

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

DRAFT PROJECT DOCUMENT

Title	TECHNOLOGICAL AND DENDROLOGICAL STUDY ON SCHINOPSIS (ANACARDIACEAE) IN CHIQUITANIA AND THE BOLIVIAN CHACO
Serial Number	PD 133/91 Rev.1 (I)
Original	SPANISH

Prepared by

Submitted by

GOVERNMENT OF BOLIVIA

Duration

Field of Activity

FOREST INDUSTRY

Co-operating Governments

Implementing Agency

FORESTRY DEVELOPMENT CENTER
GENERAL DIRECTORATE OF STANDARDS
AND TECHNOLOGY

Estimated Starting Date

18 MONTHS

Estimated Project Cost

US\$ 208,125

Financing Sources and Amount

- ITTO Contribution US\$ 119,900

- National Contribution US\$ 88,225

Signed

On behalf of ITTO

Date

On behalf of Government of Bolivia

Date

TECHNOLOGICAL AND DENDROLOGICAL STUDY
ON SCHINOPSIS (ANACARDIACEAE) IN CHIQUITANIA
AND THE BOLIVIAN CHACO

I. OBJECTIVES

- 1.1 To identify and carry out a botanical and dendrological study of the Schinopsis species in the sleeper-production area between Chiquitania and the Bolivian Chaco.
- 1.2 To study the anatomical, physical and mechanical properties, as well as durability and tannin content, of Schinopsis wood, commonly used for the production of railway sleepers.
- 1.3 To compile technical data in order to contribute to the revision and updating of Bolivian standard N.B. 271-78 concerning red quebracho sleepers.

2. BACKGROUND AND JUSTIFICATION

- The limited technical information available about Bolivian timber resulted in an inappropriate utilization of the natural forest and in a selective exploitation of species. In recent years, attempts have been made to improve this situation by promoting the characteristics and uses of lesser known timber species found in the national forests.
- Technological research on Bolivian timber species began quite recently. In 1976, a series of studies were initiated on the dendrological, physical and mechanical properties, preservation, drying, workability and anatomy of 25 lesser known timber species found in the subtropical moist forest of Santa Cruz.
- The usefulness of this research on national timber species became obvious when promoting the integrated utilization of forests through the use of the so-called "low value" species such as Bibosi (Ficus glabrata), Palo Maria (Calophyllum brasiliense), Ochoó (Hura crepitans) and Verdolago (Terminalia amazonia), among others. It is also worth noting that national technicians had an opportunity to become familiar with the application of current international standards in the studies and wood tests.
- In spite of the aforementioned facts, there is still a lot to be done. There are several problems that affect national and international marketing and the optimal use of various other Bolivian timber species found in the different types of forests or ecological formations. Some of these problems are described below.

- Since the beginning of the 1950's, with the construction of the Yacuiba-Santa Cruz railway by the Joint Argentinian-Bolivian Commission, red quebracho sleepers have been used (Schinopsis genus, probably S.Lorentzii or, in other words, S. red quebracho). The use of this species was made possible as previous information was available in Argentina on the properties of quebracho and its use for the production of railway sleepers. The marketing of this timber species increased, especially in the last few years, through a major growth in the export of sleepers to neighbouring countries.
- At the domestic level, sleepers produced from Schinopsis species are used by the National Railways Authority (Empresa Nacional de Ferrocarriles - ENFE) in the eastern and western railroad networks of Bolivia.
- In 1978, the Bolivian standard N.B. 271-78 on red quebracho sleepers was adopted, based on the Argentinian standard IRAM FAL 95-57 concerning sleepers produced from red quebracho, Guayacán and Urunday. This standard regulates the marketing and use of Bolivian red quebracho, both at the domestic consumption level and in the export of sleepers, and it is used at ENFE (National Railways Authority) for the classification of purchased goods.
- Recently, a heated debate has been taking place on the proper designation, properties and use of the various Schinopsis species in Bolivia. This controversy is to a large extent due to the wide range of common names used in different locations and to the great variety of species available, some of which are not found in Argentina and their characteristics are therefore seldom mentioned in the Argentinian literature. Finally, the lack of technical studies on Schinopsis timber species, particularly in the sleeper production areas, makes it difficult to revise and update current national standards for red quebracho sleepers and represents a potential barrier in the optimal international marketing of this wood.
- Thus, this project proposes a systematic research study on the Schinopsis species in Eastern Bolivia. This study should be based on the international research standards, particularly those applied in Argentina (IRAM standards), to facilitate a better evaluation of its findings by reviewing the Argentinian literature available on this subject.
- Finally, the development and implementation of this project will produce an improved and wider range of techniques to be used by a Technical Committee in the revision and updating of current Bolivian standards for the classification of red quebracho, and to establish a standard technical quality control system to be applied in both the eastern and western regions of Bolivia. Another important aspect of this project will be on-the-job training of national personnel and strengthening of national timber research infrastructure.

3. THE PROJECT

The following sections provide a general description of the project, with a detailed account of the various research activities and costs.

3.1 Location

The Project will be implemented in the Departments of Santa Cruz, Chuquisaca and Tarija (see attached map).

The coordinating agency will be the Forestry Development Center, 6th Floor, Av. Camacho 1471, P.O. Box 8928, La Paz, Bolivia.

3.2 Participating agencies

The Forestry Development Center (CDF - Centro de Desarrollo Forestal) will be the counterpart agency to the international body financing the Project.

The following agencies will take part in the Project:

In the Project administrative component: General Directorate of Standards and Technology (DGNT - Dirección General de Normas y Tecnología), Ministry of Industry, Trade and Tourism (MICT - Ministerio de Industria, Comercio y Turismo), with offices in La Paz, Santa Cruz and Tarija.

In the Project technical component: Chamber of Sleeper Producers, Timber Companies in Chiquitania, Decentralized Units of the CDF (Santa Cruz, Tarija and Chuquisaca); some of the technical activities will be carried out in cooperation with the DGNT-La Paz.

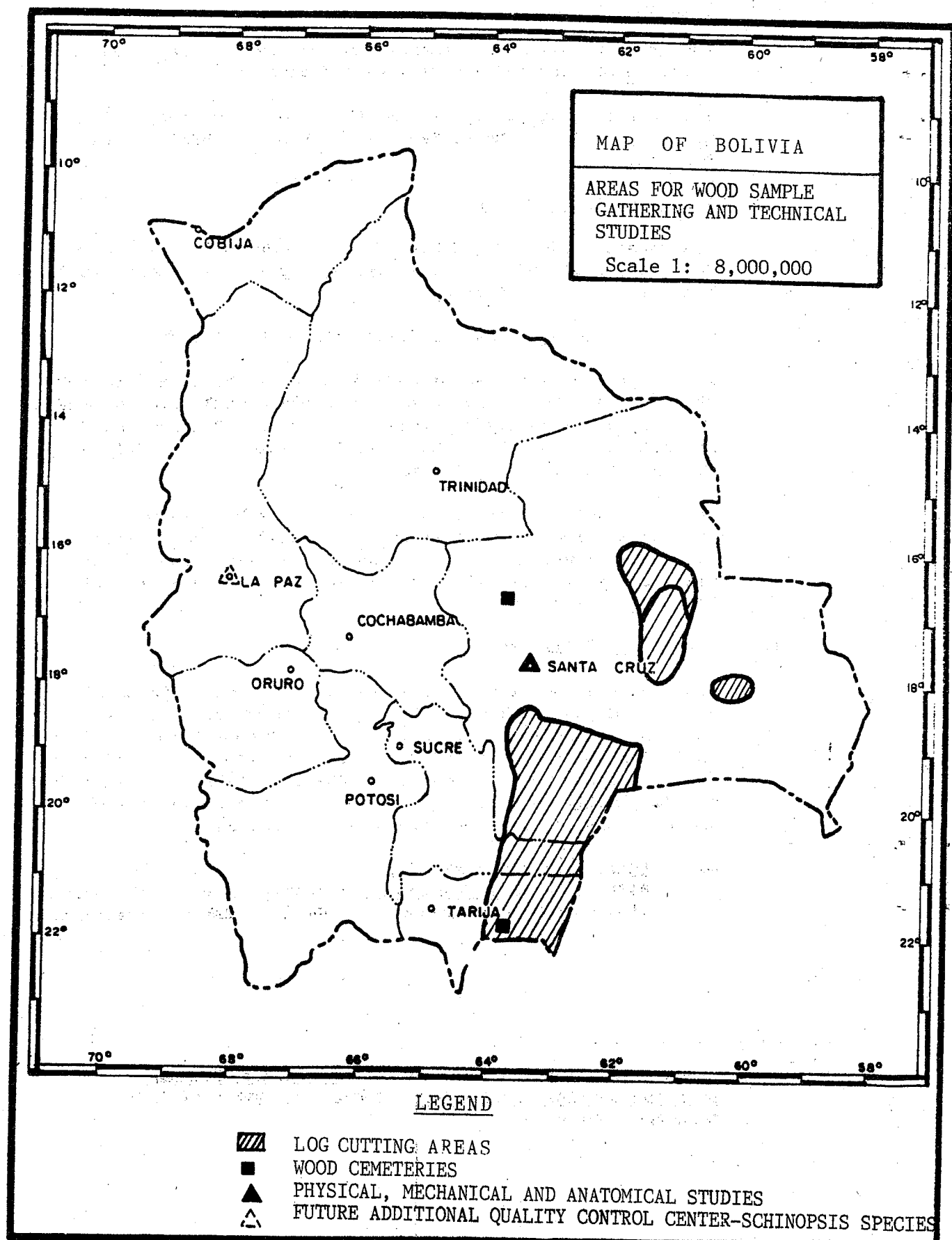
3.3 Selection of species

Based on the technical literature available on Schinopsis species (Meyer, Barkley, 1973)*, personal communications regularly maintained with J.C. Tinto in Buenos Aires, R. Lara in La Paz and M. Lozano in Santa Cruz, as well as visits made by S. Viscarra to Chiquitania and Chaco in 1989, a description of the Schinopsis species to be studied is provided below, including their possible geographical distribution.

a. Schinopsis red quebracho

Also known as S. Lorentzii; probably found to the south of Grande river, down to the northern part of Argentina.

* MEYER T. and F.A. BARKLEY, 1973. Revisión del género Schinopsis- (Anacardiaceae). LILLOA Volume XXXIII:II, Tucumán, Argentina.



b. Schinopsis haenkeana

Probably found in the high foothills of the Andes, bordering the Chaco plain, from Cochabamba to the north of Argentina. It is also found in the Santiago mountain range, near Roboré (Santa Cruz).

c. Schinopsis cornuta

To the east of Grande River and Parapetí River, probably up to the Paraguayan border and into the Chiquitania region.

d. Schinopsis glabra

Probably from the region of Izozog to the north of Chiquitania.

e. Schinopsis brasiliensis

Probably found in the same areas as S. Glabra. (Also found in the Department of La Paz.)

The scientific names used above are those quoted by Meyer and Barkley (Ob. Cit, 1973), as they are considered to be the most precise and updated ones.

Only these five Schinopsis species have been included in the work plan because no other species are likely to be found in the Project area.

3.4 General Description of Project Activities

A detailed description of the various Project activities is provided below in the following order:

ACTIVITY A	:	DENDROLOGICAL STUDIES ✓
ACTIVITY B	:	GATHERING OF SAMPLES FROM THE FOREST ✓
ACTIVITY C	:	PREPARATION OF TEST SAMPLES ✓
ACTIVITY D	:	IDENTIFICATION OF PHYSICAL AND MECHANICAL PROPERTIES
ACTIVITY E	:	ANATOMICAL STUDIES
ACTIVITY F	:	DURABILITY TESTS
ACTIVITY G	:	DETERMINATION OF TANNIN CONTENTS
ACTIVITY H	:	PROCESSING AND EVALUATION OF FINDINGS. ✓

Section 3.13 gives an account of the coordination, administration and technical assistance required in this Project.

Costs and financing sources (national and external contributions) are shown in section 4 and in the final section of the description of each activity.

A seminar is scheduled at the end of the Project to carry out a formal presentation of the Project findings for the benefit of the institutions directly or indirectly related to the activities. This seminar could be the initial work of a future regulatory Committee in the field of sleeper production and use.

3.5 Activity A: Dendrological Studies

Specific Objectives

- To mark the trees to be studied for each of the five Schinopsis species.
- To carry out a botanical study of the different species.

Methodology

The selection of the tree marking areas will take into account the sample specifications described in section 3.6.

Two trees will be selected per species, in addition to the ten trees selected for the gathering of material to be used in the technological study. These candidate trees should be healthy individuals, representative of the species in terms of size and shape. The selected trees will be marked with an oil-based paint of intense colour (red, yellow, green, blue or black).

Botanical samples (branches, flowers, fruits, seeds, etc.) will be taken from all selected trees to facilitate the proper description of each species.

The material that cannot be obtained during tree marking and felling will be taken from the additional selected trees, which will also facilitate phenological observations and the gathering of samples in various stages: flowering, fruit-bearing, defoliation, etc.

The following data will be compiled in all cases: tree number (see tree marking and numbering in section 3.6), location, date, collector's name, type of soil, diameter at breast height, total and commercial height, shape of stem, type of crown, bark appearance and characteristics, exudation; the characteristics of fresh botanical material, such as smell and taste, will also be compiled.

The samples will be treated with formaline and alcohol, pressed for drying and labelled with the common name of the species, place of collection, etc.

A file of codified samples per species will be prepared to facilitate the description of material.

Before the final and correct identification of species, the National Consultant will take the botanical material of each species to the Lillo Institute in Tucumán, Argentina, in order to compare it with the reference material.

Finally, a report on the work carried out will be prepared, describing the methodology used and the findings of the study. The report will include maps, figures, photographs and any other material which could help to fully understand the work carried out and the results achieved. A simple code will be developed for the botanical description of the five species. Finally, the Consultant will report on his work at the Seminar scheduled at the end of the Project (month 18).

Materials and Equipment

	US\$
- Oil paint (red, yellow, blue, green or black), 2 gallons per species	500.-
- Brushes, machetes, pruning shears	250.-
- Plastic bags, Bristol board, blotting paper, cardboard	150.-
- Dryer of botanical samples, sleeping [Sic](2)	800.-
- Photographic camera, film, film developing	400.-
- Field notebooks, backpacks, boots, helmets	300.-
- Wooden cases, binoculars, compass	800.-
- Typewriter, office supplies	1,000.-
- Glass bottles, first-aid kit	550.-
- Formalin and alcohol (30 lt - 90 lt)	600.-
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TOTAL	US\$ <u>5,350.-</u>

Personnel

- Current staff:
- One Assistant Technician (CDF - Santa Cruz, Chuquisaca or Tarija) to be assigned on the basis of merit.
 - Secretary/ Typist.
 - Draughtsman.

- To be hired:
- One Consultant in Dendrology with experience in the Chaco and Chiquitania flora.
 - One assistant labourer.

Cost of Project Activity

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. <u>Personnel (US\$ 20,320)</u>			
- 1 Consultant in Dendrology, 8 months @ US\$ 1,800/month (1510 m/h)	--	14,400	14,400
- 1 Assistant Engineer, 12 months @ US\$ 300/month	3,600	-	3,600
- 1 Secretary, 4 months @ US\$ 200/month	800	-	800
- 1 Draughtsman 2 months @ US\$ 200/month	400	-	400
- 1 Assistant Labourer 8 months @ US\$ 140/month	-	1,120	1,120
SUBTOTAL US\$	<u>4,800</u>	<u>15,520</u>	<u>20,320</u>
b. <u>Travel (US\$ 4,700)</u>			
- Nationally: Consultant and Technician, 12 trips	2,000	2,000	4,000
- Internationally: Consultant and Assistant Technician, 2 trips	--	700	700
SUBTOTAL US\$	<u>2,000</u>	<u>2,700</u>	<u>4,700</u>

		<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
c.	<u>DSA (US\$ 6,900)</u>			
-	In Bolivia, Consultant, 80 days @ US\$ 35/day	--	2,800	2,800
	Assistant Technician, 80 days @ US\$ 25/day	--	2,000	2,000
-	Outside Bolivia, Consultant and Technical Assistant, 15 days each @ US\$ 70/day	--	2,100	2,100
	SUBTOTAL US\$	--	<u>6,900</u>	<u>6,900</u>
d.	<u>Communications (US\$ 360)</u>			
	Total amount US\$ 30/month	360	--	360
e.	<u>Materials and Equipment (US\$ 5,350)</u>			
	As previously detailed	1,000	4,350	5,350

Dendrological Studies: Summary of Costs

		<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a.	Personnel	4,800	15,520	20,320
b.	Travel	2,000	2,700	4,700
c.	DSA	--	6,900	6,900
d.	Communications	360	--	360
e.	Materials and Equipment	1,000	4,350	5,350
	TOTAL US\$	<u>8,160</u>	<u>29,470</u>	<u>37,630</u>

WORK SCHEDULE

This is a tentative work schedule giving details of the probable duration and timetable of activities.

ACTIVITY	MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
- Preparation of work plan (15 days)	—											
- Tree selection and marking (2 species) (30 days)	—	—										
- Gathering of samples and phenological data (5 days/ month)	-	-	-	-	-	-	-	-	-	-		
- Samples division and identification (10 days/ month)	-	-	-	-	-	-	-	-	-	-		
- Visit to the Miguel Lillo Institute, Tucumán, Argentina (15 days)											—	
- Final Report (35 days)											—	—
- Seminar (1 day - to be developed at the end of the project)												

NOTE: Prospective Consultants on Dendrology are: Martiniano Coro, Professor of Dendrology at Juan Misael Saracho University, Tarija, and Raúl Lara, Botanist at the CUMAT Center, La Paz.

3.6 Activity B: Gathering of samples from the forest

Specific Objective

- To gather the required field material (timber) for the technological tests. Ten trees will be selected for each species.

Methodology

The technical personnel of the CDF are familiar with the timber collection procedure as it was applied in similar projects (PADT-REPORT, CIID/CANADA).

The work will be carried out in accordance with standard COPANT No. 30:1001. "Selection and gathering of samples", and will include the following major activities:

a. Selection of sample areas

The species will be identified with the assistance of the Dendrologist, both in the Chaco and in the Bolivian Chiquitanía, taking into consideration forest access roads, log harvesting facilities and timber processing in the local sawmilling units. The trees will be marked with an oil-based paint of intense colour (red, yellow, blue, green or black).

A tentative distribution of the sample gathering areas is proposed based on the probable distribution of the species mentioned in 3.3.

b. Selection and marking of trees

The trees will be selected according to shape and commercial potential, with a minimum diameter at breast height (DBH) of more than 60cm. over-bark.

Sixty trees will be marked. Fifty of these will be used as samples for the study of the five species in question and the rest of the trees will be used for the dendrological studies outlined in the previous section.

It was decided to use this number of trees in the study (10 trees per species) so as to determine the average value of the physical and mechanical tests with a degree of accuracy of 10%, according to the recommendations of D. Noack (1970)*

* D. Noack, 1970 - "Evaluación de propiedades de maderas tropicales", in Estudio Tecnológico de las maderas poco conocidas de Paraguay. FAO, Asunción, 1972, Appendix V.

The marking of the trees will be carried out according to the following code:

<u>Code</u>	<u>Scientific Name</u>	<u>No. of Trees</u>
1-12	Schinopsis red quebracho	12
21-32	Schinopsis haenkeana	12
41-52	Schinopsis cornuta	12
51-72	Schinopsis glabra	12
81-92	Schinopsis brasiliensis	12

NOTE: Only 10 trees (numbers 1 to 10 or the appropriate numerical sequence) of each species will be cut. The rest (the last two numbers of each species) will be left standing for the dendrological studies.

A control of the marked species will be carried out and at each work station a map or distribution plan of the marked trees will be prepared.

c. Gathering of timber samples

Felling, cutting and marking: The first ten trees of every species, marked according to the above code, will be felled and cut into two logs (A and B) of approximately 2.5 m.

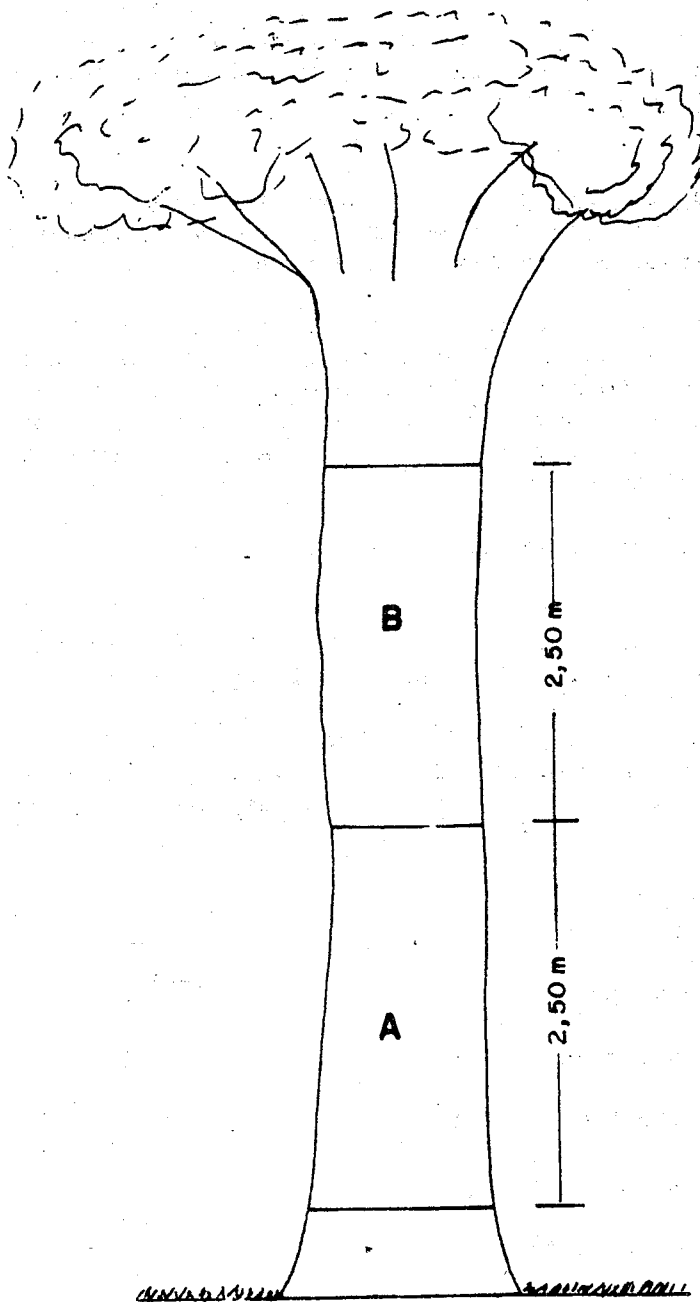
After being cut, both ends of the log will be coated with an aluminium paint to avoid excessive cracking. Each log will be marked with the same number as the tree it was cut from as well as with the letters A or B depending on whether the log was obtained from the lower or upper section of the tree, respectively. For example, if it is the first tree of the Schinopsis cornuta species, it will be marked as follows:

41 - A Lower log

41 - B Upper log

For further details see attached figure.

d. Transportation of logs.- The marked logs will be loaded onto the trucks of local logging companies and transported to the closest sawmills to be mechanically processed.



LOG CUTTING AND MARKING

Most of the sawmills in the Chaco area are located close to the Yacuiba-Santa Cruz railway line, and in the Chiquitania area the sawmills are located between the towns of San Ignacio and San José.

The final selection of the log processing sites will be made once the plan or the distribution map of marked trees will be prepared at the beginning of the project.

- e. Log cutting and board processing.- The timber will be processed as soon as possible after the tree has been felled to avoid losses due to cracking or attacks by borers (cerambycid insects).

A central board 4" wide and 2.40 m long will be cut from each log. The board will be cut in two equal parts lengthways to facilitate handling and transport. Both halves of each board shall bear the same mark as their "mother" log, i.e. there will be two half-boards with number 41A (based on the previous example) and two half-boards with number 41B (see figure).

Both sides of the half-boards should be marked to facilitate their identification.

Preferably, core wood should be used to comply with testing standards and specifications which require the use of this type of wood.

Finally, all extracted timber (200 boards from 100 logs) will be taken to the sawmill of the National Forest Products Laboratory of the UTD-CDF in Santa Cruz, in order to prepare the samples to be used in each test.

Materials and Equipment

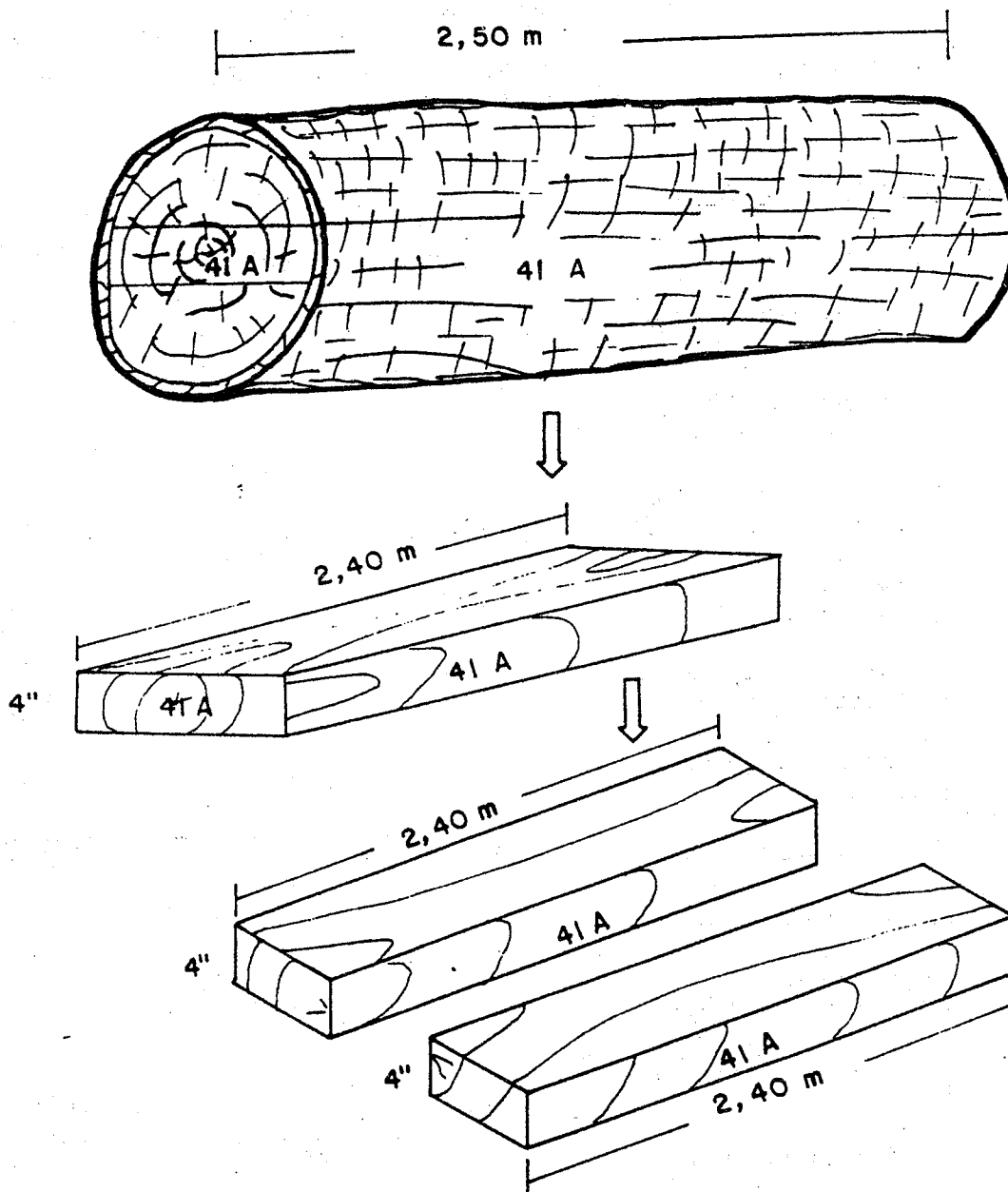
	US\$
- 10 gallons of aluminium paint	600.-
- 4 hammocks, brushes and sleeping [Sic] (4)	600.-
- Metal tags (2 sets) and hammers (2)	400.-
- Torches, lamps, batteries, boots (4)	300.-
- First-aid kit, photographic film (2)	100.-
- Compass, machetes, raincoats (4)	400.-
- Paperweight, markers, adhesive tape	65.-

SUBTOTAL US\$ 2.465.-

- Felling, transport and sawing equipment
(to be provided by the sawmilling companies
in Chaco and Chiquitania)

PROCEDURE FOR CUTTING LOG

INTO SMALLER BOARDS



IN THIS ILLUSTRATION, THE MARKING CORRESPONDS TO THE FIRST TREE OF THE SCHINOPSIS CORNUTA SPECIES.

Personnel

Current staff: 4 Forest Technicians from the CDF-Santa Cruz (2), CDF-Tarija (2) and CDF-Chuquisaca (1) for the work to be carried out in the three districts. One of the Technicians from Santa Cruz will act as Coordinator in charge of all sample gathering activities.

One Secretary, one draughtsman.

To be hired: 2 labourers to unload the boards in Santa Cruz for a period of ten days.

Cost of Project Activity

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. <u>Personnel (US\$ 3,285)</u>			
- 1 Coordinating Technician (CDF-Santa Cruz), 4 months @ US\$400/month	1,600	--	1,600
- 2 Technicians (CDF), 3 1/2 months @ US\$350/m	1,225	--	1,225
- Secretary, one month @ US\$200/month	200	--	200
- Draughtsman, 1/2 month @ US\$200/month	100	--	100
- 2 Labourers, 10 days @ US\$ 8/day		160	160
SUBTOTAL US\$	3,125	160	3,285
b. <u>Travel (US\$ 720)</u>			
- Coordinator, 6 trips @ US\$80/trip	--	480	480
- 3 CDF Technicians, 1 trip	240	--	240
SUBTOTAL US\$	240	480	720

c.	<u>DSA (US\$ 2,125)</u>			
-	3 CDF Technicians, 15 days @ US\$25/day/each	--	1,125	1,125
-	CDF Coordinator, 40 days @ US\$25/day	--	1,000	1,000
	SUBTOTAL US\$	--	2,125	2,125
d.	<u>Communications (US\$ 120)</u>			
	Total amount - US\$ 30/month	120	--	120
e.	<u>Materials and Equipment</u> (US\$ 6,465)			
-	As previously detailed	--	2,465	2,465
-	Felling, transport and sawing (by private company @ US\$ 40/log)	4,000	--	4,000
	SUBTOTAL US\$	4,000	2,465	6,465

Gathering of samples from the forest - Summary of costs

<u>ITEM</u>	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total</u>
a. Personnel	3,125	160	3,285
b. Travel	240	480	720
c. DSA	--	2,125	2,125
d. Communications	120	--	120
e. Materials and Equipment	4,000	2,465	6,465
TOTAL US\$	<u>7,485</u>	<u>5,230</u>	<u>12,715</u>

WORK SCHEDULE

<u>A C T I V I T Y</u>	<u>M O N T H S</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
- Tree marking (30 days)	_____			
- Tree felling, painting and removal (15 days)		_____		
- Sawing (15 days)			_____	
- Transport to LABONAC, Santa Cruz (15 days)				_____
- Final Report (20 days)				_____

3.7 Activity C: Preparation of Test Specimens

Specific Objective

- Preparation of test specimens according to specified standards.

Methodology

- Receiving and registering boards at the National Forest Products Laboratory in Santa Cruz.
- Sorting in groups according to tree and species.
- Resawing boards into small beams.
- Cross measuring small beams for the preparation of specimens according to the table below.
- Marking specimens according to tree codes.

<u>Test</u>	<u>Dimensions</u> (cm)	<u>No. specimens/log</u>	<u>Total No. specimens</u> <u>/species</u>
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Physical:

- Shrinking	2 x 2 x 5	2	40
- Density	2 x 2 x 2	2	40

Mechanical:

- Bending	2 x 2 x 34	2	40
- Hardness	5 x 5 x 15	2	40
- Parallel Compression	2 x 2 x 6	2	40
- Normal Compression	5 x 5 x 15	2	40
- Shearing Stress	2 x 5 x 6.3	2	40
- Tensile strength	2 x 2 x 2.8	2	40

Durability

- Laboratory	2.5 x 2.5 x 0.9	3	60*
- Material	2.5 x 5 x 50	1	20

NOTE: The last measurement of the second column was taken along the grain.

All specimens must be obtained from core wood with growth rings parallel to specimen faces, and all specimens must be free from defects. The material left over from each log must be stored in a moist place or must be covered with polythene wrapping to avoid evaporation, so that it can be used to replace any test material that has been lost or found to be defective. This stored material will also be used for the anatomical studies and to determine tannin contents.

Because the wood of Schinopsis species has a very high content of extractives, it is possible that the immersed wood may become darker after a certain period of time. Therefore, specimens and stored material must be marked with metal tags, with the appropriate number and code, immediately after they are cut.

Specimens for tests of air dried material must be stored in wooden shelves for drying and subsequent testing as required.

* Only 50 flawless specimens of each species will be sent to the Laboratory for this test.

Materials and Equipment

	<u>US\$</u>
- Flexometer, gauges or verniers (6)	150.-
- Vignettes or metal tags (2 sets), hammers	400.-
- Wood crayons, 8 dozen	80.-
- Water immersion tanks (6)	600.-
- Wooden shelves (5)	500.-
- Tools and spare parts for planer and carpentry saws (CDF)	1,000.-
- Sharpener for planer blades	3,000.-
- Forms, office supplies	200.-
- Photographic film, film developing	50.-
- Work clothes, 6 units	350.-
- Carpentry and sawing equipment (CDF)	5,000.-
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TOTAL US\$	11,330.-

Personnel

- Engineer in charge (CDF), 1 1/2 months.
- Two Technical Assistants, each on a 1-month contract.
- One Secretary, 15 days (CDF).
- Three carpenters (CDF), 1 month each.

Cost of Project Activity

	National Contrib.	External Contrib.	Total US\$
<hr/>			
a. <u>Personnel (US\$ 1,900)</u>			
- 1 Engineer in charge (CDF), 1 1/2 months @ US\$ 400/m	600	--	600
- 2 Technical Assistants, 1 month @ US\$ 300/m	--	600	600
- 3 carpenters, 1 month @ US\$ 200/m	600	--	600
- 1 Secretary, 1/2 month @ US\$ 200/m	100	--	100
SUBTOTAL US\$	1,300	600	1,900
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b. <u>Meals (US\$ 550)</u>			
[This item is included as the work will be carried out on a continuous shift basis]			
- 1 Coordinating Engineer, 30 days, @ US\$ 5/day	--	150	150
- 5 workers (2 Assistants, 3 carpenters), 20 days @ US\$ 4/day	--	400	400
SUBTOTAL US\$	--	550	550
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c. <u>Communications (US\$ 180)</u>			
Total amount - US\$ 30/m (6 months)	180	--	180
d. <u>Materials and Equipment</u> (US\$ 11,330)			
As previously detailed	5,000	6,330	11,330

Preparation of specimens - Summary of costs

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. Personnel	1,300	600	1,900
b. Meals	--	550	550
c. Communications	180	--	180
d. Materials and Equipment	5,000	6,330	11,330
TOTAL US\$	<u>6,480</u>	<u>7,480</u>	<u>13,960</u>

WORK SCHEDULE

This work schedule refers to the implementation period of each activity and not to total Project duration.

	<u>W E E K S</u>					
<u>A C T I V I T Y</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
- Preparation of control forms and gathering of material (15 days)	_____					
- Cutting of specimens (Total: 2,000 units) (20 days)		_____				
- Storing, labelling (20 days)			_____			
- Brief Final Report (6 days)					_____	

3.8 Activity D: Determining Physical and Mechanical Properties

Specific Objectives

- To determine the physical properties (apparent specific weight or density, shrinking and saturation point of fibres) of the Schinopsis species to be studied.
- To determine the mechanical strength in bending, parallel compression, perpendicular compression, shearing stress, hardness and tensile stress of the species to be studied.

a. Physical Tests

- Shrinking - according to standard	IRAM	9543
- Saturation point of fibres	IRAM	9543
- Density - according to standard	IRAM	9544

b. Mechanical Tests

- Static Bending - according to standard	IRAM	9542
- Parallel Comp. - according to standard	IRAM	9541
- Perpendic. Comp. - according to standard	ASTM	143-83
- Hardness - according to standard	IRAM	9570
- Parallel shearing - according to standard	ASTM	143-83
- Tensile strength - according to standard	ASTM	143-83

All the relevant standards are included in Annexes 1 and 2, so as to facilitate consultation during the testing stages. Preference has been given to IRAM standards because most of the available literature on the characteristics of quebracho (Schinopsis species) has been written by Argentine authors, so by using these standards we can then compare our results with those from Argentina.

All the tests will be carried out at the National Forestry Products Laboratory, Decentralised Technical Unit of the CDF, Santa Cruz.

Before carrying out the tests, all the equipment to be used will be measured and calibrated to verify the precision of the results.

For the mechanical tests, 2 specimens per tree will be tested in humid conditions and the other 2 in air dried conditions, i.e. after the storage period in wooden cases and when a weight balance has been reached (from 3-4 months for each specimen).

If an anomaly occurs during the tests or if the specimen is found to be faulty, the test will be repeated using the reserve material of the relevant species.

Materials and equipment

	<u>US\$</u>
- 1 micrometer with a precision of .01 mm	300
- 1 Breuill volumeter	600
- Crayons or wood markers (6 dozen)	60
- Gauge or vernier (1), flexometers (2)	50
- Thermo-hygrograph (1)	200
- Header and bearings for bending tests	800
- Work clothes (3 sets)	150
- 2 kg 1/2" nails, photographic film, film developing	50
- Folders, co-ordinate paper, stationary	150
- 2 kg Calcium Chloride or Phosphor Pentoxide P.A.	150
- 2 glass dryers	200
- 3 pocket calculators, 3 rulers, 3 squares	50
- AMSLER equipment for tensile strength tests	3,000
	<hr/>
TOTAL US\$	5,760

- 40-ton capacity Tinius Olsen testing press with accessories, heaters, analytical balances for mechanical and physical tests, desk calculator -
CDF contribution: 1,600 tests @ US\$ 4 /test 6,400

Personnel

- 1 Consultant/Specialist in wood technology
- 1 Coordinating Engineer (CDF)
- 1 Assistant Lab Technician (CDF)
- 1 Assistant (to be hired)
- 1 Secretary (CDF)

Cost of Project Activity

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. <u>Personnel (US\$24,000)</u>			
- 1 Consultant/Specialist, 9 months @ US\$ 1,800/m	--	16,200	16,200
- 1 Coordinating Engineer, 9 months @ US\$ 400/m	3,600	--	3,600
- 1 Assistant Lab Technician, 9 months @ US\$ 300/m	2,700	--	2,700
- 1 Assistant, 6 months @ US\$ 150/m	--	900	900
- 1 Secretary, 5 months @ US\$ 200/m	1,000	--	1,000
	<hr/>		
SUBTOTAL US\$	7,300	17,100	24,400
b. <u>Meals (US\$ 900)</u>			
[This item is included as the work will be carried out on a continuous shift basis] [Only CDF personnel is included.]			
- 1 Coordinating Engineer, 100 days @ US\$ 5 /d	--	500	500
- 1 Assistant Technician, 100 days @ US\$ 4 /d	--	400	400
	<hr/>		
SUBTOTAL US\$	--	900	900
c. <u>Communications (US\$ 270)</u>			
Total amount: US\$ 30/month	270	--	270
d. <u>Materials and Equipment</u>			
As previously detailed	6,400	5,760	12,160

Physical and mechanical tests - Summary of costs

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. Personnel	7,300	17,100	24,400
b. Meals	--	900	900
c. Communications	270	--	270
d. Materials and Equipment	6,400	5,760	12,160
TOTAL US\$	13,970	23,760	37,730

WORK SCHEDULE

This work schedule specifically refers to the activities described above and does not include the other project activities, which are described in section 3.14 below.

	<u>M O N T H S</u>								
<u>A C T I V I T Y</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
- Gauging of equipment	_____								
- Physical tests in humid conditions (15 days)	_____								
- Mechanical tests in humid conditions (26 days)	_____								
- Physical tests in dry conditions (air), (15 days)				_____					
- Mechanical tests in dry conditions (air), (35 days)				_____					
- Physical tests in dry conditions (oven), (15 days)					_____				
- Repetition of anomalous tests (10 days)						_____			
- Data processing	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>		<u>50</u>		
- Preparation of Final Report (60 days)								_____	

- The Consultant must present a paper on the work carried out at the seminar, held in month 18, upon conclusion of the project.

3.9 Activity E: Wood Anatomy Studies

Specific Objectives

- To define the macro and microscopic characteristics of the species under studied.
- To develop an identification code to differentiate the wood of the five Schinopsis species under studied.

Methodology

Because this activity will require the assistance of expert personnel, unavailable at the CDS, it is envisaged that it will be carried out with the help of the Technological Research Institute (Instituto de Pesquisas Tecnológicas), Sao Paulo State, (Brazil) as follows:

A CDF Technician, experienced in anatomic wood properties, will take a sample of two of the trees in each of the five species (a total of 10 samples) measuring 2.5 x 2.5 x 10 cm, and will take these samples to the IPT-Sao Paulo. After a short training course of 10 to 15 days, he will carry out the work required under the supervision of specialists from the Timber Division.

The work will consist in studying and describing the macro and microscopic characteristics of the wood. Once he finishes the study in Brazil he will submit a report on the results of the study.

Upon his return to Santa Cruz he will continue the study with the remaining trees of each of the species.

In Bolivia he will be assisted by a Technician from the General Directorate of Standards and Technology (Dirección General de Normas y Tecnología), who will then develop a methodology for the identification of wood to be applied at the quality control laboratory of the DGNT at La Paz.

The methodology used at the IPT for the anatomical studies will also be implemented in detail at the Santa Cruz laboratory upon the return of the Technician.

Materials and Equipment

	<u>US\$</u>
- Cost of materials at the IPT	200
- Slides, slide-seals, glass equipment, chemical reagents	200
- Microscope photographic camera	500
- Photographic film (5 rolls), film developing	200
SUBTOTAL US\$	1,100
- Wood anatomy equipment to be installed in La Paz	3,000
- Office supplies and Lab equipment (CDF contribution)	1,000

Personnel

- 1 CDF Technician with knowledge of wood anatomy.
- 1 Assistant Technician (DGNT).
- 1 Secretary (CDF).

COST OF PROJECT ACTIVITY

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. <u>Personnel (US\$ 7,350)</u>			
- 1 Technician in charge, 9 months @ US\$ 400/m	3,600	--	3,600
- 1 Assistant Technician, 9 months @ US\$ 350/m	3,150	--	3,150
- 1 Secretary, 3 months @ US\$ 200/m	600	--	600
SUBTOTAL US\$	7,350	--	7,350
b. <u>Travel (US\$ 300)</u>			
- 1 return trip SC-Sao Paulo	--	300	300
c. <u>DSA (US\$ 3,000)</u>			
- 1 Technician in Sao Paulo, 60 days @ US\$ 50/d	--	3,000	3,000

d.	<u>Communications (US\$ 360)</u>			
-	Total amount: US\$ 40/month	360	--	360
e.	<u>Materials and Equipment</u> <u>(US\$ 5,100)</u>	1,000	4,100	5,100

Wood anatomy studies - Summary of costs

	<u>National</u> <u>Contrib.</u>	<u>External</u> <u>Contrib.</u>	<u>Total</u> <u>US\$</u>
a. Personnel	7,350	--	7,350
b. Travel	--	300	300
c. DSA	--	4,200	4,200
d. Communications	360	--	360
e. Materials and Equipment	1,000	4,100	5,100
<hr/>			
TOTAL US\$	<u>8,710</u>	<u>8,600</u>	<u>17,310</u>

WORK SCHEDULE

This work schedule shows the relative duration of each of the activities described above. Section 3.14 below shows the timetable for these activities within the total project schedule.

A C T I V I T Y	M O N T H S								
	1	2	3	4	5	6	7	8	9
- Preparation of material, to be presented to the IPT (5 days)	—								
- Training of Technician at ITP (15 days)	—	—							
- Work carried out at ITP (45 days)		—	—	—					
- Continuation of activities in Santa Cruz (105 days)				—	—	—	—		
- Preparation of Final Report (90 days)							—	—	—

At the end of the Project, the designated Technician will present the results of his work at the Seminar.

3.10 Activity F: Durability Tests

Specific Objectives

- To determine the durability of the five Schinopsis species by accelerated or laboratory tests.
- To compare the results obtained at the laboratory with those obtained under natural conditions (by using wood-cemeteries).

Methodology

The accelerated or laboratory test will be performed according to standard ASTM S-2017 (See Annex 2). We have approached the IPT-Sao Paulo to enquire about the possibility of carrying out the tests at their institute and they have agreed to this proposal.

The tests will require the use of 50 flawless specimens per species, of the same dimensions as those outlined in section 3.7, and they will take 5 months to complete. The IPT was selected as the testing institution because of their experience in this field and their excellent reputation.

The natural durability tests will be performed in accordance with the recommendations of the IUFRO (International Union of Forestry Research Organizations); a detailed methodology is included in this document (see Annex 3). Two wood cemeteries will be established; one in Yacuiba, on land belonging to the CDF of Tarija, where similar tests have been previously carried out; and the other in northern Santa Cruz, near Santa Rosa del Sara, where optimal conditions exist with regards to the presence of insects and fungi; this cemetery will also be established on land belonging to the CDF.

Together with the field specimens, an additional species will be included which will be used as the control specimen. This specimen must come from a species prone to attacks by micro-organisms. The serebó (Schizolobium parahybun) species has been selected, and the specimens can be obtained at the local plywood mills (CIMAL, SOBOLMA) by using waste wood from lathe peeling operations.

Ten Serebó specimens of the same dimensions as those mentioned in section 3.7 will be planted in each of the cemeteries.

For the purposes of this study, a report on the findings will be prepared after a period of 12 months. However, the specimens will not be removed from the field -unless they have suffered serious attacks that would warrant their exclusion from the test- and will remain under observation for several years. Those specimens that have been destroyed by insects or fungi will be removed from the field.

A distribution map of the different specimens will be drawn up in both cemeteries. The specimens will be marked with tags made of aluminium, copper or some other non-rusting metal. The same metal tags used to mark specimens in section 3.7 can be used in this test.

Every two months, the cemeteries will be weeded out to avoid excessive undergrowth.

Materials and Equipment

	<u>US\$</u>
- 2 sheets of aluminium or any other non-rusting metal (1 x 1 m)	200
- 1 soil pH meter	200
- 1 pair of metal-cutting shears	30
- Machetes (4), film (4), film developing	140
TOTAL US\$	570

Personnel

- One Technician in charge, CDF-Santa Cruz.
- One Assistant Technician, CDF-Santa Cruz.
- One Assistant Technician, CDF-Yacuiba.
- Two labourers for weeding activities, CDF-Yacuiba and Santa Cruz.
- One Secretary, CDF.

Cost of Project Activity

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. <u>Personnel (US\$ 14,000)</u>			
- 1 Technician in charge, 12 months @ US\$ 400/m	4,800	--	4,800
- 2 Assistant Technicians, 12 months @ US\$ 350/m	8,400	--	8,400
- Weeding/preparation of test area, 20 days @ US\$ 10/d	--	200	200
- 1 Secretary, 3 months @ US\$ 200/m	600	--	600
SUBTOTAL US\$	13,800	200	14,000

		<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
b.	<u>Travel (US\$ 660)</u>			
-	Technician in charge, 3 trips to Yacuibá and Santa Rosa, @ US\$ 100/trip	--	300	300
-	2 Technicians, 6 trips to cemeteries @ US\$ 30/trip	--	360	360
	SUBTOTAL US\$	--	660	660
c.	<u>DSA (US\$ 1,950)</u>			
-	Technician in charge, 30 days @ US\$ 25/day	--	750	750
-	2 Assistant Technicians, 30 days @ US\$ 20/d	--	1,200	1,200
	SUBTOTAL US\$	--	1,950	1,950
d.	<u>Communications (US\$ 360)</u>			
-	Total amount: US\$ 30/m	360	--	360
e.	<u>Materials and Equipment (US\$ 570)</u>			
	As previously detailed	--	570	570

Durability tests - Summary of costs

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. Personnel	13,800	200	14,000
b. Travel	--	660	660
c. DSA	--	1,950	1,950
d. Communications	360	--	360
e. Materials and Equipment	--	570	570
<hr/>			
TOTAL US\$	14,160	3,380	17,540

WORK SCHEDULE

	<u>MONTHS</u>											
<u>A C T I V I T Y</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>
- Forwarding of samples to the IPT	—											
- Tests in IPT (laboratory), 5 months						—	—	—	—	—		
- Establishment of wood cemeteries in Yacuiba and Santa Rosa, 10 days		—	—									
- Weeding, 2 days' work each		—				—		—			—	
- Natural durability tests, 6 days inspection			—					—			—	
- Data processing						—	—	—	—	—		
- Final Report, 20 days											—	—

3.11 Activity E: Determination of tannin contents

Specific Objective

- To determine the tannin content in the five Schinopsis species under study.

Methodology

The IPT-Sao Paulo was selected as the testing institution because of their excellent reputation.

The samples from each tree will be milled and sifted into 0.250-mm particles which will then be packed, labelled and sent to the IPT for chemical analysis (Stiasny method).

The activity report should detail the work carried out in Brazil and its findings.

Materials and Services

	<u>US\$</u>
- Preparation of samples (milling, sifting, packing, labelling)	100
- Forwarding of samples	200
- Tests at IPT (50 samples) @ US\$ 40/each	2,000

Personnel

- 1 Coordinating Engineer (DGNT).
- 1 Secretary (DGNT).

Cost of Project Activity

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. <u>Personnel (US\$ 270)</u>			
- 1 Coordinating Engineer, 1/2 month @ US\$ 400/m	200	--	200
- 1 Secretary, 10 days @ US\$ 200/m	70	--	70
	<hr/>		
SUBTOTAL US\$	270	--	270

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
b. <u>Materials and Services</u> (US\$ 2,300)			
As previously detailed	300	2,000	2,300
c. <u>Communications (US\$ 120)</u>			
- Total amount: US\$ 40/month	120	--	120

Determination of tannin contents - Summary of costs

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. Personnel	270	--	270
b. Materials and Services	300	2,000	2,300
c. Communications	120	--	120
TOTAL US\$	690	2,000	2,690

WORK SCHEDULE

	<u>M O N T H S</u>		
<u>A C T I V I T Y</u>	<u>1</u>	<u>2</u>	<u>3</u>
- Preparation of samples	_____		
- Forwarding to IPT, 5 days		_____	
- Running of tests, 1 1/2		_____	
- Final Report, 15 days			_____

3.12 Activity H: Processing and Evaluation of Findings

Specific Objective

To process all the information obtained in each of the activities previously described and to evaluate the findings with regards to Project objectives.

Methodology

The information compiled for each of the Project activities will be entered into a computer for statistical data processing.

Appropriate analysis will be carried out to correlate variables and to detect possible degrees of association between the physical, mechanical, chemical, anatomical and durability properties.

The presentation of this information will include tables, figures, graphics and all other material that may help to understand and interpret the results obtained.

The following work standards will be taken into consideration:

COPANT 30: 1-018- TIMBER	"Method to determine basic unit stress".
COPANT 30: 1-011- TIMBER	"Method to carry out statistical property analysis".
COPANT 30: 1-020- TIMBER	"Classification of wood based on physical and mechanical properties".
COPANT 30: 1-013- TIMBER	"Guidelines for the presentation of the characteristics of timber species".

No further details will be provided on these standards in this document because they are well known to the CDF personnel and were applied in the PADT-REFORT Projects.

In evaluating the findings of this Project, it will be extremely useful to consult with as many texts and publications as possible on the properties of the Schinopsis species. Therefore, a list of basic available literature containing technical data on these species is provided below:

- a. GALANTE, J.J., 1953: Tecnología de las Maderas. Nigar S.R.L., Buenos Aires.
- b. KRIBS, D.A., 1968: Commercial Foreign Woods on the American Market. Dover Pub., New York.
- c. LEGNAME, R.R., 1982: Arboles indígenas del noroeste argentino. Opera Lilloana XXXIV. San Miguel de Tucumán.

- d. LOPEZ, R.A., 1973: Tecnología de la Madera. Vruña, San Miguel de Tucumán.
- e. MEYER, T. & BARKLEY, F.A., 1973: Revisión del género Schinopsis (Anacardiaceae). Lilloa, Vol. XXXIII: 11. Tucumán.
- f. RECORD, S.J. & HESS, R.W., 1943: Timbers of the New World. Yale University Press, New Haven.
- g. TINTO, J.C., 1985: Utilización de las maderas tropicales poco conocidas en la construcción de viviendas. IUFRO P. 5.01, Manaus.
- h. TORTORELLI, L.A., 1956: Maderas y bosques argentinos. ACME, Buenos Aires.

We have also asked the National Forest Institute (IFONA) in Argentina to send us all the technical publications they have produced on Schinopsis species.

This phase of the Project can be carried out in either of two places: the General Directorate of Standards and Technology or the Headquarters of the Forestry Development Center, both located in La Paz. We envisage that the equipment of the DGNT will be used.

Materials and Equipment

	<u>US\$</u>
- IBM computer (CDF or DGNT)	2,000
- Stationery, office supplies	1,000

Personnel

- 1 Consultant in wood technology, 3 months - to be hired.
- 1 CDF Technician.
- 1 Systems Analyst, 2 months - to be hired.
- 1 Secretary, CDF.

Cost of Project Activity

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. <u>Personnel (US\$ 9,700)</u>			
- 1 Consultant, 3 months @ US\$ 1,800/month	--	5,400	5,400
- 1 CDF Technician, 3 months @ US\$ 400/month	1,200	--	1,200
- 1 Systems Analyst, 3 months @ US\$ 900/m	--	2,700	2,700
- 1 Secretary, 2 months @ US\$ 200/month	400	--	400
<hr/>			
SUBTOTAL US\$	1,600	8,100	9,700
b. <u>Communications (US\$ 90)</u>			
- Total amount: US\$ 30/month	90	--	90
c. <u>Materials and Equipment (US\$ 3,000)</u>			
As previously detailed	2,000	1,000	3,000

Data processing - Summary of costs

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. Personnel	1,600	8,100	9,700
b. Communications	90	--	90
c. Materials and Equipment	2,000	1,000	3,000
<hr/>			
TOTAL US\$	3,690	9,100	12,790

WORK SCHEDULE

	<u>M O N T H S</u>		
<u>A C T I V I T Y</u>	<u>1</u>	<u>2</u>	<u>3</u>
- Data revision and codification, 15 days	_____		
- Computer data processing		_____	
- Final Report			_____

3.13 Coordination, administration and technical assistance

Specific objectives

To coordinate all Project activities, to administer funds (both national and external contributions), and to provide technical assistance for the implementation of the different activities.

Description

The organization of Project guidelines is essential in ensuring the implementation of the various work plans. The Project Coordinator will ensure the progress of all activities and will endeavour to resolve all problems that may hinder the operations, in particular, when the work is to be carried out at various locations or by different teams. The Forestry Development Center will be responsible for overall Project coordination.

The Administrator will administer the funds, allocating the appropriate amounts as required during the different implementation stages, transferring funds as needed, and ensuring that costs are kept within budget limits. The DGNT will be responsible for the administration of funds.

The Project Coordinator and the Project Administrator will establish direct contact with each of the Regional Offices of the Forestry Development Center (Santa Cruz, Tarija and Chuquisaca) to implement Project activities and to coordinate the administration of funds and technical operations.

Consultancy services for the Project will be provided by the consultants to be hired for each of the proposed activities, i.e. dendrological studies, physical and mechanical tests, processing of findings, and revision of standards for sleepers of Schinopsis species.

The participation in the Project of a world renowned company such as the SGS would greatly facilitate the achievement of Project objectives and the future update of standards for quebracho sleepers (N.B. 271-78). This company could not only provide invaluable advice on the various Project activities (physical and mechanical tests, data processing) but could also play an active role in the work of the DGNT. The participation of SGS would not involve any additional costs as the company could provide the consultants in wood technology required for the activities in sections 3.8 and 3.12.

Materials and Equipment

	<u>US\$</u>
- Stationery, office supplies, communications (to be provided by CDF and DGNT)	1,000
- Final Report	1,000
- 1 typewriter	1,000

Seminar

- Total cost - 2 days in Santa Cruz	6,000
-------------------------------------	-------

Personnel

- 1 Coordinator to be designated by the CDF.
- 1 Administrator to be designated by the DGNT.
- 1 Secretary - to be hired.
- 1 Technician/Consultant in standardization, 2 months @ US\$ 1,800/month - to be hired.
- 1 Counterpart Technician from the DGNT, 2 months.

Cost of Activity

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. <u>Personnel (US\$ 21,450)</u>			
- 1 Consultant in standardization	--	3,600	3,600
- 1 Consultant (CDF), 18 months @ US\$ 400/m	7,200	--	7,200
- 1 Administrator (DGNT), 18 months @ US\$ 350/m	6,300	--	6,300
- 1 Technician (DGNT), US\$ 350/month	750	--	750
- 1 Secretary (to be hired), 18 months @ US\$ 200/m	--	3,600	3,600
<hr/>			
SUBTOTAL US\$	14,250	7,200	21,450
b. <u>Travel (US\$ 1,440)</u>			
- 12 trips La Paz- Santa Cruz and country areas (Admin. & Coord.)	--	1,440	1,440
c. <u>DSA (US\$ 5,040)</u>			
- 6 days travel @ US\$ 70/day Total: 6 x 12 x 70	--	5,040	5,040
Expenses for the Consultants already budgeted in activities 3.5, 3.8 and 3.12 are not included here.			
d. <u>Materials (US\$ 3,000)</u>			
As previously detailed	1,000	2,000	3,000
e. <u>Communications (US\$ 540)</u>			
- Total amount: US\$ 30/month	540	--	540
f. <u>Seminar (US\$ 6,000)</u>			
As previously detailed	--	6,000	6,000

Coordination and administration - Summary of costs

	<u>National Contrib.</u>	<u>External Contrib.</u>	<u>Total US\$</u>
a. Personnel	14,250	7,200	21,450
b. Travel	--	1,440	1,440
c. DSA	--	5,040	5,040
d. Materials	1,000	2,000	3,000
e. Communications	540	--	540
f. Seminar	--	6,000	6,000
<hr/>			
TOTAL US\$	15,790	21,680	37,470

3.14 GENERAL WORK SCHEDULE

The integrated chronogram of project activities is described below. A detailed work program is included in the description of each activity.

	<u>M O N T H S</u>																	
<u>ACTIVITIES</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>
a. Dendrological studies, 12 months																		
b. Gathering of samples from the forest, 3 months																		
c. Preparation of test specimens, 6 months																		
d. Physical and mechanical tests, 9 months																		
e. Anatomical studies, 9 months																		
f. Durability tests, 12 months																		
g. Determination of tannin contents, 3 months																		
h. Processing and evaluation of findings, 3 months																		
i. Final Seminar																		

4. TOTAL PROJECT COSTS

INTRODUCTION

A detailed breakdown of costs has been included in the description of each Project activity. The following assumptions have been made in budgeting for these costs:

- That Project costs will be kept to a minimum to facilitate external funding,
- That an agreement will be reached between the CDF, the Chamber of Sleeper Producers, the DGNT and the Chiquitania Timber Producers Association, to regulate their active participation in Project activities, and
- That there are qualified professionals in the country who could be used as high-level consultants for Project activities.

Thus, we have tried to develop a realistic plan with regards to requirements (personnel, equipment, materials, work schedule, travel, etc.), as well as costs. The salaries of the consultants are considered to be appropriate and at a similar level to those of international aid organizations such as USAID/Bolivia. Obviously, any increase in the consultants' salaries would translate into an increase of costs and financial requirements in the activities concerned.

Summary of costs

ACTIVITY	National Contribution	External Cont. US\$	Total Cost US\$
a. Dendrological studies	8,160.-	29,470.-	37,630.-
b. Gathering of samples from the forest	7,485.-	5,230.-	12,715.-
c. Preparation of specimens	6,480.-	7,480.-	13,960.-
d. Physical and mechanical tests	13,970.-	23,760.-	37,730.-
e. Anatomical studies	8,710.-	8,600.-	17,310.-
f. Durability tests	14,160.-	3,380.-	17,540.-
g. Determination of tannin content	690.-	2,000.-	2,690.-
h. Data processing	3,690.-	9,100.-	12,790.-
i. Coordination, administration	15,790.-	21,680.-	37,470.-
TOTAL COST: US\$	79,135.-	110,700.-	189,835.-
%	42	58	100

5. FINANCING SOURCES

1. <u>National Contribution</u>	<u>US\$</u>	<u>%</u>
CDF Contribution	60,965	77
DGNT Contribution	11,770	15
Timber Companies (Chaco and Chiquitania)	6,400	8
Total US\$	79,135	100

The contribution of the timber companies includes gathering of field material, sawing timber into boards and their transport to the laboratory. Communications are also included in this contribution.

2. External Contribution required: US\$ 107,100 over 18 months.

3. FINANCING TIMETABLE

TOTAL US\$	1st. SEMESTER US\$	2nd. SEMESTER US\$	3rd. SEMESTER US\$
110,700	40,000	50,000	20,700
100 %	36 %	45 %	19 %

The amounts stipulated will be required at the beginning of each semester.

ADDENDUM

- In addition to the objectives and goals already mentioned in the Project document, this study aims at introducing the other Schinopsis species in the production of sleepers in order to protect one species which is currently being over-utilized (i.e. red quebracho - Schinopsis lorenzii) and in danger of depletion.
- This Project will be the first in a series of studies that the Forestry Development Center is planning to carry out in the sleeper production region. These studies will be aimed at achieving a rational and sustained utilization of these species.
- The results of this study will be submitted to the ITTO for their consideration and distribution, and can be used by other countries with similar technological characteristics.
- On page 8 of this Project document, under "Personnel", the period of employment of the Consultant in dendrology shall be reduced from 8 to 6 months. However, the total cost of this Project activity shall be maintained because the salaries for the 2 additional months shall be distributed amongst the other staff.
- On page 26, also under "Personnel", the period of employment of the Consultant in wood technology shall be reduced from 9 to 6 months. However, the total cost of this Project activity shall be maintained for the same reasons outlined above.

TECHNOLOGICAL AND DENDROLOGICAL STUDY
ON SCHINOPSIS (ANACARDIACEAE)
IN CHIQUITANIA AND THE BOLIVIAN CHACO

ADDENDUM

INTRODUCTION

This addendum takes into consideration the observations about the original project, made by the International Tropical Timber Organization (ITTO) to the Ministry of Agriculture and Rural Affairs, on May 1 of this year.

The addendum modifies the original project by incorporating new project activities aimed at obtaining currently unavailable data about the Schinopsis species that will facilitate the development of plans for the sustained yield of the Bolivian dry temperate subtropical forests. To this end, the original project objectives have been expanded to include estimates of the natural regeneration of this species and its distribution in the area under study.

JUSTIFICATION

Although the original project proposes to study five Schinopsis species, technical information is only available on one of these species, S. lorentzii, or S. red quebracho, which has been extensively studied in Argentina and Paraguay together with other Schinopsis species such as S. balansae that are not found in this country.

There are at least five Schinopsis species in Bolivia, S. lorentzii, S. haenkeana, S. globra, S. cornuta and S. brasiliensis (Meyer & Barkley, 1973); several of these species (at least the last three species) are not found in Argentina and one species, S. brasiliensis, is not likely to be found in Paraguay. For these reasons, we believe that the only way to obtain technical information about the aforementioned species would be through the implementation of a study similar to the original project proposal submitted to the ITTO. The availability of data on the natural regeneration of each species will enable us in the near future to implement sustainable forest management plans in the forests of the Chaco region.

For several years now, there has been intensive logging of Schinopsis species, especially S. lorentzii, in the Chiquitania and Chaco regions, without any control mechanisms to avoid the selective logging of these species. The objective of this project is to standardize the use of these species and avoid the selective logging of only one species. This will be achieved by targeting the group of the most abundant species that could potentially have similar uses, but that in practice are neglected as these lesser known species are considered to be inferior, although no prior studies have been undertaken to substantiate this.

This standardization will be based on appropriate technical information about technological and dendrological aspects of the species and, in this case, about the natural regeneration of the species.

It would be impossible to obtain more information at this stage as it is imperative that the required data be compiled as soon as possible because logging activities are being accelerated, the population of Bolivia is increasingly concerned about conservation issues and the rational utilization of forest resources and the technical deficiency of our national organizations is alarming. We firmly believe that with the information obtained through this project, the Forestry Development Center, the Regional Development Corporations of Tarija, Chuquisaca and Santa Cruz and the private companies, will be able to implement more realistic plans and projects on the management and utilization of the Schinopsis forests in Chiquitania and the Bolivian Chaco.

NATURAL REGENERATION ASSESSMENT STUDIES

1. OBJECTIVES

- To determine by sampling the natural regeneration rate and distribution of the different Schinopsis species found in the area under study.
- To initiate observations on the growth of trees of the Schinopsis species under natural regeneration, in sample lots scattered throughout the area under study.

2. ACTIVITIES

- It is envisaged that a forester from the Forestry Development Centre will be employed to coordinate activities with an expert in dendrology, as it is essential to correctly identify the different species of trees in their stages of development: seedling, sapling and/or adult.
- At least five sample lots will be established with an area of 1,000 m² each (square areas of 31.63m x 31.63m); in the sites selected for tree marking. The boundaries of these lots will be marked with stakes painted in clearly visible colours (red, yellow). The sample lots will be established in areas not affected by the tree removal operations for this project.
- Observations will be made in each lot about the species, tree height, location, height above sea level, soil type (samples will be taken for chemical analysis) and a plan or a sketch of the lot will be prepared which will indicate the location of all the species in the lot so as to facilitate future observations. Finally, a map will be drawn up showing the location of all the samples in the area under study.
- Tree heights will be measured at the same time as the dendrologist will carry out the phenological observations and a final measurement will be taken one year after the lot is established. The Forestry Development Center may wish to continue these observations indefinitely in their own interest.

3. MATERIALS REQUIRED

- Stakes, approx. 200 units @ US\$ 1	US\$ 2,000
- Paint, graded rulers	US\$ 500
- Office equipment	US\$ 400
- Hammocks, sleeping bags	US\$ 200
- Compass, plastic bags	US\$ 200
- First aid kit	US\$ 200
- Photographic film, film developing	US\$ 100
- Machetes, boots, helmets	US\$ 300
Total	US\$ 3,900

4. PROJECT COSTS

	<u>NATIONAL CONTRIBUTION</u>	<u>EXTERNAL CONTRIBUTION</u>	<u>TOTAL US\$</u>
<u>a.-Personnel</u>			
- Forestry technician 8 months @ US\$500/m	4,000		4,000
- Secretary 4 months @ US\$200/m	800		800
- Draughtsman 2 months @ US\$200/m	400		400
- 2 workers 6 months @ US\$ 140/m	30	1,650	1,680
Total US\$	<u>5,239</u>	<u>1,650</u>	<u>6,880</u>
<u>b.-Tickets</u>			
-12 Tickets	1,000	1,000	2,000
<u>c.-DSA</u>			
-90 days @ US\$35/d		3,150	3,150
<u>d.-Services</u>			
-Soil chem. analysis	1,000	1,000	2,000

e.-Communications

-Total amount;

12 months @ US\$30/m 360 360

f.-Materials

-As per previous
schedule

1,500 2,400 3,900

NATURAL REGENERATION

SUMMARY OF COSTS

	<u>NATIONAL CONTRIBUTION</u>	<u>ITTO CONTRIBUTION</u>	<u>TOTAL US\$</u>
a.- <u>Personnel</u>	5,230	1,650	6,880
b.- <u>Tickets</u>	1,000	1,000	2,000
c.- <u>DSA</u>		3,150	3,150
d.- <u>Services</u>	1,000	1,000	2,000
e.- <u>Communications</u>	360		360
f.- <u>Materials</u>	1,500	2,400	3,900
Total US\$	9,090	9,200	18,290

5.-SCHEDULE OF ACTIVITIES

A C T I V I T Y	M O N T H												
	1	2	3	4	5	6	7	8	9	10	11	12	13
- Preparation of Work Plan (15 days)	----												
- Selection of sampling sites, sampling; 8 days/site	-----												
- Observation of tree growth rates; 5 days/month over 11 months													
- Drafting of final report (2 months)												----	
- Seminar (1 day, at the end of the project)													

The following tables include a summary of total project costs and a proposed financing timetable.

(REVISED) TOTAL PROJECT COSTS

	<u>NAT. CONTRIB.</u>	<u>EXT. CONTRIB.</u>	<u>TOTAL US\$</u>
Initial cost	79,135	110,700	189,835
Cost additional activ.	9,090	9,200	18,290
Total cost	88,225	119,900	208,125
%	42%	58%	100%

FINANCING TIMETABLE

<u>TOTAL</u>	<u>1st SEMESTER US\$</u>	<u>2nd SEMESTER US\$</u>	<u>3rd SEMESTER US\$</u>
119,900	43,164	53,955	22,781
100%	36%	45%	19%

The amounts stipulated will be required at the beginning of each semester.

La Paz, March 1991