por las razones antes expuestas.

De acuerdo con esta situación regional de Centro América, el Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), consideró oportuno presentar un programa al Gobierno de la República Federal de Alemania, solicitando

cooperación técnica para incrementar su capacidad de investigación forestal y entrenamiento de personal graduado, en las líneas de Economía Forestal, Silvicultura, Tecnología de Maderas, Capacidad de Suelos Forestales y Entomología Forestal, campos a ser expandidos en el área de América Central y del Caribe.

El reforzamiento del Departamento de Ciencias Forestales del CATIE, vigorizará instituciones nacionales y regionales, encargadas de los recursos forestales de América Central y del Caribe.

La ayuda solicitada al Gobierno de la República Federal de Alemania, por un período de cinco años consiste en:

1. Asistencia técnica con 5 técnicos forestales en las disciplinas antes mencionadas, por US\$1,875,000.00.
2. Asistencia para la biblioteca del Centro Interamericano de Documentación e Información Agrícola (IICA-CIDIA), para la adquisición de libros de consulta forestal y suscripciones a revistas forestales, por US\$64,000.00.
3. Becas para estudiantes graduados: 10 becas por año, por US\$434,368.00.
4. Equipo para el Laboratorio de Productos Forestales del Departamento de Ciencias Forestales, localizado en la Universidad de Costa Rica, por US\$21,150.00.

De esta manera se solicitó al Gobierno de la República Federal de Alemania, un monto total de US\$2,394,518.00.

AN INTEGRATED PROGRAM FOR RESEARCH, TRAINING AND  
TECHNICAL ASSISTANCE IN SILVICULTURE, FOREST  
ECONOMICS, WOOD TECHNOLOGY, FOREST SITE  
PRODUCTIVITY AND FOREST ENTOMOLOGY IN  
CENTRAL AMERICA AND THE CARIBBEAN

Submitted  
to the

Federal Republic of Germany  
by the

Tropical Center for Research and Training  
and the  
Regional Directorate for the Northern Zone  
of the  
Inter-American Institute of Agricultural Sciences  
of the  
Organization of American States

Turrialba, Costa Rica  
August, 1972

AN INTEGRATED PROGRAM FOR RESEARCH, TRAINING AND  
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ABSTRACT

Forest resources of Central America and the Caribbean are exploited at present with little concern about the future. There is a need to increase availability of wood and wood products at lower costs to satisfy increasing demands. Fast growing selected native and introduced forest tree species, used in pure plantations with promising economic returns, may provide the necessary stimulus for private industries and government agencies to increase research programs in forestry and train specialists in various forest science disciplines.

Central America and the Caribbean can be characterized as having few functioning research programs in forestry, few trained foresters, and few coordinated plans to develop its forest resources on a sustained yield basis.

There are isolated efforts, however, to eliminate some of the problems. Honduras, with assistance from FAO, has established a Forest Ranger School in Siguatepeque, which in time will provide much needed technical knowledge at the sub-professional level. El Salvador plans to invest 3 million dollars in agricultural diversification programs, forestry being one, to reduce its annual lumber imports of 108,000 m<sup>3</sup>. But such programs require technical assistance during initial phases.

The Tropical Center for Research and Training (CTEI) is presenting to the Federal Republic of Germany a program requesting financial assistance to increase its research, training and technical assistance capacity related to forest economics, silviculture, wood technology, forest site productivity, and forest entomology in Central America and the Caribbean.

The Department of Tropical Forest Sciences at CTEI, since its formation in 1951, has steadily increased its involvement in training at the graduate level and research programs. The disciplines presently included in the Department are: Silviculture, Forest Ecology, Forest Economics, Forest Exploitation, Dendrology, Mensuration, Forest Management, Wood Technology, and Wood Utilization.

Increases in research, training and technical assistance capacity will be utilized by CTEI to stimulate and strengthen national and regional institutions in charge of forest resources in Central America and the Caribbean.

Financial assistance requested from the Federal Republic of Germany over a 5-year period amounts to:

A. Technical Assistance	US\$1,875,000.00
B. Assistance to the Library and Documentation Center (IICA-CIDIA)	64,000.00
C. Fellowship Assistance	434,368.00
D. Assistance to the Forest Products Laboratory of IICA/CTEI	<u>21,150.00</u>
	Total US\$2,394,518.00



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## 1. INTRODUCTION

This Financial and Technical Assistance proposal to the Federal Republic of Germany is the result of discussions held by Dr. Waldemar Albertin, Head of the Forestry Department of IICA-CTEI with the Ambassador of the Federal Republic of Germany in Costa Rica, his Excellency Wilfried von Eichborn, and the Chancellor Dr. Walter Wellhausen.

The main objective of the program is to strengthen the research and training capacity of the Inter-American Institute of Agricultural Sciences, Tropical Center for Research and Training (IICA-CTEI), in Turrialba, Costa Rica, which has had great positive impact in rural areas of all Latin American countries during the past 30 years since its creation.

There has been a recent shift in emphasis in the goals and objectives of IICA-CTEI towards the solution of the much neglected agricultural problems of the small countries of Central America and the Caribbean which do not have the means to develop their own specialists in agricultural sciences at the graduate level or create their own advanced agricultural experiment stations.

By concentrating the German Technical Assistance Programs in agriculture and forestry for Central America and the Caribbean at IICA-CTEI, it is believed that the impact through a team approach is greater than through individual efforts, while administrative costs can possibly be reduced.

The primary but not exclusive beneficiaries of this program will be the following countries: Barbados, Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Nicaragua, Panamá, Trinidad, and Tobago.

All of the above countries can be characterized as lacking qualified research personnel and facilities, finances for applied agricultural research projects, and specialists at their respective national centers

which could provide the necessary multiplying effect of technical know-how. The situation is probably most serious in the forestry sector.

For this reason IICA-CTEI considers appropriate to ask the Government of the Federal Republic of Germany for 1) Technical Assistance in form of experts in Forest Economics, Silviculture, Wood Technology, Forest Site Productivity and Forest Entomology; 2) Fellowship Assistance; 3) Assistance to the Library and Documentation Center (IICA-CIDIA) and 4) Assistance to the Forest Products Laboratory of IICA-CTEI.

The Department of Tropical Forestry Sciences has carried out several coordinated research programs in the past, which will aid in the development and execution of the stated objectives of this program. Presently it is offering technical assistance to Guatemala, Haiti, Dominican Republic, Nicaragua, Costa Rica and Brazil.

A. Expected benefits to be obtained from the program

- 1) Basic understanding of economic factors governing wood and wood products utilization and forest industry development.
- 2) Basic understanding of ecological zones suitable for plantations establishment, using the most appropriate species, soils, and sites.
- 3) Basic biological data on species adaptation, growth, plantation costs, management and protection of appropriate species.
- 4) Wood technological data on many additional still untested tropical and subtropical species.
- 5) Core of trained professional forest economists, silviculturists, and wood technologists, Forest Site Specialists and Forest Entomologists in each of the 5 Central American countries, Panama, and the Caribbean.

6) Better research and training opportunities at IICA-CTEI and thus stronger national institutions in Central America and the Caribbean through increased technical assistance programs offered by IICA-CTEI.

2. ACHIEVEMENTS TOWARDS THE SOLUTION OF THE CENTRAL AMERICAN AND THE CARIBBEAN PROBLEM

2.1 Forest Economics

X The physical characteristics of the forests, topography and the transportation networks play a dominant role in the present forestry situation of Central America.\* Studies on land use indicate that 36.6 per cent of the area of Central America is suitable for industrial forestry (Appendix 5). There exists a strong relationship between forest industry location and existing forests.

Revision of literature on physical characteristics of Costa Rica, shows a heavy concentration of industry in this country due to above average income per capita and a cultural tendency to favor wood-use in Costa Rican housing which is 2.9 times greater than the Central American average consumption. Additional data on employment, value added and foreign exchange, presented in Appendix 7 further illustrate the strong role forestry plays in Costa Rica.

Problem areas in forestry of Costa Rica relate directly to the lack of adequate technology and trained manpower, logging in difficult terrain, and lack of efficient utilization of tropical hardwoods. Consequently, the prices for wood products are increasing more rapidly than the general price level in Costa Rica, as is typical in Central America and the Caribbean. This problem confronting the national housing industry has resulted in a deficit of an estimated 19,000 houses per year for the anticipated increases in population, while 47 percent of the population

\* See Appendix 6-9

continues to occupy substandard housing.

Professional forestry training in Central America and the Caribbean depends entirely on outside universities for undergraduate training.

The Tropical Center for Research and Training (CTEI) in Turrialba, has been for the past twelve years, the only regional source of forestry training at the Master's level for Central America and the Caribbean.

But only few professional foresters from Central America, Haiti and the Dominican Republic have participated in the past in advanced training offered by CTEI.

## 2.2 Silviculture

The Central American and Caribbean region has shown great interest in the last years in planning the development of its forest resources.

CTEI has worked in species introduction programs for the past 12 years. The basic problem for getting reforestation programs off the ground has been lack of specialized personnel. Few Central American and Caribbean technicians have been involved in postgraduate or short-course training in silviculture to acquire a base for any reforestation program in their own countries. For this reason, direct technical assistance in reforestation has been impractical and partially discontinued.

## 2.3 Wood Technology

Basic research has been carried out in the field of wood utilization by the Wood Technology Laboratory in Costa Rica for Panamá, Jamaica and / Guayana. This research has been directed towards the evaluation of native species in order to better define their potential uses. Based on results of this research, certain species have been selected and studied more thoroughly, particularly in Costa Rica. This has already made an impact on wood industries. They have begun to use these species in a more effective way. At the same time they have improved the industrial practices to obtain better products.

The Laboratory has given technical assistance, not only to existing industries, but has also stimulated creation of new industries in Costa

Rica, such as preservation of fence posts for use in rural areas, railroad ties, and poles for the banana industry.

#### 2.4 Forest Site Productivity

Aside from general soil classifications, few indepth studies have been made on the productive potential of laterite or volcanic soils in the tropics. Soils in general have been studied at varying degrees in all countries of Central America and the Caribbean, mostly for their potential of producing cash or export crops, but not for forest tree production.

#### 2.5 Forest Entomology

Whereas forestry development in Central America and the Caribbean is lagging behind in the field of agriculture, the specific field of forest entomology is even less developed. Consequently outbreaks of insect infestations can reach epidemic proportions easily and cause great losses, because of lack of early warning systems, lack of trained forest entomologists as well as adequate knowledge of the pests. Since the tendency in forestry is towards man made plantations, major problems in tropical forest entomology are to be expected in the future.

At IICA-CTEI, located in the humid tropics, so far the major forest insect problem of the American tropics being investigated concerns the shootborer of the Meliaceae (Hypsipyla grandella Zeller), which attacks highly valuable tree species such as Mahogany (Swietenia spp.) and Spanish Cedar (Cedrela spp.), preventing the establishment of pure plantations. The presence at IICA-CTEI of several scientists interested in this field led to the creation of an Interamerican Working Group on Hypsipyla in 1970 and the formation of an International Working Party on Integrated Control of Hypsipyla under the auspices of IUFRO in 1971. At present the Interamerican Working Group consists of 70 members in 28 countries. The Working Group has received considerable assistance from the Netherlands Bureau for International Technical Assistance, in financial support as well as technicians.



The Working Group offered an In Service Training Course in 1972 and will celebrate an International Symposium on Integrated Control of Hypsipyla in the beginning of 1973. Other main achievements are the introduction of the Hypsipyla resistant australian red cedar (Toona ciliata var. australis) in Latin America and less susceptible mahogany species such as Khaya spp. Seed of the australian red cedar has been distributed to 15 countries ranging from Argentina to Mexico and favorable reports on its resistance against Hypsipyla have been received. With regard to biological control of Hypsipyla, fungi and bacteria are tested out as possible control agents. Several new parasites and predators have been discovered during field investigations.

In addition, a preliminary survey of forest insects attacking plantation trees has been made and a course in forest entomology was taught at IICA-CTEI.

### 3. CURRENT SITUATION OF THE PROBLEM IN CENTRAL AMERICA AND THE CARIBBEAN

#### 3.1 Forest Economics

Due to present difficulties of forestry development in Central America, based on existing forest resources, wood consumption per capita is declining and the cost of wood materials is increasing. Current forestry policies are not coordinated within the various land management agencies of a country, nor between countries. In view of the fragmented industry and its simple stage of integration, little hope can be given to improvements from the industrial sector itself.

Adequate forest product markets exist, and a still greater potential is untapped. However, a coordinated approach has never been tried in Central America or the Caribbean region (Appendix 11 and 12).

#### 3.2 Silviculture

Recognizing the great shortage of useful wood in Central America and the Caribbean, IICA-CTEI is following at present well-defined lines of research in the introduction of fast growing tree species which are of

interest to the Central American countries.

The Department of Tropical Forest Sciences has established small experimental plots of 200 forest tree species, and some plantations on a commercial scale.

Most promising species are Pinus caribaea, Eucalyptus deglupta, Cordia alliodora and Toona ciliata.

Growth rates of the above species, aged 4-6 years, are 1.50-2.50 m in height and 1.5-2.5 cm in diameter annually.

Observations are made on general adaptability and susceptibility to diseases and insect damage.

Preliminary estimates indicate that plantations, using fast growing introduced species produce 6 times more volume per hectare than natural forests in less than half the time span.

### 3.3 Utilization of Wood Products

There is a definite need for research, qualified personnel and technical assistance in most of the countries in Central America and the Caribbean. Presently, the principal research center for the region in technology and utilization is the Wood Technology Laboratory of IICA-CTEI. This lack of technically trained personnel is the major reason why research in utilization of forest resources, and technical assistance has not developed and prospered more effectively throughout the area.

With the proposed program, it will be possible to overcome this deficiency by initiating research, training and technical assistance activities in each of the countries.

### 3.4 Forest Site Productivity

According to FAO statistics forests in the Latin American region are being cut down at the rate of approximately 10 million hectares annually. Population increase and subsequent need for food as well as the high exploitation costs of the relatively few commercial tree species per hectare in the heterogeneous tropical forest may explain this figure. However, in many instances, the soil deteriorates quickly once the forest has been cleared and is often abandoned after a few years of agricultural use. In the Central American and the Caribbean area little is known about

the sustained yield possibilities of the naturally occurring pine and broad leaved forests. The need for site classification to demonstrate the long range capacity of the soils is therefore urgently required, so as to prevent misuse and to show possible competition with traditional crops such as sugar cane, bananas and coffee.

### 3.5 Current Forest Entomology situation in Central America

Apart from possibly Mexico, only few of the Central American and Caribbean countries have any forest entomologists working actively in this field at present. This fact may be clearly demonstrated by the epidemic of the pine beetle Dendroctonus frontalis, of which an increase in population had been noticed already toward the end of 1962 in the eastern part of Olancha, Honduras. This uncontrolled outbreak reached its climax in 1964, when 5000 km<sup>2</sup> of Pine forests in Honduras were being attacked. Losses due to this epidemic were estimated at US\$300 million, or nearly 75 percent of the gross national<sup>product</sup> for the entire country in 1964. In 1965 two US Forest Service Entomologists were sent by EPTA to advise on immediate, medium range, and long-range measures to prevent recurrence. It should be made clear however, that without proper training, research and equipment no effective measures can be taken. Additional insects attacking pines in the Central America area are: Rhyacionia spp., Ips spp. and Diorictria. Since the natural pine forests of Central America and Mexico constitute a main source of income for the countries located in this area, there is a great need for entomological research and training projects related to these coniferous species.

A second major forest entomology problem concerns the shootborer of the Meliaceae Hypsipyla grandella. In view of the high value of Mahogany and Spanish Cedar, most Central American countries have embarked upon establishing plantations of these Meliaceae. But in all cases they resulted in complete failures. Recently 250 ha of Mahogany and Spanish Cedar planted in the Petén area were considered as lost, because of severe infestation by the shootborer, which cripples the trees and causes deformation of the bole due to resprouting.

#### 4. PLAN OF OPERATION

##### 4.1 Forest Economics

###### 4.1.1 Research in Economics

###### A. Forest Exploitation

According with the reality of high cost in lumber exploitation more information in exploitation is needed from the very beginning of the program. It is necessary for a forestry engineer in the field of exploitation to know the existing level of technology in the industry, areas for future exploitation and to estimate the proposed future economy for industrial plantations.

###### B. Analysis and Marketing

Considering the situation of the Costa Rican market, which is quite different to that of other countries, where consumption is three times higher than the Central American average, a detailed study of wood marketing is needed. Documentation of the actual marketing of species apt for multiple use begins with the extraction of timber from the forest, transport and storage, and the classification and selling of sawn lumber, mouldings and plywood. Also to be studied are the price fluctuations and periods of shortage of these products (Appendix 10).

The amplitude of this work will be less problematic due to the foreseen coordination with IICA-CTEI programs where transportation studies, a price fluctuation study of basic products, and an industrial guide for the Centro-American Forestry Sector are available.

###### C. Planning and Evaluation

The evaluation of actual supply and zoning of future industrial plantations is to be coordinated with exploitation. Previous work by IICA-CTEI has documented the possible industrialization levels in Central America, country by country. Through the work that IICA-CTEI has done on planning plantations for Costa Rica, and through its presentation to the Office of Planning and Ministry of Industries and Commerce, IICA-CTEI established guidelines for the

promotion of such plantations. Assistance of IICA-CTEI to the Central Bank of Costa Rica through in-service training related to the economic evaluation of loan requests by forest industries, brings out clearly the leadership established by IICA-CTEI in programming and evaluation in the forestry sector. For this reason IICA-CTEI will continue its evaluation programs in Costa Rica, with hopes of extending programming and training to all of Central America.

#### 4.1.2 Training in Economics

X A fundamental aspect of economics applied to an integrated program is the improvement of the technical and statistical skills of Central Americans and Caribbeans. The Master's program will cover two candidates per year for staff improvement of forestry services, public administration, or for forestry schools. An estimated 7 candidates per year will be accepted in short courses covering production economics, operations research, marketing and statistical reporting. A few students will be accepted as in-service trainees for special studies in research.

#### 4.1.3 Technical Assistance in Economics

As has been found necessary in the past, IICA-CTEI will continue with assistance in regional planning of forestry. Guidance to forest industries and projections of regional production and investment levels will be the main type of assistance.

Feasibility and special marketing studies will be extended to cover reforestation and development programs of neighboring countries.

### 4.2 Silviculture

#### 4.2.1 Research in Silviculture

Utilization of biomass from tropical forests is generally limited by their inaccessibility. Nearly all countries in Central America have abundant tropical forest reserves, but few can be exploited economically at present (Appendix 2 to 4).

The composition of these forests with several hundred tree species per hectare forms an additional obstacle to easy exploitation. Presently merchantable species are few per unit area and their volume low, resulting in high exploitation costs. In view of these difficulties there exists a worldwide tendency in tropical silviculture to replace heterogeneous forests with homogeneous plantations of species with uniform technical and biological characteristics. This facilitates management towards sustained productivity.

More research is needed to better understand silvicultural techniques in evenaged tropical plantation establishment.

#### A. Species Selection

The CTEI has researched since 1960 more than 200 introduced forest tree species from tropical and subtropical regions with similar climatic conditions.

Usual procedures of trials, eliminations, and acceleration of research with promising species has resulted in plantations on a commercial scale of Toona ciliata, Eucalyptus deglupta, and Pinus caribaea.

Several other species show adaptability to prevailing climatic conditions and high growth rates, such as Terminalia ivorensis, T. myriocarpa, Acrocarpus integrifolia, Gmelina arborea, Alnus nepalensis and Eucalyptus alba.

A few promising species were eliminated from the trials because of high susceptibility to fungus and insect attacks.

Growth data are kept on all species. Every year the silvicultural knowledge of presently introduced forest tree species is increasing.

X Having recognized promising species, it will become necessary to expand the trials to other regions of Costa Rica and Central America.

Therefore, only 10 species will be researched in this program under 5 different soil and climatic conditions with 4 replications.

Blocks of 100 plants of each species will be used at 2 x 2 m spacing. Thus a total area of 8 hectares will be planted. A search for better provenances of the 10 species will be initiated.

#### B. Reforestation and Management

Depending on the conditions of acceptance of the program, 40 hectares of trial plantations, or 8 hectares each in the 5 countries will be established in Central America, using tested species.

Commercial plantations of already proven commercial species in each country, totaling 200 hectares for all of Central America, will also be established. These should be favorably placed, close to wood industries, to stimulate reforestation and management programs by local private industries.

Yearly, management plans and reforestation programs will be prepared, increasing the size of industrial plantations gradually.

#### C. Protection

One of the ever present dangers in plantation management of introduced species outside their natural environment is the possibility of large scale outbreaks of diseases or insect attack.

Experiences at the CTEI with more than 200 introduced tree species prove this point. Several promising species are now being attacked by fungi, bacteria and insects, which requires initiation of research in chemical, biological or integrated control.

Continued research in forest protection will play a prominent role in the program.

#### 4.2.2 Training in Silviculture

Few Central American and Caribbean countries have professional foresters. Personnel in charge of forest resources generally has received agricultural training only, at national universities. Graduates from a 4-year agricultural university are few in number.

It will be necessary to train some specialists in the silviculture of coniferous, as well as tropical broad-leaved forests at the postgraduate level at CTEI, and a larger number through short courses. In-service training of sub-professionals and professionals will offer experience to practicing foresters on a regional

scale, in species selection, forest soil and forest site evaluation planting techniques and management.

#### 4.2.3 Technical Assistance in Silviculture

To assure continued improvement of silvicultural techniques throughout Central America and the Caribbean, specialized technical assistance needs to be provided.

Biological data obtained from the small experimental plots throughout the region will be analyzed systematically, to provide meaningful and up-to-date evaluations of growth and adaptability of selected species.

Data related to silvicultural costs have to be compiled and compared by species, site and region.

### 4.3 Wood Technology

#### 4.3.1 Research in Wood Technology

A. **Basic** evaluation of the species included in the "Species Introduction Program" of the Forestry Department, CTEI. This research work comprises the evaluation of basic properties such as physical and mechanical properties, drying and preservation, workability and others in order to establish levels of utilization.

B. A more exhaustive evaluation of selected species such as Jaúl (Alnus jorullensis) and Ciprés (Cupressus lusitanica) will be done since there is already previous research work available on these species. Species will be studied in order to establish standards and specifications for commercial use as well as a potential source of lumber for other products such as plywood, particle and fiber boards.

C. These select species will be investigated from the standpoint of suitability for house construction, and for end products or components such as roof trusses, paneling, or floor systems. They will also be used in the construction of model houses and eventually in a joint housing program with the National Institute for Housing and Urban Development.



#### 4.3.2 Training in Wood Technology

Part of the proposed program calls for the training of personnel in the Wood Technology Laboratory with the objective of creating the necessary human potential that will be able to continue with adequate research programs to extend the goals of the project to other areas in Central America and the Caribbean.

#### 4.3.3 Technical Assistance in Wood Technology

Technical Assistance shall be provided to institutions in Central America where research in wood technology is taking place. This assistance may also be dedicated to design research programs for the purpose of increasing the technological data of timber species used in each of the countries in the area.

### 4.4 Forest Site Productivity

#### 4.4.1 Research in Forest Site Productivity

The first step in silvicultural planning is recognition of forest site quality. This requires knowledge of important ecological factors, biological as well as physical. These data, obtained through research, will determine which species can be successfully introduced in certain ecological zones.

Forest site classification will vary from country to country. A densely populated country like El Salvador, to meet its demand for wood, is now planning to set aside three areas now in agricultural use for reforestation programs, with a total area of 90,000 hectares (Appendix 1).

In every forestry program the distance between the forests and the location of industries is an important factor to consider. In the case of Costa Rica, an area of 145,000 hectares has been classified as land suitable for reforestation within a 60 km radius from San José, the capital in which most forest industries are located. Site studies within this radius need to be initiated before major investments in reforestation can be recommended.

Some plantations of Cupressus lusitanica, for example, already

exists in this area, which will facilitate site index comparisons with regions where this species is native in Central America. In Guatemala this species alone provides 10 percent of the prime material, in Costa Rica approximately 6 percent.

In other countries of Central America and the Caribbean optimum sites for this species are also available, but they have to be located and researched.

#### A. Tree-Soil Water Relations

Experiences with introduced species now adapted to climatic and soil characteristics of Turrialba, show that growth of trees is directly related to soil drainage.

Experiments with small plots of 101 tree species established in poorly drained soils at the CTEI resulted in failure of 78 species. Of the 23 surviving species, 5 years after plantation establishment, only 10 show acceptable growth rates.

Research needs to be initiated in tree-soil-water relations of selected species. The great majority of tropical forest tree species have a narrow range of tolerance to nutrient and soil moisture variations.

#### 4.4.2 Training in Site Productivity

It is considered necessary to train 2-5 specialists at the M.S. level in this field from Central America and the Caribbean. Short courses should be developed during the project for personnel already working in forestry. Regular courses in Forest Soils, Forest Site Productivity or Tree-Soil-Water Relations should be taught at IICA-CTEI by the technician in charge.

#### 4.4.3 Technical Assistance in Forest Site Productivity

The Expert in charge should travel at least once a year through all Central American and Caribbean countries to assist local foresters in the selection and evaluation of forest sites as to their potential productivity. He should also provide assistance in planning research projects in forest site productivity with national institutions and hold specific seminars wherever the opportunity during his visits to individual countries.

#### 4.5 Forest Entomology

##### 4.5.1 Research in Forest Entomology

##### X 4.5.1.1 Insects attacking coniferous species in the Central American and Caribbean area.

It is suggested that an evaluation be made on the severity of losses caused by these insects and that priorities be designated to establish a research program on the potentially epidemic species, including biological control methods. Many of the research techniques developed in the temperate climates have never been applied in the Central American area.

##### 4.5.1.2 Shootborer of the Meliaceae (Hypsipyla grandella)

In view of the vivid interest of the Central American and Caribbean countries to establish plantations of highly valued tree species and considering the existing framework as well as plantations and facilities at IICA-CTEI, it is suggested to offer assistance to the Interamerican Working Group on Hypsipyla and extending the research efforts to other countries.

Special research emphasis should be given to the role of biology, host selection, ecology and biological control in this project expansion.

##### 4.5.2 Training in Forest Entomology

In view of the great lack of forest entomologists in the Central American and the Caribbean area, it is considered necessary to train at least 2-5 specialists at the M.S. level in this field on an annual basis. In addition a few short courses should be held during the project to train the technicians so as to provide them with basic knowledge on the pests to be dealt with. These technicians will serve as contact men (counterparts) in the countries concerned for the forest entomologist in charge of the program at IICA-CTEI. A regular course in forest entomology should be taught at IICA-CTEI by the technician in charge so as to enable forestry students to develop their interest in this particular field.

#### 4.5.3 Technical Assistance in Forest Entomology

It is proposed that the technician in charge of this program should travel at least once a year through the Central American and Caribbean countries to assess the forest insect situation and to maintain contact with the counterpart personnel. Identification of insects and records should be centralized and information distributed to the counterparts. In case epidemic outbreaks might occur the technician in charge should be enabled to request for emergency technical assistance. Special emphasis should be made on prevention of these outbreaks. Funds should be available to provide the countries of the area with nucleus shipments of predators, parasites or other means of bio-control if necessary.

### 5. STRATEGY

#### 5.1 Forest Economics

A strategy for development of this program will be developed on the basis of national agencies responsible for forestry and wood utilization and their gradual incorporation into the program. Such establishment and strengthening of forestry and forest products utilization programs will be promoted on the basis of technical competence and specialized research. Initially field work will be concentrated in areas where industrial forestry has promise of acceptance and ready application. Utilization will be channeled towards modernization of existing industries and basic housing needs.

Coordination of activities with other national and interested international agencies will be administered through CTEI, especially with regards to research activities and economic goals.

Agencies such as FAO, SIECA, ICAITI, AID, UNDP, BID, the Dutch Government, and national ministries of agriculture are the principal institutions interested in this program.

#### 5.2 Silviculture

X Based on experiences gained during 12 years of species trials at the CTEI in small experimental plots, the program will be expanded towards

Y Coordinated research efforts should provide some solid data on tropical laterite and volcanic soils which will permit at the end of the 5 year period prediction of forest soil fertility and estimates of forest production capacity. Short courses and in-service training should provide additional qualified persons in all countries included in this program.

### 5.5 Forest Entomology

Y By offering postgraduate, in-service training and short courses, nuclei of forest entomologists will be formed in the countries of the area. These nuclei will serve as early warning posts in case epidemic outbreaks of a forest pest might occur. At the same time a network of local contact men will be built up, so as to provide the technician in charge with counterparts in most of the countries. Data on the biology, ecology and host selection will be obtained by the technician and a reference collection should be established at IICA-CTEI, of potential epidemic forest pests. Rearing techniques for parasites, predators and other biocontrol agents will be developed to provide the countries with nucleus shipments. A close contact of the technician with his counterparts in the various countries is necessary.

## 6. INSTRUMENTS

### 6.1 Actual Physical Facilities

The Inter-American Institute of Agricultural Sciences of the OAS (IICA) has the Regional Directorate for the Northern Zone in Guatemala City, Guatemala, and the Tropical Center for Research and Training (CTEI) in Turrialba, Costa Rica.

X The area of activity covered by the Northern Zone Regional Office includes the countries of the Central American Isthmus and Mexico. The Regional Directorate for the Northern Zone in Guatemala and the National Y Offices provides office and transportation facilities for the technical personnel. Through this structure, IICA maintains close contacts with national institutions and agricultural technicians.

IICA-CTEI, in Turrialba, Costa Rica, has the following facilities:

- 1) Laboratories with basic equipment for studies in the following fields: Soils, plant breeding, plant physiology, plant pathology, entomology, irradiation, radioisotopes.
- 2) Adequate classroom facilities with basic educational equipment.
- 3) A library specialized in tropical agricultural sciences, with about 28,000 books, 50,000 brochures and 3,000 journals.
- 4) Living quarters and a dining room for technical staff and students.
- 5) A 1.200 hectare farm of which approximately 60 hectares are in forestry plantations and 40 hectares in natural forest.
- 6) A Statistics and Computer Center equipped with an 1130 IBM Computer and peripheral equipment.
- 7) A printshop.
- 8) A mechanics shop and services.
- 9) Vehicle pool.
- 10) A Wood Technology Laboratory in San José in cooperation with the University of Costa Rica.
- 11) The Latin American Forest Seed Bank.

## 6.2 Personnel

The personnel at CTEI working in forestry research, training, and technical assistance, consist of 9 professionals, 8 subprofessionals and 14 field assistants.

### 6.2.1 Forest Resources

One forest economist and one specialist in forest administration.

### 6.2.2 Reforestation

Four silviculturists, four subprofessional assistants and 12 field assistants.

### 6.2.3 Utilization of Wood Products

Two wood technologists, two subprofessional assistants and two field assistants.

6.2.4 No experts

6.2.5 One forest entomologist and one assistant

## 7. PROPOSED ASSISTANCE

### 7.1 Technical Assistance

IICA-CTEI would appreciate the donation of 5 experts in the fields of Forest Economics, Silviculture, Wood Technology, Forest Site Productivity and Forest Entomology for a period of 5 years. The current cost per expert per year as estimated by the Technical Assistance Committee of the Food and Agricultural Organization of the UN varies between US\$75,000.00 - US\$80,000.00. Based on a cost of US\$75,000.00 per expert per year the Technical Assistance for this project will amount to US\$1,875,000.00.

#### 7.1.1 Background Information

The fields of specialization of the requested experts were selected from the following list of professional expertise related to tropical forestry which is urgently needed for Research Training and Technical Assistance in Central America and the Caribbean Region.

1. Silvics and Silviculture
2. Forest Economics, Forest Products Utilization, and Forest Industries
3. Wood Technology
4. Forest Soils, Forest Sites, Site Productivity
5. Forest Entomology
6. Forest Fire Control
7. National Forest Management (Planning and Coordinating)
8. Forest Product Marketing
9. Wildlife Management
10. Watershed Management
11. Photogrammetry, Photointerpretation, Forest Inventory
12. Forest Reserves, National Parks
13. Forest Seeds
14. Land Use Classification

15. Forest Ecology
16. Marginal Land Development (Unused lands)
17. Dendrology
18. Forest Mensuration
19. Forest Policy and Legislation
20. Nursery Techniques, Management
21. Forest Colonization
- X 22. Forest Econometrics, Forest Statistics
23. Environmental Sciences
24. Climatology
25. Forest Administration
- Y 26. Forest Soil Microbiology
27. Forest Plantation Management
28. Forest Genetics
29. Biological Control
30. Forest Experimentation
31. Forestry Librarian
32. Forestry Publication, Forestry Documentation, Editor
33. Forestry Data Processing
34. Forest Mycology
35. Logging and Transport
36. Forest Road Construction
37. Forest Mechanization
38. Soil Erosion Control

The unit cost per expert per year of US\$75,000.00 includes the following items:

1. Gross Salary
2. Recruitment Expense
3. Retirement Benefits
4. Life Insurance
5. Health Insurance (50 per cent)
6. Family Allowance
7. Educational Allowance



8. Home Leave
9. Repatriation Expense
10. Post Adjustment
11. Administrative Costs
12. International and Local Travel on Missions
13. Daily Subsistence Allowance in International and Local Travel
14. Equipment and Materials (CIF)
15. Representation Costs (Project Manager)
16. Publications
17. Operational Costs

7.2 Assistance to the Library and Documentation Center (IICA-CIDIA)

IICA-CIDIA would appreciate the following donations:

A. Collections

1)	5000 books in agricultural sciences and forestry, at approximately \$10 each	\$50,000
2)	50 subscriptions to agricultural and forestry journals at \$20 each	1,000
	Subtotal	\$51,000

B. Equipment and Furniture

1)	Library equipment and furniture for reading rooms	5,000
2)	Journal stands and book shelves	2,000
3)	Mimeograph and accesories	1,000
	Subtotal	\$ 8.000

C. Documentation Activities

1)	Specialized forestry sciences bibliographies	2.500
2)	Latin American Forestry Bibliography	2.500
	Subtotal	\$ 5.000

	Total Donations	\$ 64.000
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### 7.2.1 Background Information

The Library of the Interamerican Center of Documentation and Agricultural Information (IICA-CIDIA) is the largest and most complete of its kind in Latin America, specializing in agricultural sciences and forestry. It contains more than 60,000 books, 2,300 journals and periodicals, 110 bibliographic indexes, and audiovisual materials. The Library also receives in/form of donations many documents from International and National Institutions.

Researchers, professors and students from all American countries are provided with reference services, bibliographies, and reproductions of documents upon request.

IICA-CIDA also offers annually a 6-months training course in Library Sciences attended by 10-20 librarians from National Institutions of the Americas.

The great majority of reference materials available in the Library and Documentation Center is from the New World. There exists a great deficiency in European reference materials. Subscriptions to agricultural and forestry journals should be provided for a minimum of 5 years.

Books would be of greatest use if written in Spanish or English.

### 7.3 Fellowship Assistance

IICA-CTEI would appreciate the donation of 10 fellowships annually. Each fellowship should be of 24-months duration. The estimated cost of each fellowship is US\$8687.36. The total cost of 50 fellowships over a five-year period is US\$434,368.

#### 7.3.1 Background Information

For the academic year 1971-1972 IICA-CTEI received 172 applications for admission from selected students of nearly all countries of the American continent. Of these applicants 106 students were admitted for graduate studies at Turrialba. But only 43 students enrolled due to a severe lack of fellowships.

The IICA provided 18 fellowships, the Government of the Netherlands 10, the Organization of American States 6, FAO 3, the Bank for International Development in Ecuador 2, the University of Parana in Brazil 2, and two students came with their own financial support.

Fellowships are usually awarded for 18-20 months, the average length of time for students to complete all the requirements towards their Master of Science degree. In all cases, where a longer study period is required, students receive the necessary fellowships prolongation to complete their work.

IICA fellowships and those of the Government of the Netherlands are comparable with the exception of IICA paying \$100 per month family allowance for married students and the Government of the Netherlands not. The fellowships provided by the Government of the Netherlands however, are for 24 months each. FAO and OAS fellowships are slightly higher. Any surplus from two-year fellowships is generally used for partial financial assistance to additional students participating for instance in short courses. Approximately 66 per cent of our graduate students are married.

IICA fellowships for married students include the following items, calculated on a 12 months basis:

Stipend	\$ 2,400.00
Family allowance	1,200.00
Air transport (1/2)	125.00
Matriculation	400.00
Medical Insurance	82.68
Book allowance	50.00
Social Fees (Club)	36.00
Local Study Trips	25.00
Thesis Research Assistance	25.00
Total	<u>\$ 4,343.00</u>

Most of the fellowships in the past have been awarded to students from South America, particularly those from the Andean Countries, Colombia, Ecuador, Peru and Bolivia, and to students from Mexico. Few students from Central America and the Caribbean region were trained during the past 30 years history of the IICA mainly due to lack of qualified applicants.

7.4 Assistance to the Forest Products Laboratory of IICA-CTEI

IICA-CTEI would appreciate the donation of Kiln Drying Equipment for its Forest Products Laboratory consisting of two Kilns and auxiliary equipment to the amount of US\$21,150.00.

7.4.1 Background Information

The Forest Products Laboratory of IICA-CTEI was established in 1966. It was well equipped at that time to handle research on the physical and mechanical properties of tropical timbers. In its short history the Laboratory has made technical evaluations of timber species from Costa Rica, Guayana, Panama, Jamaica, and Nicaragua.

Few wood technological data are available at present on more than 1000 tree species native to Central America and the Caribbean with potential industrial use. Possibly the greatest lack of knowledge exists in kiln drying practices for sawn lumber. Factors such as initial moisture content of wood, desirable final moisture content, wood dimensions, dry bulb temperature and equilibrium moisture content, air velocity, sticker dimensions and spacing, drying time, seasoning degrade and end coating need to be researched to develop fast dry-kiln schedules for lumber.

a. Kiln-dry Equipment Specifications

Manufact.	Effective Wood Volume	Energy Consumption	Fan Motor Power	Model Type	Control	Price (FOB)
Kiefer	2.7 m <sup>3</sup>	2000 kcal/hr	4.7 hp	I90	Automatic	\$14,350.00
Kiefer	0.35 m <sup>3</sup>	2.4 kw	0.5 hp	Minizepp III	Semi-automatic	2,300.00
					Total	<u>\$16,650.00</u>

b.	Auxiliary Equipment	
	Moisture meters, Scales, Ovens	\$ 2,500.00
c.	Equipment Installation	<u>2,000.00</u>
	Total	\$21,150.00

8. BUDGET SUMMARY (5 year period)

I.	Estimated IICA-CTEI counterpart contribution	
A.	Physical Facilities, e.g. buildings, laboratories, Library, Equipment, Vehicles, Computer, Experimental Farm, etc.	\$ 3,000.000.00
B.	National Representation of IICA in the Central American and Caribbean countries	3,000.000.00
C.	Budget Department of Tropical Forest Sciences	<u>1,000.000.00</u>
	Subtotal	\$ 7,000.000.00
II.	Requested Funds	
A.	Technical Assistance	\$ 1,875.000.00
B.	Assistance to the Library and Documentation Center (IICA-CIDJA)	64.000.00
C.	Fellowships Assistance	434.368.00
D.	Assistance to the Forest Products Laboratory of IICA-CTEI	<u>21,150.00</u>
	Subtotal	\$ 2,394.518.00
III.	Total Budget for Program	<u>\$ 9,394.518.00</u>

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A P P E N D I C E S

## POPULATION STATISTICS OF NORTH AND CENTRAL AMERICA FOR 1971

Regions and Countries	Population (Millions)	Annual Births (per 1000 persons)	Annual Deaths (per 1000 persons)	Yearly Population Growth (%)	Years Required to Duplicate Population	Population Under 15 years of Age (%)	Population Projection for 1985 (Millions)	Gross National Product per Capita (Dollars)
<u>1. North America</u>								
Canada	21.8	17.6	7.3	1.7	41	33	27.3	2,460
U.S.A.	207.1	18.2	9.3	1.1	63	30	241.7	3,980
Mexico	52.5	42.0	9.0	3.4	21	46	84.4	530
<u>2. Central America</u>								
Costa Rica	1.9	45	8	3.8	19	48	3.2	450
El Salvador	3.6	47	13	3.4	21	45	5.9	280
Guatemala	5.3	42	13	2.9	24	46	7.9	320
Honduras	2.8	49	16	3.4	21	51	4.6	260
Nicaragua	2.1	46	16	3.0	24	48	3.3	370
Panamá	1.5	41	8	3.3	21	43	2.5	580
<u>3. Caribbean</u>								
Barbados	0.3	21	8	0.8	88	38	0.3	440
Haiti	5.4	44	20	2.5	28	42	7.9	70
Jamaica	2.0	33	8	2.1	33	41	2.6	460
Dominican Republic	4.4	48	15	3.4	21	47	7.3	290
Trinidad and Tobago	1.1	30	7	1.8	39	43	1.3	870

Source: Population Preference Bureau, Inc., Bogotá, Colombia.



Appendix 2

LATIN AMERICA: EXPORTED VOLUME OF THE MAIN FOREST PRODUCTS

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Forest Products	(Provisional)														
	<u>Millions cubic meters</u>														
Woodpulp	---	---	0.05	0.18	0.24	0.18	0.24	0.34	0.24	0.41	0.34	0.36	0.33	0.36	0.35
Hardwood Logs	0.40	0.48	0.37	0.39	0.28	0.31	0.35	0.31	0.28	0.43	0.55	0.56	0.41	0.41	0.40
Sawn Softwood	1.60	0.99	1.7	1.44	1.22	1.26	1.37	1.06	1.05	1.39	1.49	1.66	1.52	1.87	1.70

Source: FAO Statistics, 1970

## LATIN AMERICA: PRODUCTION VOLUMES OF THE MAIN FOREST PRODUCTS

Forest Products	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	(Provisional)														
	<u>Millions cubic meters</u>														
Sawn softwood	5.3	5.1	4.6	5.3	5.2	4.9	5.1	5.3	5.0	5.6	5.8	6.3	6.5	6.6	6.8
Sawn hardwood	7.2	7.5	6.7	6.5	6.2	6.3	6.3	6.6	6.4	6.9	6.8	7.2	7.2	7.4	7.6
Flywood	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5
	<u>Millions metric tons</u>														
Mechanical woodpulp	0.15	0.16	0.16	0.20	0.22	0.24	0.28	0.27	0.34	0.34	0.39	0.39	0.41	0.42	0.42
Chemical woodpulp	0.13	0.19	0.22	0.23	0.27	0.35	0.47	0.51	0.65	0.71	0.78	0.80	0.93	0.91	0.94
Paper and carton	1.04	1.18	1.23	1.39	1.49	1.57	1.80	1.84	1.94	2.14	2.33	2.59	2.67	2.70	2.78

Source: FAO Statistics, 1970.

## Appendix 4

## LATIN AMERICA: IMPORTED VOLUMES OF THE MAIN FOREST PRODUCTS

Forest Products	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	(Provisional)														

Millions cubic meters

Softwood Logs	0.37	0.41	0.32	0.34	0.24	0.27	0.28	0.23	0.22	0.25	0.27	0.35	0.31	0.28	0.30
Sawn softwood	1.48	1.10	1.62	1.42	1.08	1.05	1.32	1.09	1.03	1.23	1.29	1.40	1.34	1.37	1.40

Millions metric tons

Chemical woodpulp	0.51	0.43	0.45	0.40	0.44	0.40	0.49	0.38	0.41	0.50	0.52	0.54	0.49	0.52	0.53
Newsprint	0.42	0.49	0.53	0.54	0.52	0.60	0.64	0.58	0.54	0.56	0.60	0.65	0.6	0.70	0.73
Other paper and carton	0.27	0.35	0.36	0.36	0.31	0.30	0.31	0.28	0.29	0.41	0.43	0.58	0.56	0.60	0.63

Source: FAO Statistics, 1970

Appendix 5

LAND USE (IN HECTARES x 1000) IN CENTRAL AMERICA - -

Country	Year	Total area	Land area	Agricultural Area		Forested land	Other Area in part potentiall productive
				Arable land and land under permanent crops	Permanent meadows and pastures		
COSTA RICA <sup>(1)</sup>	1963	5070	-----	622	923 <sup>(2)</sup>	2,981 <sup>(3)</sup>	----
EL SALVADOR <sup>(4)</sup>	1961	2139	2031	648	604	604	----
GUATEMALA	1958	10889	-----	1,470	577	4,834	4,008
HONDURAS	1963	11209	-----	823	3,413	3,019	3,954
NICARAGUA	1963	13000	12100	873	920	6,450 <sup>(3)</sup>	4,757

Source: FAO, Production Yearbook, Vol. 22, 1968.

----- Data unknown

(1) 1963 agricultural census

(2) In agricultural holdings

(3) Data taken from the world forest inventory carried out by FAO in 1963.

(4) In agricultural holdings, as from 1961 agricultural census.

Appendix 6

MAIN CHARACTERISTICS OF THE FOREST INDUSTRY IN  
CENTRAL AMERICA, 1969

Industry	Number of Plants	Employment (Men)	Estimated Investment \$000	Capacity 000 m <sup>3</sup>	Production 000 m <sup>3</sup>	Percentage of Capacity Utilized
Sawnwood	471	7,928	31,498	2,334	1,477	63
Plywood	7	1,194	7,812	57	41	72
Panels	1	70	500	9	7	78
Resins	1	150	3,500	257	222	86
TOTAL	---	9,342	43,310	2,657	1,747	66

Source: Estudio de industrias forestales: IICA, Diciembre, 1969

## Appendix 7

## IMPORTANCE OF THE FORESTRY SECTOR IN CENTRAL AMERICA, BY COUNTRY

Country	Sub-Sector	Employment	Estimation of Added Value (000)	Foreign Currency Exchange 1968	
				Importation (000)	Exportation (000)
CENTRAL AMERICAN COMMON MARKET	Forest	9,353	\$24,696.8	\$ 104.7	\$ 1,290.4
	Primary	9,343	29,475.6	61,465.1	25,668.2
	Secondary	<u>10,937</u>	<u>26,239.9</u>	<u>4,185.1</u>	<u>946.6</u>
	TOTAL	29,632	\$80,412.3	\$65,754.9	\$27,905.2
GUATEMALA	Forest	2,142	6,434.6	----	153.7
	Primary	2,988	9,860.6	12,199.1	3,904.1
	Secondary	<u>3,608</u>	<u>8,649.6</u>	<u>932.3</u>	<u>132.7</u>
	TOTAL	8,738	\$24,944.8	\$13,131.4	\$ 4,190.5
EL SALVADOR	Forest	49	106.5	50.7	----
	Primary	120	390.8	12,448.6	3,520.6
	Secondary	<u>2,350</u>	<u>5,640.0</u>	<u>745.2</u>	<u>310.7</u>
	TOTAL	2,519	\$ 6,137.3	\$13,244.5	\$ 3,831.3
HONDURAS	Forest	2,366	7,106.9	3.4	943.7
	Primary	3,361	11,033.7	16,942.2	14,213.5
	Secondary	<u>1,958</u>	<u>4,699.9</u>	<u>862.5</u>	<u>251.8</u>
	TOTAL	7,685	\$22,840.5	\$17,808.1	\$15,409.0
NICARAGUA	Forest	2,068	3,400.9	3.5	70.5
	Primary	1,125	2,297.9	4,872.5	2,385.2
	Secondary	<u>1,172</u>	<u>2,812.8</u>	<u>732.2</u>	<u>9.0</u>
	TOTAL	4,365	\$ 8,511.6	\$ 5,608.2	\$ 2,464.7
COSTA RICA	Forest	2,728	7,647.9	47.1	122.5
	Primary	1,748	5,892.6	15,002.7	1,644.8
	Secondary	<u>1,849</u>	<u>4,437.6</u>	<u>912.9</u>	<u>242.4</u>
	TOTAL	6,325	\$17,978.1	\$15,962.7	\$ 2,009.7

Source: IICA-CTEI and SIECA.

Appendix 8

SUMMARY OF THE PROJECTION OF THE FOREST INDUSTRY  
FOR THE CACM\* UNTIL 1980  
(000 cubic meters of products)

Industry	Activity	1970	1975	1980
Sawnwood:	Production	1,515.9	1,850.2	2,110.7
	Exportation (net)	29%	34%	39%
Plywood:	Production	41.1	51.9	61.5
	Exportation (net)	7%	3%	2%
Panels:	Production	7.1	8.7	12.8
	Production, equivalent	226.4	237.9	250.0

Source: Estudio de industrias forestales: IICA, Diciembre, 1969.

\* CACM = Central American Common Market.

SUMMARY OF THE PROJECTION OF FOREST PRODUCTION  
BY COUNTRY, UNTIL 1990  
(000 cubic meters of products)

		1970	1975	1980	1985	1990
GUATEMALA	Sawnwood	465.1	556.7	635.8	652.1	675.3
	Plywood <u>1/</u>	1.6	2.2	2.0	4.5	5.9
	Panels	7.1	8.7	10.8	13.2	16.1
	TOTAL	473.8	567.6	648.5	669.8	697.3
EL SALVADOR	Sawnwood	5.9	6.0	7.3	7.3	7.3
	TOTAL	5.9	6.0	7.3	7.3	7.3
HONDURAS	Sawnwood	553.6	723.6	880.5	908.7	949.7
	Plywood	2.6	6.4	6.7	23.7	24.9
	Panels	-----	-----	2.0	2.4	3.0
	TOTAL	556.2	730.0	889.2	934.8	977.6
NICARAGUA	Sawnwood	113.5	130.8	151.9	176.9	208.5
	Plywood	16.9	220.0	27.6	34.0	41.4
	Resins <u>2/</u>	226.4	237.9	250.0	262.7	276.1
	TOTAL	356.8	588.7	429.5	473.6	526.0
COSTA RICA	Sawnwood	377.2	433.1	435.2	526.0	538.2
	Plywood <u>1/</u>	20.0	21.3	24.3	28.0	32.6
	TOTAL	397.2	454.4	459.5	554.0	570.8
CENTRAL AMERICAN COMMON MARKET	Sawnwood	1,515.9	1,850.2	2,110.7	2,271.0	2,379.0
	Plywood	41.1	51.9	61.5	90.2	104.8
	Panels	7.1	8.7	12.8	15.6	19.1
	Resins	226.4	237.9	250.0	262.7	276.1
	TOTAL	1,790.5	2,148.7	2,435.0	2,639.5	2,779.0

Source: IICA-CTEI.

1/ Veneer Industry included.

2/ Products in equivalents of m<sup>3</sup> roundwood.



## Appendix 10

PROJECTION OF NET TRADE IN PRIME FOREST PRODUCTS UNTIL 1990,  
FOR THE CENTRAL AMERICAN COMMON MARKET (CACM)  
AND BY COUNTRY  
(000 cubic meters of products)

Product	Country	Trade	1970	1975	1980	1985	1990
Sawnwood	CACM <sup>1/</sup>	Exporter	440.2	632.1	817.0	996.9	1,173.0
	GUATEMALA	Exporter	6.2	6.2	6.1	6.1	6.1
	EL SALVADOR	Importer	58.1	43.5	35.5	30.3	26.6
	HONDURAS	Exporter	442.2	590.5*	634.2*	716.5*	717.3*
	NICARAGUA	Exporter	15.9	14.1	12.9	12.1	11.5
	COSTA RICA	Exporter	6.7	14.1	24.0	36.3	50.8
Plywood	CACM <sup>1/</sup>	Exporter	2.9	1.6	1.0	.7	.5
	GUATEMALA	Exporter	.3	.8	1.4	2.2	3.1
	EL SALVADOR	Importer	6.6	7.8	9.3	11.2	13.6
	HONDURAS	Importer	1.7	----	----	----	----
	NICARAGUA	Exporter	3.4	5.8	8.4	11.2	14.2
	COSTA RICA	Exporter	6.6	5.0	4.1	3.5	3.1
Panels	CACM <sup>1/</sup>	Importer	2.8	----	----	----	----
	GUATEMALA	Exporter	.2	.1	----	----	----
	EL SALVADOR	Importer	.5	.5	.5	.5	.5
	HONDURAS	Importer	.4	.8	(.5)	(.7)	(.8)
	NICARAGUA	Importer	----	-----	-----	----	----
	COSTA RICA	Importer	.2	.3	.3	.4	.4

Source: Projections IICA-CTEI.

NOTE: The ( ) represent a change in the direction of the trade; for example, from importer to exporter.

\* Represent an adjustment necessary because of shortage of forests and/or shortage of industrial capacity.

1/ The net trade of all countries of the CACM as a whole and without adjustment for the required changes in the production because of shortage of forest or of industrial capacity.

## Appendix 11

PER-CAPITA CONSUMPTION COEFFICIENTS FOR THE COUNTRIES  
OF THE CENTRAL AMERICAN COMMON MARKET

(Consumption in cubic meters of product/thousand people)

	1969	1970	1975	1980	1985	1990
<b>GUATEMALA</b>						
Population (000)	1,269.00	1,580.00	1,966.00	2,298.00	2,675.00	3,110.00
Sawnwood						
Cons/M Cap	271.90	272.20	280.00	287.00	294.20	301.60
Plywood						
Cons/M Cap	.74	.747	.785	.825	.867	.91
Panels						
Cons/M Cap	4.20	4.24	4.45	4.63	4.92	5.17
<b>EL SALVADOR</b>						
Population (000)	1,050.00	1,081.00	1,271.00	1,513.00	1,815.00	2,192.00
Sawnwood						
Cons/M Cap	66.70	67.93	68.70	70.40	72.20	74.00
Plywood						
Cons/M Cap	6.10	6.13	6.23	6.44	6.60	6.75
<b>HONDURAS</b>						
Population (000)	771.00	792.00	948.00	1,128.00	1,349.00	1,619.00
Sawnwood						
Cons/M Cap	137.30	138.36	140.40	141.45	142.50	143.57
Plywood						
Cons/M Cap	3.40	3.46	3.48	3.50	3.52	3.54
Panels						
Con/M Cap	.40	.40	.44	.44	.45	.45
<b>NICARAGUA</b>						
Population (000)	640.00	659.00	784.00	929.00	1,096.00	1,303.00
Sawnwood						
Cons/M Cap	146.70	148.17	155.70	149.65	150.40	151.15
Plywood						
Cons/M Cap	20.30	20.50	20.60	20.70	20.80	20.90
<b>COSTA RICA</b>						
Population (000)	511.00	528.00	640.00	795.00	963.00	1,161.00
Sawnwood						
Cons/M Cap	706.40	702.86	701.10	699.35	697.60	695.86
Plywood						
Cons/M Cap	25.40	25.40	25.40	25.40	25.40	25.40
Panels						
Cons/M Cap	.60	.60	.60	.61	.61	.61

Source: IICA-CTEI.

Note: Population is defined in 12 years and older.

LONG-TERM PROJECTION COEFFICIENTS IN FORESTRY OF THE  
CENTRAL AMERICAN COMMON MARKET

	1970	1975	1980	1985	1990
<b>Forests</b>					
Production $m^3r/m^3s$ <sup>1/</sup>	2,086.00	2,001.00	1,927.00	1,707.00	1,596.00
Employment Men/ $m^3r$	2.97	2.80	2.50	2.20	2.10
Capital \$/ $m^3r$	9.94	11.10	12.10	12.50	12.70
<b>Saw mills</b>					
Employment Men/ $m^3s$	5.22	5.00	4.80	4.60	4.20
Capital \$/ $m^3s$	21.20	18.50	18.00	19.70	21.80
<b>Plywood</b>					
Employment Men/ $m^3p$	29.10	28.00	27.00	25.00	23.00
Capital \$/ $m^3p$	10.40	22.00	26.00	31.00	35.00
<b>Panels</b>					
Employment Men/ $m^3p$	10.00	15.00	18.00	20.00	22.00
Capital \$/ $m^3p$	51.50	51.50	51.50	51.50	51.50

Source: IICA-CTEI

<sup>1/</sup> Calculation of the arithmetic average. The data were taken per country and refer to produced volume in each country.

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES OF THE OAS  
Tropical Training and Research Center  
Turrialba, Costa Rica

DEPARTMENT OF TROPICAL FORESTRY SCIENCES

GRADUATE STUDENTS

AND

SPECIAL STUDENTS

Dr. Waldemar Albertin  
Head

February, 1972

Registration Date	No	Name	Country	Scholar ship	Length of stay Months	Diploma Date	Actual Position
1951	1	JOHN B. REAPK	U.S.A.	T.C.P.	10	M.A. 1952	Ecólogo Florida y Bahamas
1952	2	CESAR PEREZ	Colombia	T.C.P.	20	M.A. 1956	Director, Instituto Forestal Medellín, Colombia
1953	3	GERARDO BUDOWSKI	Venezuela	T.C.P.	12	M.A. 1954	Director General, U.I.C.N.
1954	4	MIGUEL GONZALEZ	Cuba	T.C.P.	15	M.A. 1955	Especialista División de Bosques, FAO, Roma
1954	5	DELFIN GOITIA	Bolivia	T.C.P.	12	M.A. 1955	Jefe, Proyecto Forestal, El Salvador.
1954	6	RAFAEL LEON S.	Ecuador	T.C.P.	16	M.A. 1955	Servicio de Extensión, Ecuador
1955	7	HUGO ALVAREZ	Bolivia	T.C.P.	15	M.A. 1956	Dasónomo, IICA, Zona Andina, Lima, Perú.
1954	8	JANIS PETRICEKS	Venezuela	T.C.P.	14	M.A. 1956	Profesor, Facultad de Ciencias Forestales, Mérida, Venezuela
1956	9	MARIO LOPEZ L.	Costa Rica	FAO	12	Sin Tesis	Jefe Departamento de Ind. Forest. ITCO, San José, C.R.
1956	10	ARNOLDO MADRIZ	Costa Rica	STICA	12	M.A. 1965	Director General, Serv. For. Costa Rica, M.A.G.
1956	11	JOSE VERDUZCO	México	T.C.P.	10	Sin Tesis	Jefe, Departamento de Riosilvicultura, Prof. Chapingo, México
1956	12	ELMO MONTENEGRO	Colombia	I.C.A.	15	M.A. 1961	Experto FAO - Argentina
1956	13	LUIS SANCHES G.	Perú	T.C.P.	16	Sin Tesis	Prof. Fac. Forestal, Univ. del Centro, Perú
1956	14	RONALD ECHANDI	Costa Rica	I.C.A.	12	M.A. 1958	Prof. Univ. de C.R.

Regis- tration Date	N°	Name	Country	Scholar ship	Length of		Actual Position
					stay Months	Diploma Date	
1957	15	FRANCISCO CHACON	Costa Rica	F.A.O.	14	M.A. 1962	I.T.C.O., San José, C.R.
	16	MANUAL SAN ROMAN	Costa Rica	F.A.O.	14	Sin Tesis	Jefe, Sección Forestal I.T.C.O. San José, C.R.
	17	JORGE RIVERA	Puerto Rico	Pto. Rico	12	Sin Tesis	Especialista Forestal, Puerto Rico
	18	PEDRO CIANCIULLI	Brasil	T.C.P.	5	ESTUDIANTE	ESPECIAL
	19	JOSE UBILLA	Ecuador	T.C.P.	12	Sin Tesis	Doc. Fac. Agronom. Univ. de Guayaquil, Ecuador.
1958	20	EDMUNDO PUJOL	Honduras	Honduras	4	ESTUDIANTE	ESPECIAL
	21	HUMBERTO TASAICO	Perú	I.C.A.	12	M.A. 1959	Experto P.O. Puerto Cabezas, Nicaragua.
	22	JUAN LOPEZ	Paraguay	I.C.A.	13	ESTUDIANTE	ESPECIAL
1959	23	PABLO ROSERO	Ecuador	O.E.A.	17	M.A. 1961	Prof. Manejo Forestal IICA, Turrialba, C.A.
	24	ANTONIO AROSTEGUI	Perú	I.C.A.	20	M.A. 1961	Tecnólogo, Jefe, Lab. de Maderas. La Molina, Perú
	25	PEDRO PETIT	Venezuela	Venezuela	12	M.S. 1968	Prof. Fac. Ciencias For. Mérída, Venezuela
	26	GUIDO RODRIGUEZ	Bolivia	O.E.A.	12	ESTUDIANTE	ESPECIAL
1960	27	OSCAR LOZANO	México	O.E.A.	22	M.A. 1962	Técnico For. Corvu Ind. México
	28	HECTOR FLORES	México	O.E.A.	18	M.A. 1963	Prof. Univ. de Nuevo León, Monterrey, México

Regis- tration Date	No	Name	Country	Scholar- ship	Length of stay Months	Diploma Date	Actual Position
1960	29	LEONCIO LOJAN	Ecuador	O.F.A.	20	M.A. 1961	Prof. Univ. de Loja, Ecuador.
	30	RAUL MARINERO	México	O.F.A.	20	M.A. 1962	Dasónomo, Departamento de Asuntos Agrarios y Coloni- zación, Méxicc
	31	LEONIDAS VEGA	Bolivia	O.E.A.	20	M.A. 1962	Silvicultor - Servicio Forestal, Surinam.
	32	JEAN DE VASTY	Haití	O.E.A.	19	M.A. 1962	Esp. For. FAO, Congo
	33	RICARDO LOMBO	Colombia	O.E.A.	21	M.A. 1963	Sub-jeefe, Depto. Tierras. y Aguas; INDERENA, Colombia
	34	RAUL DAVIU	Bolivia	O.E.A.	12	ESTUDIANTE ESPECIAL	
	35	FABIAN JARRIN	Ecuador	O.F.A.	12	Sin Tesis	Co-Director Proyecto FAO, Quito, Ecuador
1961	36	EDUARDO IZQUIERDO	Perú	O.E.A.	17	M.A. 1962	Prof. Fac. de Ciencias For. y Jefe Serv. For. La Molina, Perú
	37	AVELINO AGUIRRE	México	O.E.A.	24	M.A. 1963	Das. Bco. de México
	38	JEAN BAPTISTE	Haití	O.E.A.	20	ESTUDIANTE ESPECIAL	
	39	LUIS CAÑADAS	Ecuador	O.E.A.	22	M.A. 196	Das. Ser. For. Ecuador
	40	PETER FREEMAN	U.S.A.	I.A.C.C.	24	M.A. 1963	Das. Div. Rec. Nat. Unión Pan., Washington, D.C.
1962	41	CARLOS RIOS	Pto Rico	Pto. Rico	22	Sin Tesis	Das. Serv. For. Pto. Rico
	42	CASTOR RUIZ D.	Paraguay	A.I.D.	24	ESTUDIANTE ESPECIAL	
	43	OSVALDO DA VERA CRUZ	Brasil	OEA/FAO	24	ESTUDIANTE ESPECIAL	

Registration Date	No	Name	Country	Scholarship	Length of stay Months	Diploma Date	Actual Position
1962	44	CONRADO VOLKART	Argentina	O.E.A.	21	M.A. 1964	Das. Serv. For. Misiones, Argentina
1963	45	JUAN ALIAGA	Perú	O.E.A.	15	FSTUDIANTE	ESPECIAL
	46	RICARDO GUTIERREZ	Panamá	OEA/ADI/IICA	22	Sin Tesis	Serv. For. Parques Nacionales de Panamá
	47	ENRIQUE MAYO	Panamá	AID	20	M.S. 1965	Profesor, Universidad de Panamá.
	48	VICTOR MENDOZA	Ecuador	IICA	22	M.S. 1965	Prof. Univ. Guayaquil, Ecuador
	49	ADOLFO SALAZAR	Perú	O.E.A.	21	Sin Tesis	Director de Personal. La Molina, Perú
1964	50	JULIO A. GARCIA	Nicaragua	A.I.P.	27	M.S. 1967	Prof. Univ. Nac. del Centro, Perú
	51	OSCAR VON BORRIES	Bolivia	IICA/Z.A.	27	M.A. 1967	Serv. For. de Bolivia
	52	VENTURA MATTE H.	Chile	IICA/Z.S.	17	M.S. 1966	Muerto
1965	53	ISRAEL ACOSTA	Colombia	O.E.A.	23	M.S. 1967	Univ. Distrital, Fcc. José de Caldas, Colombia
	54	CARLOS ALONSO	Colombia	IICA	23	M.S. 1967	Asesor For. Dep. de Bosques, Bogotá, Colombia
	55	PERCY BAPTISTA	Bolivia	IICA/Z.A.	23	M.S. 1967	Serv. For. La Paz, Bolivia
	56	JOSE BUCAREY	Chile	IICA/Z.S.	24	M.S. 1967	Prof. Aux., Univ. Austral de Chile
	57	JESUS H. JIMENEZ	Colombia	O.E.A.	21	M.S. 1967	Dendrólogo--Servicio Forestal - Surinam



Registration Date	No	Name	Country	Scholarship	Length of stay		Diploma Date	Actual Position
					Months	Months		
1965	58	VICTOR LOAIZA	Ecuador	IICA/Z.A.	22		M.S. 1967	Prof. Univ. de Loja, Ecuador.
	59	IVAN MOJICA	Colombia	IICA	24		M.S. 1967	Estudia para Ph.D.
1966	60	MARIO BOZA	Costa Rica	IICA/CEI/ZN	27		M.S. 1968	Jefe, Sec. Parques Nac. Dir. For. MAG, San José, Costa Rica
	61	RAMON CAMARGO	Colombia	IICA-CEI	27		M.S. 1968	
	62	EMILIO DAVID	Perú	FAO	12		Sin Tesis	Prof. Fac. Ciencias For. La Molina, Perú
	63	MARINO GONZALEZ	Perú	MAC/Z.A.	20		M.S. 1968	Direc. Fac. Ciencias For. La Molina, Perú
	64	JAIMÉ RAIGOSA	Colombia	IICA-CEI	21		M.S. 1968	Estudia para Ph.D.
	65	ENRIQUE ROSSL	Perú	FAO	12		Sin Tesis	Prof. Fac. Ciencias For. La Molina, Perú
	66	JOSE URZUA	Chile	IICA/Z.S.	12		M.S. 1967	Prof. Fac. For. Universidad de Chile
1967	67	LUIS ISPINOZA	Perú	IICA/Z.A.	8		SF RETIRO	
	68	RODRIGO GONZALEZ	Costa Rica	IICA-CEI	32		M.S. 1970	Jefe, Dep. de Inv. For. Dirección For. MFG, C.R.
	69	GILBERTO OPCZCO	Ecuador	C.E.A.	8		SE RETIRO	
	70	ROBERT B. PECK	U.S.A.	IICA-CEI	24		M.S. 1969	Silvicultor, Maderas de Mariño, Tumaco, Colombia
	71	ARTURO FONCE	Ecuador	FAO	24		M.S. 1969	Director, Centro de Capacitación For., Ecuador
	72	SALOME VALDIVIA	Perú	USAID/LIMA	24		M.S. 1969	Silvicultor, Serv. Forestal del Perú, Chiclayo

Regis- tration Date	N°	Name	Country	Scholar- ship	Length of stay Months	Diploma Date	Actual Position
1968	73	ALVARO ARCIRIA	Colombia	FAC	3	ESTUDIANTE ESPECIAL	
	74	CARLOS CAMACHO	Colombia	FAC	3	ESTUDIANTE ESPECIAL	
	75	JORGE DE LA CRUZ	Guatemala	FAC	3	ESTUDIANTE ESPECIAL	
	76	ROBERTO FIGUEROA	El Salvador	FAC	3	FSTUDIANTE ESPECIAL	
	77	GERARDO LOZANO	Colombia	FAC	3	ESTUDIANTE ESPECIAL	
	78	DILSON AMARAL	Brasil	ZONA SUP	20	M.S. 1970	Jefe, Serv. For. Secr. de Agr. Brasil
	79	RICARDO CALIX	Honduras	C.E.I.	18	M.S. 1970	
	80	MANUEL CONTPERAS	Chile	ZONA SUP	12	M.S. 1970	Prof Aux. Dep. Manejo For. Univ. de Chile
	81	LUIS GARPIDO	Colombia	ZONA ANDINA	20	M.S. 1970	Asesor For. INDERENA, Colombia
	82	ROBERTO RAMALHO	Brasil	UREMG/BRASIL	20	M.S. 1970	Prof. de Dendrologia y Anat. de Maderas, Univ. Fed. de Vigosa, Brasil
	83	ANGEL POJAS	Colombia	C.E.I.	21	M.S. 1970	Prof. Fac. de Ing. For. Univ. del Tolima, Colombia
	84	SAYURI SHIBATA	Brasil	PEPS./Z.S.	21	M.S. 1970	
1969	85	JORGE BECERRA	Colombia	C.E.I.	18	M.S. 1971	Prof. Univ.Fco. José de Caldas, Colombia
	86	JORGE BOHORQUEZ	Perú	C.E.I.	12		Silvicultor, Serv. Forestal del Perú, Lima
	87	RAFAEL BOPNAR	Perú	C.E.A.	13	M.S. 1971	Silvicultor, Serv. Forestal del Perú, Lima
	88	JUAN CHAGAS	Brasil	ZONA SUR	18	M.S. 1971	
	89	JUAN FERNANDEZ	Bolivia	C.E.I.	18	M.S. 1971	

Registration Date	No	Name	Country	Scholar ship	Length of		Diploma Date	Actual Position
					stay Months	stay Months		
1969	90	NELSON VENTOFIM	Brasil	C.E.I.	18		M.S. 1971	
	91	EUSEBIO HERRERA	Chile	PERSONAL	3			ESTUDIANTE ESPECIAL
	92	JUAN ROZARICK	Argentina	IICA-CEI/Z.S.	3			ESTUDIANTE ESPECIAL
	93	JOSE LOPEZ	Argentina	IICA-CEI/Z.S.	3			ESTUDIANTE ESPECIAL
	94	SEBASTIAO MACHADO	Brasil	IICA-CEI/Z.S.	3			ESTUDIANTE ESPECIAL
	95	OVIDIO MOREIRA	Brasil	IICA-CEI/Z.S.	3			ESTUDIANTE ESPECIAL
	96	JUAN ULTEMARI	Chile	IICA-CEI/Z.S.	3			ESTUDIANTE ESPECIAL
	97	DARIO TOVAR	Panamá	PERSONAL	3			ESTUDIANTE ESPECIAL
	98	CRISTIAN UNDRUPAGA	Chile	PERSONAL	3			ESTUDIANTE ESPECIAL
	99	DAVID PERSHAM	Guyana	F.A.C.	2			ADIESTRAMIENTO EN SERVICIO
1970	100	JOSE DEL C. DIAZ	Argentina	IICA-CEI	3	I		SEMINARIO PROFESORES FORESTALES
	101	JORGE GARCIA	El Salvador	IICA-CEI	1	I		SEMINARIO PROFESORES FORESTALES
	102	JESUS R. LOPEZ	Perú	IICA/Z.A.	3	I		SEMINARIO PROFESORES FORESTALES
	103	IVAN MORENO	Ecuador	IICA/Z.A.	3	I		SEMINARIO PROFESORES FORESTALES
	104	MELVIN TORRES	Panamá	IICA-CEI	3	I		SEMINARIO PROFESORES FORESTALES
	105	JULIO FARUK	Bolivia	IICA-CEI	3	I		SEMINARIO PROFESORES FORESTALES
	106	PEDRO SENYSZYN	Uruguay	IICA/Z.S.	3	I		SEMINARIO PROFESORES FORESTALES
	107	JOSÉ R. GARCIA	Venezuela	IICA-CEI	3	I		SEMINARIO PROFESORES FORESTALES
	108	FABIO GOMEZ	Honduras	F.A.C.	3	I		SEMINARIO PROFESORES FORESTALES

Registration Date	No	Name	Country	Scholarship	Length of stay Months	Diploma Date	Actual Position
1970	109	RAY WOTHERPOON	Chile	IICA/Z.S.	3	I	SEMINARIO PROFESORES FORESTALES
	110	IRVING R. DIAZ	Panamá	F.A.O.	6	PEND.	ECONOMIA FORESTAL
	111	ALFREDO SAMANIEGO	Ecuador	F.A.O.	6	CURSO	COPTO ENTOMOLOGIA FORESTAL
	112	JOSE HAUEISEN	Brasil	UNIV.FED.VIGOSA	6	CURSO	COPTO ENTOMOLOGIA FORESTAL
	113	FLORIANO ISOLAN	Brasil	IICA/Z.S.	18	M.S. 1971	Director Técnico, Planta Emprcndimientos Florestais
	114	ADRIAN QUIÑONEZ	Paraguay	IICA/Z.S.	18	Sin Tesis	
	115	ANTONIO AROSTEGUI	Perú	F.A.O.	2		Director, Laboratorio de Maderas Universidad, Agraria, La Molina, Perú.
1971	116	ABEL AGUILERA	México	IICA/CTEI	18	M.S. 1972	Instituto Nacional de Invo. Forestales, México
	117	ARMANDO CLAVIJO	Colombia	G.Holanda	19	M.S. 1972	Prof. Univ. Distrital Pco. José de Caldas, Bogotá
	118	LUIS G. CHACON	Ecuador	IICA/CTEI	17	M.S. 1972	Jefe, Distrito Forestal Carchi Serv.Forestal. Min. Prod. Quito
	119	RAUL GAETE	Chile	IICA-CTEI	20		Serv.Forestal Min. Agric. Chile
	120	SEGUNDO JADAN	Ecuador	IICA/CTEI	18	M.S. 1972	Jefe, Concesiones Forestales Serv.For. Min. Prod. Quito
	121	RENAN LARA	Bolivia	IICA/Z.A.	20	M.S. 1972	
	122	ROBERTO PARRAGA	Perú	O.E.A.	18	M.S. 1972	Min.Agric. Direc.Gen. Forestal Lima, Perú
	123	JORGE RODRIGUEZ	Colombia	IICA/Z.A.	18	M.S. 1972	Dircc. Agrológica Inst. Geogr. Agustín Codazzi, Bogotá

STUDENTS PRESENTLY REGISTERED IN THE DEPARTMENT  
OF TROPICAL FOREST SCIENCES

Name	Country	Scholarship	Date of Arriving
DAVID SLIWA (a Ph.D.)	U.S.A.	EAPF/Ford	24/7/70
SCOTT ROBERTS (a Ph.D.)	U.S.A.	N.S.F.	10/6/72
EDWARD HOLSTEN (a Ph.D.)	U.S.A.	N.S.F.	25/8/72
RODOLFO SALAZAR	Costa Rica	Personal	12/4/71
LUIS FREIRE	Ecuador	IICA/Z.A.	27/9/71
ALFREDO SAMANIEGO	Ecuador	Holanda	4/10/71
SIMON MORALES	Perú	IICA/Z.A.	4/10/71
CARLOS SANTANDER	Perú	PMCA	13/10/71
MIGUEL MUSALEM	México	IICA/Z.N.	30/9/71
ANTONIO PAREDES	Rep. Domin.	Z. M.	27/9/71
VITOR BECKER	Brasil	Holanda	27/9/71
SEBASTIAO MACHADO	Brasil	Univ. Paraná/IICA	27/9/71
JAIME MALUF	Brasil	Holanda	27/9/71
ANTONIO SOARES	Brasil	Holanda	4/10/71
RONALDO SOARES	Brasil	Univ. Paraná/IICA	27/9/71

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APPENDIX 15Partial List of German Experts which dominate the Spanish  
Language and Experience in Latin America

<u>Specialty</u>	<u>Name</u>	<u>Age</u>	<u>Actual Location</u>
Silviculture	Prof. H. Lamprecht	50	U. Gottingen
Silviculture	Prof. P. Burschel	45	U. Munchen
Silviculture	F. Ass. B. Muller-Using	34	Forstschule Dustental
Silviculture	Dr. F. Reinhlod	60	Forstdient Donaueschingen
Management	Dr. J. Schmatz	35	Hess. Forstdienst
Management	Dr. K. Eckard	50	Hess. Forstdienst
Inventory	Dr. R. Brun	37	U. Gottingen
Soils	Dr. M. von Buch	50	U. Reinbek
Soils	Dr. H. W. Fassbender	35	U. Gottingen
Soils	Dr. W. Moll	50	U. Freiburg (U. Valdivia)
Utilization	Dr. G. Einsehauer	55	Hess. Forstdienst (U. Valdivia)
Technology	F. Ass. A. Bornemann	35	Hess. Forstdienst (U. Valdivia)
Forest Policy	Dr. von Furstenberg	40	FAO-Afrika
Forest Products	Dipl. For. R. Alvin	30	U. Valdivia
Wood Technology	Prof. H. Schulz	45	U. Gottingen
Mycology	Dr. K. Racz	40	Hann. Munden
Entomology	Dr. W. Ruhm	45	Hannover ?
Silviculture	Dr. H. Tillmanns	55	Guatemala ?
Wood Technology	Dipl. For. Richter		Curitiva, Brasil ?

Distribution of Positions Held by Graduates of IICA-CTEI(1947 - February, 1972)

University Professors	126	27 per cent
Experimental Station Technicians and Research Workers	47	10.5 "
Ministries of Agriculture and/ or Planning (research, adminis- tration, extension, planning)	72	15.5 " "
Other Development or Agricultural Promotion Institutions	60	13 " "
Private Industry	28	6 " "
Studying towards advanced degrees (i.e. Ph.D.)	22	7 " "
International Institutions (BID, FAO IICA, etc.)	37	8 " "
Other, various	63	13 " "
	<hr/>	<hr/>
Total	455	100 per cent

Approximately 10 per cent of IICA's graduates have gone on for advanced degrees, and have Ph.D.s (from U.S. Universities, mostly)