REPORT ON PRELIMINARY SURVEY ON FORESTRY RESOURCES IN HONDURAS

February 1981

Japan International Cooperation Agency
(J.I.C.A)

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PREFACE

It is with great pleasure that I present this report on the Prefeasibility Study, for Forest Inventory to the Government of the Republic of Honduras.

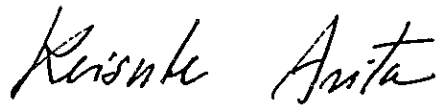
This report exbodies the results of a study which was carried out in the LA MOSQUITIA and EL PARAISO areas, of Honduras from January 25 to February 15, 1980 by Japanese survey team commissioned by the Japan International Copperation Agency following the request of the Gøvernment of Honduras.

The survey team, headed by Mr. Datsuhiro Kotari, Special Assistant to the President of JICA, had a series of discussions with the relevant officials of the Government of Honduras and conducted an extensive field survey and data analyses.

I sincerely hope that this report will be useful as a basic reference for development of the forest resources in Hondurea.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Honduras for the close cooperation thees extended to the Japanese team.

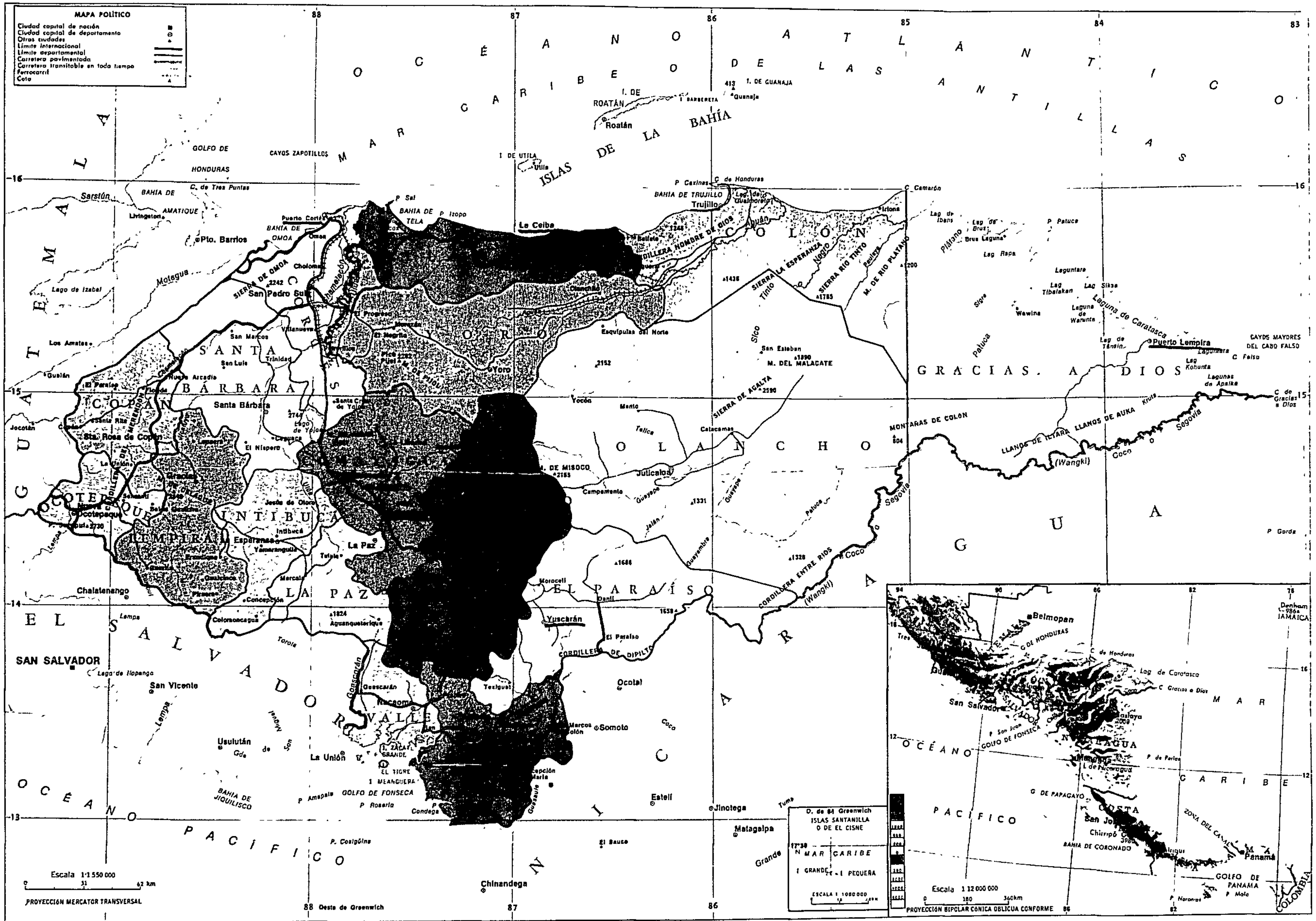
February, 1981



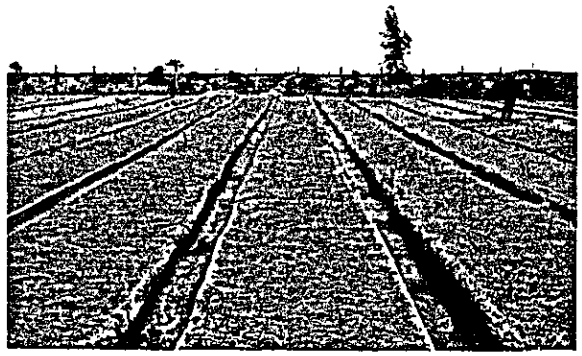
Keisuke Arita

President

Japan International Cooperation Agency



Solitary wood near Teupasenti,
El Papaiso



Nursery at Puerto Lempira,
Mosquitia

Pineries at Rus-Rus Project area,
Mosquitia

Pine wood plantation on the
outskirts of Puerto Lemira,
Mosquitia

Savanna wood plantation in
Puerto Limpira Project area,
Mosquitia

Natural Regeneration in Mosquitia

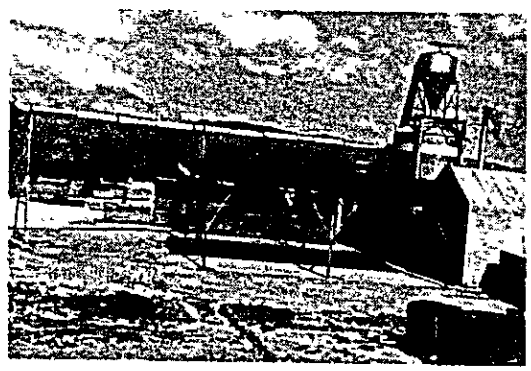
Survey schedule with CONSUPLANE and COHDEFOR

Practice wood of Esnacifor (The college of forestry)

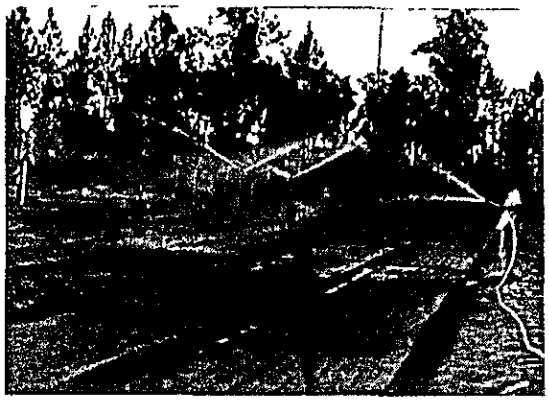
Seed growing in Rajas Project area, Comayagua

Wood in the outskirts of Rajas, Comayagua

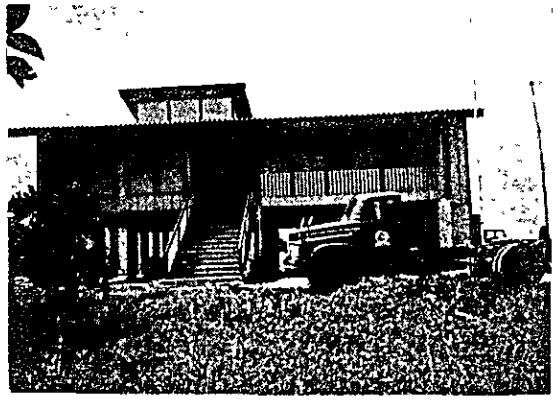
Lumbering at Casisa



Lumbering at Casisa

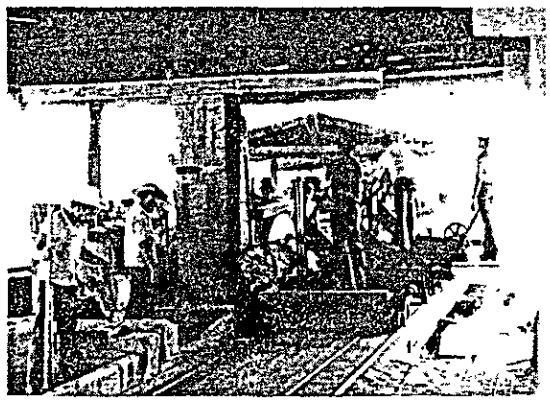


Nursery of Dursuna Project Group, Mosquitia

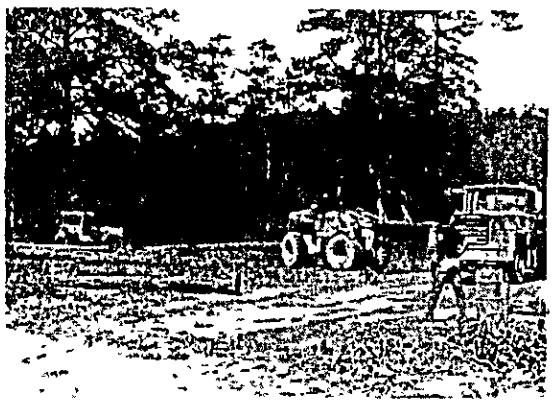


Regional Forestry Office of Puerto Lempira, Mosquitia

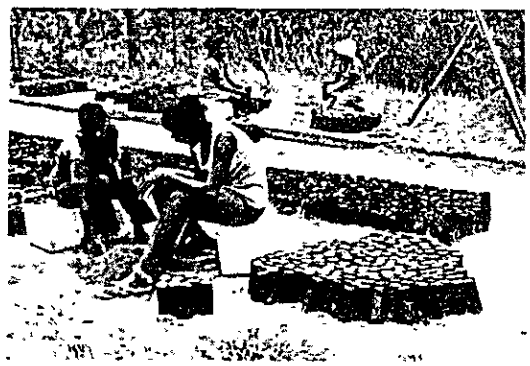
Dursuna Project Office, Mosquitia



Old-fashioned lumbering at Comayagua



Logging at Rajas, Comayagua



Filling of pot soil in Rajas, Comayagua

REPORT ON PRELIMINARY SURVEY ON FORESTRY RESOURCES IN HONDURAS

CONTENTS

CHAPTER I PURPOSES AND OBJECTIVES OF THE SURVEY

1. Purposes

Honduras is a country, the greater part of which is clad with forests. Yet the forestry industry there is still at an undeveloped stage. Other than forestal resources, Honduras has no particular natural resources to speak of, and it is evident that the future economic growth of the country will be heavily dependent upon the development and husbandry of its forestal resources.

Against this background, the Honduranean Government requested the Japanese Government to extend cooperation in a forestal resources development survey in El Paraiso and La Mosquitia. In response to this request, the Japanese Government entrusted the Japan International Cooperation Agency with the task of discussing with the Honduranean Goverment agencies concerned the feasibility of Japan's cooperation in the stocktaking survey of forestal resources at the proposed sites, master planning of forestal resources development, the scope and particulars of cooperation, and the readiness of Honduras to accommodate Japan's cooperation team, etc. and of conduction a preliminary field survey and data colloection at the proposed two sites.

Fully realizing the significance of the mission assigned to it, the Japan International Cooperation Agency organized a five-member survey team, headed by Mr. Kotari, and dispatched it to Honduras during the period from January 25 to February 15, 1980.

2. Staff Member and Itinerary of the Survey

(1) Staff member of the survey

Assignment Name	Position
1. Leader Mr. Katsuhiro KOTARI	Special Assistant, Japan International Cooperation Agency
2. Cooperation Planning Mr. Noriyuki ANTOJI	Senior Forestry Planning Officer, Forestry Planning Div., Private Forestry Department, Forestry Agency
3. Forest Survey Dr. Eisho OHTOMO	Permanent Staff Enginner, Japan Overseas Forestry Consultants, Association Ex-Forestry Management Director, Forestry and Forest Products Research Institute, Forestry Agency Ex-professor, Tokyo Agriculture and Engineering University
4. Aerial Photograph Mr. Ei TANOMOTO	Permanent Staff Engineer, Japan Overseas Forestry Consultants Association
5. Coordinater Mr. Toshiharu KAI	Staff, Forestry Development Div., Forestry Development Cooperation Department, JICA

(2) Itinerary

No.	Date	Scedule
1	Jan. 25, Fri.	Left Tokyo for Mexico City.
2	Jan. 26, Sat.	Left Mexico City for Tegucigalpa.
3	Jan.27, Sun.	Met with First Secretary Ito, of the Japanese Embassy, for arrangements.
4	Jan. 28, Mon.	Paid a courtesy call at the Japanese Embassy, and made arrangements. Paid a courtesy call at CONSUPLANE (Economic Planning Agency), and held discussions. Made arrangements with COHDEFOR (Forestry Development Authority).
5	Jan. 29, Tue.	Discussed with COHDEFOR the survey schedule and the terms of reference.
6	Jan. 30, Wed.	Inspected ESNACIFOR (Forestry Techinical High School), Siquateque, and its demonstration forest. Inspected the CASISA Lumbermill.
7	Jan. 31, Thu.	Inspected the forests at COHDEFOR's Lajas Camp. Made arrangements with the Camayague Regional Forestry Office for a forest survey.
8	Feb. 1, Fri.	Made arrangements with COHDEFOR about a forest survey. Received COHDEFOR's briefing on the on-going forestry projects and the forestry administration system in Honduras.
9	Feb. 2, Sat.	Prepared for field survey in La Mosquitia.
10	Feb. 3, Sun.	Free
11	Feb. 4, Mon.	Left Tegucigalpa for La Mosquitia. Made arrangements for forest survey with the Puerto Lempira Regional Forestry Office. Field survey at Dursuna.
12	Feb. 5, Tue.	Field survey at Rus Rus.

No.	Date	Schedule
13	Feb. 6, Wed.	Made arrangements with the Puerto Lempira Regional Forestry Office. Left La Mosquitia for Tegucigalpa.
14	Feb. 7, Thu.	Left Tegucigalpa for El Paraiso. Made arrangements for forest survey with the Danli Regional Foresty Office. Inspected sawmills at Los Almendros.
15	Feb. 8, Fri.	Visited the Teupasenti Camp, and conducted a field survey of forests.
16	Feb. 9, Sat.	Colloected survey data, and prepared interim report.
17	Feb. 10, Sun.	Made arrangements with First Secretary Ito (Japanese Embassy) about the preparation of the interim report.
18	Feb. 11, Mon.	Made arrangements with COHDEFOR about the survey data collection. Submitted the interim report to CONSUPLANE.
19	Feb. 12. Tue.	Made arrangements with COHDEFOR about the survey data collection. Collected and organized the survey data.
20	Feb. 13, Wed.	Left Tegucigalpa for Mexico City.
21	Feb. 14, Thu.	Left Mexico City.
22	Feb. 15, Fri.	Arrived at Tokyo.

CHAPTER II FORESTRY RESOURCES AND FORESTRY INDUSTRY IN HONDURAS

1. Outline of Forestry Resources in Honduras

1-1 Distribution of forests

Honduras has a total land area of about 11,2000,000 ha of which about 2,900,000 ha is accounted for by agricultural land such as farms, pomicultural yards, and grasslands, about 7,100,000 ha by forests, and 1,200,000 ha by others.

Forests account for as much as 63% of the total area, compared with theworld average of 31%. Forests cover almost the entire land, and are classified largely into pine forests and tropical rain forests (broad-leaved trees).

Pine forests are seen mainiy in the central region, western mountainous region and the Mosquitea region bordering on Nicaragua in the east. These forests include coppices in savannahs, tall stands, pure pine stands, and stands mingled with broad-leaved trees like Quercus. Sparse groves of pine trees are prevalent.
The Total area of pine forests is about 2,700,000 ha, or about 40% of the total woodland.

In Honduras, the majority of forestry production is dependent of logging of the pine forests, In addition, the export of logs hold is the third lorgest export trade of the country.

In view of this, the forestry resources, led by pine threes, are ranked highly in the portofolio of the capital assets for the socioeconomic development of the country.

The deciduous forests amount to about 4,400,000 ha, and are seen primarily in the zone stretching from the Caribbean coast (longitude 84°30' W) to the boundary with Nicaragua (longitude 86° W) and along the northern coastal zone, and partly in the backwoods lying west of the central region.

Most of the deciduous forests are ombrogenous selvas.
In the eastern region which has the largest broad-leaved tree potential in Honduras, forestry develpoment has just begun, and the reserves have yet to be clarified. But, the eastern region is estimated to have about 4,100,000 ha of broad-leaved forests, and about 3,000,000 ha of mangroves and swamp forests.

As these are tropical rain forests, the kinds of trees are many. Of them, the useful trees include mahogany, cedro, and walnut. According to the "Latin American Timber Trends and Prospects, 1963" prepared by FAO, the total forestry inventory in Honduras is said to be 1,035 million m^3 in terms of felling volume.

But, according to FAO's survey of the pine forests in Honduras, the felling volume is about 60 m^3 per ha. According to these values, it is calculated that the broadleaved forests and the pine forests less the pine forests surveyed by FAO will have a felling volume of nearly 200 m^3 per ha. It is difficult to judge whether the alleged total inventory of 1,035 mil. m^3 is correct.

1-2 Pine forests in Honduras

In Honduras, the pine forests hold the most important slot in the profile of forestry resources.

The pine trees in Honduras are rich in resin and comparatively hard. Commercially, they are well known as Honduran Yellow Pine or in Europe as Pitch Pine.

The following three subspecies of pine tree are available in Honduras.

(I) Pinus Caribaea

Grows 100 to 400 m above sea level.
The branches spread out and upward at acute angles.
Even in a thick wood, branches remain up to the middle of the trunk.
The needle leaves usually are borne in fascicles of three.

(2) Pinus Oocarpa

Grows 700 to 1,500 m above seal level.
The branches spread out and upward at acute angles, but droop the farther they are away from the trunk, forming an archlike pattern.
The branches of an adult tree, which grow from bottom up to a little above the middle portion, are fugacious.
The leaves are borne in fascicles of four to five.

(3) Pinus Pseudostrobus

Grows 1,400 to 2,800 m above sea level.
The branches have cauliflower-like structure usually, the branches up to two thirds of the tree height fall off. Young trees exhibit smooth bark.

These pines are distributed differently according to local conditions, particularly elevation. In the Mosquitia region in the eastern lowlands, Pinus Caribaea is seen. In the mountain forests in the central and western regiouns, Pinus Oocarpa is prevalent. In the highlands, Pinus Pseudostrrobus is observed, and Pinus Caribae is also seen locally on comparatively low hills.
In the central and western mountainous regions, Pinus Oocarpa accounts for 70 to 90% of the silva.

While the Orica and Olancho regiouns are said to have the largest and thickest pine forests, they are found to have sparse groves with a comparatively small volume.

At present, the stocktaking survey of pine resources has been pushed forward by COHDEFOR under the assistancs of FAO and other organization, and it will take some time now until the general profile is brought to light.

But, the pine forest survey conducted by the FAO in the early 1960s offers a rough sketch of the pine silva. In the FA'Os survey, 2,160,000 ha out of a total 2,700,000 ha pine forests was investigated, and was found to have 134 million m^3 in volume or about 60 m^3 per ha.

In the Orica region where it is claimed that there are many excellent stands, the volume per ha is 110 m^3. In the high-density stands in the Olancho region, the volume is as high as 98 m^3 per ha. In the Mosquitia region, on the other hand, the volume is as low as 20 m^3 per ha.

As regards the growth potential, the mean annual growth is no more than 2.5 to 3.0 m^3 per ha because of the predominance of the trees in their senescence and because the stand density is low.
In the closed stands, the annual growth is expected to be 6.0 m^3 per ha where the fertility of soil is medium, and 8.5 to 11.0 m^3 Per ha where the fertility is high.

According to COHDEFOR's plotting survey over the past four years, the stand volume is 160 m^3 per ha max., and 30 m^3 per ha, or 70 m^3 per ha on the average, and the volumetric annual growth rate is 20 m^3 per ha max., 3 m^3 per ha min.,
or 7 m^3 per ha on the average.

Total deforrestation is rarely practived. The standing trees of commercial value only are felled selectively.
Afforestation is not Practised.

The floor condition is favorable with the undergrowth made up chiefly of her age. The growth of natural young trees is favorable. In almost all cases, replacement is carried out by natural seeding.

Weeding is not performed because the height of herbage is low. However, the care of weedy young trees by selective felling or thinning is important.

While the pine forests are favorable not only in growth, but also in reproduction through natural seedling, the general state of stands is not always acceptable.
This is because forest fires and pests run havoc annually. Yearly, 20 to 50% of pine forests meet fires, damaging the seedlings and saplings and checking regeneration. At the same time, the adolescent trees are checked from further growth or killed by fire. The damage due to borers is inveterate, degrading the guality of timber.

In recognition of the forest resources as a mainstay for the economin growth of Honduras, the Corporacion Hondurena De Desarrollo Forestel (COHDEFOR) was established in 1974 to administer siliviculture in Honduras.

COHDEFOR has taken up the prevention of forest fire as one of its most important projects, and has been pursuing counter measures with energy. As a result, the incidence of forest fires has been on the decline. With the progress of COHDEFOR's campaign, the quality of pine forests will be improved greatly.

2. Forestry Policies and Forestry Operations

2-1 Significance of forest resources in Honduras

In Honduras, forests cover 63% of the total land area. The yields of the forests are ranked third on the list of exports from Hondras.

The pine forests are seen in the undulating hilly terrain where the soil conditions are not suitable for agriculture, and which should preferably be preserved for forestry for the husbandry of national land.

These woolands leave little room for the development of industries other than forestry, primarily because of poor chorographical conditions.

All told, the forests have a a great bearing on the socioeconomic deyelopment of Honduras. Corrently, the forests in Honduras are not well.

There are many overdeforrestated areas and many stands which are left a little worse for wear owing to frequent fires and pest damage.
If the situation is left to take care of it selfthe forests will continue to be devastated, affecting not only the forestry industry, but also the management of catchment areas, agricultural operations, and the socieoeconomic conditions of local comunities.

In line with the belief that keeping the forests in good shape is most urgent, various forestyr operations are being promoted to provide a foothold noward the harnessing of forest resources.

2-2 Forestry low

In Honduras, the basic rules concerning the forests are compiled in the forestry law (1972, No. 85) which superseded the forestry law established in 1961.

In 1974, the law concerning the Corporacion Hondurena de Desarrollo Forestel was establishied to concentrate all the managerial and operational functions. Thus, the coverage of the forestry law is de facto reduced by some degree.
The current forestry law is outlined as follows.
The powers of the Forestry Administration Bureau have been transferred to COHDEFOR.

(1) Purposes and objectiyes

a. To maximize the capabilities of the forests.
b. To maintain and upgrade the forests.
c. To promote the rationalization of production, processing and marketing of forest products.

To achieye these aims, the following objectives are set forth.

a. To maintain, foster and rehabilitate the forest resuources.
b. To promote the diyersification of the uses of forests.
c. To make the most use of the forests assigned.
d. To rationalize production, processing, maketing and consumption for husbandry of forest resources.

In order to attain these objectives, the programs are formulated for the following goals.

a. To upgrade the administrative and technical abilities of the forestry administrative authorities.

b. To maintain and manage the unassignable public forests.

c. To control forestry activities in public forests and the areas adjoining them, and to control activities in private forests as required from the viewpoint of the public good.

d. To provide incentive measures for the promotion and encouragement of forestry industry.

(2) Executive organization

The power of administering the forestry law resides in the Natural Resources Department, and the forestry administration bureau installed in it is ecforcing the low.

(3) Classification of forests

a. The forests are classified by tenancy as follows.

(i) Public forests

(1) State-owned forests.

(2) Municipal forests.

(ii) Private forests

(1) Forests owned by natural or legal persons, and not protected by state.

(2) Coparcenary trust forests owned by tribes and put under the protection of state.

b. The forests are classified by used as follows.

(i) Reserved forests The forests earmaked for the purpose of maintaining the fundamental, limnological conditionsn, and soil conditions.

(ii) Extractive forests

Forests classified according to economic value.

(iii) Other public forests

Those public forests not coming under categories (i) and (ii) above.

(iv) Other private forests

Those private forests not coming under categories (i) and (ii) above.

When the forests are designated as reserved or extractive forests, some limitations and obligations designed from the viewpoint of public utility and necessities are binding and inure to their owners or interests.

In the forestry law, the state-owned forests refer to (a) the forests owned by the state; (b) forests declared by the state legally and (c) forests not preempted by any person, whether natural or legal.

The municipal forests also follow the same rule as above.

(4) Inventory of unassignable public forests

The forestry Administration Bureau prepares and keeps and inventory of unassignable public forests.

The inventory is an official record required for administration on a working level, and includes all the reserved forests and the extractive forests designated to be filled in on the inventory.

Once the forests are on this list, the following are put into effect.

(a) The forests listed are qualified to be public.

(b) The title or principal right ot the forests listed is transferred to state or municipal government by eminent domain without detriment to the rights and interests legally owned by natural and legal persons.

(c) The term dueing which the state or municipal government are capable of holding such forests is unlimited.

(d) Others (omitted)

(Remarks: Even after the establishment of the law concerning COHDEFOR, the above still remains in force, COHDEFOR has been chartered for unitary management and operations of the forests in Honduras, and may have already been entrusted with the task of preparing and keeping the inventory of unassignable public forests.

The survey team could not investigate how the inventory is used or

related to forestry management by COHDEFOR.)

(5) Protection of forests

a. As regards the reserved forests, any activities that may lead to change or alteration of the fundament, vagetation, wildlife, ecosystem, soil, or to the shortage of groung water are banned except when approved by or conducted under direct control of, the Forestry Administration Burea.

b. As regards the extractive forests, particulary those which are intended for basic industrial purposes, the Forestry Administration Bureau will provide measures with emphasis the prevention and control of forest fires and pests.

c. For the purpose of the prevention of forest fires, fire prevention and control programs are incorporated in the form of provisions in the extraction permits or supply contracts in order to clarify the responsibilities to be shared between the government and beneficiaries.

d. Firebreaks and fuel breaks are designated throughout the country, and the owners or beneficiaries referred to above are required ro provide proper fire preventive measures at their own expense.

e. The Forestry Administration Bureau organizes fire control establishments.

f. A Forest Preservation Cimmittee is organized for determination and adjustment of measures concerning forest preservation.

g. In case of an epiphytotic or a pandemic of vermin, a state of forest emergency is declared so that the proper measures and adctions may be taken.

h. Reforestation is promoted.

i. The slash-and-burn method of agriculture is contingent upon the approval of the Forestry Administration Bureau, provided that in no case the woodland for the purpose shall have a slope of more than 15°.

(Designation of national parks)

Places with landscapes of high value are designated as national parks, and administratively handled as special reserved forests.

(6) Use of forests

a. In any public forests, any felling or logging operations are banned, except as permitted by the state. The prescribed felling and logging operations are permitted in the form of;

(1) Open bidding, (2) forest products supply contract, (3) large-scale development permit, and (4) convession.

b. Those who wish to engage in felling, logging and processing of forest products are required to file with the Forestry Administration Bureau for approval and registration.
The Forestry Administration Bureau reviews the licensees and renews the business licenses.
Unless granted a license, any person is precluded from being engaged in forestry undertakings.

2-3 Forestry management by COHDEFOR

(1) Establishment of Corporacion Hondurena de Desarrollo Forestal (COHDEFOR)

In 1974, the Corporaciton Hondurena de Desarrollo Forestal (COHDEFOR) was established pursuant to law No. 103. Since then, the management and operation of the forests in Honduras are undertaken by CHODEFOR. The rationale of law No. 103 was pressented at a Cabinet meeting as follows.

(a) The forests are the single largest natural resource on which Honduras is dependent.
Nevertheless, the forest resources have so far been exploited in an inefficient laissez-faire way. As a result, a large portion of the forestland has been left dilapilated at the cost of national economy.

(b) Unless the destructive exploitation of the forests is checked, the forest resources will be destroyed totally, and in a few years to come, may detract largely from the development potential of agriculture,
livestock rearing industry and manufacturing industry,
depriving the country of an important foothold for socio-economic development.

(c) From the viewpoint of national na dpublic interests, the government is of the opinion that it should control and protect the forest resources for husbandry in a bid for the maximum socio-economic benefits.

(d) So that the government can work effectively to this end, it is necessary to establish proper administrative laws, regulations and systems and at the same time to provide pertinent financial controls.
Baised on these reasons, COHDEFOR was established as a special incorporated organization belonging to the Natural Resources Department and being the property of the nation.

COHDEFOR was capitalized at 3 million Lempiras (1 US$ = 2 Lempiras) initially, and is permitted to increase its capital by making use of the assets to be transferred from the government, the proceeeds from its investments and operations, interest on deposit accounts, contributions, loans, etc.

(2) Undertakings

In Honduras, from the management and operation of forests to the felling, logging and milling and even to the marketing, there is nothing under which any part of the forestry business is governed and which does not have to do with the control of COHDEFOR established under the low of COLHDEFOR.
In fact, the forestry in Honduras is put in the hands of, and integrated around CHODEFOR.
Thus, COHDEFOR is the logical source of information regarding forestry management in Honduras.

According to its charter, CHODEFOR is required to make every effort for the purpose of making the mose of ofrest resources, protecting, improving, preserving and growing the forests, and raising funds for national projects of socio-economic development in Honduras.

In line with this colossal purpose, CHODEFOR Undertakes the following.

a. To manage and control all the public and private forests, and to engage in the protection and reproduction of forests,

felling and logging, processing, marketing and use of forest products.

b. To directly undertake, or commission a semigovernment enterprise or a purely private enterprise, agricultural cooperatives, etc.
to undertake, felling and logging, sawing, reservation, resin extraciton, and destillation.
In this case, the stumpage is felled, logged and hauled to the sawmills, and the export and wholesale of sawmill products and the sale of resin extracts are monopolized by COHDEFOR.

Where the privately owned forests are subjected to logging, their owners are paid for the products yielded.

COHDEFOR or other similar national agencies are required to have a 51% or more capital share in any of forestry businesses deemed essential to the national socio-economic development. Foreign investors are welcome, but their capital investment share in any business is required to be less than 49%.

In line with these objectives, COHDEFOR performs, among others, the following tasks.

a. To excute the administrative authority stipulated in the forestry law in lieu of the Forestry Administration Bureau. (According to this authorization, COHDEFOR is empowered not only as an executive organization, but also as a cognizant and accrediting organization.)

b. To conduct silvicultural, industrial and commercial surveys for forestry development, to upgrade the state of the forestry technigues COHDEFOR itself, and to make every effort to improve, productivity and karket conditions.

c. To protect the forests against fire, insect depredation and soil erosion.

d. To promote the application of technologies neccessary for proper land use.

e. To undertake civil engineering work for the protection and management of river system.

f. To install an operate engineerling outfits and trading houses for forestry, and invest in them as required.

g. To extend loans to, or stand surety for, businesses authorized to extract forest products.

h. To arrange loan agreements with local and foreign financial institutions.

i. To issue bonds.

j. To promote all other functions necessary in the performance of the duties assigned to COHEFOR.

At present, forestry in Honduras centers on pine forests, and the exploitation of broadleaved trees has just begun.
Accordingly, the operations of COHDEFOR also revolve round the pine forests.
The pine forests are compartmentalized into intensive and extensive farms for constructive forest perpetuation.
In the internsive tree farms, COHDEFOR has been conducting intensively in a planned manner the felling, logging, reproduction, reforestation, construction of logging rads, harvest control, provention and control of forest fire, resin extraciton, collection of seeds, etc. These activities have been amplified year after year to convert the extensive farms into intensive ones.

(As a link of the measures against forest fire(to be discussed later), 2,377,000 ha of protected areas, including pine forsts, are marked out, and are divided into 704,000 ha of intensive protected areas and 1,633,000 ha of extensive protected areas for efficient expenditure of fire prevention and control efforts.

These divided areas will probably, if not definitely, be identified with the operational areas referred to above)

(3) Organization

The supreme function of COHDEFOR if the administrative council, headed by the president of the Republic of Honduras, and consisting of the ministers of National Defense, Economy, Natural Resources and Finance, and the director of the Economic Planning Agency.

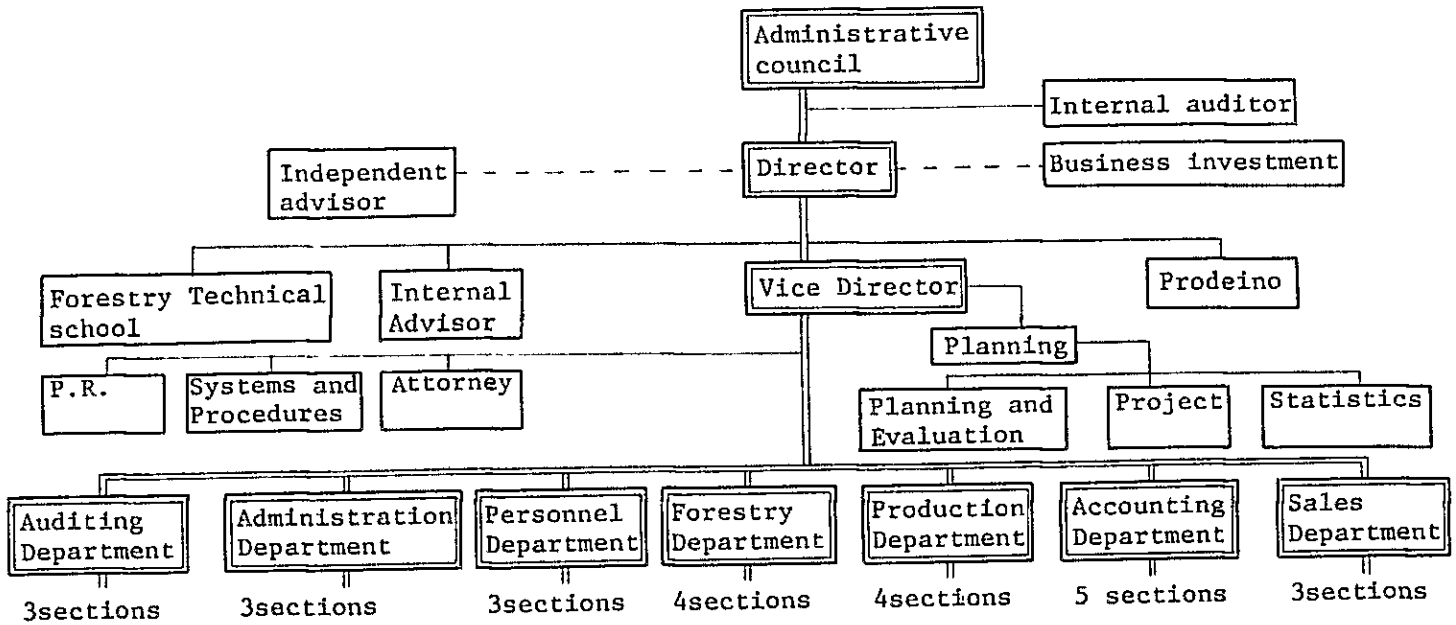
The major functions of the Council include the review and approval of the basic policies and plans of COHDEFOR, supervision of administrative and operational activities, the appointment and dismissal of officials, review and approval of annual projects and budgets, and review and approval of financial statements.

The organizaion of COHDEFOR ia as shown in Figs. II-1 and II-2. It is presided over by the director, and is divided into seven departments and twenty-five sections.

It also ahsa local administrative network with eight regional forestry offices and twenty-nine local work offices.

(See Fig II-3)

The number of officials is about 2,300, of which some 400 are on the central extensive staff. The remaining 1,900 are assigned throughout the local network.



Notes (1) Invested companies

CASISA
SEMSA
CORFINO
FIAFSA
Mad. Locoma pa S.A.de C.V.
PROMASA
TROPLAY S/A
IWPSA
RESIHOW S.A.
PROIMSA

(2) PRODEINO

(3) Staff ——
Line ═══

Fig. II-1 COHDEFOR organization

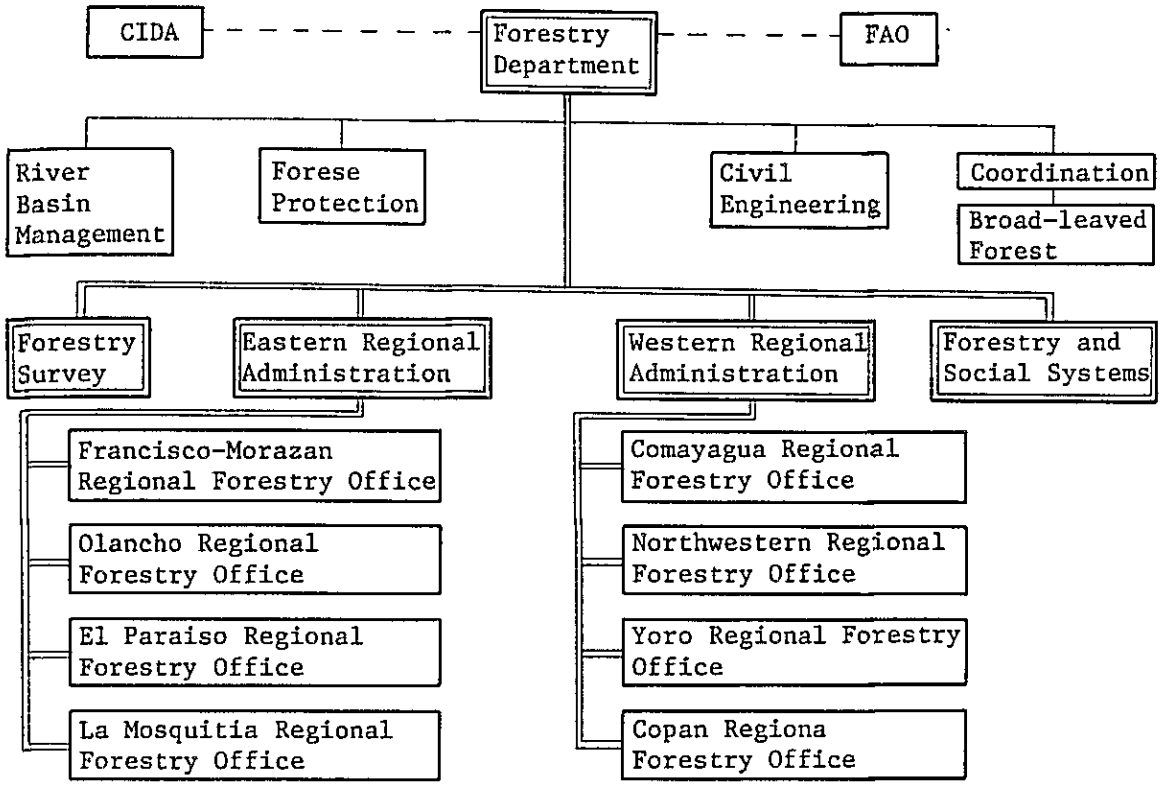


Fig. II-2 Organization of Forestry Department

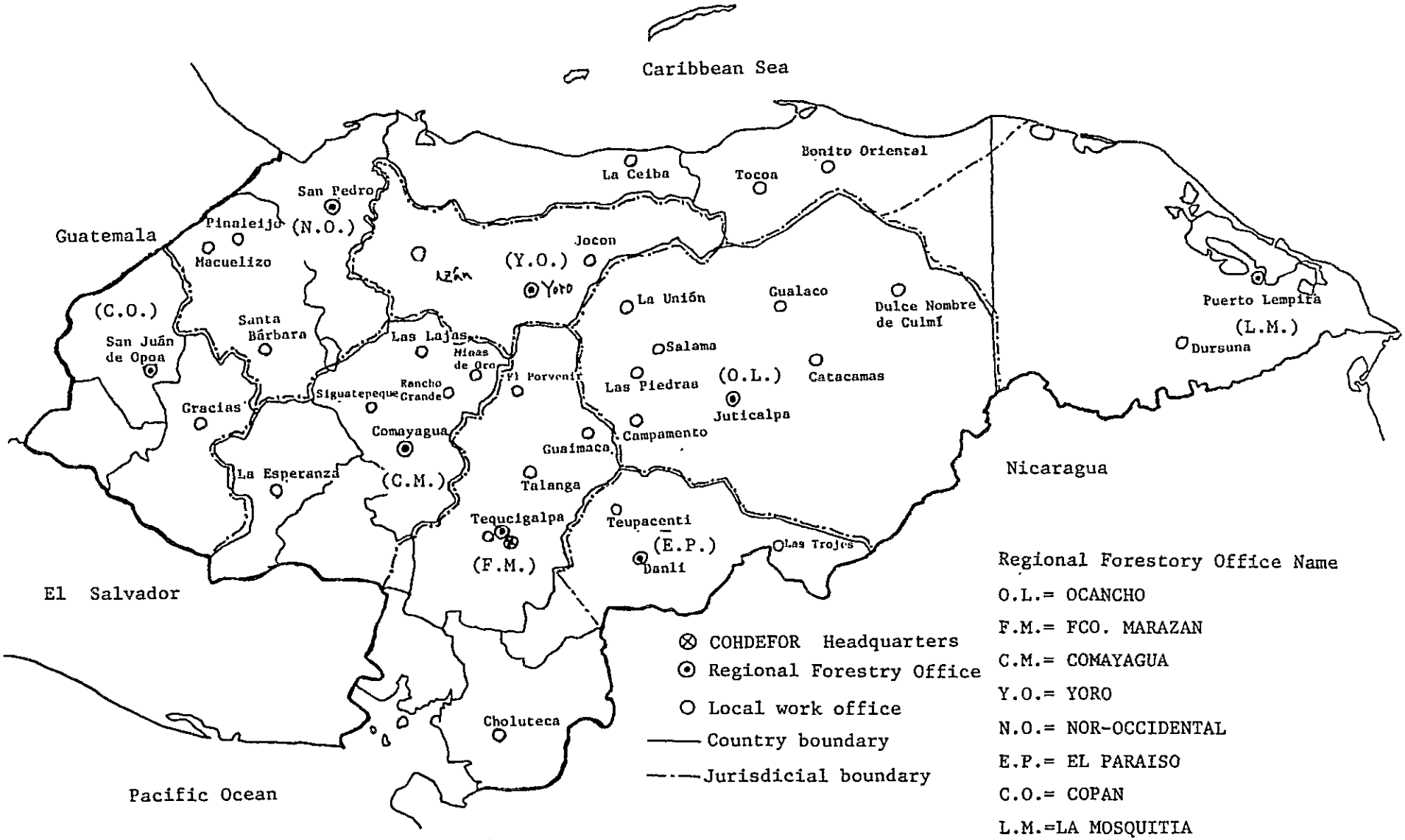


Fig. II-3 Distribution of COHDEFOR regional forestry offices and work offices

(4) Forestry and social systems

In Honduras, the forests have been run down by major disasters, such as conflagration, and have been left decrepit for many years.

In order to develop a healthy forestry industry and to develop local communities, it is a matter of urgency to protect the forests against these disaters.

On the occasion of its inauguration, COHDEFOR took up forest protection measures as one of its major aims.

Such measures include the silvan community systems which are in service as legislated for the purpose of local measures.

A similar system is also seen in Japan, in which tha local communities are granted usufruct to use and enjoy the fruits of a part of the national forests, and in return are required to lend themselves to the protection of the forests.

In a silvan community system which is composed of local working groups and cooperatives of loggers and lumbermen, agricultural cooperatives, etc., the croplands and forests are managed integrally for the purpose of preventing fires, destructive pasturing, illegal felling, slash-and-burn agriculture, protecting the forests, and encouraging the encouraging the reproduction of forest resources, and at the same time, absorbin labor force to eliminate unemployment problems and to promote the protection and reproduction of forests.

The tracts to be managed by the cooperatives or other bodies are determined, and the rules of operation within them are established.

In addition, the terms and conditions concerning the protection and use of the forests are determined. All these are arranged in the form of contracts with COHDEFOR.

The local inhabitants in the woodlands usually are engaged in farming operations in arable lands, extraction of resin, operation of small-scale lumbermills, and protection and reproduction of forests under the techical guidance and financial assitance of COHDEFOR development projects.

By 1979, 129 such bodies had already been organized.

(5) An outline of COHDEFOR's undertakings

a. Production of lumber

As seen in Table II-1, the lumber ouput in 1979 was 1979 was 1,103,000 m^3 from pine trees and 36,000 m^3 from broad-leaved trees., or 1,139,000 m^3 in all, enphasizing the importance of pine trees.

The output from within the jurisdiction of the three regional forestry offices, Fco.

Morazan, Olancho and Comayagua, accounts for 65% of the total.

The output in 1977 was 1,134,000 m^3.

The lumber output in the past few years has been steady.

Table II-1 Lumber output by regin (1979)

Region	Pine tree	Broad-leaved tree	Total
Fco.Morazan	(27) 292.2	(2) 0.7	(26) 292.9
Olancho	(17) 181.7	(28) 10.0	(19) 191.7
Comayagua	(20) 221.9	(1) 0.2	(20) 222.2
El Paraiso	(12) 136.9	(2) 0.7	(12) 137.6
Yoro	(12) 137.6	(6) 2.1	(12) 139.7
Nor. Occidental	(7) 78.2	(61) 21.9	(9) 100.1
Copan	(5) 54.6	(0) 0.2	(5) 54.8
La Mosquitia	(0) 0.1	(0) 0.0	(0) 0.1
Total	(100)1,103.2	(100) 35.8	(100)1,139.1

Notes: 1. Unit: thousand m^3 The values in parentheses denote composition ratios in per cent.

2. The regions are classified by the jurisdicial territories of respective regional forestry offices.

The lumber output is not as large as would be expected from a forested area of 7,000,000 m^3.
This is probably because the pine forests upon which the current forestry development is heavily dependent are not high grade, because the exploitation of broad-leaved forests is slow in progress, and also because the industrial infrastructure has not yet been developed fully.

According to the compendium of International Statistics, the annual fells of firewood seem to amount to about 3,000,000 m^3 in addition to the lumber for industrial use.

In addition to the above, the byproducts produced in 1979 include 33,000 electric poles, 217,000 racks of firewood, 43,000 barrels of rosin, 56,000 sleepers, 300 tons of red sandalwood, 43,000 tons of chicle, etc.

b. Construction of logging roads, etc.
In 1979, the logging roads constructed amounted to 22 km in aggregate length, the logging roads repaired to 683 km, and the aggregate length of serviceable logging roads was 705 km. The length of the logging roads per ha of the total forestland was 1 m.
The logging road available per ha of the pine forests was a little short of 3 m.
Therefore, many more logging roads need to be constructed.

c. Production, exports and domestic sales
The production of sawed lumber, etc. will be discussed in Section 3, "An Outline of Lumber Industry." In 1977 and 1978, the lumber output stayed at a level of about 260 million board-feet.
Most of the lumber products are bought out by COHDEFOR for export and domestic wholesale.
The exports are chiefly lumber.
The ratios of lumber exports by destination are shown in Table IV-2.

Table II-2 Exports of lumber overseas (%)

Area	1975	1976	1977	1978
Caribbean countries	70	70	66	57
European countries	16	15	19	17
America	14	15	15	26
Total	100	100	100	100
Export total (million b.f)	192	180	189	152
Ratio to total forestry output	95	73	73	58

Note: America includes North America, Latin America and Japan.

The greater part of export is to Caribbean countries. Europe is the second largest market. The exports to the European countries are mostly high-quality lumber, and Europe is the largest market so far as high-quality lumber is concerned. The major importing countries in Europe Include Spain, Italy and West Germany.

Latin America is also a large market comparable to Europe. Venezuela is the largest importer in Latin America, but is a market where Honduras has been vying with Chile, Brazil and Nicaragua. The exports to North America are mainly accounted for by mahogany, cedro and other broad-leaved tree products rather than by pine goods. The export to Japan has begun only recently. The exports to Japan amounted to 2,400,000 b.f. in 1977, or 1,700,000 Lempiras, totally only a little over 1% of the total exports.

The domestic wholesale by COHDEFOR was 4.371,000 b.f. in 1976, and 1,654,000 b.f. in 1977 (down 60% from the year before). This was because COHDEFOR shifted its efforts to export. The balance was made good by supplies from local private sawmills.

d. Investment and loan

For the purpose of building up the local lumbermills, processing plants, etc, to promote the husbandry of forest resources, COHDEFOR has been extending investment and loan services.

(Investments)

In 1977, investments amounted to 16,500,000 Lempiras of which 8,900,000 Lempiras, or 54%, went into equity investment. Ninety per cent of the equity investment went to the big three businesses - CASISA, FIAFSA, and CORFINO.

In 1979 COHDEFOR invested ten companies as shown in Fig. VI-1. 3,200,000 Lempiras, or 20% of the total amoun ot investments, was earmarked for a feasibility study of a paper and pulp project, and the design and engineering of infrastructural facilities such as roads, ports and harbors. The remaining twenty-six per cent was used for the construction and improvement of roads and regional forestry offices, and other investment projects.

(Loans)

The loans extended by COHDEFOR in 1979 amounted to 16,200,000 Lempiras .of which: 84% went to producers and forwarders for lumber export; and the remaining 16% was granted to the producers, processors, and resin makers belonging to the silvan community system for the purpose of new installations, merger of existing mills, etc.

e. Forestry Technical School

As an institution attached to COHDEFOR, the Forestry Technical School has been installed with a view to training private and goverment forestry engineers and upgrading the state of the techniguer of forestry in Honduras as a whole. (See Fig. II -1)

The curriculum consists of two courses of study; Dendrology and Silvicultural Engineering. The syllabus covers all fields of forestry, and particular emphasis is placed on the reproduction of forests, genetics, forest pathology, biology, etc.

In 1977, the student enrollment was 138, and the graduates numbered 49. The dendrology course had an enrollment of 111, and turned out 22 graduates. The silvicultural engineering course has an enrollment of 27, and produced 27 graduates.

The School was established to contribute toward the progres of forestry in Honduras and other Latin American countries as well. Accordingly, students from Latin American countries have been enrolled in the School.

In 1977, the School was financed with loans amounting to 120,000,000 Lempiras, including loans from the Overseas Development Fund of West Germany which accounted for 67%, and loans from Guatemala and other Latin American countries. Most of the loans are used as scholarships for the students.

In addition to the regular courses cited above, short-term cours are opened for the purpose of upgrading the foresters of both private and governmental organizations.
In 1977, nine such courses were held and attended by 414 participants.
The activities of the school include the following:

(1) Seed bank

High-quality seeds of Hoduranean Oocarpa, Caribaea, etc. are collected stored and sold for afforestation and export.

(2) Forest biology

Insets and plants are colloected from all over the Latin American countries, and analized taxonomically for the purpose of clarifying entomology and phytology in Latin America.

(3) Afforestation

A survey concerning the production of seedlings, afforestation, etc. is being carried out. The potted seedlings and the seedlings grown outdoors of the Honduranean pines are transplanted in the demonstration forest of the School.
In addition, the effects of fire on the ecology of Honduranean pines are also being investigated.

f. Budget

In FY1977, the budget for COHDEFOR amounted to 121,900,000 Lempiras, of which 77% was operating expenses, and the reamaing 23% was accounted for by capital expenditure.

In FY1978, the budget was increased 29% from the previous to 157,700,000 Lempiras, of which 61% was operating expenses, and the remaining 39% was capital expenditure, reflecting the efforts to promote and encourage activities for the development of its forestry department.

In 1977, operating income amounted to 111,600,000 Lempiras, 85% of which came from the lumber exports, and the expenses amounted to 92,900,000 Lempiras, to create a surplus of 18,700,000 Lempiras.

COHDEFOR's balance of payments in FY1977

	thousand L.
Gross income	111,616
Lumber exports	94,461
Domestic sales of lumber	957
Sales of byproducts	7,957
Sales of others	5.910
Other income	2,331
Cost and expenses	92,919
Selling expenses	73,897
Administrative expenses	14,261
Non-capital construction, etc,	4,761
Balance	+ 18,697

(6) Forest fire prevention and control

Emphasizing the importance of forest protection, CHODEFOR has been actively engaged in the promotion of forest fire prevention and control measures as outlined below.

COHDEFOR has installed a forest protection section in its Forestry Department and assigned it undertake the preservation and protection of all the forest resources in Honduras.

In Honduras, the pine forests are ranked among the most hazardous areas in terms of fire incidence.

By 1974 when COHDEFOR was started, 20% to 50% of the pine forests were suffering from fire every year. The fires have delayed natural regeneration, and turned several hundreds of cubic meters of merchantable pine trees every year, seriously affecting the Honduranean economy.

Since its installation, CHODEFOR has put forest fire protection at the top of its strategic priorities and pursued it with energy.
As a result, the damages due to forest fores have a steadily declined.

In 1979, the damaged area was 29,000 ha, or 1.2% of the total protected area of 2,337,000 ha, demonstrating the efficacy of COHDEFOR's efforts.
For thr purpose of forest fire protection, COHDEFOR has marked out protected areas (which amounted to 2,337,000 ha in 1979, and are expected to increase year by year), chiefly of pine forests. The protected areas are largely classified into intensive protected areas (704,000 ha) and extensive protected areas (1,633,000 ha) in order to provide fire prevention and control measures depending on the importance of forest resources.
The intensive protected areas refer to those of the forested tracts where silviculture has been conducted with high regard for constructive forest perpetuation, which are identifued as particularly important from the viewpoint of location and inventory.

Those other than the intensive protected areas and which are

inaccessible are classed among the extensive protected area. In the intensive protected areas, the fire control target is to reduce the fire-stricken area to less than 6%. For the extensive protected areas, the fire-fighting services are despatched only when the intensive protected areas are out of danger.

a. Administrative organization

COHDEFOR's forest protection section, in Tegucigalpa, is assigned to work out a master plan to be promoted on a national level. Each of the eight regional forestry offices that cover the entire country has an administrative department and a project department. These two departments are called upon to prevent and control forest fire. Each department has fire marshal, who is responsible for directing the rangers and implementing forest protection programs.

b. Prevention

(1) Fire prevention campaign

Recognizing that there is a need for greater education of the public in forest fire safety, the local people, especially sylvan farmers, resin extractors, seed collectors and loggers, are educated about fire prevention, control and safety through demonstration of campaign cars, films, pamphlets, handouts, through mass media such as radio, TV and newspaper, through school education, and installation of billboards, etc.

(2) Forest protection committee

In order to maintain a continued effort for forest protection, thirty-three forest protection committees have been installed to cover the nation. These committees are organized by the heads of local government, leaders of local communities, etc. But these committees, however, have not yet raised substantive results.

(3) Application of the forestry law

COHDEFOR law and the forestry law stipulate penal provisions to control careless offenses, etc. But there have

been obstacles standing in the way of prosecuting the offenders, detracting from the laws.

(4) Permission of slash-and-burn farming fire is widely use to clear the farmland. The prescribed burning of debris is carried out in the presence of an official of the regional forestry office whith a proper firebreak brovided.

In 1979, about 15,000 slash-and-burn permits were issued for 63,000 ha of farmland, which is estimated to be about 50% of the actual slash-and-burn area. Namely, as much area as burned with permission was burned without authority.

(5) New construction and repairs of logging roads has been planned in order to establish a well-reticulated road network which will facilitate the entry of firefighlers in case of fire outbreak and also will facilitate the silvicultural operations. At present, the construction of approach roads to the internsive protected areas has been given top priority.

(6) Training of fire services

There are 102 fire companies in Honduras, which have been trained to fight forest fires. The military have also been given short-term firefighting courses.

c. Initial suppression

(1) Fire company

A fire company is made up of a captain, an engineer and six firefighters, or eight members in all.

(2) Equipment

The principal firefighting equipment available now includes 76 pickups, 343 piggyback pumps,
822 woodsman's rakes, 503 ordinary rakes,
673 fire extinguishers, 259 axes, 348 shovels,
770 woodsman's hatchets, and 53 chainsaws

(3) Detection

For the detection of forest fires, seventy-five watchtowers

have been installed chiefly in the intensive protected areas. In addition, land and aerial patrols have been conducted. In order to cover the pine forests (2,700,000 ha) totally, excluding the forests where fire incidence is low, it is necessary to install at least 195 additional towers.

(4) Radio commnunication

A total 150 radio transmitter-receivers have been installed in watchtowers, fire engines, administration office, regional forestry offices, Teguchgalpa COHDEFOR, to report fire outbreak, direct fire companies, etc. with a substantive result.

(5) Firebreaks

In 1979, 655km of firebreaks were constructed in the intensive protected areas, which together with the existing maintained and repaired length of 986 km, tatals 1,641 km.

d. Fire control

In 1979, there were 2,135 fires wich struck 28,593 ha of forests, or 1.2% of the total area of protected forests (2,377,000 ha). In tha intensive protected areas (704,000 ha), 1.152 fires broke out to damage 10,300 ha or 1.5% of the total area of the intensive protected forests, far below the target level of 6%. In the extensive protected areas (1,633,000 ha), fire broke out 983 times, and 18,270 ha or 1.1% was destroyed.

e. Causes of forest fires

While it is almost impossible to identify the causes of the fires precisely, 99% of all forest fires are considered to have been due to human action. Forest fires are set by arsonists, by people burning grasslands for their cattle, cigarettes carelessly tossed by passer-by, embers not adequately doused by beekepers, slash-and -burn farmers, fisherrmen, hunters, firewood collectors, children playin with fire military drills, camprires, debris burning, pyromancers, etc.

In 1979, the chief culprit was found to be the arsonists who were responsible for 33.4% of the fires, followed by passers-by with 15%, ranchers with 13.5% and slash-and-burn farmers with 12.5%.

The smokers and campfires which in Japan are most notorious were found responsible to anextremely small degree with 1.6% and 0.1%, respectively, making the situation very different from that in Japan.

f. Incidence of forest fires

The incidence of forest firesin recent years is as shown in Table II-3.

The occurrence of forest fires is largely governed by the weather conditions in each specific year, and it is difficult to eveluate the effect of firefighting services simply from the table. But considering the fact that potentially high-hazard weather prevailed in 1979 compared with the ordinary years, and that the average area wiped out per fire was reduced largely when the number of fires in 1979 was almost on a level with that in the previous year, it can be seen that the forest fire protection measures have worked well.

Table II-3 Incidence of forest fires

Year	Incidence	Damaged area	Area per fire
1975	1,026	45,504 ha	44.0 ha
1976	872	10,166	11.6
1977	2,326	66,983	28.8
1978	2.142	113,525	51.5
1979	2,135	38,593	13.4

3. Lumber Industry Outline

In Honduras, the lumber industry is led by pine lumber. Recent statistics of lumber output are shown in Table II-4.

At the beginning of the 1970s, the lumber output increased yearly, and peaked in 1973 with 305 millon board-feet.

In 1975, the output dropped to 203 million boart-feet. Since then, the lumber output has been edging upward; in 1978, the output recovered to 261 million board-feet.

Table II-4 Lumber output per year

Year	Output (million B.F.)
1970	139
1971	236
1972	262
1973	305
1974	285
1975	203
1976	246
1977	259
1978	261 (N:256; L:5)

Most lumber has been exported abroad. (See Table II-2)
In 1975, more than 90% of lumber products was exported as the lumber output hit the bottom.
Recently, the lumber output has been increasing steadily, and the ratio of exports has leveled off to around 60 to 70%.
It is presumed that COHDEFOR has been placing the highest priority on exports while supplying the domestic market with the remainder.

The lumber output per country is as shown in Table II-5.
It is found that lumber production centers around the large extraction sites. (See Table II-1)
Francisco Morazan, where the Capital Tegucigalpa exists, accounts for 30% of the total output, followed by Comayagua, Olancho and El Paraiso. These four counties account for 70% of the total output.

Table II-5 Lumber output per county per year (million B.F.) (%)

County	1974	1975	1976	1977	1978
Francisco Morazan	(36) 103.1	(30) 60.3	(30) 74.9	(29)74.7	(31) 82.2
Comayagua	(12) 34.9	(16) 31.9	(12) 30.3	(11)28.0	(9) 24.3
Olancho	(16) 40,4	(14) 27.8	(15) 35.9	(15)39.2	(14) 36.7
El Paraiso	(12) 34.4	(13) 26,5	(16) 40.3	(15)38.6	(15) 38.9
Yoro	(6) 18.5	(10) 19.4	(8) 18.5	(90) 23.8	(9) 24.3
Intibuca	(3) 8.0	(5) 9,9	(5) 12,2	(6) 14.9	(7) 18.0
Santa Barbara	(4) 10.0	(4) 8,8	(4) 9.6	(5) 12.1	(4) 10.9
Copan	7.1	6,2	6.3	7.5	4.4
Lampira	7,0	5,7	6.8	8.2	8.9
La Paz	(11) 3,4	(8) 2,9	(10) 1.9	(10) 2.3	(10) 4.1
Cortes	9,7	1,4	5,4	5.5	3.9
Choluteca	3.2	1,2	2,9	2.9	3.4
Others	0,6	0,7	1,4	1.1	1.1
Total	(100) 285.2	(100)202.7	(100)246.4	(100)258.8	(100)261.1

The lumbermills installed are as shown in Table II-6. The number lumbermills in service is 120, and those which are registered, but out of service, number 20. By county, the aforementioned four counties have 55 mills (46%) out of the 120.

Table II-6 Number of lumbermills per county

County	1976		1977		1978	
	Registered	In use	Registered	In use	Registered	In use
Francisco Morazan	25	19	21	19	20	18
Comayagua	19	17	18	16	17	13
Yoro	19	13	16	12	18	15
El Paraiso	14	11	14	12	14	13
Santa Barbara	14	11	14	12	14	13
Olancho	14	11	15	13	15	12
Intibuca	9	9	9	8	10	9
Cortes	8	5	5	4	4	4
Copan	7	7	7	7	8	8
Choluteca	5	5	5	5	5	5
Lempira	4	4	4	4	4	4
La Paz	5	4	4	3	4	4
Others	6	4	6	3	7	3
Total	150	121	139	118	140	120

Considering that the output from these counties is larger for their mill holdings, it is found that the lumbermills there will be large. The output capacity vs. number of lumbermills is as shown in Table II-7 below.

Table II-7 Output capacity, number of lumbermills, and output ratio

Output capacity (mil. B.F.)	1976		1977		1978	
	Number of mills	Output ratio,%	Number of mills	Output ratio.%	Number of mills	Output ratio.%
up to 1.0	52	9	43	9	45	9
1.0 to 1.5	23	12	19	9	23	11
1.5 to 2	10	7	18	12	11	7
2 to 3	8	7	12	12	18	17
3 to 4	10	14	8	10	7	9
4 to 6	8	16	8	15	6	12
6 to 12	6	19	8	22	8	25
12 to up	3	16	2	11	2	10
Total	120	100	118	100	120	100

Note: The output ratio refers to the ratio to the total lumber output.

Those mills which have an output capacity of up to 1 million board-feet a year number 45, or 38% of the total (120 mills), and account for less than 10% of the national total output.

On the other hand, those which have an annual output capacity of more than 2 million board-feet account for 34% of 120 mills, raising as much as 73% of the total output.

It is worthy of note that the top 15 mills (see Table II-8) have been turning out 45% of the total output, some of them each contributing 4 to 5% of the total output.

As shown in Fig.II-4, these fifteen leading mills are installed in the aforementioned four counties.

Table II-8 Large-scale lumbermills (1978)

No.	Name of mill	Location	Output	Ratio
1	Santa Fe	Fco. Moranzan	13.9	5%
2	Sansone 3	ditto	13.3	5%
3	Sansone 1	ditto	11.5	4%
4	Santa Maria	ditto	9.4	4%
5	Progreso 2	El Paraiso	9.3	4%
6	San Diego	ditto	8.9	3%
7	San Pedro	Lempira	6.9	3%
8	Arcieri	Fco. Moranzan	6.9	3%
9	San Ignacio	ditto	6.3	2%
10	Sansone 2	Comayagua	6.1	2%
11	Azacualpa	Olancho	5.8	2%
12	Locomapa	Yoro	5.5	2%
13	San Jose	Olancho	5.4	2%
14	Lumberton	Fco. Moranzan	4.8	2%
15	Bijao	Olancho	4.7	2%
	Total		118.70	45%

Note: 1. No. in the table above corresponds to the number appearing in Fig. II-4.

2. The ratio is to the national total output.

3. The output is given in million board-feet.

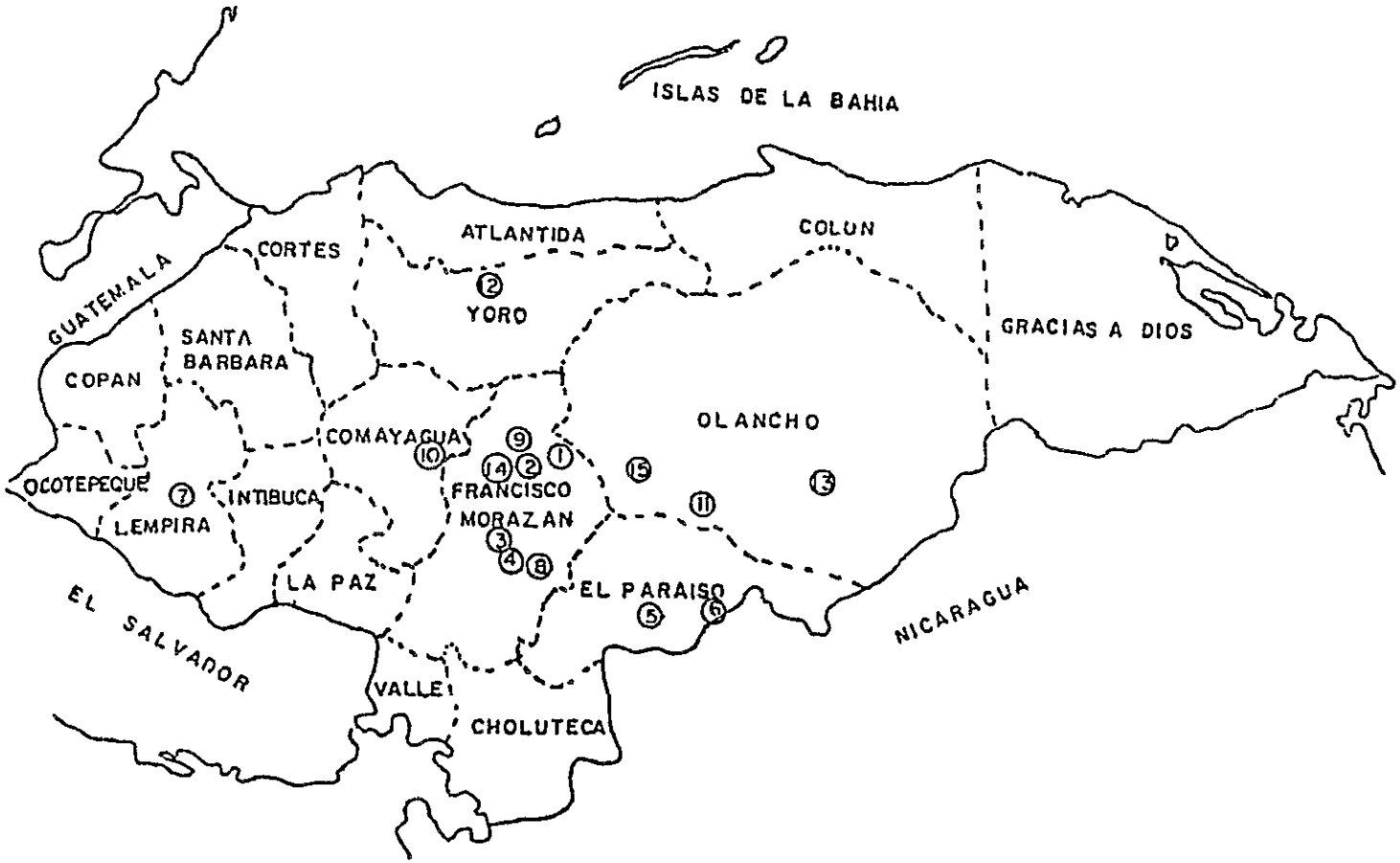


Fig. II - 4 Distribution of large-scale limbermills
(The encircled numbers correspond to the item numbers in Table II - 8.)

As already discussed, the large-scale mills are regarded as prime movers of the foresty industry in Honduras, and have been built up through capital investment and technical assistance by COHDEFOR.

As shown in Table II-11, there are nine lumbermills processing broad-leaved logs.
These works produce 5 million board-feet altogether, the output per works being short of 1 millon board-feet. Many of them have been processing pine logs, also.

Most of the lumbermills are running on old-fashoned equipment.
In the large-scale mills, on the other hand, advanced facilities are installed, including remote-controlled equipment and dryin kilns.
As shown in TableII-9, the lumbermills using circular saws account for for nearly 80% of the total, and the mills equipped with band saws only 20%.

Table II-9 Output of broad-leaved lumber, number of lumbermills, etc.

Year	Name of company	Number of lumbermills	Output (mil. B.F.)	Ratio,%
1975	Maderas Preciosas S.R.L.	2	6.03	75
	Jose Lamas, S. de R.L.	1	1.58	20
	Otros	6	0.37	5
	Total	9	7.98	100%
1976	Maderas Preciosas S.R.L.	2	5.97	81
	Bonito Oriental	1	0.59	8
	Otros	7	0.77	11
	Total	10	7.33	100%
1977	Maderas Preciosas S.R.L.	2	3.6	68
	Jose Lamas S. de R.L.	1	0.3	6
	Bonito Orintal	1	0.7	13
	Otros	4	0.2	4
	Danli Industrial	1	0.5	9
	Total	9	5.3	100%
1978	Maderas Preciosas S.A.	2	2.4	50
	Jose Lamas S.de R.L.	1	0.3	6
	Danli Industrial S.A.	1	1.2	25
	Bonito Oriental	1	0.3	6
	Otros	4	0.6	13
	Total	9	4.8	100%

Table II-10 Lumbermills - type, number and output (million B.F.) (%)

Classification	1977			1979		
	number of mills	Output	Ourput per mill	number of mills	output	output permill
Circular saw	(79) 93	(50) 130.2	1.40	(79)95	(48) 124.5	1.31
Circular saw	(21) 25	(50) 128.5	5.14	(21)25	(52) 136.6	5.46
Total	(100) 118	(100) 258.7	2.19	(100) 120	(100) 261.1	2.18

There are twnty-four mills equipped with planers, where interior grages of pine lumber and planed boards, etc. are manufactured.

As shown in Table IV-10, plywood production is undertaken by two firms - Troply and Timsa, where pine and broad-leaved logs are turned into plywood. Their total output is 1,450,000 m^2 in terms of 3/8" thick boards.

They share the market with a 60 / 40 ratio. Troply concentrates on the production of pine plywood, while Timsa is chiefly engaged in the production of broad-leaved plywood.

Thus, it is difficult to measure the two companise against dach other.

Table II-11 Plywood output (1978)

Unit	TROPLY		TIMSA		Total		
	Troply Broad-leaved	Pine	Timsa Broad-leaved	Pine	Total Broad-leaved	Pine	Total
m^3	-	8,757	4,684	368	4,684	9,125	13,809
m^2 (3/8" thick)	-	919,391	491,748	38,614	491,748	958,005	1,449,753

In addition to the lumber and plywood, the production of rosin has been encouraged.

In 1978, the rosin output was about 12,000,000 lbs., and the output of turpentine oil reached about 320,000 gallons.

The silvan community system is encouraged to produce these products which offer great employment opportunities to the inhabitants in the backwoods.

CHAPTER III DISCUSSIONS, AND FIELD SURVEY FINDINGS

1. Discussions

1-1 Discussion outline

The survey team had talks with the Honduranean counterpart five times (on the mornings of Jan. 28 and Feb. 11 and on the evenings of Feb. 1 and 8).

Present were:

Honduranean counterpart: -

- o Jorge Luttich, manager for forestry, CONSUPLANE
- o Representatives of COHDEFOR listed below
  (Not all attended every meeting, however.)

Director	: Dagoberto Gomez Suazo (present at only the official meetings)
Forestry general manager	: Manuel Hernandez P.
Manager for eastern region liaison and coordination	: Rene Serrano Calderon
Superintendent, Olancho Regional Forestry Office	: Ramon Alvarez (attended only the first meeting)
Accounting general manager	: Oscar Armand Giron Soto (present at only the official meetings)

The following is a brief of each of the meetings, the details will be discussed later.

- o January 28, Morning (visited CONSUPLANE)

The survey team met Moises Starkman, General Manager for Resources Development, Norma de Sierra, General Manager for Technical Assistance, Roberto Ruiz, General Manager for Agricultural Development, and Jorge Luttich, Manager for Forestry. At the meeting, the

Honduranean counterpart told the survey team that it attaches great importance to the exploitation and development of Mosquitia. In the evening, the survey team discussed the terms of reference with Luttich (CONSUPLANE), Hernandez, Serrano and Alvarez (COHDEFOR) according to the official document of the Honduranean Government.

On the agenda were the region for which development assistance is required, its area, and the contents of development assistance, etc.

The meeting was wound up around 3:30 p.m., and the survey team paid a courtesy call on Director Gomez. The Director also gave top priority to the development of Mosquitia, stressing that the site is too sterile for argiculture, that the only possibility there is forestry, and that it is urgent to produce employment opportunities for the local inhabitants through the development and buildup of forestry and its infrastructure.

On January 29, the survey team exchanged views with the Honduranean counterpart about the discussions of January 28, and requested the Honduranean counterpart to answer its questions in writing.

The questions asked by the survey team were as follows.

- o Are the subjects of development assistance limited to Mosquitia and Paraise?
- o Is there any concrete plan about the scope of the survey of the two sites?
- o The survey team requests a document stating the purposes and implementation programs of the development of the sites, if any.
- o Can the survey team expect the assistance of a Canadian aerial survey outfit in investigating Mosquitia?
- o The survey team requests parcellary data about the two sites.
- o Is there any on-going model project intended for the two sites?

In reply to these questions and requests, the Honduranean counterpart presented various papers to the survey team, though they were insufficient to the needs of the survey team.

It is found that the technical cooperation of the Canadian Government is not available in Mosquitia, and that Mosquitia is state-owned almost entirely while Paraiso is a mixture of privately owned lands and state-owned lands, and that a Cadastral map has yet to be prepared though efforts are currently being made by the Cadastral Bureau to clarify the individual tracts as to boundaries, acreage, ownership, etc. It is said that parcellary data is obtainable to a limited extent from the local people.

Hernandez gave the survey team a briefing about Mosquitia by making use of a slide projector.

The survey team was deeply impressed with the great enthusiasm, determination and perspective shown by the Honduranean counterpart.

At the meeting, Luttich, Hernandez and Serrand represented the Honduranean counterpart.

On February 1, Hernandez and Serrano spoke about forestry administration and forestry in Honduras, and the status quo of COHDEFOR, and views were exchanged between the two parties.

It was learned that COHDEFOR was founded for the purpose of:

(1) Production of forest goods

(2) Protection of forests (prevention and control of forest fire, and protection and management of headwater forests)

(3) Buildup of social and living infrastructure, so that forestry takes deep root in the social and economic life of the Honduraneans.

The afternoon meeting started with discussions with Hernandez and Serrano over the projects in Mosquitia and Paraiso, the area covered, transfer of engineers to Japan for training, dispatch of experts to Honduras from Japan, and the problems concerning flight over the Nicaraguan territory for aerial photogrammatic surveying. A little past 4:00 p.m., Director Gomez and Manager Luttich joined the meeting for official debates. The head of the survey team expressed thanks to COHDEFOR for the facilities afforded to the survey team, and promised that the survey team would report the

findings to the Japanese Government and would endeavor to make the efforts of both parties rewarding as soon as possible. Finally, he requested that the problems of flying in Nicaraguan airspace be solved at the earliest possible convenience.

Director Gomez expressed his thanks to the survey team, and requested that the development assistance be made available as early as possible.

On February 11, the survey team except for the head who left Honduras for Tokyo, held a meeting with Hernandez and Serrano in which the survey team members inquired about remaining unclear points regarding the survey, and the Honduranean counterpart answered the questions.

On the agenda were the disparities between the extensive and intensive forests (already discussed in the foregoing paragraphs), the season propitious for aerial photogrammetric survey (to be discussed later), and cadastral data about Paraiso, etc.

1-2 Minutes

In the first discussion meeting, the priority of development and coverage of the proposed sites were put on the table.

According to CONSUPLANE's letter of July 31, 1979, to Mr. Kaneda, Japanese Ambassador to Honduras, the Japanese Government was requested by COHDEFOR to extend cooperation in the investigation of Paraiso and Mosquitia regarding the following two points.

o Aerial photogrammetric survey of a total 2,384,800 ha (Paraiso, 721,800 ha; Mosquitia, 1,663,000 ha)

o Inventory survey of a total 1,638,500 ha forests

It was also requested in the letter that the survey priority be given to the coniferous forests. The coverage of the proposed tract was so large that the Japanese Government needed time to consider the project. When Mr. Katari visited Honduras, he learned that the Honduranean Government would like the Japanese Government to undertake a detailed survey. The immensity of the tracts became the center of arguments amongst the survey team which was about to leave Japan for Honduras.

The Japanese survey team called this problem up for discussion with the Honduranean counterpart, and was told that COHDEFOR and CONSUPLANE were at cross-purposes with respect to the aerial photogrammetric coverage area. To get it right, it was explained at the first meeting that COHDEFOR is considering the forests in Mosquitia and Paraiso alone and is not particular about the coverage area. If the forests alone are to be considered, Mosquitia has 565,000 ha of coniferous forests and 679,000 ha of broad-leaved forests while Paraiso has 173,000 ha of coniferous forests and 62,000 ha of broad-leaved forests.

As the coverage was still to large, the survey team negotiated with the Hoduranean counterpart over and over again, and it was finally agreed that the survey would cover about 200,000 ha of two sub-project sites (Dursuna and Rus Rus) out of the Segovia project site (258,780 ha covering 57,300 ha of Puerto-Lempira sub-project site, 125,647 ha of the Dursuna sub-project site and 75,833 ha of the Rus Rus sub-project site) in Mosquitia and about 300,000 ha of forests in Paraiso, including the inclusions and adjacencies.

The 1,638,500 ha area to be covered by forest survey is too large even if inventory survey alone is considered.

If a detailed survey is to be conducted as requested by the Honduranean counterpart, it will take much time and labor.

The survey team explained that a detailed survey would do much toward the formulation and implementation of a master silvicultural plan, that in Japan, the unit project area is about 50,000 ha, and that the technical assistance would be possible if the detailed survey area is limited to that extent, and asked the Honduranean counterpart to conduct detailed survey of the remainder according to the survey know-how to be transferred by such technical assistance. The survey team also asked the Honduranean counterpart to consider the formulation of a development project for which Japan will offer its services.
The Honduranean counterpart told the survey team that the unit project size was about the same as in Japan, and consented to the survey team's proposal for the scale of the detailed survey, though the places of detailed survey were not specified.

After several meetings, the Honduranean counterpart requested the survey team to conduct a detailed survey in the Rus Rus sub-project site which has an area of about 75,000 ha.

As regards the formation of forest plans, the Honduranean counterpart hoped to send engineers to Japan for training, and to enlist Japan's cooperation in the fields of afforestation and forest protection.

At first, the Japanese survey team took it for granted that Paraiso should be given priority over Mosquitia in the forest survey.

This was because the FAO's report of a forest survey conducted in 1962 to 1965 states that Mosquitia is destitute of well-developed coniferous forests compared to Paraiso and it's forest consists mostly of broad-leaved trees.

Japan is more experienced in handling coniferous than tropical broad-leaved trees.

For this reason, the survey team told the Honduranean counterpart that Paraiso should be given top priority. The Honduranean counterpart answered to the contrary. It said that FAO's survey committed an error in this point, and asked the survey team to go and see that Mosquitia is pine forests.

At the suggestion of the Honduranean counterpart, the survey team visited the site and found that pine forests are predominant in Mosquitia. Along with the Honduranean government's line that Mosquitia, which still remains a terra incognita whereas other counties have been developed, needs to be developed as early as possible as the last resort for the country's forestry and for the livelihood of the local people, CONSUPLANE and the COHDEFOR insisted at every meeting that Mosquitia be given top priority.

On the other hand, Paraiso has already been developed, and an implementation plan for the Teupasenti project site has by and large been completed, and is likely to provide feedback for the formulation of implementation plans for other project sites in Paraiso.

The Honduranean counterpart expressed their opinion that they would be able to do everything else only if the Japanese survey team would take an aerial photograph.

Considering these and other various factors, it was finally agreed that Mosquitia should be given top priority, and that Paraiso would be considered if circumstances permit.

As regards the despatch of experts to Honduras, the Honduranean counterpart requested Japan to send experts in nine fields including pest control, seedling culture, planning and survey for logging, and raising of forests.

The last, but not least, matter on the agenda was that an aerial photogrammetric survey will unavaoidably violate the airspace of Nicaragua, and this problem was discussed.

The survey team requested the Honduraneans to obtain flight permission in advance. While admitting the practicality of the survey team's offer, the Honduranean counterpart commented that the broad-leaved forests along the Segovia River which divides Nicaragua and Honduras are reserves and are excluded from the development project, and that the flight would be computer controlled to avert photo-taking within 10 to 15 km of the border. It was claimed that the Honduranean Government used the same technique successfully when surveying Paraiso. The Honduranean counterpart observed that relations between Nicaragua and Honduras were improving, and that it would not be so difficult to obtain the permission of the Nicaraguan Government.

As nothing certain was obtained from the Honduranean counterpart, the survey team strongly urged the Honduranean counterpart to settle the matter in advance in order to ensure the safety of aerial surveyors if the survey project is sanctioned by the Japanese Government.

2. Field Survey Findings

As discussed in the foregoing paragraphs, it was determined to survey La Mosquitia and El Paraiso, and Japan was requested to undertake aerial photogrammetric survey for the latter and aerial photogrammetric survey and forest survey for the former.

The discussions here will therefore be limited to forests and forestry environments for Paraiso, and cover general socio-economic conditions and others for Mosquitia which are relevant to the forest survey.

2-1 General review of La Mosquitia

2-1-1 History

Mosquitia was discovered by Columbus in 1502 when he was on his fourth voyage.

He put up the Spanish flag on Cape Castilla (now attached to Colon), and declared the land a Spanish dominion. Then, he sailed east, and hear a cape on the border of Honduras andNicaragua, his ship was almost wrecked.

After a close call, the fortunate Columbus gave thanks to God, and named the cape "Gracias Adios." Since then, the region has been so called.

On December 10, 1881, the Marco Aurelio Soto regime made Colon independent from Mosquitia to aid administration for the purpose of regional development.

The history of Mosquitia is quite different from that of other counties in Honduras, as shown below.

In antagonism with Spain, the pirates of the United Kingdom, France and the Netherlands began to depredate the northern coast of Honduras in 1579. The coastline of Mosquitia was separated between Taguzgalpa (now Nicaraguan Mosquitia) and Tologalpa (now Honduranean Mosquitia), and the latter was the den of robbers.

Pirates abducted women from all over the coastal zone, married them and gave birth to half breeds. The pirates called the half breeds Maustics, from the Spanish "Moscos," and the English "Mosquitos."

By 1642, Trujillo and Roatan, and even Cuanaja were in the hands of the pirates.

Some time between 1650 and 1652, an English galley carrying black slaves ran aground at Cape Gracias adios, and the crew and the slaves were cast ashore. In fear of indigenous people, they left the shore and went deep into the mountains. Then, they mixed with the Jicaque tribe who governed the cape and the riparian region of Segovia, and their offspring were later called the Zambos.

Entering the 1670s, the United Kingdom expanded its piracy and expeditions more and more while spreeding anti-Spanish feelings to the indigenous people. Among such aborigines, there was a William Pitt, of Bermuda, who launched the exploitation of forests in Mosquitia.

In addition, the English sent Oldman, a son of the chieftain of the natives, to England for education in an attempt to establish English sovereignty in this land, and enthroned him to replace his father. Since then, the Misquito dynasty continued as long as the English influence lasted.

The Zambos and Misquitos were furnished with firearms to build up their military force.

In 1701, they waged a war of aggression against the inland tribes of Honduras at the command of an Englishman.

In 1740, Trelawney, Viceroy of Japamica, instigated the Misquitos to bring all the costs of Central America under English domination, which led to a bellingency between the U.K. and Spain. In 1763, both nations exchanged olive branches in Paris, and the U.K. was obliged to demolish its fort in Bahia, Honduras. But, the U.K. left many colonies in Mosquitia.

Later, in 1767, R. Hodgson colluded with the U.K., and kept London informed secretly of the details of local resources and features. According to the 1963 Paris treaty, the English occupation forces ought to have withdrawn from Mosquitia by the end of 1969.

But the English colonials stayed on, and continued to exploit Mosquitia in flat defiance of the Spanish Government denouncement.

It is on record that the exports in 1766 by the British from Mosquitia included 80,000 lbs. of cocoa, 300,000 lbs. of sarsaparilla, 12,000 lbs. of tortoiseshells, 100 barrels of sugar, 3,000 lbs. of herbs, 2,000 lbs. of coffee, quantities of mahogany, indigo, silver, gold, etc., amounting to £130,000. The statistics, however, do not include contraband goods.

As the English encroachment went unchecked, the British Government again sent troops into Honduras to reinstate the colonies and win back its control over Mosquitia.

On the other hand, Spain emigrated people to Honduras in 1787, but failed because the settlements were insalubrious.

According to statistics at that time, it is reported that in 1791, Mosquitia had 569 English settlers, 1,763 black slaves, and 204 domestic animals, and that all the resources of Mosquitia had already been exploited, with mahogany leading the list of exports with an annual average of 3,000,000 c.f.

Again, in 1796, Spain and the United Kingdom rushed headlong into war, and the British troops occupied Bahia Island.

People were emigrated from San Vicente to Bahia and the northern coats of Honduras.

Supported by the British Government, the Zambos and Misquitos extended their influence, and were dreaded and lionized by the neighboring tribes. Even the Guatemalan Government kneeled down before them, and offered tributes.

In 1816, George Frederic I reigned over Mosquitia. Then, his younger brother Roberto succeeded as king. But Roberto was divested of kingsship by the British, and instead a black African was enthroned and titled "George Frederic II." Later, Roberto Charles Frederic succeeded him, and was forced to appoint Col. Alexader Macdonald, Viceroy of Belize, as a regent of Mosquitia.

In the reign of George Frederic I, Gen. Sir John MacGregor won a concession over the land south of the San Juan River, and tried to establish the Kingdom of Poya to bring the entire zone of Mosquitia under his sway and to become an absolute monarch.

But his attempt failed.

The aborigines, called Poyas or Payas, were akin to Misquitos.

The kings of Misquitos supplied the British generously with colonies, and this culminated in the era of Roberto Charles Frederic (1840 to 1842) at which time Mosquitia was subdivided.

In 1846, the British Government officially recognized Mosquitia as a kingdom, and gave the Zambos the hereditary right to its dynasty. George William I was elected and installed to the throne, and the British ambassador to Mosquitia was elected advisor to the king in order to push forward a new colonial policy.

The British control over Mosquitia lasted until 1859, during which time the British Government backed the kings of Mosquitia while pushing forward a policy in which Mosquitia was declared, at first, to be politically independent of the Spanish rule and later to be politically independent of the Republic of Honduras.

As the English Government gradually estranged itself from the Misquitos, the dynasty fell into oblivion.

Back in 1821, the Central American Federation was inaugurated. But, in 1838, Honduras became independent as a republic. In 1858, Nicaragua challenged Honduras for Mosquitia. The two nations discussed the issue many times, but the situation was not solved. In 1894, the two countries submitted the territorial matter to arbitration by the King of Spain. In 1906, Alfonso XIII decided the case in favor of Honduras, ruling that the border line be held intact. But, Nicaragua raised objections against the decision. After years of contentions with Honduras, Nicaragua agreed with Honduras in 1957 to submit the case to the International Court of Justice (ICJ) for retrial, and the ICJ vindicated Alfonso XIII's decision. Thus, Gracious a Dios County (Mosquitia County) was born.

2-1-2 Nature

2-1-2-1 Land and soil

The County of Mosquitia has an area of 1,663,000 ha. While little is known about the inventory of developable resources there, it is reported that agriculture and forestry are the greatest development potentialities.

The lands available for agriculture are estimated to total 240,000 ha, and exist chiefly in the form of wetlands, swamps and riparian tracts.

There is little livestock raising as the vegetation is as dystrophic as the soil on which it grows.

Fourty per cent of Mosquitia forms plains at an elevation of up to 100 m above sea level.

Along the coast are strips of freshwater and brackish swamps and wetlands. The average elevation is 180 m, and 20% of the area exceeds 500 m in elevation.

The terrains show moderate slopes, and the coastal zone is flat. Most of the soils are entisols or acid sols accompanied by mollisols or ultisols (80%). The soils are oligotrophic under the influence of the climatic conditions prevailing in the region. The content of phosphorus is as low as 4.0 to 4.5%.

Generally, the soils in the region are classified into three categories.

a) The soils of the deltas and lagoons in the estuaries are very wet, and are suitable for agricultural purposes.

   These low basin areas are particularly important for fishery development and as wildlife habitats. They account for 15% of the region.

b) Broad-leaved forests east of the Patuca River and in Mt. Mocoron

   Little is known about this region. The soils will be similar to those in the regions showing similar climate and vegetation. The broad-leaved trees form pure stands or are mingled with Pinus Caribaea. Some localities will be converted into pine forests (by large-scale afforestation) or croplands, but such conversion will require vast sums of money. Thus, the region should be reserved for future use. The region accounts for 40% of Mosquitia.

c) Pine forests in savannah

   Of the three regions into which Mosquitia is divided, this region is the most interesting from the viewpoint of the extraction of pine stumpage.

Pinus Caribaea seems to be well acclimatized to the environment of the region.

The region shows a flat terrain, but the soils are the poorest of all.

It is said that the region necessitates artificial draining in some specific seasons of the year.

The region accounts for some 45% of Mosquitia. Generally speaking, Mosquitia has a deep soil bed, but is oligotrophic. It is reported that the fact that pine trees grow on the cutover of primeval forests of broad-leaved trees throws a sidelight upon the Oligotrophy of the soils. The existing savannahs consist of sand and gravel. But considering the fact that the English extracted volumes of mahogany in the 17th and 18th centuries, the site may have been not so poor in soil quality as at present. Probably, the destructive felling of broad-leaved trees and frequent forest fires have depleted the site.

If conditioned with fertilizer the sowl quality will improve. In Nicaragua, INFONAC enriched a site similar to Mosquitia with phosphate with substantial results. Since costly fertilizer cannot be covered by the Honduranean budget, some other measures will have to be developed through further study.

2-1-2-2 River systems

Mosquitia is crisscrossed with rivers. The major rivers include the Patuca, the Platano and the Coco. The Coco is also called the Segova, and has its origin in Nicaragua. Its lower reaches form the boundary between Honduras and Nicaragua.

The Patuca drains at Azacualpa of Olancho, the Guayape and the Almendros gathering water from the rivers in Olancho and El Paraiso. It flows through Olancho, runs northeast through the center of Mosquitia, and empties into the Caribbean Sea. Its total catchment area is 2,450,000 ha, including 1,090,000 ha within Mosquitia. Its discharge is 120 to 1,000 m^3/sec. depending on the season, 500 m^3/sec. on an average.

The Segova has a discharge of 180 to 1,340 m^3/sec. or 810 m^3/sec. on an average, and has a catchment area of 2,500,000 ha, including 400,000 ha in Honduras.

Other rivers are estimated to have a discharge of about 50 m^3/sec.

The rivers which exist within the jurisdiction of the regional forestry office in Mosquitia, which flow within the area proposed for the development survey, include the Dursuna draining into the Ibantar, the Rus Rus which is a tributary of the Segova, and the Nakunta and the Kruta which flow through the savannahs.

Because of an abundance of rivers, hydroelectric power development projects were planned in 1975 as listed in Table V-1 below.

Table III-1 Hydroelectric power development plans (according to ENEE-HARZA Engineering Co.)

Project	River	Generated output, megawatts	Cost (mil. Lempiras)
Patuca 1	Patuca	270	318.8
Patuca 2	Patuca	700	500.7
Patuca 3	Piedras-Amarillas	210	274.7
Wampu 1	Wampu	50	115.3
Wampu 2	Wampu	40	90.4
Sico 1	Sico	75	119.4
Sico 2	Sico	95	219.5
Total		1,440	1,638.8

Considering the annual rainfall distribution, the greater part of Mosquitia is suitable for agricultural development, and does not require artificial irrigation.

Arable land amounts to 240,000 ha, of which 120,000 ha can be irrigated from the Coco, the Patuca, the Tigre and the Platano.

But, the construction of irrigation works will not always be easy.

Similarly, the groundwater sources have a large capacity, and are estimated to have an annual extractable volume of 4,000 mil. m^3. But the use of groundwater is ignored partly because of the high costs involved and partly because of abundant surface water.

2-1-2-3 Climate

The climate in Mosquitia is largely influenced by the movement of air over the Caribbean sea.

The semi-perennial reverse whirlwind over the North Atlantic develops the Alice wind, which moves under the air mass tending northwest to disturb the climate of the region. The tropical air mass usually brings about heat and moisture in the region. It is usually unstable, and causes high humidity and rainfalls.

The shoreward and seaward winds also bring about sweltering heat and moisture to influence the climate of the region.

Mosquitia as a whole has much rain, but the rainfall varies largely with localities. In the coastal zone, the annual rainfall is 2,700 mm, while in the upper reaches of Patuca, the annual rainfall is 1,400 mm. Compared with other counties, particularly in the central area, of Honduras, Misquitia is less affected by the dry season.

The annual average temperature is considerably high at 26.7°, but varies only slightly. In the coastal zone, the annual average temperature is 27.5°C as against 25°C in the inland Olancho.

2-1-3 Infrastructure

2-1-3-1 Highways

There is a highway running from Puerto Lempira to Ahuasbila near the Honduras-Nicaragua border. Its total length is 256 km.

The availability of this road is as detailed below.

- o From Puerto Lempira to Sirsistara interchange : 35 km (all-weather type)
- o Sirsistara branch : 8 km (available only in summer)
- o From Sirsistara interchange to Mocoron interchange : 35 km (all-weather type)
- o Mocoron branch : 10 km (available only in summer)
- o Mocoron interchange to Leimus interchange : 25 km (all-weather type)
- o Leimus branch : 23 km (all-weather type)
- o From Leimus interchange to Rus Rus : 42 km (all-weather type)
- o Suji branch : 16 km (all-weather type)
- o From Rus Rus to Ahusbila : 62 km (available only in summer)

In June 1977, the Culmi-Ahuas-Peurto Lempira project got under way for the 120-km, 2,400,000- Lempira Ahuas-Ahuasbila section.

(The traffic in the mountainous regions is by horse and foot.)

2-1-3-2 Airports

Puerto Lempira, Brus Laguna and Ahuas have airdromes for twin-engine C-47s.

Other municipalities also have airdromes for small planes.

SAHSA and LANSA are operating three flights a week between Bruslaguna-Peurto Lempira and Ahuas. In Mosquitia, the Morava Church is operating MFA.

2-1-3-3 Navigation

There are piers along the coats of Brus Laguna, Puerto Lempira and Caratasca lagoon, providing berthage to low-draught vessels of up to about 60 tons. Up to 250 ton vessels can be harbored, however.

Plaplaya and Cauquira are the ports most accessible from the Caribbean Sea. Mosquitia has many ponds, lakes and rivers, and is suitable for waterway transportation. Canoes and boats with out-board motors are used. The Crutta River is a wonderful natural

waterway, while the Coco and the Patuca are a little inferior to the Crutta because their under keel clearance is shallow.

There is an on-going project for the construction of a canal of about 20 km between Ibans Lagoon and Caratasca Lagoon, the Brus Laguna-Patuca section being under eay.

It is also planned to connect Tibalkan Lagoon and the Patuca to facilitate communication with the inland area.

2-1-3-4 Telecommunications

Telephone and telegraph services are not available in Mosquitia, but there are post offices in eleven municipalities. There is a state-run radio broadcasting station in Puerto Lempira, but it is not operating regularly. Instead, such organizations as the Moraba Church own private radio stations to fulfill the public needs.

2-1-3-5 Education

Mosquitia has 52 elementary schools in Puerto Lempira and 12 in Brus Laguna, or 64 in all. Of them, those capable of offering the regular curriculum up to the sixth grade number 43 only. In Puerto Lempira, there is a junior high school offering a curriculum including liberal arts.

In Brus Laguna, planning for a similar educational institution has been under way since 1978.

While the school attendance ratio has been steadily increasing, the illiteracy rate is 41.4%. The illiteracy rate of females is as high as 50.2%. Those who have attended school number 7,570, of which 4,175 are graduates of elementary school. Few have received higher education.

2-1-3-6 Health and hygiene

Mosquitia has 4 first-aid centers, 2 local health centers, each with a paraprofessional nurse, in Laguna and Bank Raya, a single-doctor health center in Puerto Lempira, and a hospital in Ahuas.

The local people are often forced to go to unauthorized physicians for medical attention partly because of the scarcity licensed practitioners and partly because of the poor socio-economic conditions by which almost every municipality is stricken. At present, there is a plan to install local health centers at the following places.

o Brus Laguna, Yahurabila, Palacio, Plaplaya, Wanspusirpi, Tancin, Morocon, Twila, Ahuasbila

Assignment of medical specialists to these centers is also planned.

The leading endemic diseases include diarrhea attributable to drinking water, bacterial and amebic dysentry, and malaria (393 malarial cases reported in 1976).

The increase of malaria incidence has been checked by regular control undertaken by SNEM (a national agency for malaria control).

2-1-3-7 Housing

According to the 1974 census, the number of houses was 3,540, including 3,513 detached houses, 23 apartment houses, and 4 village houses. The family size per house is roughly estimated to be 6.5 persons.

The houses, for the most part, are huts made of wood, thatched with straw, and floored with boards or left unfloored.

47.1% of detached houses have one or two rooms, and of houses have five rooms or more are only 3.9%. There are no public water services at present. Well water or river water is used for drinking. For lighting, gas or pine torch as are used. 3,046 houses are totally without sanitary services. As can be inferred from the above, the local people are leading a precarious socio-economic life with a low standard of living. It is hardly expected that the situation will be improved in the near future.

As discussed above, Mosquitia is far behind in terms of infrastructure, which will be difficult to build up.

The communities for which roads are available are limited to those lying south of Puerto Lempira.

Even Brus Laguna is not provided with roads; the traffic means available for connection to its northern municipalities and to the back country are limited to navigable waterways and small planes.

The vessels that can be berthed alongside the piers are limited to those with low draft.

Accordingly, there are no means of transportation for heavy cargo.

In fact, Mosquitia is one of the most underdeveloped counties in Honduras.

2-1-4 Occupation and income

According to the 1974 census, the working population was 4,915, of which 98.7% was accounted for by those who are engaged in a single occupation or more. The farmers account for 79.6% of the total.

14.1% of the working population is engaged in public, social or private service and in the manufacturing industry.

Farming is operated in a traditional way for autarchy. The major crops are cereals, cassaba and banana which are staple foods for Misquitos.

The per capita annual income is estimated at about 70 Lempiras, showing that the local inhabitants find it hard to make a living. (2 Dempiras = 1 US dollar)

2-1-5 Economy and industry

As its history suggests, Mosquitia, for the most part, is owned by the state.

There is little, if any, privately owned land around the agricultural and stock-farming communities. There are well-tended farmlands along the Segova, which are probably used by the farmers across the river from Nicaragua.

The major industries in Mosquitia are agriculture, forestry, fishery and hunting, and 80% of the economic population is engaged in these primary industries. (The economic population in Mosquitia is 24% as against the Honduranean average of 29%.)

Only 5% is engaged in the manufacturing industry.

Agricultural operations are carried out mainly for crops for self-sustenance.

Farms can be owned privately with the permission of the government.

The population doubled from 10,905 in 1961 to 20,738 in 1974.

The censuses shows that the farms increased from 731 mansana in 1966 to 2,920 mansana (mansana = parcel of land).

In 1976, the plantations increased to a total 1,604. The ranches increased from 570 mansana in 1966 to 5,263 mansana in 1974.

On the other hand, the cultivated lands with crop declined from 5,497 mansana to 2,783 mansana. Threatened by the growth of agricultural and livestock-rearing farmers, however, the Misquitos are appealing for improvement of the situation. The major crops are cassava and rice.

Other agricultural produce includes banana, maize, haricot beans, sugarcane, and coffee. The cultivated land per farming household is about 2 to 3 mansana, and is operated by each separate farming household.

Game includes iguana and deer.

The outlets for fishing products are limited. The season for sale of fish is several months before Holy Week.

Haylock in Cauquira is operating three fishing boats. In Catarasca, there is marine products processing plant owned by C.C.RICE of Florida. As marine products, lobsters and shrimps from near Puerto Lempira are famous.

Copper, uranium and bauxite are said to lead the mineral resources. At present, prospecting for oil is being promoted.

Forestry will be detailed in a separate section.

There is no doubt that the predatory British in the days of colonialism depleted Mosquitia of gold, silver, tortoise shell, sugar and volumes of mahogany.

It will take much time, labor and money to rehabilitate the land.

2-1-6 Administration and public institutions

Up until February 1977, No.2 Strategic Artillery Battalion had stayed in Puerto Lempira for the purpose of patrolling the border with Nicaragua. They also cooperated in the implementation of the comprehensive regional development projects, particularly of the infrastructural development plan.

In February 1977, they were replaced by No.2 Engineering Battalion.

In Puerto Lempira, there is a COHDEFOR office, which is engaged in the preservation of forest resources and the control of private felling and logging.

There is a bank called BANAFOM in Puerto Lempira. It was established in 1976.

When it started financial services, it set the credit ceiling at 200,000 Lempiras, but the loans extended actually were only half the originally set value. Three quarters of the borrowers were livestock farmers.

The Natural Resources Ministry has an agricultural extension service station in Puerto Lempira, which is guiding and supervising the clients of BANAFORM as to the appropriation of the loans. A warden for fishery and hunting is posted in Ahuas.

The Public Health Ministry has selected Mosquitia as the most needy region, and has installed local health centers (CESARE), at Brus Laguna and Raya.

Local education has been already explained. The Ministry of Education has divided Mosquitia into three districts - Puerto Lempira, Brus Laguna and Indian Reservation.

The educational administration emphasizes the language and culture of the Misquitos, and is endeavoring to preserve them in line with the government policy to protect the minority aborigines.

According to the 1974 census, those who received secondary education numbered 286, and those who received higher education 33.

2-1-7 Private organizations

Morava

The Morava Church has been playing an important role in this area in terms of sociology and culture. Its first missionary came in 1849. Now the Morave Church operates a hospital in Ahuas, airlines, and radio broadcasting stations, influencing greatly the entire Mosquitia area.

Two thirds of the population are parishioners of the Morava Church.

The Church has contributed much toward improving the literacy rate.

Catholic

Mosquitia, Colon, Atlantida and Cortes are under the San Pedro Sula Parish.

One third of the people are catholics. MASTA, OEGAD and SOPROGRAD are bodies organized by the Mosquitos.

The OEGAD is an organization of the students of Mosquitia.
Its headquarters is located in the capital, and it has four chapters in local schools. The OEGAD, originally a fraternal society established with the main objective of finding the students scholarship and boarding, is also active in making the culture of Mosquitia known throughout Honduras.

The MASTA is an all-Misquito tribe organization established at the first conference of the Misquitos in Ahuas held in June 1976 under the aegis of the OEGAS. It is a federation embracing the OEGAD and the SOPROGRAD which is a society of professionals.

2-1-8 Forestal resources

In Mosquitia in its hard and long British colonial days, and particularly on its Caribbean coasts where the British consolidated its control over the people, the forests were felled in a destructive manner, leaving infertile savannah in their wake over a wide tract several tens of kilometers back from the coastline. Seen now are only lanky grasses. As we go deep into the back country, Pinus Caribaes begins to appear. Broad-leaved trees can be seen along the creeks and on the fairly fertile terraces.

But the pines which have been saved from destructive felling and forest fires are present in spots or clumps few and far in between. The state of overgrowth varies largely depending on the locality. There are overgrowth trees of various heights and diameters.

The undergrowth is naturally regenerated saplings of 4 to 5 years old or a cultured second growth. The stand density is generally thin. There is a variety of forests, from the stands which are left from creep-up cutting and which will be wiped out soon, to the stands which will be thinned out to make their crowns open.

Compared with the stands in Paraiso, the stands in Mosquitia are generally sparse.

The forest fires are attributable to the sparsity of the stands. But, the upper branches may have been lopped selectively by the Nicaraguans before the finalization of the border line.

The incidence of forest fires is considerably high. Once a fire breaks out, it spreads and consumes a wide tract. There are many trees which are charred by the flames.

Since the establishment of COHDEFOR to manage Mosquitia, natural regeneration of pine trees has been spurred. This is probably due to the reduction of forest fires.

The samplings are uniformly 4 to 5 years old. (In 1979, the county least subjected to forest fire in Honduras was Mosquitia with 63 cases, but its burned area was the largest with an average 132 ha per case.) The flora curve (diameter vs. stumpage curve) represents a gradual deforestation type (U type). But, it is divided into

several singular types according to which the stands can be classified. It will be possible, and preferable, to formulate proper silvicultural plans for the combinations of classified stands and regenerated undergrowths.

The following discusses the forest resources in detail.

2-1-8-1 Status quo of forest resources

The forests are largely classified into pine forests and broad-leaved forests.

At present, the board-leaved forests are not handled as the subjects of economic activity, because there is no way of exploiting them and because there are too many specfies of broad-leaved trees with unknown lumber qualities. The pine forests are composed of Pinus Caribaea alone. The quality of Pinus Caribaea is well known, and is widely accepted for general-purpose lumber and for pulp.

The pine forests are not dense, and lie scattered. Locally, however, there are stands (subcompartments) with medium density.

The average density is about 16 m^3/ha.

The economic forests of pine trees are estimated to be about 280,000 ha and have a volume of 4,500,000 m^3.

But some of these forests are not exploited because they are located sporadically in the out-of-way backwoods.

The annual growth rate of the forests in Mosquitia has not been measured, and can only be estimated.

In 1976, ten permanent experimental stations were established. But, it is not possible to forecast the annual growth rate precisely since the stations have existed for only five years. Roughly speaking, however, the annual stand growth of natural pine trees is 4 to 8 m^3/ha or 6 m^3/ha on the average. There is little doubt that changes in annual growth rate depend on the fertility of soil.

The forests all over Mosquitia are sererely damaged by man-made fires every year. It is evident that the forest fires have checked the growth of stands.

If a silvicultural plan is formulated and implemented properly, the annual growth rate will surely be improved to 8 m^3/ha.

If the stands on good soil are tended intensively, their maximum expected growth will be 14 m^3/ha.

2-1-8-2 Planting and felling plans by COHDEFOR

The area of pine forests in Mosquitia will be determined accurately when an aerial photo is available.

According to COHDEFOR, it is estimated that there is 450,000 ha of land suitable for economic pine forests, and that about 280,000 ha of such lands is now sparse pine forests. COHDEFOR has now been promoting afforestation for 170,000 ha and natural regeneration for 280,000 ha.

While COHDEFOR's plan aims at an annual afforestation area of 5,000 ha, the area afforested in 1979 was only 220 ha. This was because the high-pegged oil prices prohibited the use of planting machines and heavy trucks, and because the only transportation means available was pickups. Particularly, the diesel-powered machines had to be left idle. COHDEFOR said that its plan would have to be reviewed for alternative measures.

Its afforestation plan is predicated upon the availability of enough manpower and equipment for silviculture.

Namely, it is based on the availability of special roadways for access to the forests, a comprehensive plan for forest fire control, and a silvicultural plan having a proper cyclic felling schedule for 5,000 ha-a-year afforestation and natural regeneration.

According to COHDEFOR's program for 1978, the felling cycle to harvest timber and pulpwood was set at 35 years.

Assuming that the buildup of engineering teams, collection of basic data, consolidation of infrastructure and acquisition of an outfit will take some five years, COHDEFOR envisages that the cyclic felling will start in 1983, and that the first fruits will be obtained in 2017. It is estimated that, from the year 2017 on, the annual felling sites will be 5,000 ha out of the afforested 175,000 ha, plus naturally regenerated forests. Considering the felling volume available from primeval forests and the thinning of the afforested stands, the economic felling may be started ten years earlier, that is, from 2007.

The thinning may be started from 2002, but the yields will be small logs not suitable for lumber and will be used as pulpwood.

The thinning yields are estimated at 200,000 m^3. If 5,000 ha is felled annually from 2017 on, the annual output will be as follows.

o Volume of timer	: 1,370,000 m^3 (275 m^3/ha)
o Volume of thinnings	: 200,000 m^3 (40 m^3/ha)
Total	: 1,570,000 m^3
o Felling cycle	: 35 years

2-1-8-3 Silviculture status quo

The forests taken up for the survey this time belong to the Segovia project site coming under the jurisdiction of COHDEFOR's regional forestry office in Puerto Lempira, Mosquitia. The project site is divided into the following three sections (SUBUNIDAD).

o Lempira	: 57,300 ha (extensive forests)
o Dursuna	: 125,647 ha (mostly intensive forests, and partly extensive forests)
o Rus Rus	: 75,833 ha (extensive forests)
Total	: 258,780 ha

The programs now under way in Mosquitia concern forest fire prevention and afforestation. But resin extraction, extension services, and research and study are also being promoted.

A 200,000 ha area is designated for fire protection, half of which is under intensive care. In addition, three watchtowers fully equipped with radio telephone, etc. have been installed. (One fire company is assigned to each tower.) Within the intensive protected forests, a network of firebreaks was completed in 1978. COHDEFOR has placed special emphasis on afforestation in the site, and has introduced planting machines, tractors and other equipment.

Two nurseries have been newly established - one in Puerto Lempira and the other near the Dursuna camp at the center of the project site.

Now they are being expanded. The nurselings are potted saplings and seedlings.

The seeds are sown around January, and low cut training is carried out after eight weeks. In June, the nurselings are delivered to the site as yearlings.

In 1979, the total production of nurselings was 331,000 and 48,000 potted saplings were produced from Puerto Lempira.

As stated previously 220 ha was planted with the nurselings.

Planting methods (mechanical, manual), planting pots, etc. have been studied, and have not yet been established. Many young trees blighted by pests and diseases.

What has made project execution in Mosquitia particularly difficult is a scarcity of experienced workers and COHDEFOR engineers who are familiar with the conditions in Mosquitia.

COHDEFOR is interested in resin extraction among other projects because it will offer employment opportunities to the local inhabitants and at the same time will enlighten them as to the importance of forest protection.

In Mosquitia, there is no sawmill.

According to COHDEFOR statistics, the log output in 1979 was 57.56 m^3 of pine trees and 33.07 m^3 of broad-leaved trees, or 92.63 m^3 in all, and may have been used for private use. Although COHDEFOR is planning the installation of a sawmill in Puerto Lempira and a portable sawmill at the extraction site, it is not economical because the local demand is little and because transportation to market is difficult.

It is said that the Campamento in Dursuna, which has been nearly built up to the level at which the project will be managed, will undergo further development for completion in 1982. At present, about 70 workers are encamped.

2-1-8-4 Current five-year investment plan

According to the on-going five-year (1978 ∿ 82) plan for Mosquitia, it is projected to conduct aerial photogrammetric survey, afforestation, protection and installation of a portable sawmill at the cost of 2,400,000 Lempiras.

The aerial photogrammetric survey ought to have been conducted over a tract of 1,500,000 ha in 1978, but was not carried out. This was because Mosquitia was second, on the priority list, to Olancho and other unphotographed areas in Honduras.

Since the greater part of the forests in Mosquitia are dilapilated, the area to be afforested will be enormous.

At present the area in need of afforestation is estimated to be at least 170,000 ha. But the afforestation will be limited to those parts which are fertile and worthy of afforestation. In the first year of the five-year plan, the methods and systems of planting were studied as discussed in the foregoing.

It is planned to invest a total 547,200 Lempiras in the five-year period for the purpose of gradually increasing the afforested area to 9,900 ha by 1982 with 500 ha as a start in 1978. Forest protection is mainly concerned with measures against forest fire.

The forests under fire protection are estimated to be 200,000 ha, half of which is intensive forests already regenerated or earmarked as suitable for future regeneration.

COHDEFOR plans to develop 200,000 ha of intensive protected forests and 100,000 ha of extensive protected forests from 1980 wards, in the hope that the areas procured this way for natural regeneration will develop into valuable forests.

As regards the construction of roads as a part of infrastructural development, it is planned to construct 20 km of all-weather highways and 80 km of dry season roads every year or to complete an aggregate road length of 500 km in the five-year period.

The factors taken into account for the construction of new roads are the traffic convenience of the existing communities, road transportation of logs in the future, and improved accessibility to experimental and protected forests.

As regards the camp in Dursuna, which was mentioned in the foregoing paragraph, living quarters will have to be developed to accommodate more than a hundred workers in the future.

As already described, Mosquitia has no sawmill. Because of the humid climate prevailing in the region, the lumber must be injected with preservatives. The upkeep of wooden buildings is therefore considerably high. The haulage for preserved wood from other regions is also costly.

COHDEFOR consumes 200,000 board-feet for housing development, but one board-foot costs no less than 0.6 to 0.8 Lempira. Transportation is also cumbersome because the lumber is bulky.

It is inferred that financial difficulties have precluded other government agencies from promoting housing development plans.

There are stands which are denser than needed for natural regeneration, and they should be thinned out to leave parental trees.

For these reasons, COHDEFOR is contemplating the installation of a portable sawmill. Installation of the sawmill would answer the local demand for luber, train the local people to be ready for

the time when large-scale production in Mosquitia starts, and provide experience and know-how in logging through removal of weedy trees.

The total investment in the sawmill is estimated at 267,400 Lempiras.

According to cost-accounting analysis, sawmill products will be on the average 300 Lempiras/1,000 b.f. less than the products imported from the other regions.

Considering that COHDEFOR consumes 200,000 b.f. annually, the investment will be recouped in about four years.

After COHDEFOR's consumption, the remainder is 75% of the total output, and must find its way to the market.

If the products can be exported to Nicaragua, they will yield an annual profit of 50 Lempiras per 1,000 b.f. In this case, the investment will be recovered in two years.

While COHDEFOR's five-year plan is as explained above, the records for 1978 and 1979 show that achievement of the plan will be extremely difficult.

Except for the forest fire measures and camp construction, there are many programs unexecuted or executed to a very limited extent.

COHDEFOR is also hopes that the existing plan be corrected properly as soon as possible by taking aerial photos in order to obtain accurate information about the forests.

Accordingly, it is urgent that aerial photos be taken for stock-taking survey of the forests, to conduct various tests and experiments, particularly those concerning afforestation, and then to review and revise the investment plan.

The tests and experiments for afforestation are imperative because the stand growth in the afforested area in the site is generally poor compared with that in the naturally regenerated area.

Probably this is due to the following:

- o The nurselings to be transplanted are too small (15 cm in height) because they are sown in January and transplanted in June.
- o The planting density is as thin as 1,600 pcs./ha.
- o Many seedlings have pest infestation.
- o Degree of tending
- o The savannahs are not provided with windbreaks, and are unprotected from salt-laden winds from the sea.

In addition to the current tests such as pot tests, mechanical planting tests and manual planting tests, there are many urgent matters, such as the planting tests of nurselings of 2 years old and 3 years old, location of the causes of blight damage, and the growing of 2 and 3 year old seedlings in the nursery.

There are some stands where thinning and other tending operations are carried out.

But the study of thinning methods (selection of thinnings, thinning intensity, etc.) should be started as soon as possible.

The pine forests at the site are naturally regenerable, and many of them have young seedlings. These forests must be handled with great care. As already discussed, the age, density and distrubution of overgrowth should be classified into several types combined with the age, density and other factors of the undergrowth for the purpose of formulating proper silvicultural programs for each specific type. If possible, this work should be conducted in parallel with the inventory survey.

It is also desirable to clarity the silvicultural plans for each specific stand type when the forest inventory survey is completed.

2-2 General review of El Paraiso

El Paraiso stands on the south of Francisco Morazan where Capital Tegucigalpa is located.

It also borders on Nicaragua, and has an area of 794,600 ha. It is highly developed compared with Mosquitia.

2-2-1 Nature, forests and forestry

For Paraiso, the Honduranean counterpart requests Japan to conduct an aerial survey only. While its nature, forests and forestry will be discussed briefly here, its forestry industry will be discussed in detail in a separate section as the forestry industry in El Paraiso is ranked second to F. Morazan.

The regional forestry office administrating Paraiso is located in Danli which is about one and a half hours from Tegucigalpa. The road is paved, and transport is much more convenient than in Mosquitia.

Topographically, El Paraiso has steep, undulating and hilly terrain, and is similar to Japan.

The climate is favorable because the elevation is 500 to 1,700 m.

In nearby Tegucigalpa, the maximum temperature is 34°C (in March), and the minimum temperature is 6.7°C. Like Mosquitia, El Paraiso has two seasons - rainy season and dry season. The rainy season lasts from June to November. The soil is above par for Honduras.

In the Comayagua region, the topsoil is whitish, and very shallow; in the extreme case, pines grow on a topsoil as shallow as 1 to 2 cm. In Paraiso, on the other hand, the topsoil is deep and predominantly reddish. Those hollows which have deep topsoil are highly fertile and far better than the soil in Mosquitia.

Accordingly, the stands are much better and larger than in Mosquitia.

Although the species in Mosquitia is Pinus Caribaea while that in Paraiso is Pinus Oocarpa, the stand density and tree height in Paraiso are better than those in Mosquitia.

Some stands are comparable to the much celebrated forests of cedars and cypresses in Japan.

Some such stands are dotted with broad-leaved trees like Quercus.

It is reported that Pinus Caribaea is found sporadically in the undergrowth of pine forests, and that the strobilaceous pines are found sporadically in the forests 1,000 m or higher in elevation.

Just as in Mosquitia, the forestry operations place emphasis on the prevention of forest fire. PR and educational activities for the local people are promoted enthusiatically. The rosin extractors are also obliged to take part in fire control in and around their operating forests. There are five watchtowers within the jurisdiction of the Danli regional forestry office in order to keep watch of the jurisdiction on an around-the-clock basis. The watch officers always keepin close contact with each other by radio. Fire companies have been established, for example, the Potrarillos work office in the Teupasenti project site within the jurisdiction is provided with above standard accommodation facilities for the firefighters.

The fire department is composed of three companies, each having seven members.

The Potrarillos work office is also provided with a small nursery farm, and is better than the counterpart of Mosquitia in terms of manning, equipment and accommodation facilities.

As is usual in Honduras, there is a mixture of national land and privately owned land in Paraiso.

The privately owned lands are fenced to contain domestic animals, etc.

(The greater part of Mosquitia is owned by the state, and private lands are few, except for those in the riparian communities.)

As already discussed, the timber on the privately owned lands is under the government control, and even the landowner cannot fell it without the permission of COHDEFOR.

In case logging is permitted for private use, the landowner need not pay for it.

On the other hand, in case COHDEFOR fells timber in the privately owned stands, it is obliged to pay the landowner 2 Lempiras per m^3 of the felled volume.

It should be noted that as already stated, COHDEFOR does not fell and log the timber, but sells off the stumpage to the sawmills, and that COHDEFOR buys up the processed products from the sawmills, and resells and exports them.

El Paraiso has many sawmills, and is near F. Morazan which forms the largest center of sawmills in Honduras. Accordingly, the forests in El Paraiso are said to have been excessively overcut. Nevertheless, the stands are generally in good shape.

This is probably due to the high productivity of the land.

Regeneration is mostly natural.

Large-diameter trees are cut selectively, and there are few wide tracts totally afforested or deforestated.

The purchasers of the stumpage are obliged to construct forestry roads.

Considering the development state of the region, there is a well-knit network of forestry roads.

The forestry roads as such are not so good; their slopes, etc. are poorly maintained. For the yarding operations, bulldozers, trucks and other mechanical equipment are employed.

2-2-2 Forestry industry

In the sawmill industry in Honduras, Paraiso, together with Olancho, is ranked second to F. Moranzan. As is seen in Table V-2 below, Paraiso produced an average of 35.75 million b.f. of sawn products a year for five years from 1974 to 1978, accounting for 14.2% of the total output in Honduras.

Table III-2 Output of sawn products

Region \ Year		1974	1975	1976	1977	1978
Paraiso	mil. b.f.	34.4	26.5	40.3	38.6	38.9
	(%)	12.1	13.1	16.4	14.3	14.9
National total		285.2	202.7	246.4	258.8	261.1

The total number of registered sawmills in Honduras was 140 in 1978. But, only 120, or 85.7% of total were actually running.

In Paraiso, there are 14 registered sawmills of which 12 alone are operating.

Of these active mills, Teupasenti, San Diego, Progrese #2, and Jamastran are much celebrated. The former three are always operating planers. (There are only 20 mills equipped with a planer.) Jamastran has another factory in Olancho, and is operated by Maderas Preciosas S.A. which is the largest producer of hardwood products in Honduras.

The 1974 ∿ 78 outputs of the sawmills in Paraiso were as listed in Table V-3 below.

Table III-3 Mill outputs (1974 78)

(* shows dormant mill) (in mil. b.f.)

Mill	1974	1975	1976	1977	1978
Teupasenti	5.4	5.6	5.6	2.9	4.3
San Diego	7.7	4.8	8.7	7.0	8.9
San Antonio	1.5	3.8	3.8	3.1	3.1
Progreso #2	3.8	2.8	7.8	8.9	9.3
Jamastran	0.5	2.3	3.0	2.5	2.6
El Parvenir	2.1	1.7	0.8	1.4	1.4
Las Brisas	2.4	1.6	4.1	4.2	2.3
Beatriz	1.0	1.2	1.2	1.7	1.4
Santa Isabel (Lardiz)	0.9	0.9	0.9	0.8	0.8
Progres #1*	3.6	0.8	-	-	-
San Martin	1.0	0.8	0.4	0.8	0.7
Las Trojes	1.2	0.2	1.9	2.3	1.9
Buena Vista	1.5	-	2.0	2.9	2.2
San Isabel* (lamas)	1.7	-	-	-	-

The products are mostly pine. In the four-year period from 1975 to 1978, pine products accounted for 96.5% of the total in 1975, 97.2% in 1976, 98.1% in 1977, and 98.0% in 1978, or 195 mil. b.f., 239 mil. b.f., 254 mil. b.f., and 256 mil. b.f., respectively.

In Paraiso, Danli Industrial S.A.'s San Diego mill, Pacifico Industrial's Progreso #2 mill and Maderas Oriente's Teupasenti mill lead all the others in output. The former two were ranked fourth and fifth among the 120 sawmills in 1977 and 1978.

The majority of hardwood saw logs is produced in Olancho and Paraiso.

Maderas Preciosa S.A. has a mill each in Olancho and Paraiso, and leads the sawmill industry in the production of hardwood products.

Since 1977, Danli Industrial S.A.'s San Diego has closely followed Maderas Preciosa S.A.'s Jamastran mill.

The secondary processing of sawn products has been undertaken by Jamastran and by Aprovechamiento Forestales established in 1978 which has been manufacturing brush handles for U.S.A., spindles, stepboards, etc.

The following is a brief description of each of the biggest sawmills in the jurisdiction of the Paraiso regional forestry office.

o San Diego:

Operated by Danli Industrial S.A., this is the largest mill in Paraiso. As is seen in the foregoing table, San Diego produced 8.9 mil. b.f. in 1978, holding the sixth place in Honduras in the production of sawn products.

It is equipped with a planer, a large drying kiln, etc. The drying kiln has a capacity of 40,000 to 45,000 b.f. of 1" boards and 50,000 b.f. of 2" boards.

The past achievements of San Diego are shown in Table V-4.

Table III-4 Production by San Diego

Year / Product	1975	1976	1977	1978
Softwood (pine)				
o Output, mil. b.f.	5	9	7	8
o Ratio to national total, %	3	4	3	3
o Ranking in Honduras	7th	4th	5th	5th

Year Product	1975	1976	1977	1978
Hardwood				
o Output, b.f.	94,075	167,690	457,349	1,190,975
o Ratio to national total, %	-	-	9	25
o Ranking in Honduras	-	-	5th	2nd

o Progreso #2:

This sawmill is operated by Pacifico Industrial, and its output is comparable to San Diego's. It processes pine logs alone, and hardwood is not handled. With an output of 9 mil. b.f., the mill was ranked fourth in Honduras in the production of pine lumber in two straight years, 1977 and 1978.

In 1978, it was ranked fifth in terms of the combined total output of softwood and hardwood when San Diego was sixth.

o Teupasenti:

This sawmill is operated by Maderas de Oriente. Its equipment is comparable with the two sawmills outlined above.

Until 1976, its annual output was at a level of 5.6 mil. b.f. and was ranked seventh in the output of pine lumber.

Of late, its output has fallen a little, which may be due to financial difficulties.

o Jamastrain:

Operated by Maderas Preciosas S.A., this mill mainly handles hardwood (broad-leaved wood). Until 1976, its output was below that of its sister mill in Olancho. Since 1976, however, its hardwood lumber output has been second to none in Honduras.

The annual transition of hardwood lumber output by two sawmills in Paraiso is as shown in Table III-5.

Table III-5 Hardwood lumber outputs by two major sawmills in Paraiso

Sawmill	1975	1976	1977	1978
Jamastran	b.f. 2,279,842	2,997,913	1,903,621	1,623,050
San Diego	94,075	167,690	457,349	1,190,975
Honduranean total	7,946,455	7,331,347	5,354,591	4,782,432

Jamastran is equipped with a chemical preservation treatment facility.

The broad-leaved tree species handled include mahogany, cedar, maria, sangre, guanacaste, and quercus.

From the statistics in Table III-5, it is found that the hardwood resources in Honduras have been dwindling.

2-3 Comparison of Paraiso and Mosquitia

Paraiso and Mosquitia for which Japan is asked to conduct a survey have been discussed in detail in the foregoing paragraphs.

To recapitulate the preliminary survey results, the principal particulars of the two sites are shown in juxtaposition in the following table.

	Mosquitia	Paraiso
(1) Location	1 hour and 50 min. by Cessna (twin-engined) from the capital to Puerto Lempira where the regional forestry office is located. It takes 2 hrs. to go from Puerto Lempira to Dursuna (70km) by jeep.	1 hour and 30 min by paved highway from the capital do Danli where the regional forestry office is located. About 2 hrs. jeep ride from Danli to the Potrarillos work office. The road is badly kept.

	Mosquitia	Paraiso
	The transport is good though the road is not paved.	
(2) Climate	Elevation, 100 to 500 m above sea level. Tropical yet bearable climate. Dry season: Dec./Jan. to Jun./Jul. Rainy season: Jun./Aug. to Nov./Dec.	About 1° to the south of Mosquitia. Elevation, 500 to 1,700 m above sea level. Acceptable climate. Dry and rainy seasons are almost the same as in Mosquitia.
(3) Topography	Rolling terrace.	Steep, undulating, hilly terrain.
(4) Race	Black African-mixed Zambos (Misquitos), 80%; aborigines (Paya, Zumo), 20%	The overwhelming majority is accounted for by mixed bloods of whites and aborigines.
(5) Religion	German Moravians, 2/3. Catholics, 1/3.	Mostly Catholic.
(6) Population	20,738 (1.4/km^2) according to 1974 census. The smallest in Honduras.	About 60,000 in Danli alone. The population density is above the national average of 24.3 persons/km^2.
(7) Living standard	Low	High

	Mosquitia	Paraiso
(8) Health & hygine	Improving. About 10% of the workers in Dursuna have malaria. Endemic diseases include gastro-enteropathy, vermina, and pneumonopathy.	Good. No malaria at all.
(9) Forest		
(i) Stand character-istics	Pinus Caribaea, savannah. Many second growths. Some dales spotted with broad-leaved trees. Few large-diameter trees. Stand density is low.	Mainly Pinus Oocarpa. Quercus and other broad-leaved species are seen sporadically. The undergrowth is mixed with Pinus Caribaea. Farms and grazing lands between stands. Stand density is medium.
(ii) Soil	Extremely thin topsoil, with little humus. Oligotrophic.	Thin topsoil, but thicker than in Mosquitia. Better fertility than in Mosquitia.
(iii) Viability	The growth of trees is generally poor.	Good.
(iv) Natural regenera-tion	Possible, except in savannah.	Possible.
(v) Damage	Many scars of forest fires.	Recovering from fire damage.

	Mosquitia	Paraiso
	Conspicuous damage by borers which lodge in the top of transplanted younglings. Fire prevention system under way.	Active fire prevention activities, and active extension and education services to local people.
(5) Forest road	Arterial forest road: 193 km; branch forest road: 57 km. Vehicular access to forests is easy because of flat or moderate-slope terrains. Roads are wide in width, and their surface conditions are good.	There are many roads, arterial and peripheral. They are not so much forest roads as logging roads, and are narrow in width. They are undulating, and their surface conditions are not good.
(6) Tenancy	Mostly national. There are few farms and grazing lands.	There are many privately owned lands within the national land. They are fenced. The privately owned forests are easy to clear and turn into cropland.
(10) Forestry operations		
(i) Planning	The operations plan has yet to be formulated. But, there seems to be implementation programs for Lempira and Dursuna.	It is reported that the operations plan has been formulated for the Teupasenti project site. The intensive forests are said to be expanding gradually.

	Mosquitia	Paraiso
(ii) Matters concerning silvicultural operations	The silvicultural operation plan should be formulated based on an aerial photograph, and operation guidelines (particularly, operation methods as classified by stand types) should be established. It is urgent to formulate pest control measures, improve nursery techniques, and to expand the employment opportunities for local people through promotion of forestry.	The Honduranean counterpart will be able to formulate the silvicultural operation plan without help if an aerial photograph is available. The future relations between farming operations and forestry operations among the local people are unknown.
(iii) Implementation	Because of national land, the implementation of plans is easy. It is possible to formulate a model of measures for local people.	Because there are many privately owned lands, the planning surveys and the implementation of plans will be restricted to a considerable degree.
(11) Relations with Nicaragua	Honduras and Nicaragua border the Segovia River on the south. The riparian area on the other side of the river has a small population and is mostly farms and forests. Nicaraguan unrest, if developed, will not greatly affect Mosquitia.	Paraiso has a boundary with Nicaragua on the south. Since the road network is well developed, Nicaraguan unrest will affect Paraiso.

	Mosquitia	Paraiso
(12) Forestry industry	No sawmill at all. COHDEFOR is planning the construction of a portable sawmill.	The sawmill industry in Paraiso is ranked second in Honduras. Accordingly, the forests are a bit strained. It is therefore necessary to control the felling and logging at the site for the purpose of constructive forest perpetuation.

As regards the aerial photogrammetric survey, the Honduranean Government should make prearrangements with the Nicaraguan Government as the aerial survey cannot accomplished without violating Nicaraguan airspace.

Even when the surveying plane is made to circle within the Honduranean territory as suggested by COHDEFOR which thinks it unnecessary to take photos near the border because the frontier forests are to be reserved, it is imperative to obtain the prior approval of the Nicaraguan Government or conclude a proper agreement with the Nicaraguan Government in advance in case the worst should happen.

It should not be difficult to obtain such approval or conclude such an agreement considering that the relations between the two countries have been changing for the better as twenty years have passed since the settlement of the dispute over Mosquitia.

While Paraiso has steep hills of 500 to 1,800 m above sea level, Mosquitia forms savannahs and moderate terraces of 100 to 500 m.

Accordingly, the installation of beacons, photography and mapping for Mosquitia will be by far easier than for Paraiso, and the time and labor for them will also be far less.

As regards the installation of beacons, Mosquitia facilitates vehicular transportation of materials, supplies and workers to the installation sites, whereas in Paraiso, the installation work will be considerably difficult because the materials and supplies must be hauled up over a long distance of hilly area by hand.

As regards the forestry survey, the forests in Mosquitia facilitates vehicular access everywhere, while in Paraiso, it is remotely possible. Accordingly, survey progress will be significantly different between Mosquitia and Paraiso.

In Mosquitia, the overwhelming majority of the projected area is state-owned with the exception of a small tract along the Segovia River where there are a few privately owned farms and grazing lands, and the forests on the frontier are excluded from the development project. Accordingly, there will be little or no need to make arrangements with the local people before survey.

On the other hand, Paraiso has a combination of privately owned lands and state-owned lands, and the survey may be hampered by unexpected friction with the local people.

What with the difference in customs and habits and with the fact that the Spanish language alone is spoken, there is a great fear of developing troubles with the local people. From the viewpoint of silvicultural operations, Paraiso is interesting technically because its topography is similar to Japan's and natural regeneration is easy with little floor vegetation, and the forests will be easier to reorganize than in Mosquitia because cadastral data is available.

In Mosquitia, large-diameter uppers were felled sweepingly in the past, and there are many fire-ridden sites. In addition, the forests are thick with bushes. It is therefore unavoidable to combine afforestation with natural regeneration. There are many second-growth stands. Many of them are either stands that will proceed immediately from the felling of low-grade trees to euphoric felling, or stands that will be totally denuded after euphoric felling. Of course there are stands that are mature or have not yet been subjected to the felling of low-grade trees.

For these stands, it will be necessary to formulate silvicultural plans according to the stand types and characteristics.

Although Paraiso is interesting from the engineering viewpoint, it leaves much to be studied from the viewpoint of actual silvicultural operations, reorganization, etc.

Be that as it may, Mosquitia will be easier to survey than Paraiso.

As regards the living conditions under which the survey will be promoted, Campamento Patrarillos in Paraiso and Campamento Dursuna in Mosquitia are both served with electricity, but the latter is not provided with water.

In Paraiso, the water service has already been completed. But the construction of a water service is now under way in Mosquitia, and the poor living conditions in Mosquitia should be tolerable.

As regards health and hygiene, Paraiso is of course better than Mosquitia. But, Mosquitia has an agreeable dry-season climate for its tropical location, and is less afflicted by diseases. Generally speaking, Mosquitia may be classed among the favored regions.

While the two sites have been compared for the study, what is most important in determining the survey priority is to pay due deference to the opinions of the Honduranean counterpart. Considering the various circumstances already discussed, the Honduranean counterpart puts Mosquitia in the first place of priority.

The forest survey in Paraiso will be undertaken by the Honduranean counterpart itself if an aerial photograph alone is available.

This interim report has been prepared according to the unanimous decision of the members of the survey team that Mosquitia should be given top priority and that the survey of Paraiso should be considered if circumstances permit.

IV. Promotion of future cooperation

(1) In Honduras, more than 60% of the national land is covered with forests, of which about 40% are accounted for by the Honduranean pines much celebrated all over the world. There are broad-leaved trees over a wide and untapped tract.

Up until recently, however, high-quality coniferous trees available from comparatively convenient sites have been felled, processed and exported contributing much to the government coffers.

(2) As the logging has been concentrated in the coniferous forests to a considerable degree, forestal potential has been on the decline, particularly in the suburban sites. Aggravated depauperation of the forests has to accelerated the erosion of topsoil. Concerned over the situation, the Honduranean Government has been making every effort to systematize forest development in specific areas by bilateral or multilateral cooperation with Canada and other countries. In addition, the Honduranean Government has been promoting self-reliant policies through the improvement of the organization of COHDEFOR which integrates and manages the forests, forestry and woodworking industry, consolidation of forestry-related laws and regulations, etc.

(3) Under these circumstances, the Honduranean Government has requested the Japanese Government to extend cooperation for the purpose of establishing a forestal resources development plan for the Paraiso region east of Capital Tegucipalpa and the Mosquitia region in the northeast corner of the country.

In response to this request, the survey as detailed in this interim report was conducted.

(4) According to the survey, the following points have been clarified to some degree.

(a) The two sites referred to above are quite different from each other in terms of socio-economic conditions and natural environments. And, from the viewpoint of exigencies, Mosquitia is more in need of development than Paraiso.

(b) The terms of reference common to the two sites are the cooperation in the aerial photogrammetric survey for the purpose of taking stock of the forestal resources that underlie the build-up of the current forestry development plan.

(c) As regards Mosquitia, which the Honduranean Government desires to develop first of all, it is requested that 75,000 ha of tracts subjected to a minor degree of deforestation be selected out of 200,000 ha, and that for the 75,000 ha area, ground and aerial surveys be conducted for the purpose of formulating a detailed silvicultural operation plan necessary for the preventation of the degradation of the forests and for the conversion of the area into high-quality forests. In addition, the Honduranean counterpart requests the Japanese Government to send, during the course of the implementation of said plan, experts in the areas of nursery, engineering and pest control with which COHDEFOR has little experience.

(d) As regards the local environments, there will be nothing standing in the way of technical cooperation in Mosquitia.

But the flight schedule or flight path for the aerial survey should be determined after fully satisfactory discussions with the Honduranean counterpart or, if necessary, after the Honduranean Government has made proper arrangements with the Nicaraguan Government for the safety of the surveyors.

(e) As regards the Mosquitia region for which Japan is requested to undertake the survey, forestry development after the development planning survey is for the time being to be undertaken by COHDEFOR.

Accordingly, the survey cooperation will be extremely significant.

(5) According to the survey findings above, the most viable course of cooperation in future will be as follows.

(a) The Mosquitia region should have top priority.

As regards the Paraiso region, it should be studied whether cooperation should be limited to the aerial photogrammetric survey without detailed ground reconnaissance. Anyway, it will be better to wait and see what are the particular requests of the Honduranean Government, and to evaluate the feasibility of co-operation with them.

(b) As regards the aerial survey, the number of days available for survey flights will be extremely limited by local weather conditions. It is therefore important to collect and analyze weather data carefully in advance and to maintain close liaison between the parties concerned before and during the aerial survey.

(c) The forest survey which is particularly important for the co-operation and on which the Honduranean counterpart places utmost importance should be conducted with respect to the items mutually agreed in advance between the two countries.

The forest survey should be comprehensive, and should preferably include: a growth potential survey necessary for the determination of felling ages and for the calculation concerning constructive forest perpetuation; a survey for the purpose of establishing the silvicultural operation methods as classified by stand types on the presupposition of natural regeneration; a soil survey and vegetation survey for the purpose of regeneration and afforestation, particularly in savannahs; a characteristic survey of the existing forests for the purpose of assessing the profitability of the development projects to be formulated, and for formulating investment plans; and a survey for the preparation of available stand volume; etc. For the purpose of improving the productivity of the forests in the requested sites, it will be necessary to construct a good number of additional forestry roads. These roads should be designed to meet their specific purposes, and thus the design standards should be established in advance.

(6) The national plan for constructive forest perpetuation has not been established to the extent that it can be implemented immediately. As a result, in many places there are forests whose reproductive functions are endangered as already stated. Considering these and other various factors, it is quite understandable that COHDEFOR is very anxious to obtain survey cooperation from Japan.

Considering that forestry development in Mosquitia offers employment opportunities and thus an increased standard of living for the people, it is important that survey cooperation be offered as early as possible.

It is therefore recommended to dispatch an S/W mission to Honduras before the dry season toward the end of this year for detailed working-level arrangements and for conclusion of the committed survey schedule and other agreements.

Since Honduras has a considerably long rainy season, the aerial photogrammetric survey should be the first project conducted.

It will be very difficult to complete the survey in a short, uninterrupted time, and will unavoidably take some two to three years.

(7) The official request of the Honduranean

Government for the survey cooperation was made in March 1979. On that occasion, CONSUPLANE which is in charge of national economic planning in Honduras earnestly requested the Japanese Government to conduct a forestry inventory survey and at the same time to dispatch experts copable of formulating a master plan for the entire forestry industry in Honduras and of making recommendations to the various international cooperation projects in forestry in Honduras. The Japanese Government agreed to give priority to the survey, but deferred the decision about the dispatch of the experts on account of various circumstances in Japan, and because of the lack of mutual exchange between the two countries in the field of forestry. But the Honduranean Government still requests that Japan send experts to CONSUPLANE. As the basis of the survey project and the Honduranean readiness to accept the Japanese survey team have been clarified, dispatch of the experts to

CONSUPLANE is worthy of consideration as it will be greatly beneficial to the development of the entire forestry industry in Honduras.

CHAPTER V. Guide to Forest Inventory Planning

1. Guide and Proposal for Forest Inventory Planning

As in all other kinds of survey, the first consideration in planning a forestry development survey is to make clear the objective for which it is to be conducted. A survey carried out without any clear target or objective only incurs a huge loss of funds, labour and time. It should also be noted that a detailed survey does not call for coverage of a large number of survey items many of which are not essential for the purpose of the survey. Coverage of too many survey items of no great importance makes it impossible to concentrate survey activities on items of crucial importance and consequently reduces the validity of survey results. A survey can be evaluated as "detailed" only when its objective is achieved. Hence, clear establishment of the objective is the first step in planning a forestry development survey.

In all countries advanced in forest industry, the forestry development survey is considered in two clearly distinguished categories. In one category, it is conducted for the purpose of forest administration and is generally called a forest resources survey and in the other, it is carried out for mapping of a forest management plan. To be more specific, the former is intended to grasp the stock and growth by tree species of forests in the entire country or local area to formulate various forestry programs on a relatively long-term basis. The latter is intended to work out a future manageplan for each individual stand and sub-compartment. Accordingly, The survey method and system employed in one category naturally vary from those applied in the other. In developing countries and in countries like the United States and Canada which cover an extensive land area and have a rather simple forest type, distinction between the two categories, which is made in Japan and Germany, is usually disregarded. In these countries, The forest resources survey is carried out in greater detail than in Japan and Germany in order to meet the objectives of the two categories. This is partly because there is no need to formulate a detailed management plan for each sub-compartment as pratised in Japan and Germany.

When the objective of survey is determined, the next step is to collect as much as possible indispensable or useful data and information. Availability of such basic data bears closely upon the survey accuracy and efficiency, and especially important among them is a detailed map of the survey area. If a recently taken aerial photo is

available, it greatly faciliates the survey.

If the survey is required to produce data for not only forest administration but also management planning as in the case of the Mosquitia district, it is necessary to collect all relevant data covering natural environment, socio-economic and cultural aspects, and particulary labour customs and practices. It was for this reason that the preceding chapter was devoted to a detailed account of the Mosquitia district.

Collection of basic data should be followed by the determination of survey items and method, and then by a preliminary survey at the site to modify the survey method, if necessary.

When the survey method is thus finalized, the field survey is to be conducted under the guidance of well-trained group leaders and sub-leaders. In addition to the survey groups, an examination group should also be organized to check the conformity between the results of the field survey and the existing state of survey plots in accordance with the Standards for Forest Survey established by CIDA-COHDEFOR in 1980.

With the progress of survey activities, the survey data should be analyzed by the mehtod suited to the survey objective, and compiled into a report.

The format of the survey report should be determined in advance through arrangement with the users who will be the forest management planners.

A proposal for the forestry survey in the Mosquitia district is given below. The above-mentioned forest survey standards of CIDA-COHDEFOR were established in February 1980 mainly for application to the central mountainous zone of Honduras, but it is counsidered applicable to the greater part of forest land in the country. In these standards, aerial photos are used only for plot confirmation and stratification, and the team feels that it should be utilized more extensively.
The standards present some other minor problems, but will be used as the basis for the following survey proposal and explanation because it was eatablished on the strength of past experiences in Honduras and also because the survey is aimed at producing data for formulating a forestry development plan and a forest management plan.

Honduras covers an area of 11,200 thousand ha which is divided into 18 administrative provinces. For the purpose of forest administration, the

country is divided into four eatern regions and four western regions as mentioned already. Each region is divided into a number of unidads (working areas), and if the area covered by a single unidad is very extensive, it is further divided into subunidads. For the purpose of administration and management, each subunidad is generally classified as intensive forest or extensive forest.

The Rus Rus subunidad covered by the present survey is included in the Segovia unidad which is under the jurisdiction of COHDEFOR's regional forest office located at Puerto Lempira, Mosqutia. The Segovia unidad is composed of the following subunidads.

Puerto Lempira	57,300 ha	(Extensive)
Dursuna	125,647	(Intensive, partly extensive)
Rus Rus	75,833	(Extensive)
Total	258,780 ha	

To the south of the Rus Rus subunidad flows the Segovia river which is the Honduran-Nicaraguan border. A number of clusters in the subunidad excluding Rus Rus, such as Auasbila, Kahka, Yasko, San Ramon and Waspuk Suji are all found along the Segovia. An all-weather expressway (137 km), running from Puerto Lempira to Rus Rus, extends 62 km farther to link Rus Rus with Auasbila. The Dursuna subunidad forest office is located approximately in the center of the distance between Puerto Lempira and Rus Rus. A branch road reaching Suji and a loop road branching off at Rus Rus from the expressway and joining it later are also available. Topography is flat or mildly undualated at an elevation of less than 500 m. There are some sharper undulations and swamps, but they are accessible by car.

The surface soil layer is not thick, contains fragments of rocks, and presents reddish pink color, Geologically, the eastern regions belong to the Quarternary and consist of alluvial formations such as gravel terraces and floodplains, whereas the western regions are composed mainly of acidic volcaniclastic materials of the Tertiary, with red-colored valcaniclastic materials mixed in sheets in the calcareous rocks of the Gretaceous period in certain places.

The ground surface is covered with grasses, with bushes found only in few places. The soil is extremely infertile and covered with P.Carbaea or

grasses, although broad-leaves trees are found in deeper places or along creeks in low areas where the soil is not very infertile.

Pine tree forests show different states from place to place, but most of them present just about the same state as described in the preceding chapter for the Mosquitia district. Specifically, most are in the state immediately before final regeneration cutting of the preregeration system and the residual crop stand of upper trees, which is generally sparse, shows different aspects from place to place, The upper trees are generally small in diameter class, and many residual trees present traces of fire damage.

2. Sequence of Survey, and Data Collection

The following is an outline of the proposed survey procedure.

a) Study alternative plans proposed for the survey and select the most approriate one.

b) Check the applicability of the survey plan thus selected with the competent Honduan authorities, and at the same carry out aerial photography and mapping. In the course of discussion with the Honduran authorities, decision should be made on the expected accuracy of the survey, method of stratification, the expected accuracy in each stratitied sample, the format of the forest inventory ledger, the expected accuracy in the estimation of growing stock and stand composition of each sub-compartment, the choice between the use of the existing volume table and the formulation of a new one, and the method of estimating the area to be planted or the area that can be planted. Arrangements should also be made for the formation and number of survey groups, the necessity for training survey personnel, the availability of survey equipment and materials including, in particular, automobiles and fuels, the recruitment of drivers, the availability of sleeping accommodations, the supply of daily necessities, and assurance of hygiene and sanitary facilities.

Collection of data relating to all the above arrangements is also necessary in order to start the disucssion.

c) When the survey method is finalized as a result of the above discussion and arrangements, its validity should be checked by a pretest and necessary corrections should be effected, if found

necessary. Further, the sample size should be determined according to the expected acuuracy on the basis of the estimated value of variance.

d) The pretest will be followed by a full-scale field survey. In order to process the survey data with an electronic computer, the codes to be entered in the field survey cards need to be determined.

e) When the field survey is completed, its results are to be compiled into a report together with the data of additional studies. Specifically, if a volume table is newly prepared or a vegetation study or a soil sruvey is conducted, they should be compiled into the survey report.

The above is an outline of the proposed survay method. A detailed account is given below on each item to be given special consideration in the survey and on how the survey is to actually implemented.

2-1 Maps

It is presupposed that aerial photography will be conducted for producing new maps for the purpose of the survey. The scale of maps required in countries where intensive forestry is prevalent is 1 : 5,000. Considering the site and forest conditions in the survey area, a map on the scale of 1 : 10,000 would be sufficient. For the sake of convenience, it is commendable ot prepare another map on the scale of 1 : 20,000.

The base map used by COHDEFOR has scale of 1 : 20,000 enlarged from the 1 : 5,000 map prepared by the Honduran Geographical Survey Institute. This maps show rivers, municipalities, clusters, roads, contour lines, etc.

2-2 National Land Classification

COHDEFOR classifies the whole country by watershed, and also by regional forest office and working area. The following code numbers are given to areas classified by regional forest office.

Compyagua	01
Copan	02
El Paraiso	03
Francisco Marazan	04
La Mosquitia	05
Nor-Occidental	06
Olancho	07
Yoro	08

In the land classification by watershed, performed and made public by the Hydrological and Weather Department of the Ministry of Natural Resources, the name of each area and its code number are presented. The following are the areas and code numbers related to the Mosquitia district.

Aguan	108
Trujillo	114
Iriona	115
Sico	116
Platano	117
Sigre	118
Patuca	119
Ribra	120
Warunta	121
Mocoron	122
Nakunta	123
Tuntuntara	124
Cruta	125
Coco	126

The areas closely related with the present survey are those with code numbers from 119 to 126. In addition to the above classification which is the primary basin-wise classification, there are secondary and tertiary classifications, but the details of these lower-order classifications are not known.

The land in Hondura is divided into private land, public land embracing villages, etc., and national land by the Cadastral Department of the Honduran Government. The national land is further divided into parks, reserved land, and national forests.

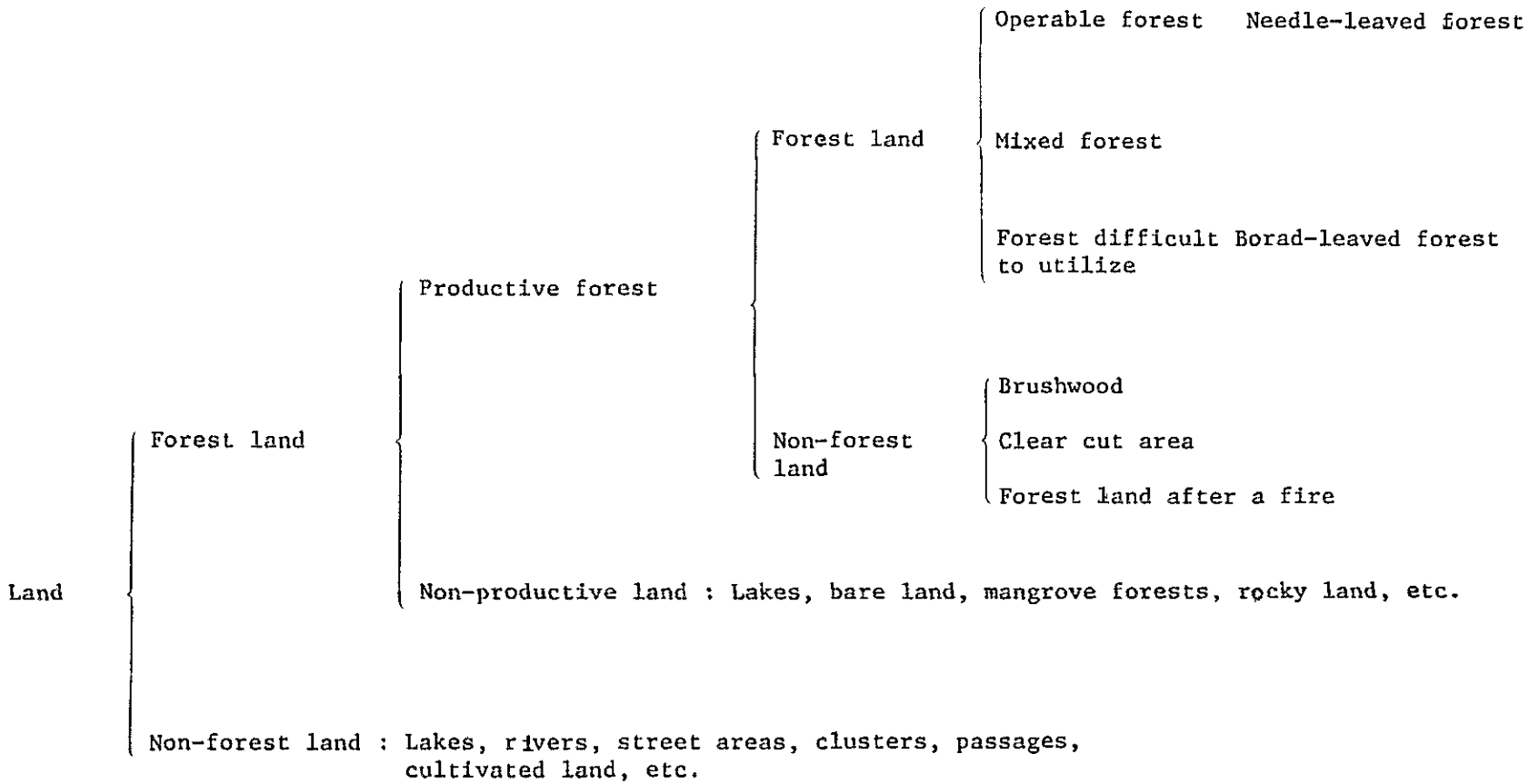
2-3 Forest Land Classification

A forest survey must be preceded by the classification of the survey area according to land utility. For the purpose of the present survey, COHDEFOR and CIDA adopted the following classification on the basis of their past experiences.

(1) Forest Land

a) Productive Forest Land

The productive forest land is appropriated solely for forest production irrespective of its being a national, public or private forest land, or its being an economic forest land or not.


Land
Forest land
Productive forest
Forest land
Operable forest
Needle-leaved forest
Mixed forest
Forest difficult to utilize
Borad-leaved forest
Non-forest land
Brushwood
Clear cut area
Forest land after a fire
Non-productive land : Lakes, bare land, mangrove forests, rocky land, etc.
Non-forest land : Lakes, rivers, street areas, clusters, passages, cultivated land, etc.

Productive Forest Land Currently Embracing a Forest:

This forest land is required to have a minimum density of more than 5% of useful tree species, or more than 20 mature trees per ha. For the aerial photo interpretation, it is required to have a minumum area of 5 ha. This area would suffice for the purpose of the planned forest management, although it is possible to distinguish a minumum of 1 ha in tha Japanese photo interpretation technology.

Productive Forest Land Currently Not Having a Forest:

This is a former cultivated land, a clear cut area, or an area subjected to a heavy forest fire where no forest is currently existent. This class of forest land is required to be planted in a short time, and is planned to be distinguished to 2 ha in the aerial photo interpretation.

Product Forest Land Currently Difficult to Utilize:

The forest land with a gradient of more than 60% is classified as "difficult to utilize," and its boundaries are marked on the map with contour lines.

b) Non-Productive Land

This is a weathered rocy land with no vegetation or a humus layer on the surface, lakes and ponds, or other land where forest cultivation is not possible.

c) Non-forest Land

The non-forest land is a land which is devoid of a forest at present and is not likely to turn into a forest land in the future. Conceivable uses of this class of land are agriculture, dairy farming, and preservation of sand and clayey soil. Streets, lakes and ponds, rivers, and infrastructural project (road construction,etc.) areas are classified in this category.

2-4 Forest Division and Stratification

2-4-1 Forest Division

In parallel with the survey area classification by land utility mentioned above, the forest division is conducted. Forests are usually divided at least into compartments, but it is not known whehether the Rus Rus subunidad is so divided. Even if to is divided, it may by found necessary to divide it newly for the purpose of the survey.

The forest division into compartments will be followed by the division into sub-compartments, and this can be performed according to the same standards as applied in Japan because the COHDEFOR's standards stipulates that each sub-compartment (rodal) should comprise tree species with approximately the same age gradation, density (or crown density) and height grade.

2-4-2 Forest Stratification

The best way to increase the accuracy of a forest survey is to make maximum use of all existing data and information. In the case of the present servey, however, aerial phtography is planned to be conducted so that the forest stratification will be based on the new aerial photos. The standards of forest stratification include the forest type, structural tree species and their age and height, stand age, growth condition, abnormalities that have occurred in each compartment in the last five years, etc.

The forest type is divided into needle-leaved forest, mixed forest and broad-leaved forest. The needle-leaved forest mean a forest consisting of 80% or more of needle-leaved trees, and the broad-leaved forest also means a forest consisting of 80% or more of broad-leaved trees. The forest with an intermediate percentage are classified as mixed forest.

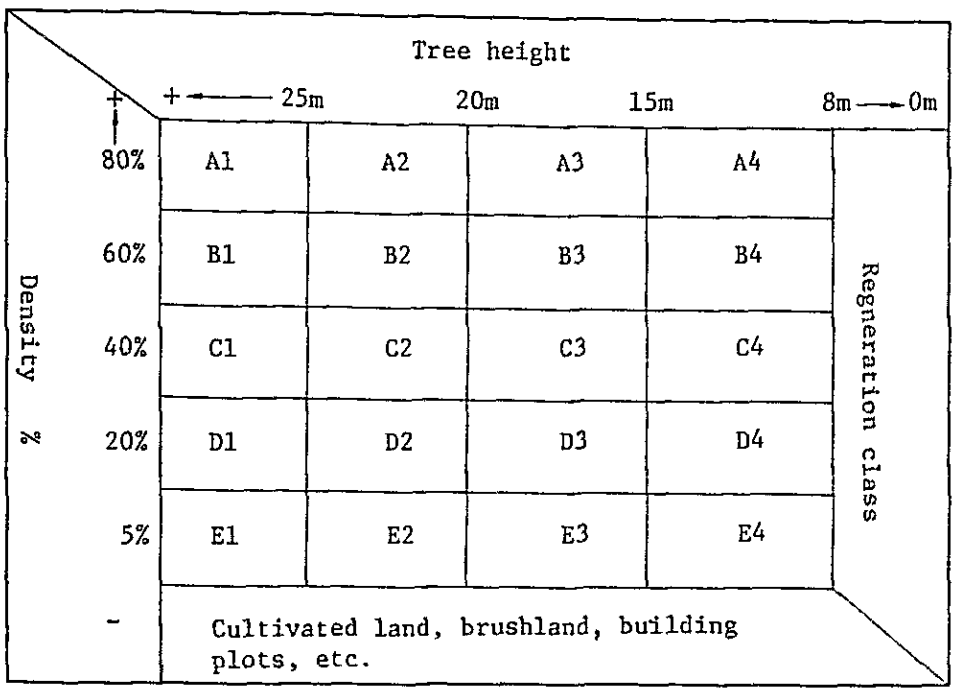
Classification by tree species is similar to the forest type division. Specifically, a forest with 80% or more of single tree species is considered to consist only of the tree species. It is said that the three pine tree species in Honduras cannot be discriminated from each other on aerial photos on the scale of 1 : 20,000.
Most mixed forests in Honduras are pine tree forest in which broad-leaved trees such as Quercus, Liquidamber, etc. are mixed.

The density and height gradation are the most effective standardards for sub-compartment classification. These two will be more effective that the forest type or tree species especially because the forests in the Mosquitia district are composed mostly of Carribbean pine trees.

The density is to be divided into five calsses, i.e., 80% or more for A, 60 - 80% for B, 40 - 60% for C, 20 - 40% for D, and 5 - 20% for E. The height gradation will be divided into four classes according to the average height adopted in the japanese height-class division, i,e., 25 m or more for class 1,20 - 25 for class 2, 15 - 20 m for class 3, and 8 - 15 for class 4.

The validity of the above classification method in the Mosquitia district should be checked in the pretest.

The following figures shows a combination of the density and the tree height.



For classification by forest age and growth condition, CIDA-COHDEFOR adopts the following four classes.

Regeneration class
Growing class
Intermediate class
Mature class ——→ { Regular class
                   Irregular class

Regeneration Class:

This class is often seen in clear cut areas for natural or artificial regeneration, places subjected to a forest fire, and places of former shifting cultivaiton. All forest lands with an average tree height of less than 8 m are grouped under this class. In certain cases, a limited number of seed trees are planted in these areas for assurance of regeneration.
In the survey, the number of trees per ha, structural tree species, and reasons for the regeneration (clear cutting, etc.) need to be made clear.

Growing Class:

At this class, the annual growth enters the highest stage and thinning is started. The greater part of trees have a diameter of 11 cm or more and a height of 8 m or more, so that the crop differentiation can be with ease. The average breadth diameter at this stand condition is 25 cm or less.

Intermediate Class:

Stands reaching this class become operable and the annual growth reaches its peak. The average growth also increases largely, and the greater part of trees come to have a breast diameter of 25 - 35 cm.

Mature (Overaged) Class:

At this class, the trees reach the final maturity stage and their annual growth starts to decline, but their average growth remains constant. Fovorably located trees grow to a considerable size at this stage.

Stands of this class have no underwood, and they are divided into regular ones with a unfiorm diameter distribution and irregular ones presenting differences in tree height, diameter and

age.

Forest stratification is required not only for classification by the above-mentioned standards but by a past forest fire or total cutting in a sub-compartment. When a part of forest land is cleared for cultivation or coffee trees are planted, the stand of that part naturally changes.

Classification of regeneration land by type and cause of regeneration is also considered necessary, but this may be omitted because forest stratification is to be based on the existing condition. However, it should certainly be included in the survey items.

For the purpose of stratification, it is usually the case that aerial photography is conducted at first and its results are corrected by ground checking.

When the stratification is completed in this way, the area of each statified layer is calculated using transparent section paper or dot grid plated.

If a stratifed layer is too small in area, it is often combined with a similar layer for the survey activities.

An example of actual stratification is given below by referring to the case of Rancho Grande working area surveyed in 1979. For stratification of this area, which is under jurisdiction of Comaygua Forest Office, aerial photos taken in 1975 were used. These aerial photos were interpeted in 1978 and after completin of the survey in 1979, a total of 125,000 ha was interpreted, in which the smallest area stratified was 5 ha for intensive forests and 10 ha for extensive ones. The pine tree forest area covered by this survey was 49,000 ha, and area calculation was performed using section paper with each devision taken at 0.390625 ha.

Example of Forest Stratification if Rancho Grande Unidad:

Forest Class: Pine tree forest were expressed by P and board-leaved tree forests by H. Forests subjected to cutting in the last three years were classified as forest land if the density was larger than 5% or the number of trees per ha was larger than 10.

Forest Sub-class: Each forest class was sub-divided as follows.

P(pine tree forests) - Pine tree forests with a crown density of 80% or more or with 25 or more pine trees per

ha, and those which have been recently subjected to cutting.

PH(mixed forests of borad-leaved trees and pine trees) - Forests with 20 - 80 % of crown density of pine trees or with more than 25 pine trees per ha.

H(broad-leaved forests) - Forests with a more than 80% of crown density of broad-leaved trees or less than 25 pine trees per ha.

PH(mixed forests of pine trees and borad-leaved trees) - Forests with 20 - 80% of crown density of pine trees of with 25 or more pine trees per ha.

R(Quercus species) - Forests with more than 80% of crown density of Quercus species or with less than 25 pine trees per ha.

On the basis of the above standards, the forest land in Rancho Grande unidad was stratified as follows.

PI stratum - Less tan 75% of crown density of regenerating trees, and less than 25 adult trees per ha.

PII stratum - More than 75% of crown density regenerating trees, and less than 25 adult trees per ha.

PIII Stratum - Young forests with a pyramid-shaped treen crowns and an average tree diameter of 10 - 25 cm, which have 25 or more young tress per ha and less than 25 adult trees per ha.

PIII stratum was further stratified as follows.

$PIII_1$ sub-stratum - Sparse, with 25 - 200 young trees per ha.

$PIII_2$ sub-stratum - Medium, with 200 - 700 young trees per ha.

$PIII_3$ sub-stratum - Dense, with more than 700 young trees per ha.

V stratum - Forests composed of adult trees, mature trees and 9veraged trees, with a diameter of 25 cm or more and with a circular crown shape.

V stratum was further stratified as follows.

V_1 sub-stratum - Sparse, with 25 - 30 trees per ha.

V_2sub-stratum - Medium density, with 30 - 42 trees per ha.

V_3 sub-stratum - Dense, with more than 42 trees per ha.

The followin combinations were used in the stratification.

$PIII_x/II$, PV_x/H, PV_x/R, PV_x/II, PV_x/III, H/A(Coffee)

In the above combinations, x denoted the density, and the dominant tree species was indicated by the numerator and the dominated tree by the denominator.

A (Farmland) - Land under cultivation for production of wheat, kidney beans, banana, coffee, or intensive grassland, inclusive of roads and rivers with a width of less than 8 m.

S (Savanna) - Land covered with weeds with less than 10 pine trees per ha, not including land for shifting cultivation, but inclusive of roads and rivers with a width of less than 8 m.

M (Brushland) - Land dominated by brushes with less than 10 trees per ha which exceed 3 m in height, inclusive of roads and rivers width of less than 8m.

C (Structures) - Roads with a width of more than 8 m, buildings, structures, and nursery beds.

Rivers and lakes - Rivers and lakes with a width of more than 8 m.

NP (Non-productive land) - Rocky or gravel land not suited to forest cultivation, farming or grassland, inclusive of motorways, rivers and torrents with a width of less than 8 m.

Stratification of Rancho Grnade Unidad

Stratum	Intensive forest	Extensive forest	Total area
Total area	42,110.54 ha	82,932.46 ha	125,043.00 ha
Forest land	26,767.54	48,040.46	74,808.00
Pine tree forest	23,305.54	35,398.46	58,704.00
PI + II	3,522.87(43)	7,519.01	11,641.88
PIII (Total)	3,965.05	2,444.81	6,409.86
$PIII_1$	1,304.94(29)	811.40	2,116.34
$PIII_2$	1,165.71(29)	720.14	1,885.84
$PIII_3$	1,494.40(54)	913,27	2,407.67
PV (Total)	15,817.62	25,434.63	41,252.25
PV_1	5,870.67	10,631.40	16,502.07(56)
PV_2	6,044.61	9,500.01	15,544.62(83)
PV_3	3,902.34	5,303.22	9,205.56(67)
Broad-leaved trees	3,462.00	12,642.00	16,104.00
Quercus species	631.00	1,785.00	2,416.00
Others	2,813.00	10,857.00	13,688.00
Non-forest land	15,063.00	33,311.00	48,274.00
Farmland	4,333.00	13,360.00	17,693.00
Savanna	1,298.00	1,069.00	2,367.00
Brushland	9,040.00	18,542.00	27,582.00
Buildings and structures	377.00	200.00	577.00
Non-productive land	15.00	40.00	55.00
Open space (no photos)	280,000	1,681.00	1,961.00

Ref. Determination of the number of samples (Expected accuracy assumed to be within 10%.)

$$n = \frac{t^2 \times (Pi \cdot Si)^2}{E^2 + t^2 \times \frac{V3}{2} PiSi^2/N}$$

$$Ni = n \times \frac{Pi \times Si}{Pi \times Si}$$

The accuracy attained in the Rancho Grande stratification was 9.9% (on a reliability level of 95%).