2-5 Sampling Method

There are many sampling methods, but the CIDA-COHDEFOR standards stipulares the use of stratified random sampling. Considering that aerial photos are planned to be newly taken for the survey, it may as well be recommended to adopt the double or triple sampling resorting to regresssion formula or proportional method especially because random sampling usually calls for much time and labor for plot confirmation. The time and labor required for plot confirmation will be greater in the Mosquitia plain than in the central mountainous zone of Honduras because the former has no landmarks at all. Thus, the choice between the random sampling and other methods needs to be made after the pretest.

If the double sampling is to be adopted, it is advisable not to resort to the regression method as this produces the same results as extreme segmentation of the survey area. Increase in the number of strata makes the regression method meaningless.

The plausible method would be to assume 3,000 - 4,000 points on the map covering the entire survey area, and determine the area of each stratum by the number of points embraced. (This will produce the same results as the use of dot grid sheets; the dots spaced at the same intervals giving the same results as the systematic sampling)
Of this 3,000 - 4,000 points, about 1,500 points exected to be included in the forest land are to be transferred to the photos for interpretation of tree species, crown density, tree height, crown diameter, etc., and 300 - 400 points are to be samples from them and plotted in the survey area. The sampling work is to be conducted only on the map, and the photos are to be used solely for interpretation.

In Honduras, allocation of plots to each stratum is performed by the proportional method. Although this is the commonest method of plot allocation, it is advisable to select the most efficiency method on the basis of the coefficient of variance and fluctuation obtained in the pretest. For an example of actual plot allocation, refer to the afore-mentioned case of Rancho Grande.

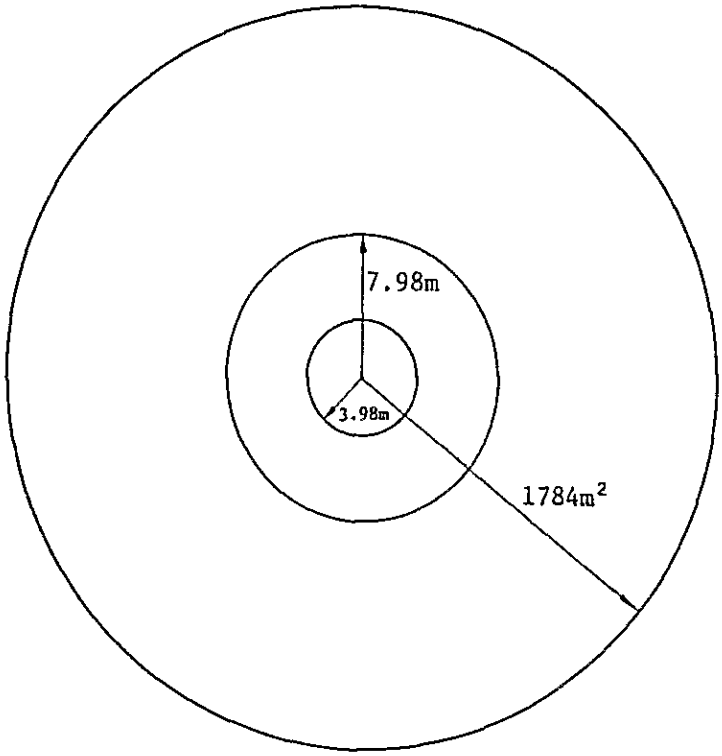
2-5-1 Form and Area of Sample Plot

The form and area fo plot influence not only the efficiency but also the outcome of forest surveys. The forms most frequently used in the past are rectangular, square and cicular. In the past studies, it was found that

if the area is the same, the form which exhibits the highest accuracy is a rectangle whose longer side is 2 - 3 times as long as the shorter side, and then comes square and circle. In recent years, however, circular plots have come to be used widely in many countries of the world. The circular plot used these days is depicted on the ground surface, so that its horizontal projection is oblong is the ground has a gradient. In this case, the area of the ellipse needs to be made equivalent to the specified area. Accordingly, the radius of the circle changes accoding to the gradient, but it can be obtained by multiplying the radius of the circle changes according to the gradient, but it can be obtained by multiplying the radius of the circle on the horizontal surface by $\sqrt{\sec\theta}$ (θ is angle of slope). The advantage of the circular plot consists in the possibility of eliminating the time - and lobor-consuming surveying to be conducted in the neighborhood of other plots. In areas like the Mosquitia district where bushes are found only in few places, this method will prove effective and consequently it will be possible ot consider the adoption of the so-called one-point sampling or line sampling.

The plot area varies by the age and tree size class of the stand to tbe covered. In Germany, it is determined by the tree diameter. Specifically, it is taken at 0.025 ha for small tree-diameter forests (diameter - 2.82 m), 0.01 ha for medium tree-diameter forests (diameter-5.64 m) and 0.04 ha for large tree-diameter forests (diameter - 11.28m), with small circles used for trees with a diameter of more than 7 cm,medium circles for trees with a diameter of more than 10cm, and this way, three circles differing indiameter from each other are plotted from the same center.

This method is also adopted in the CIDA-COHDEFOR standards which specifies circurlar plots measuring 0.1 ha, 0.02 ha and 0.005 ha in area. The diameter of these circular plots is 17.84 m, 7.98 m and 3.98 m as shown below.



Establishment of Circular Plot

Breast diameter	≥	11.0cm = 1,000 m^2	(diameter	17.84m)
Breast diameter	<	11.0cm = 200 m^2	(diameter	7.98m)
Tree height	<	1.3 m = 50 m^2	(diameter	3.98m)

Note : Trees on the circumference of circle are included only if the center their stump or brease height diameter is within the circle. If both centers are within the circle, the choice between them is to be made according to the site condition. In certain cases, the trees on the circumference are alternately included.

As for the tree diameter to be measured in each circle, trees with a breast height diameter of more than 11.0 cm are measured in large circles, those with a breast height diameter of less than 11.0 cm in medium circles, and those with a breast height diameter of less than 1.30 m in small circles. Whether these tree diameter standards are suitable in the Mosquitia district must be checked in the pretest. In particular, the necessity of measuring all trees with a diameter of more than 11.0 cm in large circles may be questioned as this will entail considerable time and labor. The team feels that a circular plot with an area of 0.04 - 0.05 ha would suffice for trees with a diamater of 11-25 cm, and a circular plot with an area of 0.1 ha should preferably used for measurement of only those trees with a diameter of more than 25 cm. By this arrangement, the time and labour required for the survey will be greatly saved.

2-5-2 Determination of Sample Size

Determination of the sample size should be preceded by the decision of the expected accuracy. The expected accuracy should be determined accourding to the purpose of usin gthe survey results. If it is set at too high a value, it only incurs unnecessarily high cost, labor and time and further retards the smooth progress of the survey. Considering the past activities and the existing state of forestry in Honduras, it is considered that 10% on an overall average would be the reasonable value of expected accuracy. The accuracy of medium and large diameter strata, which was left rather ambiguous in the past surveys in Honduras, needs to be clarified in the discussion with the Honduran authorities. The team feels that an accuracy of 10 - 15 % would be wuitable.

According to the CIDA-COHDEFOR standards, the expected accuracy is set at 10% for small, medium and large diameter strata with a crown density of more than 20% (reliability level : 95%).

Stands with a crown density of less than 20% are regarded as noneconomic forests and not included in the sampling plan.
However, a minimum 20 plots will have to be surveyd to fing the volume of useful tree species and the present regeneration condition.

The regeneration land in the non-economic forest area is also excluded from the sampling plan, but a certain number of plots will have to be surveyed to fing out the number and distribution of trees per unit area by species. If non-economic forest areas without regenerating trees extend over an area of more than 20 ha, they will have to be survey to obtain data for formulating a afforestation plan.

The sampling method specified in the CIDA-COHDEFOR's standards is as follows. The basic map prepared by the Geographic Survey Institute is to be divided into four parts, and each part is subdivided into 24 sqaure parts for random sampling. If a sample squre part embraces no forests or the forest strata needed for the survey, the sampling is to be performed again. A line should be drawn on the forest samples on the map in such a way that it will pass through different stands.
The line, which should have a length of more than 1 km, may be bent but at an angle of less than 90°. The line should be as perpendicular to the contour lines as possible. The survey lines should be determined with all these taken into consideration.

The number of plots of to be located on each line should range from 3 to 6 according to the site topography and the difficulty of access. All alots should be spaced at more than 150 m, and should be embraced in sub-compartments. If these conditions are not fulfilled, sampling needs to be performed again.

3. Formation of Survey Groups, and Survey Equipment

Each survey group is planned to comprise five members according to the data of forest surveys in Paraguay, and this may be a little too many. Prior discussion with COHEDOR is necessary for determination of the number of members of each group in consideration of the nature and required efficiency of the survey. The discussion with COHEDOR is also necessary to determine the numbers of Japanes and Honduran technicians capable of acting as group leader, as well as the number of automobiles that can beused for the survey.

The survey team will divided into 4 - 5 groups working under the guidance of the team leader-coordinator and his assistant. The team leader-coordinator will undertake overall control and coordination of the survey groups and also supervise their field work. For this purpose, he will have an assistant and 1 or 2 field workers.

Each servey group will comprise five members who will be the group leader, the assistant group leader, the technician with experience in forest resources, and the two Honduran counterpart members.

The assignment of each group member will be as follows.

Group leader : He will be responsible for determining the direction of/ distance to the survey point. He will make decisions regarding the selection of sample trees, increment core measurement, tree height measurement, grading, soil survey, tree class determination, etc. and enter the field notes. He will enter the field work diary and assume the accounting responsibility during the field work. He will also drive the automobile.

Assistant group leader : He will assist the group leader in the performance of the above-mentioned duties, measure the upper tree diameter using a relascope, etc., determine the total basal area per ha, and measure the tree age. He will also drive the automobile.

Technicial with experience in forest resource survey : He will hold the pole with the assistant group leader. He will tell other group members the names of tree species and measure the tree diameter. He will measure the redius of the sample site with the assistant leader to determine its circumference. He will assist in the tree height measuremnet, increment core measurement, and graging, and will cook meals for the group members.
He will supervise the setting up of the camp.

Two Honduran counterpart members: One of them will be well informed of the site conditions and inform the group members of the communication/transport means, land ownership, history of past felling work, etc. He will cooperate with other members in clearing up the forest to make a path, in the surveying work, and in clearing up the environs of sample tress for easy discrimination and measurement of trees.

The servey group will carry the following equipment and materials.

Portable stereoscope
Aerial photos marked with the selected points
Topographic map marked with the selected points
Table of sample points
Card-type field notebook

Aluminum plate

Portable compasses and pole

Measuring tapes (30 m, 50 m and 100 m)

Calipers (46 cm and 60 cm)

Diameter tape

Hyspometer

Increment borer and increment core measuring tape

Relascope

Chalk (red and white)

Phote pencils

Pencils

Telescope

Table of circular plot radiuses for slopes

Grading table

Desk-top electronic calculator

4. Field Survey

The field survey consists of plot confirmation and establishment, measurement of trees within each plot, and other survey activities.

The method of confirming the plot varies considerably by the sampling method. In case of a plot sampled at random, the course and distance to the plot from the nearest and clear planimetric feature (such as a river, road, etc.) must be determined using maps and aerial photos, and the plot must be confirmed by successive surveying from the selected planemetric feature. Since this method involves much labor and time, equi-distant (systematic) sampling is usually employed in forestry. The plot sampled by this method can be easily detected because the surveying can be started from a point that can be easily found the course and distance from that point to the plot is known. This method has the drawback of causing a deviation if the survey point has periodic variation. In the past forest surveys, however, this drawback was hardly encountered. application of this method is very difficult in mountainous areas, but in flat or mild undulating areas like the Mosquitia district, it is very easy and effective. Hence, the validity of this method should be checked in the pretest. In CIDA-COHDEFOR's standards, it is stipulated that the plots should be established after drawing the lines. CIDA-COHDEFOR's method is explained below, although it seems that the above-mentioned equi-distant sampling method excels it.

4-1 Establishment of Survey Lines and Plots Specified by CIDA-COHDEFOR

Either end of the line should be located in a clear planimetric feature (river, road, etc.), and the following items should be written down in the field notebook before starting the line surveying.

Line No.
Line direction or angle
Date and time of starting survey
Name of the survey group leader

At the end of the line, the following items should be written down in the field notebook.

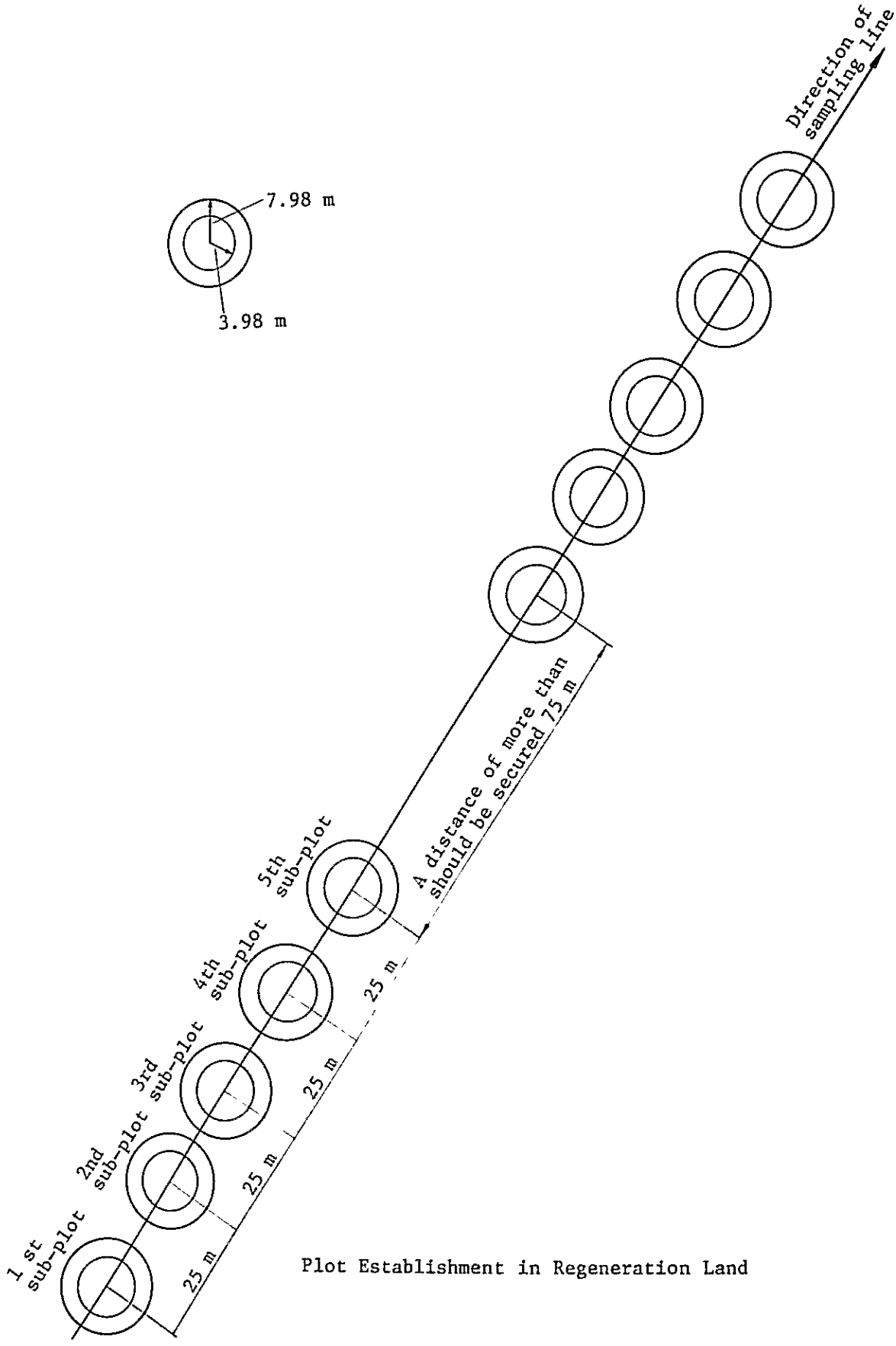
Line No.
Date and time of completing survey
Distance covered
Name of the survey group leader

At the point of inflection of the surveying course, the derection angle, line number, distance covered, and new course should be indicated on a nearby tree or a pile driven for this specific purpose. A 50-m metal measuring tape should be used in the line surveying. A field notebook of a specific format is required to be used in this line establishment and surveying work.

At the starting point of the line, a pile should be driven on which the course and direction to the next survey point should be indicated. The group leader should draw a sketch of the neighboorhood of the line in the field notebook.

The plots should be established on the sampling line thus surveyed. In this case, five sub-plots at a center-to-center distance of 25 m from each other should be established as shown below for young stands immediately after regeneration. This is group of five sub-plots should be more than 75 m apart from the nearest other group of five sub-plots on the sampling line. Each sub-plot should have tow concentric circles measuring 50 m^2 and 200 m^2 in area, respectively. In the 200-m^2 circle, trees with a diameter of 0 - 10.9 cm should be measured. In the 50-m^2 circle, the number of trees with a height of less than 1.30 m should be counted. On this sampling line, more than six groups of sub-plots can be established.

A pile should be firmly driven in the center of each plot, on which the plot number, line number, etc. should be indicated.



Plot Establishment in Regeneration Land

4-2 Survey Items

The following are the survey items required to be covered in each plot in CIDA-COHDEFOR's standards.

Names of tree species
Breast height diameter
Regeneration data
Soil structure
Slope
Topography related to locality and development accessibility
Sample tree measurement : names of tree species, tree class, breast height diameter, total tree height, utilization height, increment core, age, defects, and qualitative classification

Name of Tree Species : Common and scientific names of tree species are shown in the appendix.

Breast Height Diameter (DAP) : Diameters larger than 11 cm at the breast height should be measured (Unless otherwise specified, the diameter with bark should be measured).

The breast height should be measured from the ground on the hill side. In case of trees growing in a rocky area with their roots enveloping a rock, it should be 1.3 m immediately above the rock. In case of inclined trees, it should be 1.3 m above the ground on the in clined side. In case of branched trees, each tree should be measured as a single tree if the brenching point is higher than 1.3 m and should be measured separately if the branching point is lower than 1.3 m. If any abnormality is found around the breast height girth, the height of two equi-distant points above and below the breast height should be measured, and the median should be taken. If the root swelling extends to the breast height, the measuring point should be elevated to a place where no swelling is extended.

DAP measurements should be rounded to multiples of 2. For instance, 11.0 - 12.9 cm should read 12 cm, and 13.0 cm - 14.9 cm should read 14 cm. Trees are to be classified as follows by diameter.

Small diameter trees	12 - 24 cm
Medium diameter trees	26 - 34 cm
Large diameter trees	More than 36 cm

Regeneration Data: Information required for regeneration can be obtained from 50-m^2 and 200-m^2 plots. Three tree species showing the best regeneration condition should be selected and recorded in the field notebook.

In the 200-m^2 circular plot, the regeneration data should be obtained by grouping trees into two classes of diameter, i.e., 0 - 5.5 cm 5.6 - 10.9 cm.

Soil Structure: The soil should be grouped into the following six classes according ot the content of clay, sand, gravels, and rocks.

Franco Limoso	Muddy soil
Arcilloso	Clayey soil
Areno arcilloso	Sandy clayey soil
Arena	Sandy soil
Grava	Gravelly soil
Rocoso	Rocky soil

Slope: Slope is expressed by or percent, but CIDA-COHDEFOR's standards require that it be expressed as a percentage.

Slope division -	
1 - 15 %	Flat or mildly undulated
16 - 30 %	Medium
31 - 60 %	Sharp
61 % or more	very steep

Topography: Topography is required to be classified as follows to study the feasibility of forestry development.

Easy - Ground surface is smooth, obstacles are more than 5 m apart from each other, and slope is less than 30 %.

Medium - Obstacles on the ground are located within 5 m from each other, and slope ranges from 31% to 60%.

Difficult- Valleys with a depth and width of more than 10 m are included, rocks are large in size, and slope exceeds 61% or more, so that forestry development is difficult.

Sample Tree Measurement: 3 - 4 useful tree species with a breast height diameter of more than 11 cm should be selected near the center of each plot. Each of these trees should fill the following requirements.

a) The crown should have a perfect form.
b) The trunk should not be branched.
   It should not be a dominated tree. In other words, the crown should belong to the dominant, co-dominant or intermediate class, but not to the supressed class.
c) The trunk should not form an angle of more than 15% with the ground.

The following studies should be made for dample trees.

a) Name of tree species
b) Crown class (degree of dominance)
   The crown class should be divided as follows according to the crown location in the canopy.

   Dominant - The crown is higher than the canopy and extended. The tree is exposed to sufficient sunlight on the top and to substantial sunlight on the side. The tree height is larger than the average of the stand, so that the crown is well developed but subjected to some lateral pressure.

   Co-dominant - The crown is the same as the canopy in height, and receives sufficient sunlight on the top but the tree side is exposed to rather limited sunlight. The crown has average size and is subjected to lateral pressure.

Intermediate - The tree height is smaller than the average of the stand. The tree is exposed to little sunlight from above and receives no sunlight on the side. The crown size is small and subjected to lateral pressure.

Suppressed - The tree is far lower than the canopy and receives no sunlight from the top or on the side.

c) Breast height diameter

The breast height diameter is required to be measured to the nearestmillimeter using a diameter tape. However, a diameter gauge may be used, in which case it is in two directions and the median of the two values is written down.

d) Total tree height

The total tree height is required to be measured to the nearest 10 cm using a clinometer SUNTO or HAGA. However, it can be measured with a blumeleis or a relascope, but it would be difficult to measure it with a weiss.

The distance between the tree and the measuring device should be larger than the total tree height. If the tree has an inclination of more 15°, the measurement is required to be made from the direction perpendicular to the tree and the horizontal plane embracing the tree's projection on the ground.

e) Utilization height

Measurement of this height is required to be made for trees with a diameter of more than 30 cm. The purpose of this measurement is to prepare a volume table for local sawmills and a table of effective volume, and it is required particularly for broad-leaved trees. The height should be measured to the nearest 10 cm. The utilization height is determined as follows according to the tree form.

o Normal trees

The height up to the root of crown is to be measured.

o Trees with an abnormally formed crown (trees that have a single branch)

The height up to the root of the single branch and the height up to the portion where normal branches are found on the girth are to be measured, and the median is adopted as the utilization height.

o Forked trees

The height up to the root of the fork is to be measured.

o Trees with a large branch

The branch referred to here should be longer than 2m and have a diameter of more than 12 cm, and the height up to the root of this branch should be measured.

f) Increment core

The increment core measurement should be conducted for all needle-leaved trees, but not for broad-leaved trees.
CIDA-COHDEFOR's standards require that the growth in the last five years should be measured to the nearest millimeter, but it is desirable to measure the growth over the last ten years.

g) Age

The increment borer should be inserted at the breast height to determine the age from the number of growth rings. If the core is rotten and does not present growth rings clearly, the age should be obtained from the diameter by proportional allocation.

In case the age exceeds 100 years, it should be written down as 99 years in the field notebook. The age of broad-leaved trees need not be measured. (It is necessary to add reaching the breast height.)

h) Defects (and qualitative classification)

Defects of trees should also be surveyed and entered in the field notebook. This defect survey should be made separately for trees with a dimater of more than 30 cm and for those with a diameter of 28 cm or less for the purpose of checking the defects that can be detected by external observation. The qualitative classification of trees should be made according to the defects thus detected. In this classification, two logs with a length of 3 m should be assumed to be taken from each tree, and their grades should be used in determining the grade of each tree.

The grading and qualitative classification of logs are as explained below.

Grade Classification of Logs

Defect	1st grade		2nd grade		3rd grade	4th grade
	Primary log	Secondary log	Primary log	Secondary log	Both logs	Both logs
Warp	Rejected		Rejected	Accepted if removable	Accepted if removable at time of lumbering	Accepted
Spiral fiber	Rejected		Rejected		Rejected	Accepted
Stab, burl or dent	Rejected		Rejected	Accepted only on one side	Accepted only on one side	Accepted
Mushrooms	Accepted only on one side, provided that no cancer or decay is developed on the other side		Accepted on both sides, provided that no cancer or decay is developed on one side		Accepted	Accepted
Decay	Accepted only on one side provided that no cancer or mushrooms are developed on the other side		Accepted on both sides provided that no cancer or mushrooms are developed on one side		Accepted	Accpeted
Cancer or chancro	Accepted only on one side provided that no mushrooms or decay are found on the other side		Accepted on both sides provided that no mushrooms or decay are found on one side		Accepted	Accepted
Trace of cicatrization of fire damage	Up to 1/3 of girth accepted		Half of girth below the breast height diameter accepted		Trace of fire damage is accepted provided that the tree is alive	Same as left
Forking	Not accepted if it is above the breat height diameter		Rejected	Accepted	Accepted	Accepted
Log length	3 m		3 m		3 m	Not determined

Qualitative Classification

Trees with a diameter of more than 30 cm with bark:

Quality class 1

Trees producing first grade primary and secondary logs, with top which are neither broken nor dead, and which are free from insect damage.

Quality calss 2

Trees producing primary and secondary logs, of which one is given the first grade and the other the second grade, with their top neither broken nor dead, and free from insect damage.

Quality class 3

Trees producing primary and secondary logs, of which one is give the second grade and the other the third grade, trees producing the third grade primary and secondary logs, and trees producing only one third grade log.

Quality class 4

Trees presenting all defects.

Trees with a diameter of 12 cm - 28 cm

Quality class 500

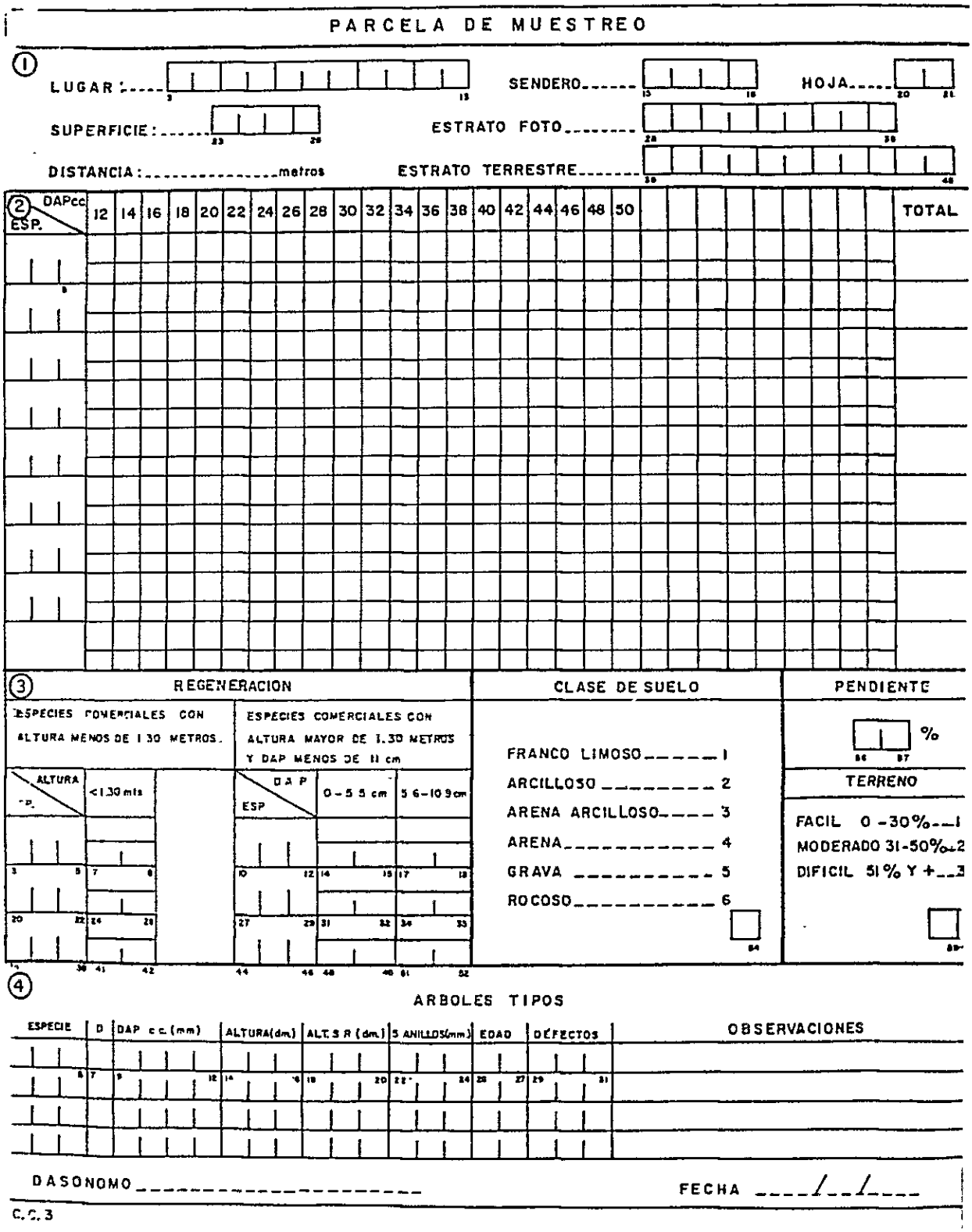
Trees expected to be given the first or second grade when the diameter exceeds 30 cm, and free from any major defects.

Quality class 600

Trees with major defects that cannot be used for lumbering in the future. Quality class 600 corresponds to class 3 and 4 of trees with a diameter of more than 30 cm.

The above are the survey items stipulated in CIDA-COHDEFOR's standards for the purpose of formulating a forest management plan. There are some additional survey items, but these call for further soil and vegetation surveys. The format of the CIDA-COHDEFOR's field notebook is shown below for reference.

PROYECTO INVENTARIO FORESTAL
MACIZO CENTRAL



CIDA – COHDEFOR

PROYECTO INVENTARIO FORESTAL

MACIZO CENTRAL

TABLAS DE CUBICACION — ARBOL TIPO

LUGAR ARBOL Nº: HOJA:

ESPECIE: DOMINANCIA: EDAD: 5 ANILLOS:

D.A.P. c.c. (mm.): ALTURA TOCON (cm.): ALTURA TOTAL (dm.):

PUNTA (dm.): CALIDAD:

TROZA	DIAMETROS (mm)		LARGO	DEFECTOS		DEFECTOS EXTERNOS		
NUMERO	CON CORTEZA	SIN CORTEZA	dm.	mm.	CODIGO	TIPOS	1ª TROZA	2ª TROZA
TOCON 0 0						TORCEDURA	0 1	0 1
0 1						GRANO ESPIRAL	0 2	0 2
0 2						BAYONETA	0 3	0 3
0 3						HINCHAZON	0 4	0 4
0 4						PODREDUMBRE	0 5	0 5
0 5						CANCER	0 6	0 6
0 6						HERIDA	0 7	0 7
0 7						QUEMADURA	0 8	0 8
0 8						BIFURCACION	0 9	0 9
0 9						QUEBRADURA	1 0	1 0
1 0						OTROS etc.	1 1	1 1
1 1								
1 2								
1 3								
1 4								

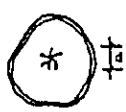
DEFECTOS QUE REDUCEN EL VOLUMEN

CODIGO 12

PUDRICION DEL CORAZON

d = DIAMETRO DE LA PUDRICION

CODIGO 13



PARTIDURA EN ESTRELLA

d = DIAMETRO DEL CILINDRO INCLUYENDO TODAS LAS RANURAS.

CODIGO 14

PARTIDURAS DERECHAS

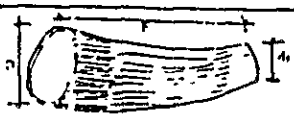
$d = \sqrt{4/3 \cdot Y \cdot Z + 1}$

CODIGO 15

PARTIDURA DE ANILLO

$d = \sqrt{D^2 - d^2 + 1}$

CODIGO 16



TORCEDURA

$d_2 = \sqrt{d(F - \frac{D-d}{2})}$

CODIGO 17

HINCHAZON

$d = \sqrt{4/3 \cdot Z \cdot Y}$

SENDERO: _____ /DISTANCIA: _____ /PARCELA: _____ /ARBOL TIPO Nº: _____ /ESTRATO: _____

PASONAMO: _____ FECHA: ____/____/____

4-3 Supervision of Field Survey

The field survey is prone to involve various errors such as the improper use of diameter gauges, error in discriminating tree species or aerial photo interpretation, inadequate use of survey equipment, or measurement of the breast height diameter in the wrong place. These errors occur quite frequentls, although they can be prevented if sufficient care is exercised. To minimize these errors, it is necessary to check the survey equipment during or before the survey, and to train the survey personnel. To prevent such errors, CIDA-COHDEFOR makes it a rule to let higher class supervisors check the survey results by sampling. If too many errors are found, these supervisors issue instructions for repeation of the survey.

The supervision is conducted on the direction and distance of survey lines, arrangement of plots, and the description and sketch entered in the field notebook at the time of sampling line surveying.
As for sample plots, the supervisors check if the radius is adequately determined according to the slope, and also examine if any error is involved in including the trees on the circumference of plot.
In this case, no instructions for repeating the survey are issued unless errors are excessive.

In the aspect of tree measurement, it is required that the volume difference should not exceed 10% if there is a gap between the species-wise number of trees with a diameter of less than 12 cm and their volume. This error is caused by omitting the measurement of trees within the boundary or plot, erroneous measurement of diameter, and misdjudgement of tree species.

Regeneration and site surveys are required to produce data which reflects the actual conditions as much as possible.

The survey of sample trees is of great importance because the data obtained is used in the preparation of the height curve and the volume table for local sawmills, and in the growth estimation. Accordingly, the sepervisors check if sample trees are selected suitably and the crown class is judged adequately. The measured tree diameter is required to be accruate to within 0.5 cm of the actual value, and the measured total tree height and utilization height are required to produce no greater difference than 10% from the actual values. The measured increment core should also produce no greater difference than

20% from the actual value. The supervision also covers the qualitative classification of trees.

The survey proposal based principally on CIDA-COHDEFOR's standards and partly on the team's views has been explained above.

CIDA-COHDEFOR's standards are intended to be applied in the central mountainous zone and not in the Mosquitia district where the stand and soil conditions are quite different. It is also to be noted that since the survey is intended to produce data for formulating a forest management plan centering on afforestation, it is necessary to conduct a detailed soil and vegetation survey. According to the method to be determined through discussion with CIDA-COHDEFOR. As for soil classification, the U.S. system needs to be studied as it seems to be preferable to the Japanese system in Honduras.

Appendix. Table of Tree Species

Common name	Scientific name
ACEITINO (NEGRITO)	SIMAROUBA GLAUCA
ACHOTILLO	SLOANEA FAGINA
ACHOTILLO DE MONTAÑA	SLOANEA TUERKEIMII
ACHOTILLO DE MONTAÑA	SLOANEA ZULIAENSIS
ACOBO (MACUELIZO)	TABEBUIA ROSEA
AGUACATE ANISE	PERSEA SP.
AGUACATILLO COLORADO (CHIGUA)	OCOTEA SP.
ALMENDRO DEL RIO	ANDIRA INERMIS
AMARILLO (VARILLO)	SYMPHONIA GLOBULIFERA
AMARGOZA	ANDIRA SP.
AMETE DE MONTAÑA	FICUS GLABRATA
BALSA (GUANO)	OCHROMA LAGOPUS
BARBA DE JOLOTE	PITHECOLOBIUM ARBOREUM
BARRENILLO (COPALCHI)	CROTON GLABELLUS
BELLOTA (ROBLE DE MONTAÑA)	QUERCUS SKINNERI
BILLY WEBB (CHICHIPATE-BILIHUETE)	SWEETIA PANAMENSIS
BILIHUETE (BILLYWEBB-CHICHIPATE)	SWEETIA PANAMENSIS
CACHO DE VENADO	EUGENIA SP.
CAIMITO	CHRYSOPHYLLIM MEXICANUM
CAOBA DOMINICANA	SWIETENIA MAHOGANI
CAOBA (CAOBINA HONDUREÑA)	SWIETENIA MACROPHYLIA
CAOBINA (CAOBA HONDUREÑA)	SWIETENIA MACROPHYLIA
CAPULIN BLANCO	TREMA MICRANTHA
CARAO	CASSIA GRANDIS
CARBON BLANCO	GUAREA SP.
CARBON COLORADO	GUAREA SB.
CEDRILLO (CIRUELILLO)	MOSQUITOXYLON JAMAICENSE

CEDRO ESPINO (TETA)	ZANTHOXYLUM BELISENSE
CEDRO	CEDRELA ODORATA
CEIBA	CEIBA PENTANDRA
CHICHIPATE (BILLY WEBB-BILIHUETE)	SWEETIA PANAMENSIS
CHICLE (ZAPOTILLO)	ACHRAS CHICLE
CHIGUA (AGUACATILLO COLORADO)	OCUTEA SP.
CINCHO	LONCHOCARPUS LATIFULIUS
CIRIN	MICONIA SPP.
CIRUELILLO (CEDRILLO)	MOSQUITOXYLON JAMAICENSE
CIRUELO DE MONTAÑA (GATEADO-JOBILLO)	ASTRONIUM GRAVEOLENS
CIRUELILLO	MAURIA SP.
COCO MAMA	OUARARIBEA FIELDII
COLA DE PAVA	CESPEDESIA MACROPHYLIA
COME NEGRO (NARANJILLO)	PERA BARBELIATA
COPALCHI (BARRENILLO)	CROTON GLABELLUS
CORTEZ	TABEBUIA GUAYACAN
CUAJADA	DENDROPANAX AFF. ARBOREUS
CUCARACHO	PITHECOLOBIUM SP.
CUCARACHO	CORNUTIA GRANDIFLORA
CUCARACHO	VATAIREA LUNDELLIL
CUERO DE TORO	CHAETOPTELEA MEXICANA
CUMBILLO (NARANJO)	TERMINALIA AMAZONIA
CUPANIA	CUPANIA SP.
ENCINO	QUERCUS LAURIFOLIA
ESKIA	
FRUTA FUNI	CHIMARRHIS
FRUTA DE PAVA	HASSELTIA SP.
GATEADO (JOBILLO, CIRUELO DE MONTAÑA)	ASTRONIUM GRAVEOLENS

GRANADILLO	DALBERGIA TUCRENSIS
GUACIMO	LUEHEA SEEMANNII
GUACO	HERNANDIA SONORA
GUAMA	INGA VERA
GUAMA BLANCA	INGA SAPINDOIDES
GUANACASTE	ENTEROLOBIUM CYCLOCARPUM
GUANO (BALSA)	OCHROMA LAGOPUS
GUAPINOL	HYMENAFA COURBARIL
GUARUMO	CECROPIA INSIGNIS
GUARUMO COLORADO	POUROUMA ASPERA
GUAYABO	TERMINALIA LUCIDA
GUAYBON	TERMINALIA OBLONGA
HICHOSO	BROSIMUN SP.
HIGO (HIGULILLO, HIGUESO)	FICUS SPP.
HIGUERO	FICUS SPP.
HIGUILLO (HIGO, HIGUESO)	FICUS SPP.
HIGUESO (HIGO, HIGUILLO)	FICUS SPP.
HORMIGO (PALO DE MARIMBA)	PLATYMISCIUM DIMORPHANDRUM
HUESITO	HOMALIUM RACEMOSUM
HUESO DE PAVA	ZUELANIA GUIDONIA
HULE (MADRE DE HULE)	CASTILLA TUNA
INDIO DESNUDO (JIOTE)	BURSERA SIMARUBA
JACARANDA (TAMBOR)	JACARANDA COPAIA
JICARILLO (MANO DE LEON)	COCHLOSPERMUM VITIFOLIUM
JIOTE (INDIO DESNUDO)	BURSERA SIMARUBA
JOBO (JOCOTE)	SPONDIAS MOMBIN
JOBILLO (CIRUELO DE MONTAÑA, GATEADO)	ASTRONIUM GRAVEOLENS
JOCO MICO AMARILLO	RHEEDIA INTERMEDIA

JOCO MICO	VITEX SP.
JOCOTE (JOBO)	SPONDIAS MOMPIN
KEROSEN	TETRAGASTRIS PANAMENSIS
LAUREL (PARDILLO)	CORDIA ALLIODORA
LECHON	SAPIUM SP.
LIQUIDAMBAR	LIQUIDAMBAR STYRACIFLUA
LORON	SAURAVIA LAEVIGATA
MACUELIZO (ACOBO)	TABEBUIA ROSEA
MADRE DE HULE (HULE)	CASTILLA TUNE
MANCHADO	BILLIA HIPPOCASTANUM
MANO DE LEON (JICARILLO)	COCHLOSPERMUM VITIFOLIUM
MANTECO	AMPELOCERA HOTTLEI
MASAQUILIA (MASICA)	BROSIMUM ALICASTRUM
MASICA (MASAQUILLA)	BROSIMUM ALICASTRUM
NANCE	BYRSONIMA CRASSIFOLIA
NARANJILLO (COME NEGRO)	PERA BARBELLATA
NARANJO (CUMBILLO)	TERMINALIA AMAZONIA
NEGRITO (ACEITUNO)	SIMAROUBA GLAUCA
NISPERO	MANILKARA ACHRAS
NOGAL	JUGLANS OLANCHANA
PALETO (TAMARINDO SILVESTRE)	DIALIUM GUIANENSE
PALO DE MONTAÑA (HORMIGO)	PLATYMISCIUM DIMORPHANDRUM
PARDILLO (LAUREL)	CORDIA ALLIODORA
PINO OCOTE	PINUS OOCARPA
PINO COSTANERO	PINUS CARIBAEA
PINO TRISTE	PINUS PSEUDOSTROBUS
QUIEBRA MUELA	TERNSTROEMIA AFF. MEGALOTYCHIA
RAMON	TROPHIS AFF. RACEMOSA

ROBLE DE MONTAÑA (BELLOTA)	QUERCUS SKINNERI
ROSITA	HYERONIMA OBLONGA
SALAMO	CALYCOPHYLLUM CANDIDISSIMUM
SANGRE BLANCO	PTEROCARPUS OFFICINALIS
SANGRE REAL (SANGRE ROJO)	VIROLA KOSCHNYI
SAN JUAN GUAYAPEÑO	VOCHISIA FERRUGINEA
SAN JUAN PELUDO	VOCHISIA HONDURENSIS
SAN JUAN REAL	VOCHYSIA HONDURENSIS
SANTA MARIA	CALOPHYLLUM BRASILIENSE
SELILLON	POUTERIA IZABALENSIS
SOMBRA DE ARMADO	SCHOEDFIA SCHOEBERI
SOMBRA DE TERNERO	CORDIA NITIDA
TAMARINDO SILVESTRE (PALETO)	DIALIUM GUIANENSE
TAMBOR (JACARANDA)	JACARANDA COPAIA
TANGO	ZOLLERNIA TANGO
TAPA TAMAL	ALCHORNEA AFF. LATIFOLIA
TEJO	ILEX GUIANENSIS
TETA (CEDRO ESPINO)	ZANTHOXYLUM BELISENSE
TONTOLO	PROTIUM SESSILIFLORUM
URRACO	LICANIA PLATYPTERA
UVA	COCCOLOBA TUERCKHEIMII
VARILLO (AMARILLO)	SYMPHONIA GLOBULIFERA
ZAPOTE	CALOCARPUM MAMMOSUM
ZAPOTILLO (CHICLE)	ACHRAS CHICLE
ZAPOTON	PACHIRA AQUATICA
ZORRA	SCHIZOLOBIUM PARAHYBUM

CHAPTER VI GUIDELINES FOR PLANNING OF AERIAL PHOTOGRAMMETRY OF FORESTS

1. Description of Requests and Areas

Requests made by the Government of Honduras with regard to the aerial photogrammetry of the forests, and a forest inventory and the areas concerned are as shown in Table VI-1.

The 200,000 ha. of the 267,000 ha Mosquita district requested for photographing and topographical maps is a forest area. Excluding the area adjacent to the Nicaraguan border which is not subject to photographing, the total area for photographing and preparation of topographical maps is 239,000 ha.

75,000 ha of the area for which forest inventory is requested, is forest area. Since forests are scattered throughout the area, the total area for forest inventory is not limited to 75,000 ha. but is expected to be much larger. It is important to take this fact into consideration in the planning stage.

Photographing is also requested for the 628,000 ha. El Paraiso district, 300,000 ha. of which is forest area. Excluding the area adjacent to the border with Nicaragua which is not subject to photographing, the total area for photographing is 528,000 ha.

Table VI-1 Description of requests and areas

District	Description		Area inclusive of surrounding area	Area adjacent to the Nicaraguan border	Total area for photography and topographical maps
	Type of work	Forest area			
Mosquitia	Aerial photographing	HA 200,000	HA 267,000	HA 28,000	HA 239,000
	Topographical mapping	200,000	267,000	28,000	239,000
	Forest inventory	75,000			
El Paraiso	Aerial photographing	300,000	628,000	100,000	528,000
Total	Aerial photographing	500,000	895,000	128,000	767,000
	Topographical mapping	200,000	267,000	28,000	239,000
	Forest inventory	75,000			

2. Aerial Photogrammetry of Forests

Prior to the proposal of a survey program in accordance with the above requests, the conditions related to photography of the areas, on which the forthcoming survey should be based, are presented.

2-1 Photogrammetry of Forests in the Republic of Honduras
(History of Aerial Photograph Use)

Aerial photography in relation to forestry was first introduced in the 1960s. Since then, through the guidance of FAO and various projects, which were executed with the cooperation of such countries as Holland, Canada, the U.S.A., Finland and others, knowledge in this area has greatly increased and interpretation of photographs has achieved a significant level.

(Records of Aerial Photography and Future Programs)

The aerial photographs which are now in the possession of the Government were taken between 1960 and 1969 with the exception of a few which were photographed later between 1974 and 1975. Due to extensive changes since then, they are currently of little use.

The COHDEFOR (Forest Development Public Corporation) which plans photography of forests every five years is dependent on foreign firms since no local photography firms are available. A total of US$250,000 is appropriated annually to contract photographers. The Corporation is however dissatisfied with the results of the previous photography contracted. Photographs taken in 1979 of some parts of the Intibuca and the La Paz districts and of the Morazan district, where the capitol is located and which is situated to the west of the La Paraiso district, were not completely delivered while the preliminary survey team was stationed in the country.

The total area COHDEFOR plans to photograph in the beginning of 1980 is 36,330 km^2, excluding the area photographed in 1979 as previously mentioned. At present, Photo Sur Inc. of Canada is stationed in the country in accordance with the program and significant achievement is expected in the Coln district near the northern Caribbean sea and in the eastern Yoro district.

(Availability of Foresty Maps and Preparation Procedure)

Availability of forestry maps for administration, operation and inventory is extremely limited. It was found that a topographical map on the scale of 1 to 50,000 which was published by Japan's Geographical Survey Institute was used as an administration and operation map. Although it does not cover the entire nation, a rush map is being prepared to be used in the future as an operation map, under the following procedure:

The photogrammetry section of COHDEFOR headquarters traced rivers, roads, and administration and forest boundaries shown on the aforementioned topographical map of 1-to-50,000 scale on to a Milar sheet with the same scale in order to mark later such boundaries as distric forest offices, and operation camps in order to produce an operation

rush map. Copies of the rush map are being distributed among district forest offices and operation camps.

Operation camps mark cutting and reforestation boundaries shown on aerial photographs taken in accordance with the work in progress onto the copies of the rush map. Complete maps will be produced when cutting and reforestation operations are inspected for all the administration areas.

Forest cover maps are not available and are not planned.

(Availability of Photogrammetry Equipment)

At present, no organization in the nation is equipped with photogrammetry equipment. Even COHDEFOR and its branch offices, which utilizes aerial photographs more than any other organization, is not equipped with proper cartography equipment. Availability of reading equipment is also extremely limited. The only equipment the preliminary survey team could find during the survey period was two Japanese reflex stereoscopes. These were found in the Lajas operation office which is said to be the most well equipped and complete office, in terms of organization and the extent of operations, within the COHDEFOR organization, including the headquarters, district offices and operation camps.

(Utilization of Aerial Photographs)

As there are no adequate forestry maps and references, The Corporation must depend on aerial photographs for the implementation of its projects. Aerial photographs are also an effective means in the development of operation programs.

(Application of Aerial Photographs)

Although it is not practical to judge the current level of photogrammetry technology under the current conditions of no adequate survey and cartography equipment, it can be concluded that interpreting technology has reached a relatively high level in view of the fact that yield volumes are forecast and cutting areas are determined by the reading of forest inventories.

(Necessity of Aerial Photographs)

The Republic of Honduras, which places priority on the development of forests, are aggressively promoting cutting and reforestation. Under such emphasis together with insufficient reference materials currently available on forest conditions, aerial photography is not just essential but is the only means to determine cutting areas to satisfy projected yield volumes and to select reforestation areas.

Implementation of the existing photographing is not as smooth as desired due to the slow progress in photography previously mentioned. Hence, Japan's cooperation is earnestly hoped for.

2-2 Conditions of Areas Requested for Surveys

(Topographical features)

The Mosquitia district requested for photography, topographical maps and forest inventory is situated at latitude 14°34' ∿ 15°09' and longitude 83°50' ∿ 84°45' W facing the Caribbean Sea. It is a flat area 50 ∿ 300 m above sea level with few topographical characteristics. The Coco O Segovia river which runs east to north in the south of the district forms the boundary between Honduras and Nicaragua.

The El Paraiso district for which photography is requested, is situated at latitude 13°48' ∿ 14°20' and longitude 85°31' ∿ 87°02'. It is a mountainous area with complex undulating features. The border line with the Republic of Nicaragua is to the south of the district.

(Control Points)

No existing control points are available at present in the Mosquitia district and its vicinity. Hence, it is necessary to set up control points by means of JMR observation prior to cartographical work.

(Climate)

The climate is tropical characterized by high humidity and high temperature in the coastal plains. Temperature varies from a maximum of 39°C in April to a low of 20°C in December. Humidity exceeds 90% in September.

The, climate is much more mild in the highlands. In the capitol, Tegucigalpa, the highest temperature of 34°C is registered in March and the lowest temperature of 6° or 7°C in February. Humidity is 8% in January.

There are only two seasons, wet and dry. The rainy season is from May to October, and is referred to as winter. The dry season starts in November and ends in April, and is referred to as summer. Large rainfall is recorded in the area facing the Carribbean sea. There is frequent wind and flood damage and tornados are occasionally experienced. Cumulative climatic reference data used in the development of photography programs is not obtainable since no systematic observations have been conducted. Cloudiness has not been observed. Therefore, interviews were conducted to ascertain weather conditions in the Mosquitia and El Paraiso districts. The results are summarized as follows:

Mosquitia District

Since the dry season is from December until May, the period between January and April, especially March, is best suited for photography. During this period, the sun is highest at 1400 hours. Mist in the early morning indicates that the weather is going to be fine during day. Mist normally clears away between 7 and 8 a.m. Photography is impossible between May and December due to alternating mist and rain.

El Paraiso District

Fine days are often found in January through April during the dry season December to May. Some fine days are also found in May. Being mountainous in contrast to the Mosquitia district, weather factors peculiar to mountainous areas should be taken into consideration and caution should also be taken for scattered clouds and fogs.

Photography Bases

Airports scheduled to be used as photography bases and their conditions are shown in Table VI-2. In the Mosquitia district, Puerto Lenpira airport has the best location but is inadequate in buildings,

storage and fueling facilities. Furthermore, it does not offer accommodation. Therefore, the airport is not suitable as a base. Therefore Laceiba or Trujillo airport will be used as the permanent base and the Puerto Lenpira airport as the standby base in bad weather.

In the El Paraiso district, the Tegucigalpa International Airport in the capitol is best suited as a base since no other comparable airports are available.

Table VI-2 Airports and conditions

Airport	Location	Qualification	Distance from capitol, Tegucigalpa	Distance to photography site	Meteorological radio
TEGUCIGALPA	14°05'N 87°13'W	International	-	EL PARAISO 70 km MOSQUITIA 340 km	OK
LACEIBA	15°47'N 86°48'W	Domestic	190 km	MOSQUITIA 290 km	OK
TRUJILLO	15°55'N 85°57'W	Domestic	240 km	MOSQUITIA 220 km	OK
PUERTO LENPIRA	15°16'N 83°45'W	Domestic	400 km	MOSQUITIA 60 km	OK

Potential Photography Agents

In terms of the extent of the work involved, it would be extremely uneconomical to send an aircraft from Japan. Hence, equipment and crews should be recruited from the nearest and most reliable agent. Available and technically reliable firms are Holland's KLM, which has experience in the Honduras, Canada's Photo SUR Inc., the present contractor, Mark Hurd Survey Inc. and Airo Service of the U.S.A., which have experience in Central American Countries such as Panama.

The aforementioned four firms are adequately mobilized to conduct photography in the areas.

Photo SUR Inc., which has been engaged in photography in Honduras as of since 1980, is likely to continue its work in the following years. Thus, the firm may seem the most likely choice. However, the firm is equipped with only one set of equipment and is not quite capable of covering the vast area in the 1980's photography. Therefore, it is highly questionable that the client will accept this firm since they are concerned with speedy execution of the contract.

Holland's KLM, and Mark Hurd of North America are located far more distant than the previous candidate and, as a result, mobilization is costly.

The remaining Air Service, on the other hand, is headquartered in Houston, Texas, and the distance to the site is shorter in comparison with the two other firms mentioned earlier. Furthermore, they have worked for Japanese before and their technology is highly reliable. Hence, it is recommended and economical to mobilize them.

(Transportation)

Transportation from the capitol, Tegucigulpa, to the site is as follows:

(Mosquitia)

Only two regular flights are available weekly. No other means of overland transportation are available. (Flight hours: one and hour and 50 minutes) No transportation is available between Puerto Lenpira and the Dursuna office (center of the survey area) except for cars (driving time: Approx. one and half hours)

(El Paraiso)

It takes about one and half hours by motor car from Tegucigalpa to the Danli district forest office which is located in the center of the district.

(Communication)

The only means of communication available from the Mosquitia district is radio. Communication between the Dursuna operation camp and the district office in Lenpir is made by means of radio and ordinary telephone can be used via the district office.

Communications by ordinary telephones is possible for the El Paraiso district.

(Security)

Public peace and order is well maintained throughout the Republic of Honduras and the survey areas are also peaceful.

(Forest Conditions and Vegetation)

Natural forests of Caribbean pine trees are found throughout the Mosquitia district which is flat with little undulation as mentioned earlier. Good regeneration by natural seeding is found in most of the forests, which are often two-storied of single species.

In areas where pine trees grow, no broad-leafed trees are found except for very few along the rivers. Since they grow in areas different from Caribbean pine trees, no mixed forests of coniferous and broad leaf species are seen.

Vegetation is not complex. Only short species of graminaceae are found. Thus, visibility is normally good in forests and it is possible to drive into any area during the dry season. This is advantageous in the implementation of surveys. Description of forest conditions and vegetation are omitted for the El Paraiso district since for that district only photography is requested.

2-3 Special Conditions for Consideration

Diplomatic relations with neighboring Nicaragua are not strained but are not particularly friendly either. In the execution of photography, therefore, caution should be taken not to violate the neighbor's airspace. It will be important to make such requests as mentioned in 2-4-4 to the Government of Honduras in advance in order to follow necessary procedures for security and to obtain permission and guarantees from the Government of Honduras.

It is highly recommended to promote a survey in accordance with the proposal given hereafter, which has been developed in consideration of the aforementioned conditions.

2-4 Requests to the Government of Honduras

Prior to the implementation of the survey, cooperation of the Government of Honduras is requested on the following points:

2-4-1 Presentation of reference materials and data necessary for the development and implementation of a survey program.

2-4-2 Permission and necessary procedures to be followed in relation to the implementation of the survey program.

2-4-3 Permission to use photography bases and guarantee for the security of the aircraft and crews in flight.

2-4-4 Confinement of photography to safe areas especially in the vicinity of the border with the Republic of Nicaragua in order to prevent violation of Nicaraguan airspace. Guarantee of security for the prevention of conflicts and accidents and relative procedures.

Approval of any necessary reduction, alternation or deletion of the area to be photographed in case of conflict or danger.

2-4-5 Permission to bring and take survey equipment and other items in and out of the Republic of Honduras with tax exemption and the necessary procedures to be followed.

2-4-6 Guarantee for free conduct and security of Japanese specialists and engineers who are engaged in the implementation of the survey program.

2-4-7 Permission to take negatives of aerial photographs, survey materials and other reference data necessary out of the Republic of Honduras and the relative procedures.

2-4-8 Permission for cutting of pole timbers and miscellaneous small trees which obstruct the survey.

2-4-9 Permission to take photographs on the ground in order to obtain necessary data.

2-4-10 Permission to install and maintain control points and markers in the site.

2-4-11 Provision of interpreters, guides, counterparts and offices according to necessity.

2-5 Photography Program Proposal

Aerial photography should be conducted with the following procedure:

2-5-1 Formation of photography team

The photography team will consist of the members mentioned in Table VI-3. Equipment, instruments, materials and other items necessary for photography are as mentioned in 2-8.

Table VI-3 Photography Team

Classification	Number of personnel	Remarks
Director	1	Chief engineer
Pilot	1	
Navigator	1	
Cameraman	1	
Maintenance personnel	1	
Total	5	One processing personnel and an assistant will be added if processing is to be conducted on the site.

2-5-2 Instruction and supervision

The photography team is provided with a manager who will instruct, direct and inspect so that the team can function independently.

Furthermore the team will execute its work under the supervison of the organization developing the survey program and/or the specialists designated by the organization in accordance with section 5.

2-5-3 Photography Areas

Vertical survey photographs are prepared for the Mosquitia district of 239,000 ha. and the Paraiso district of 528,000 ha. as shown in the photography plans attached.

2-5-4 Photography Courses

Photography is made on the courses shown in the plans, VI-1-1 and VI-1-2, in accordance with the table VI-4.

Table VI-4 Photography Courses

Area	Mosquitia	Paraiso
Number of diaphysial courses	5pcs	-
Number of plane courses	16pcs	21pcs
Total	21pcs	21pcs
Total length of diaphysial courses	181KM	-
Total length of plane courses	874KM	1919KM
Total	1155KM	1919KM

2-5-5 Number of Photographs Scheduled

The numbers of photographs to be taken and to be edited are as shown in Table VI-5 below:

Table VI-5 Number of Photographs to be taken and edited

Area	Mosquitia	Paraiso	Total
Number of photographs to be taken	844	1383	2227
Number of photographs to be edited	714	1170	1884

2-5-6 Season and Time For Photography

As mentioned in 1-2, the number of clear days suritable for photography is largest during the dry season between December and May. In consideration of the time required for the installation of air-photo markers and safety, photography should take place between January and April. Photographs will be taken between 11:00 and 17:00, that is, three hours before and after 14:00, when the sun is at its highest.

2-5-7 Photography Bases

As mentioned in 2-2, for the Mosquitia district Trujillo airport or, according to circumstances, Laceiba airport should be used as the permanent base and Puerto Lenpia airport as the standby. Meanwhile, Tegucigalpa airport should be used for the Paraiso district.

2-5-8 Installation of Air-photo Markers

Air-photo markers should be installed in the nine locations shown in the attached plan, VI-1-2, prior to photography. Installation should be completed within the first ten days of January when photographing starts.

An air-photo marker is cross-shaped and made of boards 20cm × 150cm in size.

Markers should be installed and painted in colors contrasting to the surroundings so that they can be clearly seen in photographs.

2-5-9 Equipment and Materials To Be Used

The aircraft should have a cruising range of at least eight hours, with superior stability and climbing capacity. A vertical surveying camera of superior resolution and without shortcomings such as parallax should be used. Further, a focal length of 21cm and a frame size, 23 × 23cm should be employed. Panchromatic film of non-stretching material is desirable. Sensitized paper to be used should be of medium thickness and semi-glossy.

2-5-10 Photography Factors

Photography should be executed in accordance with the following factors shown in Table VI-6:

Table VI-6 Photography Factors

District	Mosquitia	Paraiso
Scale	1:20000	1:20000
OL	60%	60%
SL	30%	30%
Highest altitude	300M	2290M
Lowest altitude	50M	350M
Air base	150M	1300M
Photographing altitude	4200M	4200M
Crusing altitude	4350M	5500M

2-5-11 Processing

Films should be developed promptly taking the following points into consideration.

Processing should be in conformity with films used. Exposure and fog must be prevented. Films should be washed thoroughly after developing so that no chemicals remain. Developed films should be dried promptly in order to prevent soiling and expansion or contraction. Indications and instruments should be clearly visible.

After development, films should be cut leaving a margin of 1m before and after the image, numbered in accordance with the sequence of photographing and stored in the proper order.

2-5-12 Contact Photographs for Orientation

A set of contact photographs for orientation should be prepared from developed films.

2-5-13 Orientation Inspection

Provisional orientation is made with the contact photographs in order to check the results of photographing according to the following standards:

The entire area for photography must be covered and viewed stereoscopically.

Each course must be shown in a direct line: Turns and curves, etc. must not exceed the degree that hinders interpretation and mechanical orientation in the cartographical process. Photographing altitude and scale should not deviate by more than 3% within a course and 5% between courses. Pictures should not be inclined by more than 5 degrees. Drift angle should not exceed 5 degrees. A deviation of more than ±5% should not be found for 60% of overlapping and 30% of side-lapping. Clouds and shade should not hinder interpretation of photographs. Damage and dirt should also not hinder interpretation.

2-5-14 Supplementary Photography

Any photographs of an area or portion of an area which are rejected as a result of inspection in accordance with the previous section should be immediately re-photographed or supplementary photographs should be taken and orientation should be checked again.

2-5-15 Editing and Arrangement of Films

Those films which are approved by inspection should be so edited that the number of films is kept to a minimum, after it is confirmed that all the stipulated conditions are satisfied.

If a course is photographed more than once and these photographs are used for editing of the same course, two models should be used in conjunction.

Films should be kept in rolls after editing and the following remarks should be entered on either end of the roll and the external surface of a storage box.

District	
Date photographed	
Film number	
Course	
Photo numbers	
Number of photographs	

2-5-16 Preparation of Orientation Map

In the preparation of an orientation map, principal points and baselines of photographs are indicated on the topographical map together with the number of films, courses and photographs, areas photographed, and other necessary data.

2-5-17 Reprinting

Reprints are made from edited films as shown in Table VI-7.

Table VI-7 Re-printing of Photographs

District	Mosquitia	Paraiso
Contact photographs for results	1 Set	1 Set
Contact photographs for mapping	1 Set	-
Contact photographs for survey	1 Set	-
Positive films for mapping	1 Set	-

2-5-18 Quantity of Products

Products of photographing and their quantities are as follows:

Negative films on a scale of 1 to 20,000	: One set
Contact photographs on a scale of 1 to 20,000	: One set
Orientation maps	: One set
Detailed description of aerial photographs	: One set

2-6 Proposal for Preparation of Topographical Maps

2-6-1 Area for Topographical Mapping

Topographical maps should be prepared for a forest area of 200,000 ha. and the district area of 239,000 ha. shown in the attached Topographical Map Planning Diagram VI-2. For the area adjacent to the border with Nicaragua, where no aerial photographs are to be taken, relative positions should be indicated according to reference materials available.

2-6-2 Topographical Map Preparation

A topographical map is prepared on the basis of photogrammetry and in accordance with the following steps:

2-6-3 Setting Up of Control Points by JMR Observation and Installation of Permanent Signs

Since no existing control points are available in the areas and their surroundings, JMR observation should be carried out in nine locations, where air-photo markers are installed, as shown in the photography planning diagram attached. Permanent signs should be installed at the three observation points in Torre so that they can also be used as control points in the subsequent survey. The accuracy of JMR observation should be within ±5m.

2-6-4 Aerotriangulation Survey

An aerotriangulation survey is carried out in accordance with control points and the summary table previously mentioned, and a survey should be made for the orientation point of each photograph model for the entire mapping area. The results should be tabulated and orientation points should be stippled on positive films.

Six orientation points should be provided within a model and two points should be provided for an adjacent course. These two points can also be used as orientation points. Orientation point network diagrams can be any size convenient for handling. A fair copy should be made on a No.300 Milar sheet and necessary remarks and finishing touches should be given.

The number of models for the aerotriangulation survey depends on the results of photography. A total of 595 models are planned, 170 for the diaphysial courses and 425 for plane courses.

2-6-5 Cartographical Work

The results of the aerotriangulation survey previously mentioned and control points are developed on a No.500 Milar sheet in advance. The sheet is then set in precision cartographical equipment with the stippled positive film to draw the following factors in order to prepare the original.

The size of the map should be 60cm × 90cm excluding the margins, divided into a grid of kilometer squares.

A total of 318 sheets should be produced according to the sections shown in the topographical map planning diagram attached.

A reduced scale of 1 to 20,000 should be employed with contour lines at intervals of 5m. Rivers, lakes, swamps, houses, buildings and other structures should be drawn and forest offices, Torre and nurseries should be clearly marked.

Permanent roadways are indicated in double solid lines and roadways such as seasonal roads, which are not usable during the rainy season, in double broken lines.

Trails are indicated in single-broad broken lines regardless of their width.

In addition, forest divisions, stock boundaries, and others in the process of surveying separately conducted by forestry specialists should be drawn. Height and crown diameters and the unit of standby trees should be measured and indicated in colors different from those used in topographical maps.

2-6-6 Arrangement and Editing of Rush Map

Details and other necessary information should be indicated with proper symbols on the rush map mechanically produced. Details should be given as much as possible from reference materials for the area adjacent to the border with Nicaragua and for which no photographs are taken but is included in sections, 8, 12, 13, 14, 15, 16, 1 and 18 shown in the topographical planning diagram attached. Further, the cartographical area should be clearly separated from the editing area by means of a long-broken line.

Numbers representing distance should be marked at intervals of one kilometer in the margins along two sides, east and south.

The following necessary data are indicated as follows:

Data	Location
Title	: Upper center of map
Connection to the next map	: Upper right
Compass direction	: Upper right
Legend	: Below the compass direction
Scale	: Lower center
Survey date	: Lower left
Survey method	: Lower left
Photographs used	: Lower left
Planning organization	: Lower right
Cartographer	: Lower right

Remarks and data are all indicated in the Spanish language.

2-6-7 Production of Fair Original

On the basis of the rush map which is completed in the aforementioned procedure together with the use of proper symbol a topographical map is then prepared on a No.300 Milar sheet or a No.300 polyester sheet which will not expand or contract.

In the preparation, the boundaries of forests and stocks, and other forest inventory data which is to be dealt with in the process of forest inventory should not be shown on the fair original.

2-6-8 Reproduction

The original of the topographical map is photocopied in order to produce the second original and other copies necessary for the forthcoming survey.

2-6-9 Index Diagram

An index diagram should be prepared on Milar material of the proper size in order to indicate the size and the number of a map, the position of each aerial photograph and other necessary data.

2-6-10 Proof-correction

The map is proofread in each process in order to maximize accuracy.

2-6-11 Type and Number of Products

In relation to the production of the topographical map, the following types and quantity of materials are produced:

Table of control points	: One set
Table of aeroangulation survey results	: One set
Orientation point network diagram	: One set

Original topographical map,
on a scale of 1 to 20,000 : One set

Index diagram : One set

2-7 Collection of Materials

The following aerial photogrammetry materials were collected in the preliminary survey:

Aerial chart on a scale of
1 to 500,000 : One set (One sheet)

Topographical maps on a scale of
1 to 50,000 : One set (29 maps)
(Out of 45 maps, 16 are missing)

Breakdown : Mosquitia district : 20 maps (Five missing)

Paraiso district : 9 maps (11 missing)

Mosquitia district reference maps
on a scale of 1 to 60,000 : One set (Two maps)

(Note: The entire area for the forthcoming survey is not covered.)

2-8 Equipment and Materials to Be Taken to the Site

Equipment, instruments and materials to be taken to the site are shown in Table VI-8.

Table VI-8 Equipment and Materials

Application	Item	Quantity	Unit		In	Out	Remarks
Photography	Aircraft	1	Unit	-	Contracted 0	0	
Photography	Maintenance parts and tools	1	Set	-	Contracted 0	0	
Photography	Camera	1	Unit	-	Contracted 0	0	

Application	Item	Quantity	Unit		In	Out	Remarks
Photography	Magazine	4	Units	-	Contracted 0	0	
Photography	Camera accessories	1	Set	-	Contracted 0	0	
Photography	Film	15	Rolls	-	0	0	60cm
Photography	Film processor	1	Unit	-	0	0	Delivery to the site is necessary only if films are processed on the site.
Photography	Dryer	1	Unit	-	0	0	
Photography	Developing accessories	1	Set	-	0	0	
Photography	Printer	1	Unit	-	0	0	
Photography	Paper processor	1	Unit	-	0	0	
Photography	Paper dryer	1	Unit	-	0	0	
Photography	Paper	2000	Pieces	-	0	0	
Photography	Chemicals	1	Set	-	0	-	
Photography	Refrigerator	Large size 1	Unit	-	0	-	For storage of films

Application	Item	Quantity	Unit		In	Out	Remarks
Preparation of topographical maps	Air-photo marker boards	40	Pieces	0		-	20 × 150cm
Preparation of topographical maps	Materials for the installation of air-photo markers	1	Set	0		-	Posts, wires, needles, hammers, brushes, pliers, etc.
Preparation of topographical maps	Materials for permanent signs	1	Set	0		-	Cement, molds, etc.
Preparation of topographical maps	Materials for JMR observation: Receiver	4	Unit	-	0	0	60kg × 4 = 240kg
Preparation of topographical maps	Materials for JMR observation: Cassette reader	2	Unit	-	0	0	50kg × 2 = 100kg
Preparation of topographical maps	Materials for JMR observation: Micro processor	2	Unit	-	0	0	50kg × 2 = 100kg
Preparation of topographical maps	Materials for JMR observation: Simulator	1	Unit	-	0	0	60kg
Preparation of topographical maps	Materials for JMR observation: Attachments and other accessories	1	Set	-	0	0	100kg

Application	Item	Quantity	Unit		In	Out	Remarks
Preparation of topographical maps and forestry survey	Jeep	3	Unit	Procurement in Perto Lenpira is not possible.	O	Δ	Arrangement should be made so that items can be purchased in Honduras and delivered to Perto Lenpira.
	Maintenance parts and tools	1	Set		O	Δ	
	Gasoline	20000	ℓ		O	-	
	Oil	2	Drums		O	-	

In the above table, items marked with Δ should be provided to the Government of Honduras on completion of the survey with proper clerical procedures.

2-9 Planning and Supervision

The survey is to be planned and conducted under the supervision of the Overseas Technical Cooperation Agency which executes overseas projects on behalf of the Government of Japan. The Overseas Technical Cooperation Agency has the right to send specialists according to necessity in order to plan, supervise and inspect the work.

2-10 Survey Schedule

Description of the survey and its schedule are as shown in Table VI-9.

2-11 Provision of Equipment and Materials

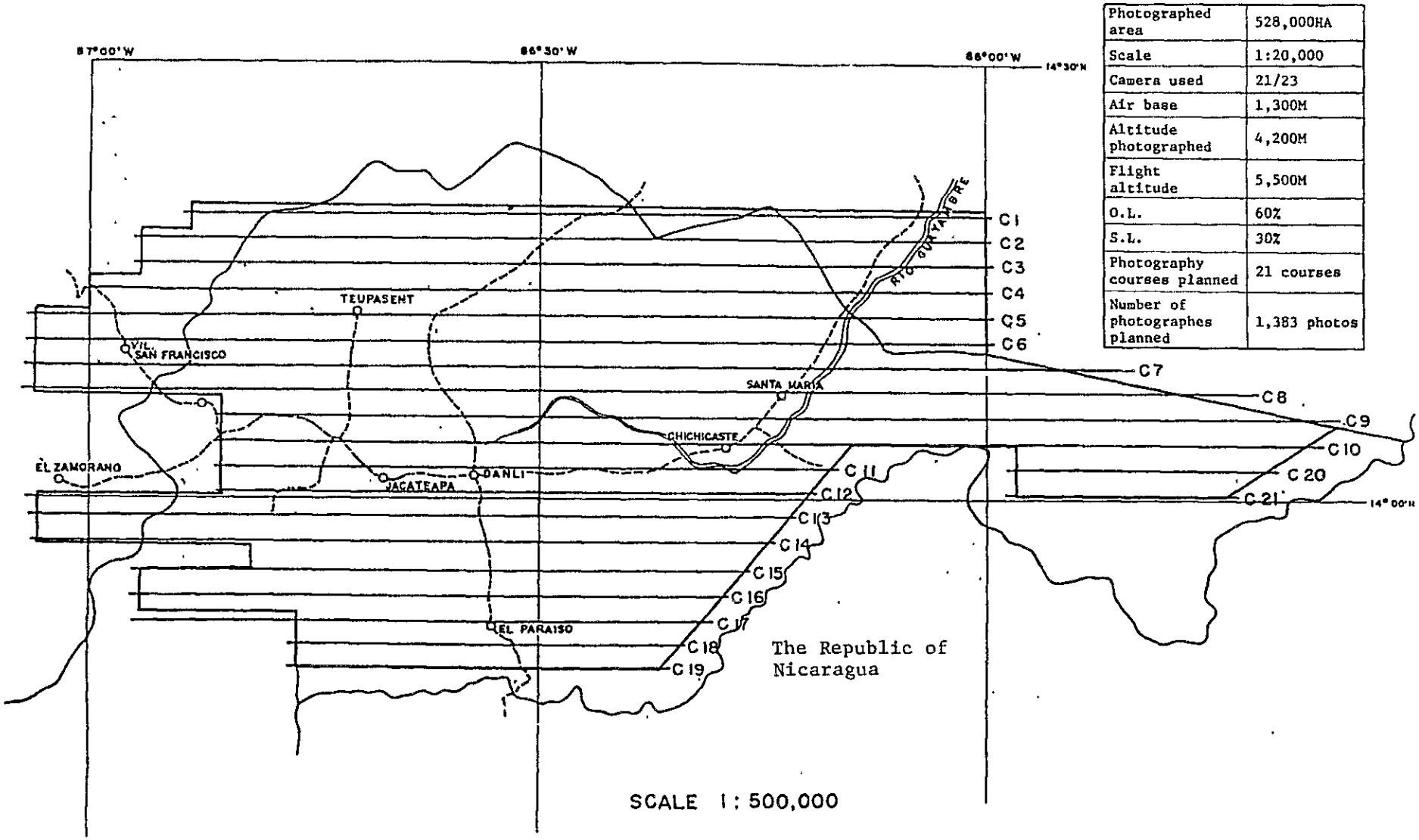
It is desirable to provide the items shown in the Table VI-10 to the Government of Honduras on completion of the survey if such provision is made possible.

Table VI-10 Provision of Equipment and Materials

Item	Quantity	Remarks
Jeep	2 units	Jeeps used during the survey.
Reflex stereoscope	20 units	COHDEFOR headquarters Photogrammetry section: 2 Inspection section: 2 8 forest offices: 2 each Including three units used during the survey
Others		Items marked with Δ in Table VI-8.

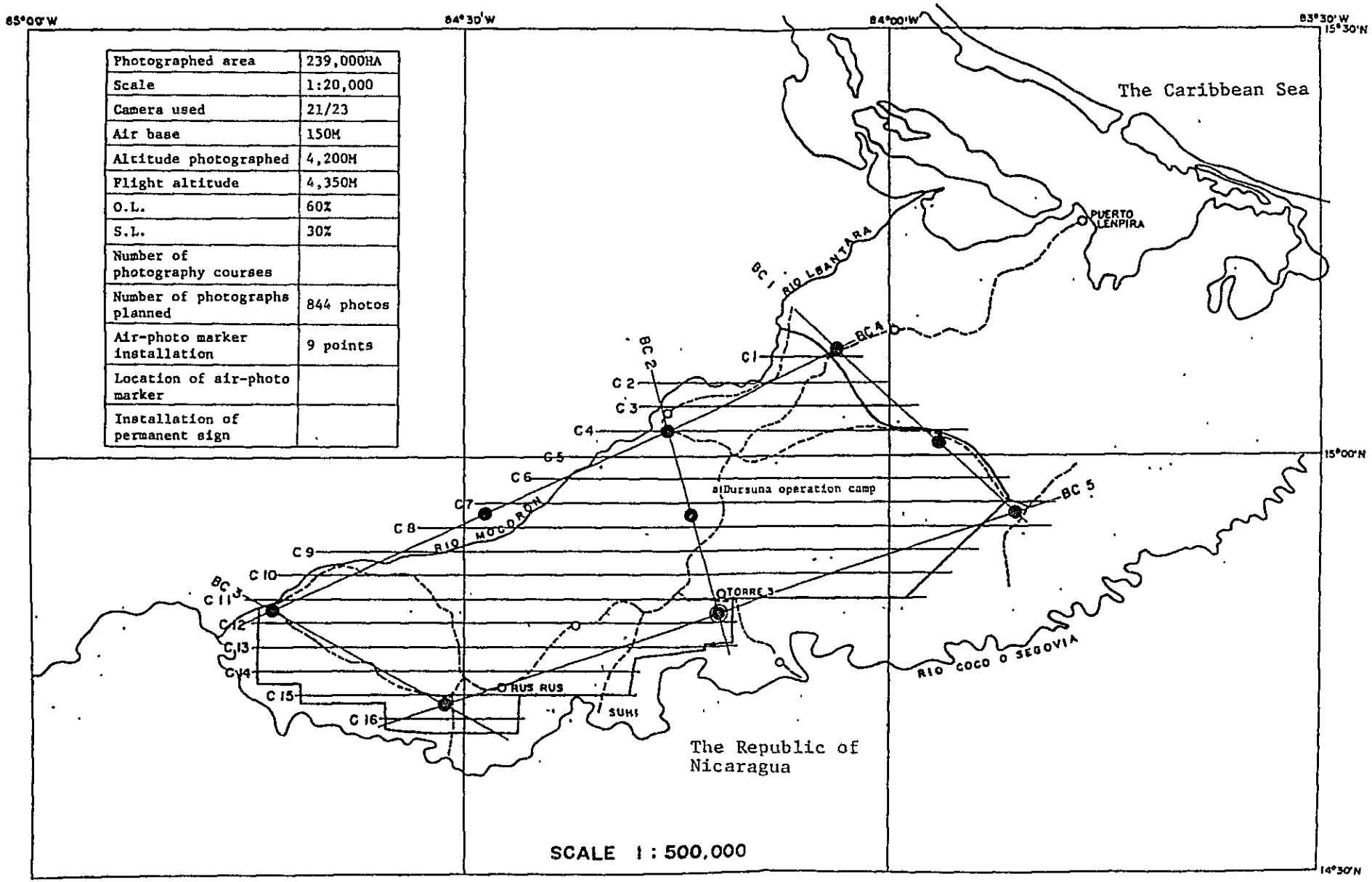
Table VI-9 Survey Schedule

Work \ Month	1980	1981				
	December	January	February	March	April	May
1. Preparatory work in Japan (Photography planning and others)	← →					
2. Installation of air-photo markers		←	—	→		
3. Preparation for photo-graphing		←	→			
4. Photographing			←	→		
5. Arrangement of air-photo marker details and drafting of orientation diagrams				← →		
6. Survey for control points and bench marks				←	→	



Photographed area	528,000HA
Scale	1:20,000
Camera used	21/23
Air base	1,300M
Altitude photographed	4,200M
Flight altitude	5,500M
O.L.	60%
S.L.	30%
Photography courses planned	21 courses
Number of photographes planned	1,383 photos

Fig. VI-1-1 Photography Plan (Paraiso)



Photographed area	239,000HA
Scale	1:20,000
Camera used	21/23
Air base	150M
Altitude photographed	4,200M
Flight altitude	4,350M
O.L.	60%
S.L.	30%
Number of photography courses	
Number of photographs planned	844 photos
Air-photo marker installation	9 points
Location of air-photo marker	
Installation of permanent sign	

Fig. VI-1-2 Photographing Plan (Mosquitia)

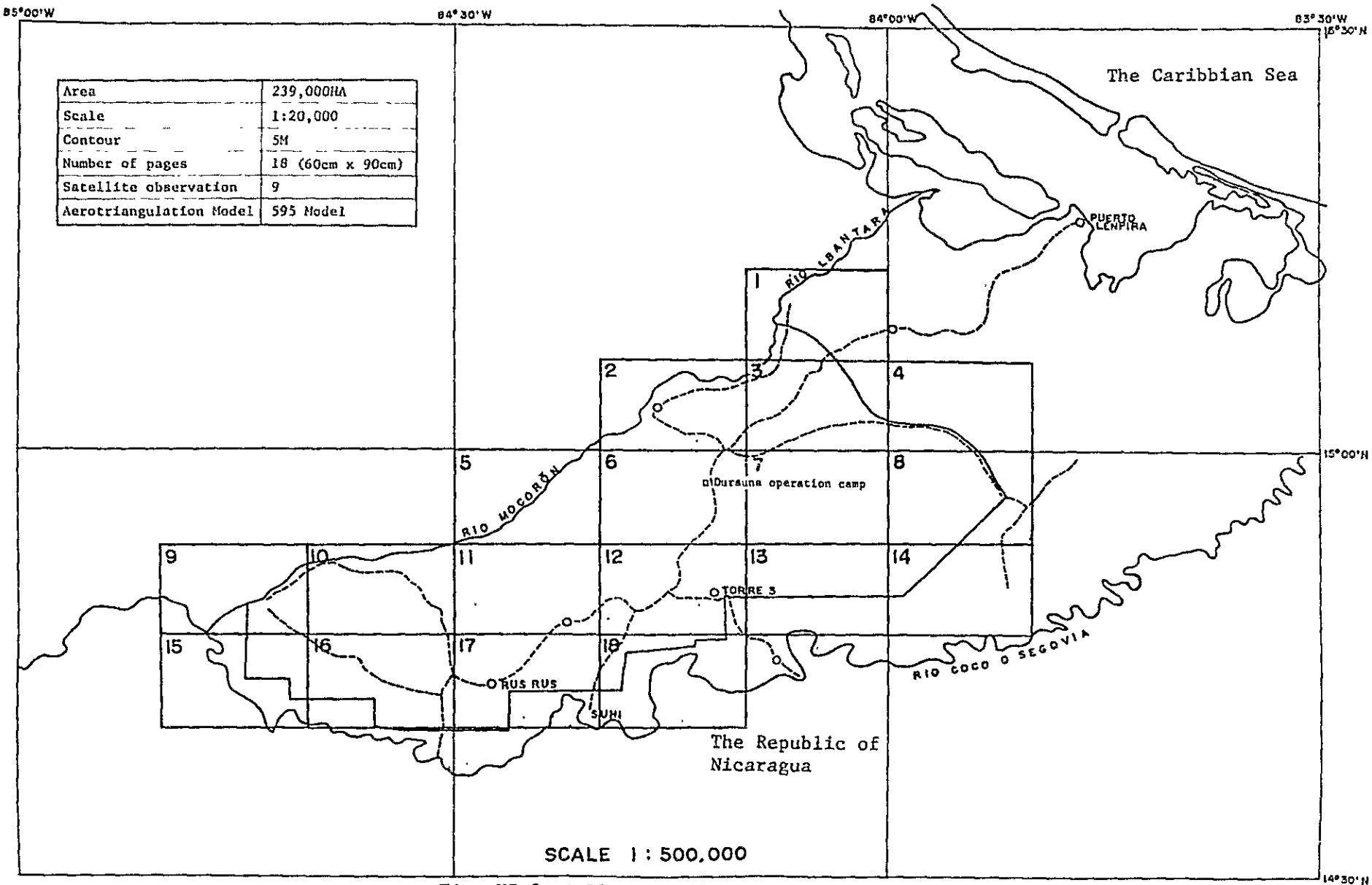


Fig. VI-2 A Plan To Make Topographical Maps

VII. REFERENCE MATERIAL

1. Preliminary Forestry Survey Team in Honduras

Interim Report

Upon the request of the Government of the Republic of Honduras, the Government of Japan has sent the Preliminary Forestry Survey Team headed by Mr. Katsuhiro Kotari (Special Assistant to the President of JICA) to that country for the period from January 25 to February 15 to discuss the possibility of the Japanese cooperation in respect to the scope of co-operation requested by the Honduran Government and also to carry out a field survey and the collection of data and information.

The results of the above mentioned survey carried out by the present Survey Team may be outlined as below.

1. Significance of the forests in Honduras.

The forests in Honduras account for about 60% of the total area of the country, providing extremely important resources for the sawmilling and other wood industries, and also for future industrial development in pulp and paper.

But from the viewpoint of natural conditions such as topography, soil and vegetation, etc., it is not only very important economic problem, but also social problem for this country to improve and maintain the existing forests in the better conditions.

Moreover an increasing concern has been expressed in recent years in that country about appropriate forestry development, forest management and the improvement of forestry techniques.

2. The necessity of formulating a forest management plan.

In Honduras the forest resources development occupies an important position among the items of the national economic development. However, adequate arrangements have not been made to ascertain forest resources quantitatively and to formulate a reasonable forest management plan.

If development by uncontrolled felling is obliged to be carried out by the economic and social conditions in future, not only continuous supply of forestry products will be made difficult, but also it will have critical effects on agriculture and watershed management through the change of natural environment.

Therefore if the systematic and appropriate forest management is carried out in making use of forests in this country, the various functions of forests will not only increase substantially, but also it will greatly contribute to the social and economic progress of the nation.

From the above-mentioned Japan's cooperation with forest management planning in LA MOSQUITIA and EL PARAISO of the project area is expected to lead to the fostering of Honduran specialists in this field, thus contributing greatly to the formulation of forest management.

3. The scope of the requested cooperation.

The scope of cooperation in LA MOSQUITIA and EL PARAISO has been ascertained as follows:

In LA MOSQUITIA, requested is the forest inventory by the use of aerial photographs.

In EL PARAISO, requested is an aerial photography.

It has been made clear that the high priority is placed upon LA MOSQUITIA than EL PARAISO in making the survey requested by the Honduran Government.

The outline is shown in the annex.

4. The arrangements to be made by the Honduran Government.

As regards the arrangements to be made by the Honduran Government, receiving the Japanese cooperation, is outlined as below.

(1) The survey for the development of forest resources is one of the important policy measures in Honduras.

(2) The COHDEFOR is the national implementation agency, promoting the policy in forestry, and also making efforts to improve technically under the cooperation of other developed countries and FAO.

(3) It is the pre-requisite for the survey that the special entry permit by the airplane to fly over the adjacent Nicaraguan territories must be obtained beforehand, through the appropriate official channels by the Honduran Government.

5. This mission considering of the discussions, so far made, would like to recommend the immediate realization of the formal survey to both the Honduran and Japanese authorities concerned.

6. Others

This mission wishes to convey the following requests from the Honduran Government to the Japanese Government.

1) To accept some Honduran counterparts for technical training in Japan.

2) To take aerial photographs, if possible in EL PARAISO.

February 11th, 1980.

K. Kotani

KATSUHIRO KOTARI

Head of the Japanese Survey Team

ANNEX

The Scope of Cooperation requested by the Honduran Government

1. IN LA MOSQUITIA

   (1) Aerial photography Maximum 200,000 ha.

   (2) Forestry Resources Development Survey
   Maximum 75,000 ha.

2. IN EL PARAISO

   Aerial photography Maximum 300,000 ha., if possible.

2. Initial Request from the Government of Honduras

Señor
HARUSHIGE KANEDA
Embajador del Japón
Su Despacho

Excelentísimo Señor Embajador:

De la manera más atenta me dirijo a usted para que por su digno medio, se gestione ante su llustrado Gobierno la cooperación técnica que requiere la Corporación Hondureña de Desarrollo Forestal para llevar a cabo actividades forestales específicas en los Distritos de El Paraíso y La Mosquitia.

Los distritos forestales de El Paraíso y La Mosquitia se han considerado que tienen un potencial forestal muy grande, el cual no ha sido posible cuantificar por no contar con el inventario forestal de dichas zonas, lo que nos impide el establecimiento del corte anual permisible, así como la estimación de vida productiva o instalación de nuevas industrias forestales.

Extensión de las Zonas

Distritos Forestales	Extensión Superficial Km^2	Extensión Boscosa Estimada en Km^2	
		Coniferas	Latifo-liadas
El Paraíso	7,218	1,734	616
La Mosquitia	16,630	5,653	1,586
Sumas	23,848	7,387	2,202

Las actividades específicas para las cuales se solicita la cooperación japonesa bajo las recomendaciones técnicas que se estimen convenientes serían:

a) Toma de la Fotografía aérea (23,848 Kms.^{2})

b) Realización del Inventario Forestal (16,385 Kms.^{2})

Este trabajo se haría prioritariamente en las áreas pobladas por coníferas.

Sin otro particular a que hacer referencia, me complace testimoniarle las muestras de mi más distinguida consideración.

JUAN RAMON MONDRAGON
Secretario Ejecutivo Por. Ley

3. COHDEFOR Official Request

February 12, 1980.

Excellency
Harushige Caaneda,
Japan Embassy,
Your Office.

Excellency Mr. Caaneda:

This document is in reference to the government of Honduras Official Request to the government of Japan for Technical Assistance in the Forestry Field.

The findings of the Japan's Mission to Honduras and the changes in our Forest Activities since the original Request, now permits to view more specifically our country's needs. After inspecting the Forest Areas, analizing the countries total forest program and discussing the various possibilities, the original request has been modified to include those areas which are now prioritary. Our conclusions are as follows:

1. Due to its actual forest development and vast potential, top priority has been given to the Mosquitia District.

   1.1 Aerial Photography of 200.000 Hectares of pine forest (Pinus caribaea) located in the Dursuna and Rus Rus Management sub-units.

   1.2 Forest Inventory of the same area.

   The above information will be used by COHDEFOR to establish the management plan of this area.

2. Aerial Photography of the Paraiso District has been included in COHDEFOR'S 1980 plans. Also, it is expected that during this year the forest inventory needed to prepare the management plan of this area will be started by our inventory division.

   COHDEFOR requests that JAPAN considers the possibility of complementing the aerial photography to cover those areas that can't be covered this year.

   The total Paraiso Pine Area consists of some 300.000 Hectares.

3. COHDEFOR requests that short term on the job training in Japan, be included as part of the cooperation program, to prepare the trained technical personnel needed for implementation of the management plans.

This training would be specifically on the field of silviculture, Reforestation, Inventories, Nurseries, Logging, Erosion Control, Pest and Disease control and Research.

Complementary information about the above Requested cooperation has been privided to the experts from Japan, as well as general information of Honduras Forestry Program.

Hoping that this future Technical Assistance will be only the beginning of a Long Term Relationship in the Forestry Field between the government of Japan and the government of Honduras.

Sincerely

CORONEL DE INFANTERIA DEM

GERENCIA GENERAL

HUMBERTO GOMEZ SUAZO
GERENTE GENERAL

cc Secretario Ejectuvio CONSUPLANE
Woods Department
File