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**PROYECTO CENTROAMERICANO
DE FERTILIDAD DE SUELOS**

*Soil science in Honduras. Classification,
fertility and conservation*

**Harvey Newton
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Anexo 21



**CENTRO AGRONOMICO TROPICAL DE INVESTIGACION Y ENSEÑANZA
TURRIALBA, COSTA RICA**

1978

CATIE
CENTRO AGRONÓMICO TROPICAL DE INVESTIGACIÓN Y ENSEÑANZA

SOIL SCIENCE IN HONDURAS
CLASSIFICATION, FERTILITY AND CONSERVATION

Compiled by:

H.P. Newton
P.C. Duisberg

Preliminary document for discussion prepared for the
"Reunión Técnica Regional sobre Fertilidad y Análogos
de Suelos", in San Salvador, El Salvador, March 12-18,
1978.

For review and completion by the Honduran soil scientists.

Turrialba, Costa Rica
1978

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SOIL SCIENCE IN HONDURAS
CLASSIFICATION, FERTILITY AND CONSERVATION*

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I. Introduction

This is one of six reports on the state of soils work in the countries of the Central America isthmus. A similar outline and pattern is presented in each in order to make the country reports as comparable as possible. Reports are based on interviews by members of the "Soil Analog Project" plus published information and reports available. However, no claim to completeness or full accuracy can be made, except in the case of Costa Rica. In Costa Rica the report was prepared with national soils scientists. It is hoped that the reports will serve as a basis for discussion during the first regional soils meeting at San Salvador, El Salvador from March 13-18, 1978, and that soils scientists from the different countries present will improve and complete the documents for their countries using the Costa Rica report as a model.

This effort should lead to the production of a comprehensive document on the state of soils work in Central America and a realistic assessment of the weaknesses and needs to strengthen the field. The field of soil science in Central America cannot serve as a basis

* Preliminary document for discussion for the "Reunión Técnica Regional sobre Fertilidad y Análogos de Suelos" in Salvador, El Salvador, March 13 to March 18.

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for improving soil analogs and overall development unless it can be strengthened in every country. The analogs which have been possible through the soil analog subproject of CATIE/RCCAP for the Pacific area of Nicaragua, Honduras and El Salvador represent only a first step in supporting national development plans and agriculture by determining similarities between soils within and between countries. If basic knowledge of soils agencies can be constantly improved, the quality of analogs will also improve. The potential economic and social savings of identifying soils requiring very similar management, fertilization and conservation practices is enormous.

II. Summary and Suggestions for the Fields of Classification, Fertility and Conservation

Honduras has the biggest and most comprehensive program in soils in Central America at this time. It is a part of the "Programa Catastro Nacional". When this expensive program is complete Honduras will have valuable modern soil classification information on large scale maps for major portions of the country at the level of soil families and series. However, it does not now appear that the project will leave either a group of soil surveyors or laboratory analysts capable of continuing and expanding the work after the foreign contractors leave. Neither, does it appear likely that a satisfactory soils agency or office will be set up in which they could continue the work. Since, the program is still in progress there might still be time to overcome some of these difficulties if they are recognized and attacked with vigor.

Some progress has been made in improving capability in soil fertility but we agree with the evaluator for AID/ROCAP, Dr. R.W. Pearson that "external technical assistance should be provided to Honduras soil fertility programs for at least a two year period" and further that part of the need is to help "coordinate the countries soils laboratory and fertility program with the national soils program".

The period of the next year will be particularly important since the laboratory is scheduled to be moved to new and better facilities and the Soils work of the national catastro will be approaching its end. At a minimum CATIE should be requested to give as much advisory support as possible from the central staff remaining after its AID Soil Fertility project officially terminates.

The program of soil conservation is only a drop in the bucket compared to the need and there has been no comprehensive assessment of the degree of erosion or any plans for a major effort in this field. In a country with the rolling and rugged topography of Honduras and increasing pressures for asentamientos and land for campesinos, the erosion hazards are particularly great and unless met vigorously will result in soil and fertility losses much greater than gains through new agricultural programs.

Since, there was insufficient time to make a thorough review of the status of soil science, it is recommended that the Honduran soils technicians revise and complete this review. Nevertheless, a number of suggestions might be advanced subject to modification as further facts are discovered.

A. CLASSIFICATION

1. Plans should be put in motion to request one of several Central Americans skilled in the new taxonomy and possessing administrative and leadership skills to join the soils part of the Catastral program to assist in training Honduran technicians.

2. Plans should be made to form a soil survey unit under the temporary direction of the above man probably within the Ministry of Natural Resources as soon as the Cadaster ends.

3. The most promising Honduran soil surveyers on the Catastral program should be given a series of intensive short courses of theoretical training.

4. The soils laboratory should be thoroughly **evaluated**. It is suggested that Ing. Roberto Díaz of CATIE be requested to give continuing advisory services, specially with respect to the analytical techniques necessary for the classification of soils.

B. FERTILITY

5. The Pearson Report of AID/RDCAP should be implemented and AID/Honduras should be asked by the Honduran government to obtain an advisor who would be linked to CATIE for at least two years. This man would have to spend about one fourth time advising the laboratory and three fourths time training and reviewing fertilizer trials.

6. If the Programa Catastro Nacional starts a laboratory, it should be incorporated into the main laboratory when the PCM ends.

7. The Director of the soils laboratory should be given an opportunity to visit all other national laboratories and then be given

training under Ing. Roberto Díaz at CATIE before the laboratory is moved to its new location.

C. CONSERVATION

1. At least two of the most interested and promising agronomists should be sent abroad to obtain masters degrees in a field related to soil conservation. One should develop a program at the Programa Nacional de Manejo y Conservación de Suelos for the farm level and the other in the Watershed Protection program of CONDEFOR. Plans should be made for close coordination.

III SUMMARY OF SOILS INSTITUTIONS IN HONDURAS

TABLE I

E N T I T Y	Major Soil Emphasis	1977 Budget Dollars	1978	S T A F F		
				Pro- fessionāl	Sub-pro- fessional	Clerical

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III SUMMARY OF SOILS INSTITUTIONS IN HONDURAS

TABLE I

Cont.

Offices	Library (Books documents and maps)	ACCESS TO:		EQUIPMENT		Other Collaborators (Major)	Mobility and transport	Outputs	Principal users of information
		Laboratory	Greenhouse	On hand	Ordered				

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IV. Early Period of Soil Science

A. CLASSIFICATION

A country wide soil survey was published by FAO in 1969. The scale of the map is 1:100,000 and the map consists of one single sheet. The work was done by C.S. Simmons and Ing. Agr. V. Castellanos, who is now with CONDEFOR. Simmons actually was in Honduras from 1958 until 1968. The report is 80 pages of which 37 cover the detailed description of about 30 soil series but the boundaries are not well defined and series included associated soils. The soil samples taken during this survey have been stored in small vials (about 50 - 100 g of soil each) in drawers at the soils laboratory at El Pichacho. The samples are deteriorating: i.e. some of the labels are coming off.

It appears that Simmons worked with 1:50,000 topographic maps in most of the central part of the country. He had to use a 1:250,000 map on a strip along the Salvadorian border and the North-Central portion of the Atlantic Coast (mostly the Department of Colón), and to map the Department of Gracias a Dios in the east. He also used aerial photographs where available. There were some strips in Gracias a Dios department and the Department of Olancho and Paraiso where neither topographic maps nor aerial photographs were available. Field observations were done by surface trips except for most of the Department of Colón and the Eastern part of the Department of Olancho which was done by aerial inspections and river trips.

In any case this survey, while still the only one covering the country completely is too general and the soil series areas too broad. It will be replaced by the survey of the National Cadaster for most

areas and uses.

OAS through its Mission 105 had prepared an agrologic map and a land capability map in 1962. The soils of approximately 1/3 of the country were mapped at about reconnaissance level without laboratory work. For most of the remainder only slope maps existed. Maps of 1:250,000 were used. Based on these maps, Dr. C.V. Plath, FAO in cooperation with Dr. C.S. Simmons and Ing. V. Castellanos prepared a map at 1:500,000 scale of "Potential Land Use". The map is dated 1964 but the report was published by FAO in 1967 with a map at 1:1 000 000 scale. Similar reports and maps were prepared in all six countries of the Central American Isthmus.

Comayagua Valley Development Project - Feasibility Study

This study was done by H. Halcrow and partners under contract to the British Ministry of Overseas Development and includes detailed studies on an area, which covers about 32,000 ha. There are semi-detailed and some detailed soils maps, maps on actual and potential land use, geology and water resources. The work was undertaken during 1972/73. The area has been remapped on a semi-detailed basis by the "Programa Catastro Nacional". (PCN).

B. SOIL FERTILITY WORK

Earlier work is discussed in the section on the "Programa Nacional de Manejo y Conservación de Suelos".

C. SOIL CONSERVATION

No information on earlier work in this field was available for preparation of this document. Present work is discussed in the "PNMCS" section.

V. Present Soils Entities
and Laboratories

A. CATASTRO DEMOSTRATIVO

The survey covers the two Departments bordering the "Golfo de Fonseca" in the South, i.e. Departments of Choluteca and Valle.

The field work for this survey was finished in early 1975. However, there have been several delays in preparing the final reports, and some of the soils descriptions have been lost due to a fire in the offices.

The soils survey has been done on 1:20,000 maps. Unfortunately some accuracy has been lost when the information was transferred from the aerial photos to plain plastic sheets and then from these plastic sheets to the topographic maps. There are 74 sheets of the soil survey covering these two departments.

The following maps of interest to soils work were produced by the Catastro Demostrativo:

- 12 mapas de isohietas (mensual) 1:250,000
- 12 mapas de isolíneas de EVPT (mensual) 1:250,000
- 1 mapa de Isohietas (Promedio anual) 1:250,000
- 1 mapa de Isotermas (Promedio anual) 1:250,000
- 1 mapa de uso potencial de la Tierra 1:250,000
- 1 mapa de precipitación (promedios por mes y año) 1:250,000
- 1 mapa de temperaturas (promedio por mes y año) 1:250,000
- 1 mapa de Zonas Climáticas (Koeppen) 1:250,000
- 1 mapa de suelos 1:250,000

- 1 mapa de Capacidad de Uso de la Tierra 1:250,000
- 1 mapa de Factores Ambientales 1:250,000
- 1 juego de 7^b mapas de Suelos 1:20,000
- 1 juego de 7⁴ mapas de Capacidad de Uso de la Tierra 1:20,000
- 1 juego de 7⁴ mapas de Factores Ambientales 1:20,000
- 1 juego de 7⁴ mapas de uso actual de la tierra y vegetación natural 1:20,000

There are also 1:10,000 cadastral sheets for these two departments.

All these maps are available except for some sheets of the "Capacidad de Uso de la Tierra" and the 7⁴ sheets of "Uso Actual de la Tierra y Vegetación Natural". The latter map in its draft form seems so detailed that it may confuse potential users. These sheets therefore will be reviewed before they are put into final form although it appears that no one until now has figured out how to simplify these maps.

There is also a draft report which contains very detailed climatic data of the area entitled: "Programa de Catastro Nacional, Proyecto de Catastro Demostrativo. Borrador para discusión. Análisis de las Condiciones Climáticas y de los Recursos Hidráulicos. July 1975".

Unfortunately the soils report and profile descriptions also are still in draft form.

The PCN inherited all material produced by the Catastro Demostrativo. It is being reviewed and put into the final form.

B. PROYECTO CATASTRO NACIONAL (PCN)

1. General

This project is a follow-up of the Catastro Demostrativo

However, it is a very much enlarged project with mostly new personnel, and also a different consulting firm. It started in 1976. Soils work is under the supervision of Ing. Agr. Haluk Yuksel, who worked as chief soil surveyor in the Guayas Basin, Ecuador 71/72 for a similar project.

In September 1977, Ing. Agr. J. Díaz joined the PCN - Soils section as counterpart to Yuksel. In addition there are 10 junior soil surveyors (Ing. Agr.) working in the field, who are receiving training in the project. There are also 3 subprofessionals working in the soils sections plus some workers and drivers.

2. Reconnaissance Survey

The soil survey unit of the PCN has completed a reconnaissance survey of about 42,00 sq Km so far. The total project area is about 66,000 sq Km, and might have been completed last year, except for administrative problems.

They have observations of about 3,350 soil sites, including detailed morphological descriptions of soil profiles. On the average, one observation has been made for each 13 sq Km, with the density of observations higher in the valleys, and less in the mountainous regions. When completed, there will be about 5,500 observations for the 66,000 sq Km, or one per 12 sq Km. A breakdown by departments is as follows:

<u>Department</u>	<u>Area covered (end of Aug.77)</u> (Km ²)
Comayagua	5,376
Cortez	3,954

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<u>Department</u>	<u>Area covered</u> (end of Aug.77) (Km ²)
Atlántida	4,251
Yoro	7,939
El Paraiso	5,063 (70% of department, as for the remainder no airphotos nor topographic maps are available)
Santa Bárbara	5,115
Francisco Morazán	7,946
Olancho	<u>2,500</u> (not yet completed)
	42,146

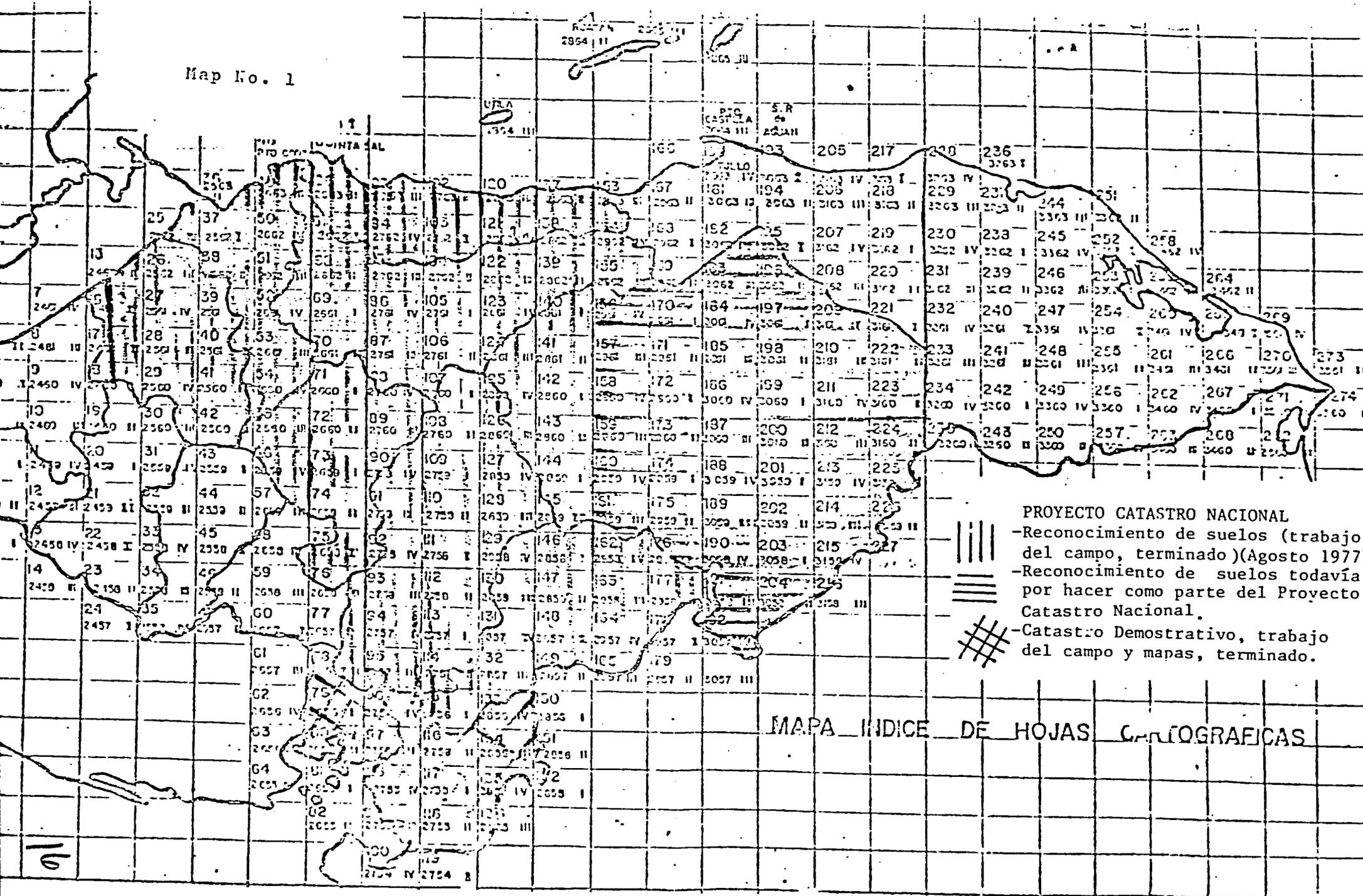
For field work in the reconnaissance survey the PCM uses geomorphic maps where possible. These maps were made by the photo interpretation of 1:60,000 scale aerial photographs, separating certain landforms and/or certain combinations of landforms found on different geological formations. These boundaries were then transferred into 1:50,000 scale topographic maps by reo-hand. Such maps have been prepared for the Department of Comayagua, Cortez, Atlántida and Yoro.

The attached map N° 11 shows the area mapped by the "Catastro Demostrativo", and those completed and still being mapped by the "Programa de Catastro Nacional".

3. Semi-detailed Survey

This survey will cover most of the valleys in the project area or a total of about 4300 sq Km. One valley near San Pedro Sula will be done by a different project carried out with the help of Harza Engineering, a U.S. consulting firm. Until now, only the Comayagua Valley

Map No. 1



- PROYECTO CATASTRO NACIONAL
-  -Reconocimiento de suelos (trabajo del campo, terminado)(Agosto 1977)
 -  -Reconocimiento de suelos todavía por hacer como parte del Proyecto Catastro Nacional.
 -  -Catastro Demostrativo, trabajo del campo y mapas, terminado.

MAPA INDICE DE HOJAS CARTOGRAFICAS

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has been re-mapped. About one observation per sq Km was made, soil samples collected and profiles described. This resulted in 400 observation sites. The mapping was done by using 1:20,000 aerial photographs, both in the field and for photo interpretation. The final map will be on an uncontrolled photo mosaic of 1:20,000.

4. Training and Information

The ten field assistants of the PCN have been trained in a special four-week photo interpretation and soil classification course. They have also been provided with adapted manuals in Spanish on "Morphological Description of Soils in the Field" and "Classification of Alluvial Soils". Nevertheless, the consultant still must do the really skilled work and it is doubtful whether the staff can continue his standards after his departure. On the other hand it seems that Honduras will obtain rather good soils information and maps for the areas covered by the projects. PCN schedule calls for the completion of both reconnaissance and semi-detailed mapping within the project area during the dry season of 1978. It will, of course, be some time, after the field work is completed that any report will be ready.

The PCN is also collecting climatic data for its project area. By late 1977 the following maps had been prepared in draft form:

<u>Nombre</u>	<u>Condición</u>	<u>Escala</u>	<u>Zona</u>
Mapas isohietas	(borrador para discusión previa impresión)	1:250,000	PCN
Mapas isotérmicos	borrador para discusión, previa impresión.	1:250,000	PCN
Climas de acuerdo con Koppen	(no finalizado)	1:1,000,000	PCN

<u>Nombre</u>	<u>Condición</u>	<u>Escala</u>	<u>Zona</u>
Temperatura de acuerdo a la presión	(no finalizado)	1:1,000,000	PCN
Coefficiente de Angot (Déficit y Exceso)	(no finalizado)	"	"

C. PROGRAMA NACIONAL DE MANEJO Y CONSERVACION DE SUELOS - SECRETARIA DE RECURSOS NATURALES (RN)

1. Land Classification Work

The PNMCS is headed by Ing. Agr. Francisco Martínez, who recently completed his masters degree work at the University of Florida.

The "Programa Nacional de Manejo y Conservación de Suelos" has done about ten soil surveys of small irrigation projects, classifying soils as to their irrigation class. Although there are some descriptions of individual profiles, there is no attempt to fit these data into any classification system. The average project size is about 400 ha. It includes projects in the Jamastra and Talanga Valley, and project Yojoa. The PNMCS has only one copy each of their reports, and no copies are available for distribution.

During 1977 the PNMCS did the following soils classification work:

<u>Region</u>	<u>Location</u>	<u>Area</u> ha	<u>Purpose or type</u>
Centro Occidental	S. Sebastián	250	Irrigation
" "	Lamani	130	
Centro Oriental	El Rodeo	2000	
	Las Animas		
	Las Delicias		
	Teupasenti		

<u>Region</u>	<u>Location</u>	<u>Area</u> ha	<u>Purpose or type</u>
Centro Occidental	Yarula, Santa Elena, Cabañas	8000	Reconnaissance in mountains, semi-detailed in Valles de Yarula, S. Elena for development planning.
Centro Oriental	Valle de Talanga	3000	Detailed study by contractor. Potential for sugar cane.
" "	El Paraiso	4000	Potential for different crops for regional development.
	Jacaleapa	_____	
	Total	17300	

As far as could be determined, this department's soils people are the only ones doing any survey work within RN. If this is correct, it hardly seems possible for the PCN to follow suggestions made by some specialists and work through an existing government department.

2. Soil Conservation Work

The PMMCS is also charged with soil conservation work as the name implies. Their work during 1977 consisted of making some types of terraces surveying for contour farming and similar activity. The department worked on a total of 43 ha, short of the planned goal of 200 ha for 1977. Even if 200 ha had been covered, this would have no noticeable impact on soil conservation problems in a country the size of Honduras and with soil conservation problems of catastrophic magnitude as demonstrated by hurricane "Fifi".

Presumably the department will be in a better position in 1978 as

some of the personnel have received "on the job" experience. They will have more personnel, have vehicles and hopefully will have funds available for gasoline, etc.

Even though some soil conservation work is done by COHDEFOR (re-forestation in itself being one major soil conservation measure) it seems essential that PMCS should be strengthened very considerably in this work in the best interest of the country.

3. Soil Fertility Work

a. Fertilizer Field Experiments. Field experiments are done at the Experiment Stations in the various parts of the country, and through the Regional Agricultural Centers by the "Programa Nacional de Manejo y Conservación de Suelos".

The program carried out the following Soil Fertility - field experiments in 1977.

<u>Region</u>	<u>No Crop</u>	<u>Tested</u>	<u>Remarks</u>
Centro Occidental	2 Rice	N,P,K	1 lost
	1 sorghum	N,P,K	
	1 soya	N,P,K	
	1 potatoes	N,P,K	
	1 cabbage	N,P,K	
	2 wheat	N,P	
	1 castor	N,P	
	1 tomato	N,P	
Centro Oriental	2 corn	N,P,K	
	8 beans	N+K, P, K+MK	
	2 castor	N+MK	
Occidental	1 soya	NK	exact number of each not available.
	16 sorghum, corn bean, potato onion, wheat, tobacco		
Total	39		

One can find more old experimental data in the library of the "Secretaría de Recursos Naturales" and in the files at the "El Picacho" laboratory.

Most of those still found seem to be part of the FAO "Freedom from Hunger Campaign". They have no soils descriptions attached.

Reportedly more experiments were undertaken, but no publications containing these could be located. Thus it seems that results have not been utilized or preserved too well as of now.

The soil fertility project at CATIE has accumulated about 1000 fertilizer experiments from Honduras in its files. Those were checked for reliability and about one half of them were selected and are presently analysed by computer in an attempt to draw some comprehensive and useful conclusions from these experiments and to relate them to the respective soil analogs.

Results of these efforts will be reported at this meeting.

b. Soil Samples Taken. The PMCS has also taken a number of soil samples, which were analysed at "El Picacho".

Región Occidental	150
Región Centro Oriental	100
Región Centro Occidental	200
	<hr/>
	450

Analyses of these samples indicates the following: Deficiencies of Mn and Zn and an abundance of P and K in the area of Danli, deficiencies of Mg in the area of Copán, excess of Ca in the area of Comayagua. There was a general lack of N everywhere.

4. Soils Laboratories

a. El Picacho. This laboratory is located above the city of Tegucigalpa and is fairly hard to reach, unless one has a car. However, it is scheduled to be transferred behind the Ag. Building of the "Secretaría de Recursos Naturales", whenever this building, now under construction, is ready. They analyse normally for texture (by manual inspection), OM, P, K, pH. The laboratory suffers from lack of funds, equipment, and apparently erratic work instructions from various higher offices.

They analysed 100 routine samples for the PCM between May 6 (1977) August 15. From January to August the PCM has received about 400 results from this laboratory or about 3 samples/day. They recently received some new equipment, i.e. an atomic absorption spectrometer. However, their flame photometer has not been functioning properly for some time. They are set up to follow the P.C.S.U. methods of the International Soil Testing Project.

The annual report for 1977 of the "El Picacho" laboratory shows the following work completed: Samples received and analysed 5891, routine determinations 29131, special determinations 2400, fertilizer recommendations 576.

Routine analyses included pH (5801) OM (5213) P,K (4563 each), Cu, Mn, Zn, Fe (346 each) Ca, Mg (457 each), texture by manual inspection (4173) special analyses: Ca + Mg (581), field capacity (1283), exchangeable K (1258), F.C. (1697), C.E.C. (1302), wilting point (1283), extractable acidity (206), available moisture, density, saturation percentage (504 each), bulk density (1714), Al (132), exchangeable Na (1206),

Ca, Mg (677 each), texture (2047), total N (38).

The 576 fertilizer recommendations were for different crops, which covered a total area of 8170 ha. The busiest months with the largest number of samples entering and being analysed were March and September, and the month with the minimum amount of activity were April and October.

Of almost 6000 samples 2/3 were analysed free of charge, and for the remaining 1/3 the laboratory collected L. 1,00 (U.S. .50) per sample. The laboratory produces a monthly report, which lists the number of soil samples received and analysed.

There is no other use made of the analytical data.

It appears that the laboratory needs substantial assistance, i.e. in equipment, procedures and organization, possibly the transfer to a new building and location will help. Dr. R.W. Pearson recommended technical assistance in soil fertility from AID for a minimum of two years.

This building is now under construction. There have been many delays and false starts in the past. In November 1977 most walls were up. No one seems to know when it will be ready for operation. Once ready, the laboratory from El Picacho will be transferred there, which will be a better location as it is right behind the building housing most agricultural offices of the Ministry of Natural resources in Tegucigalpa. Ingra. Reina Matamoros F. is in charge of the "El Picacho" laboratory.

b. El Zanorano. This laboratory is described in the section on the

Pan American School of Agriculture.

c. Mejoras Alimenticias. This is a commercial laboratory apparently well equipped. They charge \$10 - 14 per sample.

d. Programa Catastro Nacional. PCN has collected over 3,000 soil samples by now, and expects to collect at least another 3,000. The collected samples are presently stored at El Picacho. However, as indicated above, production by El Picacho has been unsatisfactory, forcing classification of some strictly on the basis of field data without proper laboratory analysis. They now have decided that they will have to have their own laboratory, and have the sum of US\$17,500 set aside for it. They have also located an operating space for it. One of the nine soils assistants will be in charge of it. The possibility of having the analysis done by the laboratory which did the soil samples for the Nicaraguan Catastro was considered but not followed up as the PCN is also charged with the training of local technicians.

There are no plans at the moment as to what will happen to this laboratory once the PCN in its present form ends.

D. PROGRAMA NACIONAL DE INVESTIGACIONES AGROPECUARIAS - SRN

Ing. Antonio Silva is in charge. This unit should have an interest in fertilizer field trials. However, no data was available from them.

The only information obtainable were library references to annual reports, mostly "FAO Freedom from Hunger Campaign" fertilizer trials.

E. UNIVERSIDAD NACIONAL AUTONOMA DE HONDURAS

The University has two main branches, which have an agricultural school (Carrera de Ciencias Agrícolas). These are in Tegucigalpa and La Ceiba.

1. Centro Universitario Regional del Litoral Atlántico - La Ceiba.

This branch has a soils department, which is headed by Ing. Agr. Humberto Chirinos Urbina. He is assisted by Ing. J.E. Rojas D. both are full time professors at this Institution.

The department of soils offers these courses:

Edafología I
 " II (Fertilidad)
 Enmiendas y Fertilizantes
 Conservación del Suelo
 Relación Suelo-Agua-Planta
 Análisis de Suelos y Plantas

About 20 students representing 8% of the student body in agriculture are interested in soils studies. Between 3 and 5 Ing. Agr. with interest in soils work graduate each year.

There is no separate budget for soils work. The department will draw on the general funds of the university as available and needed. In addition the department manages to obtain funds for research through informal arrangements between it and public and private organizations.

Present research projects of the department include:

- a. Estudio Agrológico de los Suelos del CURLA
- b. Evaluación del estado nutricional de suelos Entisoles y Ultisoles, mediante técnica del elemento faltante en invernadero.
- c. Respuesta de la soya al Encalado en suelos Entisoles y Ultisoles.
- d. Respuesta de maíz y soya al N,P,K en suelos aluviales.

2. Tegucigalpa Center

No information is obtained for this document.

F. ESCUELA AGRICOLA NACIONAL DE CATACAMAS

No information was obtained for this document.

7. Escuela Agrícola Panamericana

This school, give excellent training in agriculture and enjoys a very high international reputation. However, it is not a recognized university.

The school has a soils laboratory, which has ample space and is well equipped. It is used as a teaching laboratory in regular courses and for student research projects.

The school has one full time professor in soils in the form of a Peace Corps volunteer (D.T. Walters, M.S), whose specialty is in soil-plant relationships. The following courses in soils are offered (each of which carries 3 credits, presumably more or less equal to a 3 credit course at any agricultural university):

Introduction to soils
Soil Fertility
Fertilizers
Ecology and Conservation of Natural Resources
Soil Conservation

Research carried out, includes:

- a. Fertilization of corn and sorghum
- b. To establish critical nutrient levels of soil tests for corn, beans and sorghum.

Some students are permitted to work for one year on special projects, about 6% of the student body generally opts for such an assignment.

VI. Relation of Soils to other Natural Resources Agencies

A. MINISTRY OF NATURAL RESOURCES

Honduras is the only country in Central America which has a Ministry of Natural Resources. Other countries have only departments or directions. In spite of this the forestry organization, concerned with a very major Honduranian resource is outside its organization. The "Programa de Catastro Nacional" is also outside even though it quantifies and surveys major natural resources, especially soils and some hydraulic resources. The catastro in its present form and size is a temporary organization, created to do a specific job, and has to rely on outside financing to accomplish this. However, to continue its work it is indispensable that it be integrated in to the permanent government structure. Its soils and hydrology information and personnel, presumably should be absorbed within the appropriate departments of the Ministry of Natural Resources. There is little evidence that this will be done effectively.

A schematic diagram of the present management of organizations concerned with natural resources in Honduras is shown in Figure 1.

B. CORPORACION HONDUREÑA DE DESARROLLO FORESTAL (COHDEFOP)

COHDEFOP was formed about 1974. It is autonomous.

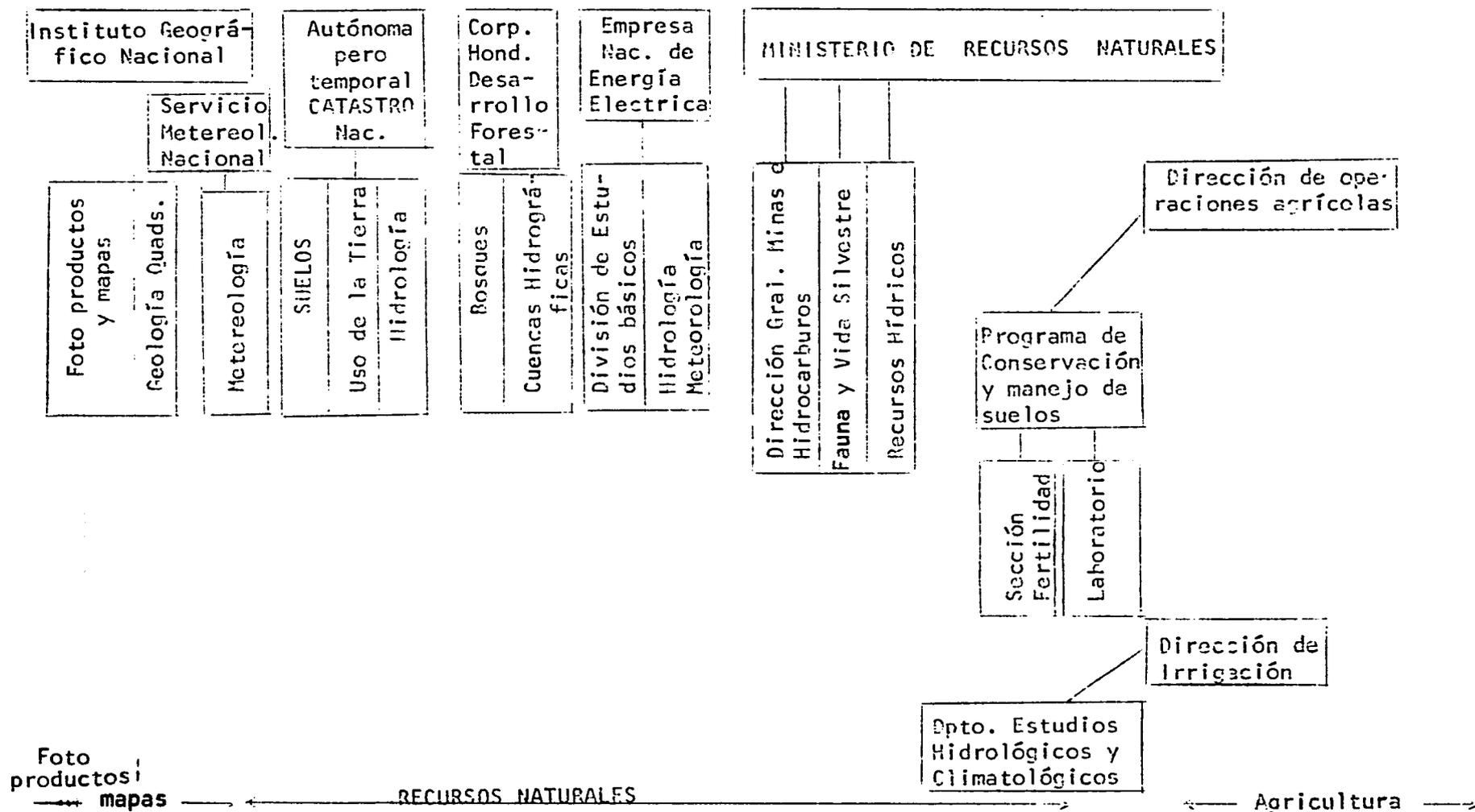
It apparently was felt that a Forestry Department in the Ministry of Natural Resources could not do the job. It also recognizes the fact that forests constitute the main natural resource of Honduras and may need a special agency.

Although COHDEFOP has problems in obtaining sufficiently qualified personnel considering the magnitude of its objectives, it has attracted

Figure 1.

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HONDURAS



NOTA: Se debe ampliar y corregir este diagrama.

talented Honduranian foresters, who had previously left the country.

It has a staff of at least 40 foresters and has some trained soils scientists. COHDEFOR seems by far the strongest forestry organizations in the Central America Isthmus.

This government autonomous forestry corporation seems to be functioning rather well although it has many problems. It appears outstanding in quality of personnel, management, financing and applied research orientation. It is pioneering in the field of social development of mixed forest and farming areas and has a department by that name which forms cooperatives, and stimulates subsidiary forest industries. This program should be studied in detail as a complex mixed system of agriculture for poor farmers. The total budget is \$12 million dollars of which 25 million goes to the Forestry Department. The corporation controls the cutting processing and sale of timber and wood products. It conducts research and manages nine forest districts. Last year, 1977 the forest fire control system was relatively ineffective. COHDEFOR attributes it to unusual weather conditions, which prevented controlled burning in the pine area. The major special project is a pulp and paper mill. If this is carried to completion it would produce one fourth of the Honduras GNP according to Dr. Marcos Rodas Flores, one of the officials of COHDEFOR.

COHDEFOR is concentrating on the pine forests. However, the push by spontaneous settlers is primarily into the broadleaf humid tropical forests and poses a great problem. Little is known concerning successful use of this Life Zone. In addition, the Agrarian Reform Agency (INA) is encouraging some settlement in this Life Zone.

COHDEFOR exports 85% of its pine. The bark beetle has been under control since 1963 or 1964 but is always endemic.

Foreign technical assistance is mostly from FAO, with lesser help from CIDA (Canada), Peace Corps and the University of Arizona.

The Forestry School at Siquatepeque is turning out peritos as rangers. COHDEFOR is trying to classify forest sites. It is teaching campesinos how to burn safely. It has the authority, but has a hard time in controlling private forests. Its watershed management department is engaged in pilot experiments near Tegucigalpa, but is extending them to the Los Laureles project (part of the Choluteca Drainage areas which is a source of drinking water).

COHDEFOR will also study the hurricane Fifi watershed and make land use studies on the Aguan river watershed in the humid tropical life zone. It has designated 10,000 ha of broad leaf humid tropical forest in the Poncaya area on the Patuco river for study and observation.

C. EMPRESA NACIONAL DE ENERGIA ELECTRICA, SERVICIO METEOROLOGICO NACIONAL, DIRECCION GENERAL DE RIEGO Y SERVICIO NACIONAL DE AGUAS DUCTOS.

Meteorological and hydrological data are collected by four different agencies. The Proyecto Hidrometeorológico Centro Americano of the World Meteorological Organization did not succeed in unifying the work under a single agency but did succeed in having the Empresa Nacional de Energía Eléctrica designated to receive all data and to store it on a computer. In addition, it stimulated the expansion of the network of

climatic stations and raised standards and morale which has resulted in increased reliability of data.

In meteorology the network increased from 9 to 11 type A (Complete) stations, 3 to 52 type B (rain and temperature) and 81 to 185 type C (rain only). In addition, the countries first 8 evaporation pans were installed. In hydrology the increase was from 4 to 74 stream gaging stations, the first 9 sedimentation stations and the first 13 analyses of river quality of water.

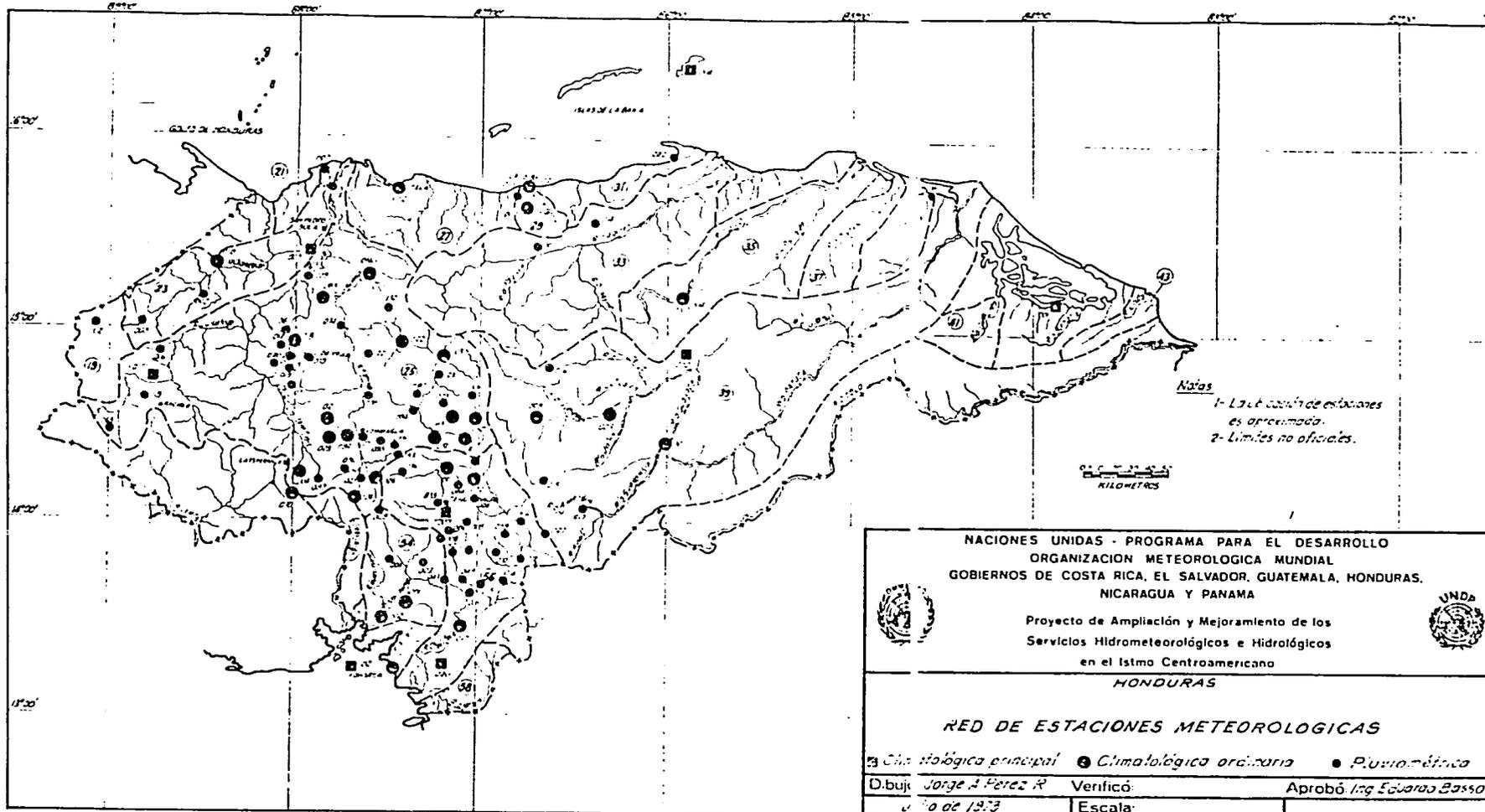
The distribution can be see on Map 2. The distribution is uneven and concentration is greatest where population and development are greatest.

1. Other Climatic Data

One ecological map with the Holdridge "Life Zone System" exists for Honduras, done in 1962 at the scale of 1:1 000 000. As part of the "Soil Analog Project" Dr. J. Tosi, of the Tropical Science Center, San José, and co-worker of Dr. Holdridge produced about 20 1:50,000 Life Zone maps so the system can be used with the soils maps being produced by the catastro to determine analogs. The soil analog workshop at CATIE in October 1977 decided to adopt this system for the climatic factor in the first analogs for Central America as it had already been determined in Nicaragua, one of the three countries considered for the testing of the analog theory.

Besides the observations produced by the weather stations, there are other data useful for agriculture produced by members of Utah State University, Logan, Utah, USA. The principal worker of this.

Fig



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group is G. Hargreaves, who designed one of the more useful indices, the moisture availability index (MAI).

The publications of Length of Precipitation Records of Honduras", by George H. Hargreaves and J. Karl Hancock, Utah State University, 1976. "Monthly Precipitation Probabilities for Moisture Availability for Honduras" by George H. Hargreaves, Utah State University, Logan, Utah, 1976.

D. INSTITUTO GEOGRAFICO NACIONAL (IGN)

IGN in cooperation with the "Instituto Panamericano de Geografía e Historia" has published a booklet "Guía para Investigadores de Honduras, 1977". This booklet contains complete information on the availability of topographic maps, geological maps and aerial photographs.

The following sheets with index maps are attached:

Lámina	I:	Departamento de Honduras
"	II:	Fotografías aéreas 1:60-64000 (1954-70)
"	III:	" " Norte Sur 1:20,000 (1946/47)
"	IV:	Fotografías aéreas a diferentes escalas 1:5000 y 1:20,000 (1945-66)
"	V:	Fotografías aéreas recientes 1:20,000 (1973-76)
"	VI:	Fotografías aéreas zona "Fifi": 1:20,000 (1974)
"	VII:	Mapas topográficos 1:100,000 y 1:250,000
"	IX:	Hojas geológicas 1:50,000
"	X:	Mosaicos controlados 1:50,000
"	XI:	Indice de mapas topográficos 1:50,000

The IGN also has these sheets of the geologic map of Honduras at 1:50,000 on a topographic map base.

Comayagua	N° 2757	1	....
El Rosario	" 2659	1	....
Nueva Armenia	" 2757	1	....
San Buenaventura	" 2757	1	....
San Juan de Flores	" 2758	1	....

Talanga	N° 2759	II	....
Tegucigalpa	" 2758	II	....
Zambrano	" 2758	IV	....
Minas de Oro	" 2760	III	....
Cedros	" 2759	I	....

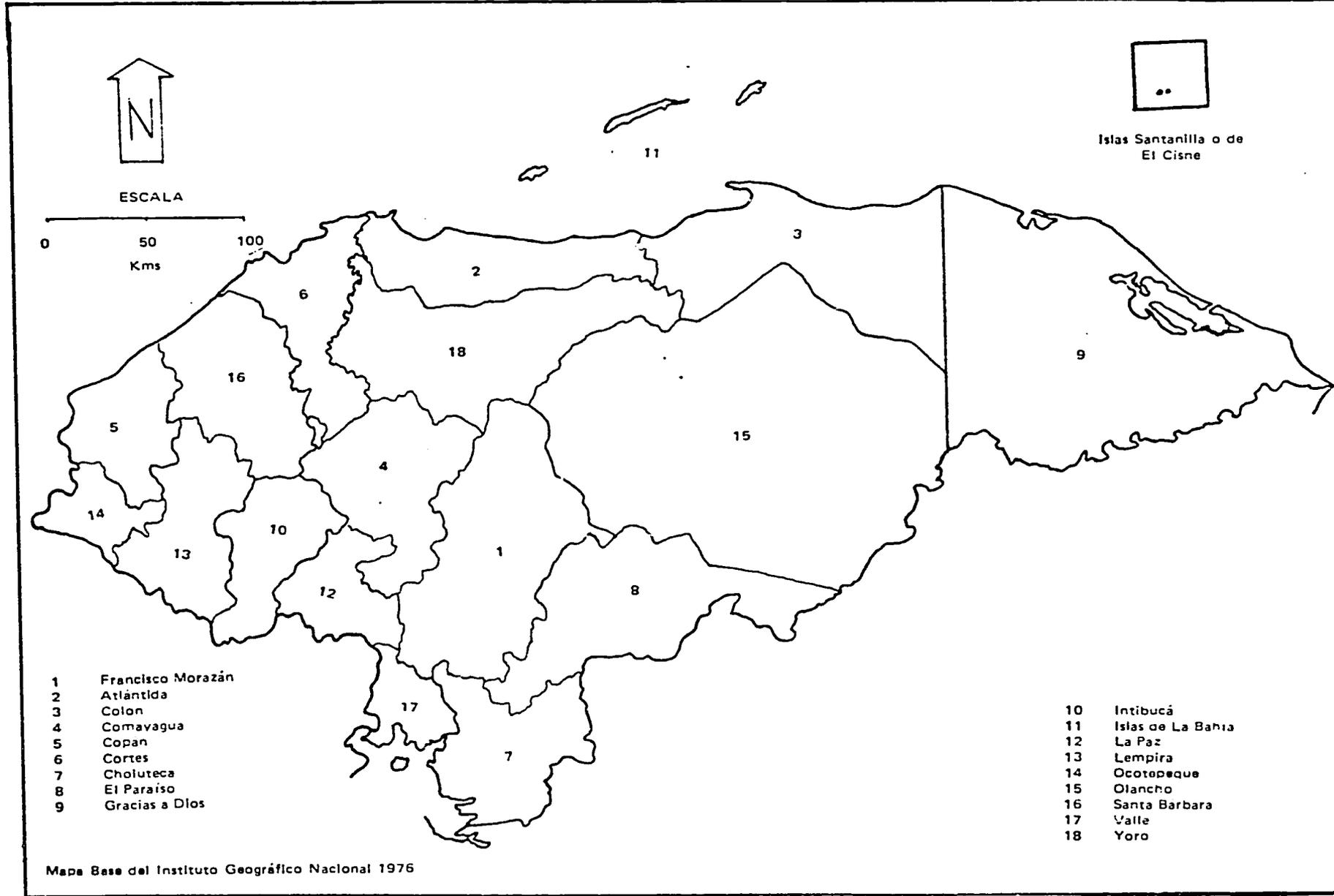
VII. Compilations of References and Maps

- A. Bibliografías Agrícolas de América Central Honduras, IICA-CIDIA, Turrialba, Costa Rica, 1974. Contains useful soils references.
- B. Índice de Mapas de América Latina y el Caribe existentes en el IICA-CIDIA, IICA-CIDIA, Turrialba, Costa Rica, 1975. Sección Honduras

Appendix

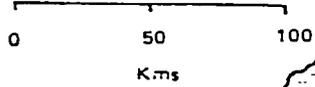
- A. Maps 1 and 2
- B. Láminas I- XI

FITO: 812-78
 Feb. 27, 1978
 HPN-PCD/mdem





ESCALA



Islas Santanilla o de El Cisne



CUBRIMIENTO DE FOTOGRAFÍAS AERÉAS BÁSICAS TOMADAS POR

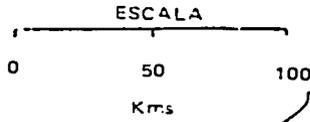
World Wide	1954-1956
U.S.A.F.	1959-1961 1963-1964
U.S. Navy	1963
I.A.G.S.	1970

ESCALA 1:60,000 a 1:64,000 Aprox

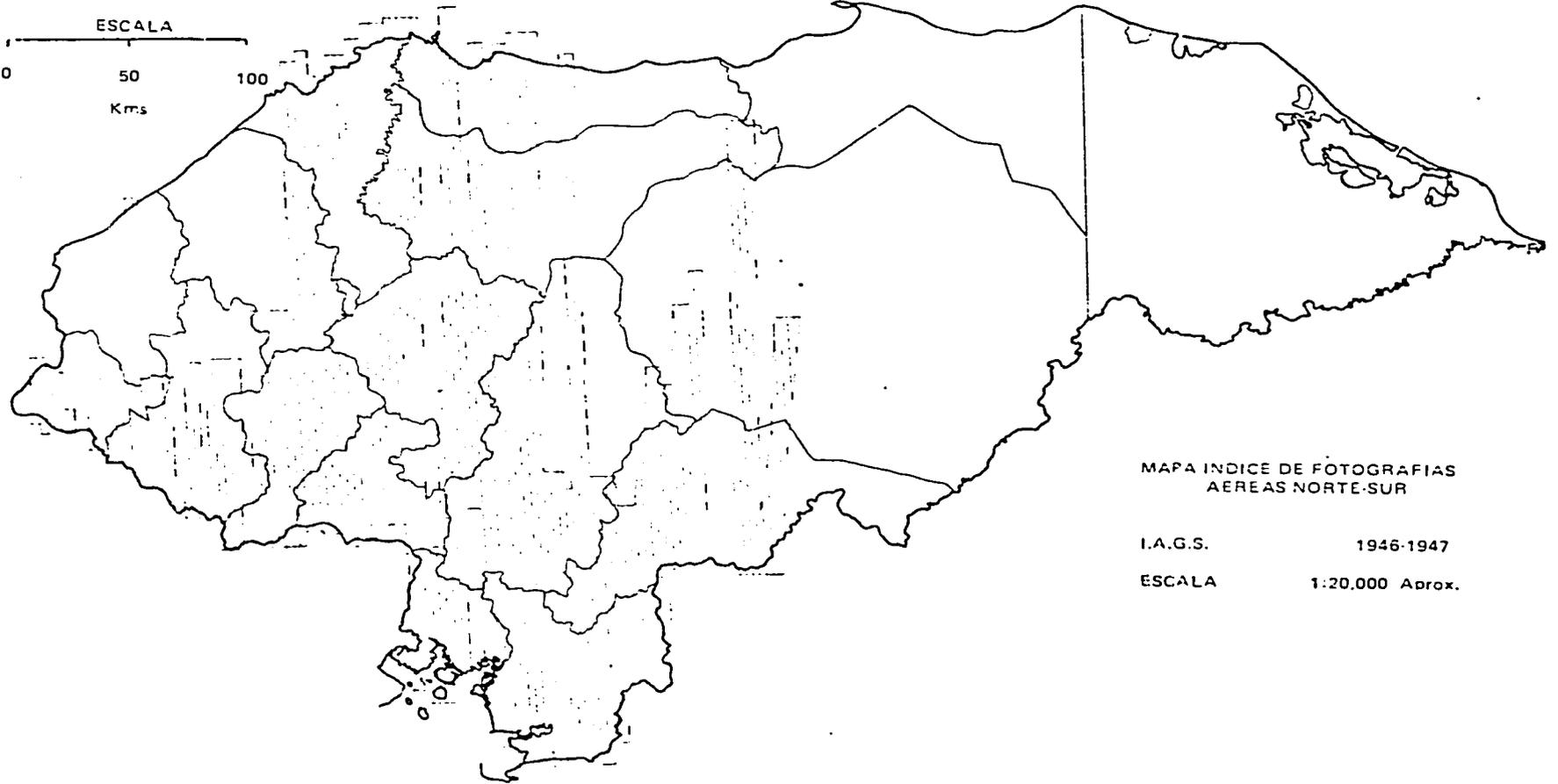
Mapa Base del Instituto Geográfico Nacional 1976

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Islas Santanilla o de El Cisne



MAPA INDICE DE FOTOGRAFÍAS
AERÉAS NORTE-SUR

I.A.G.S. 1946-1947

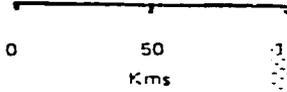
ESCALA 1:20.000 Aprox.

Mapa Base del Instituto Geográfico Nacional 1976

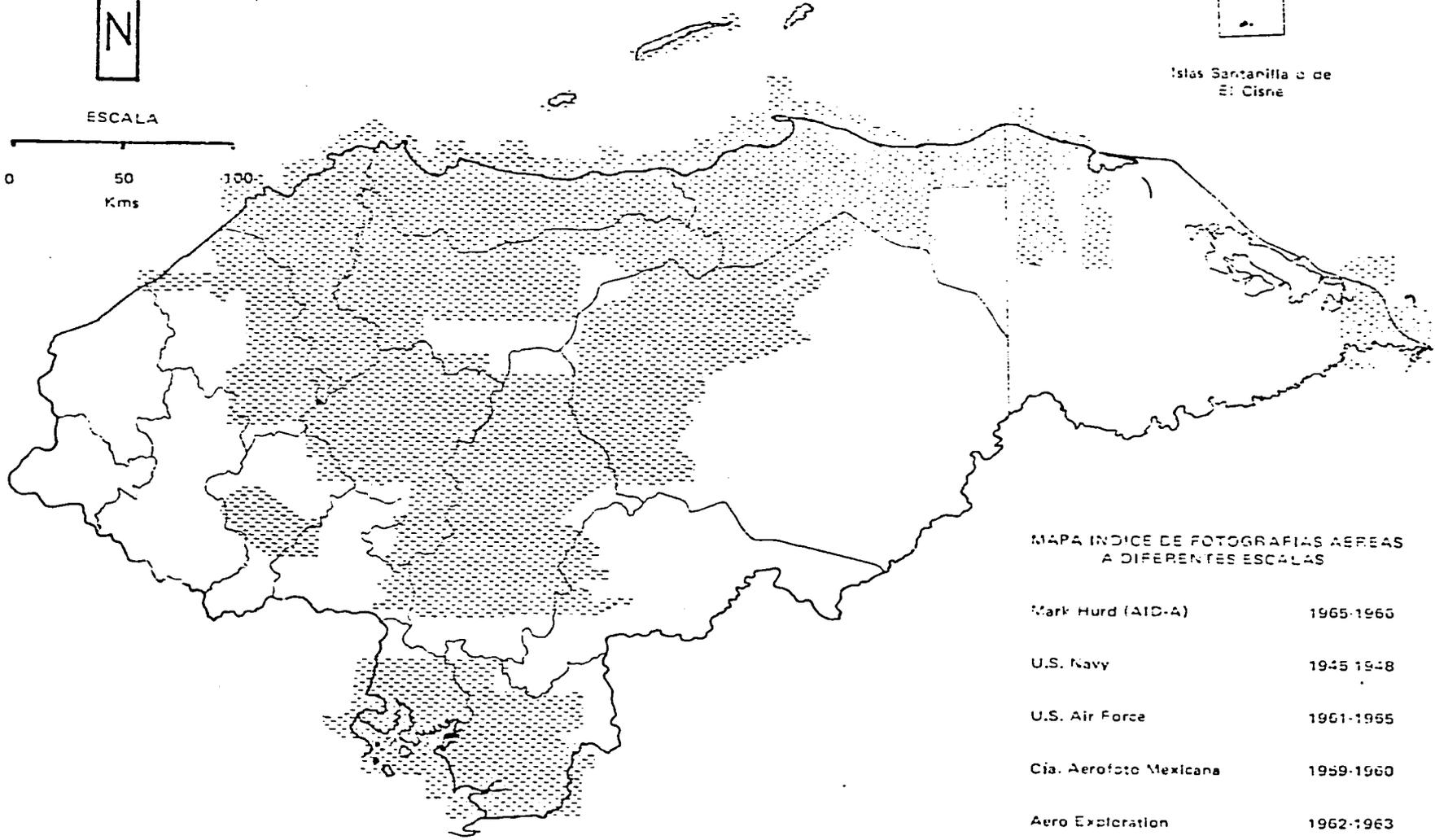
11



ESCALA



Islas Santarilla o de
El Cisne



MAPA INDICE DE FOTOGRAFIAS AEREAS
A DIFERENTES ESCALAS

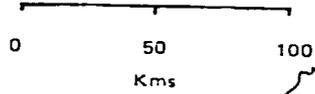
Mark Hurd (AID-A)	1965-1966
U.S. Navy	1945-1948
U.S. Air Force	1961-1965
Cia. Aerofoto Mexicana	1959-1960
Aero Exploration	1962-1963

ESCALA 1:5,000 a 1:20,000 Aprox.

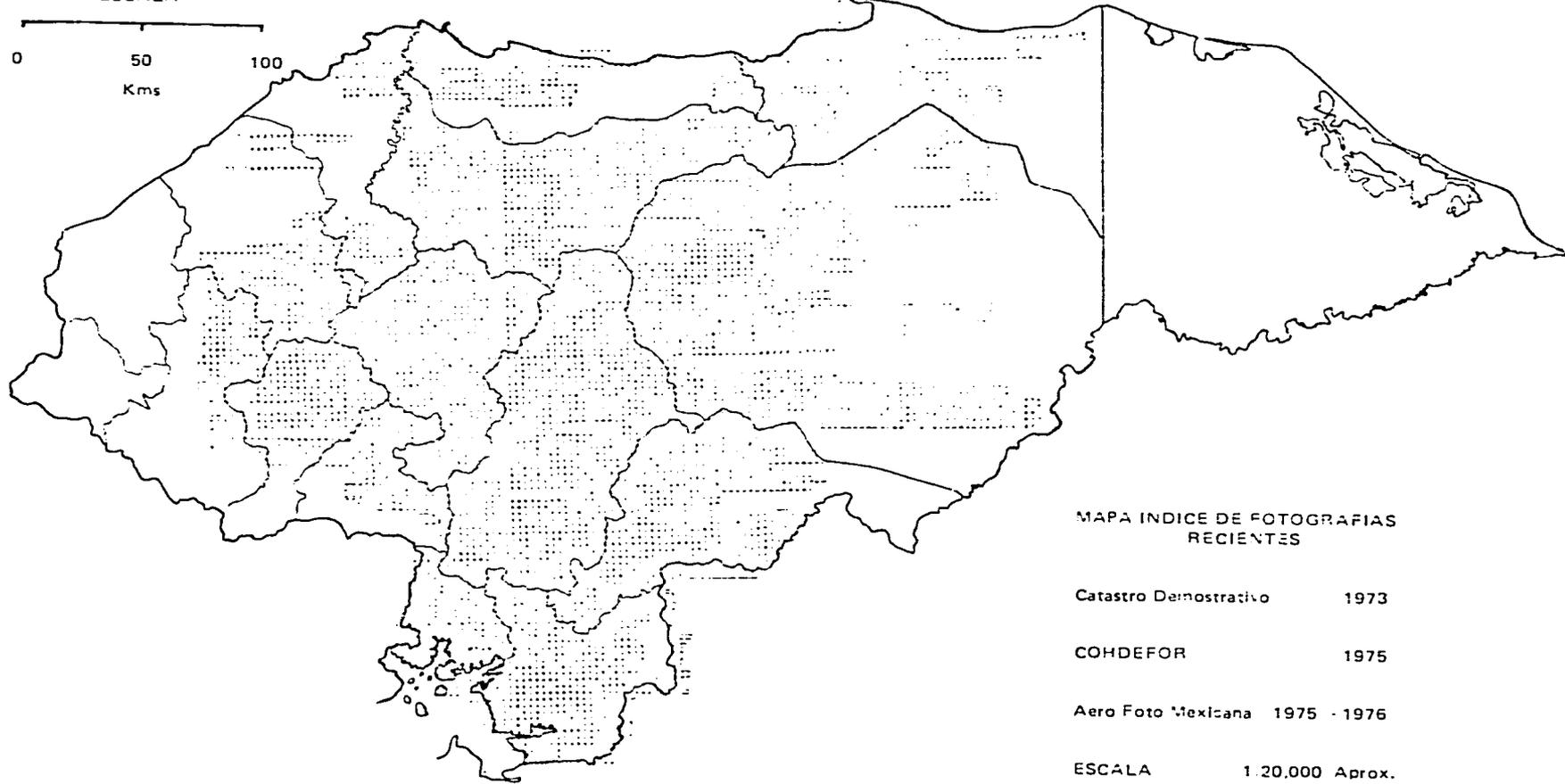
Mapa Base del Instituto Geográfico Nacional 1976



ESCALA



Islas Santanilla o de El Cisne



MAPA INDICE DE FOTOGRAFIAS RECIENTES

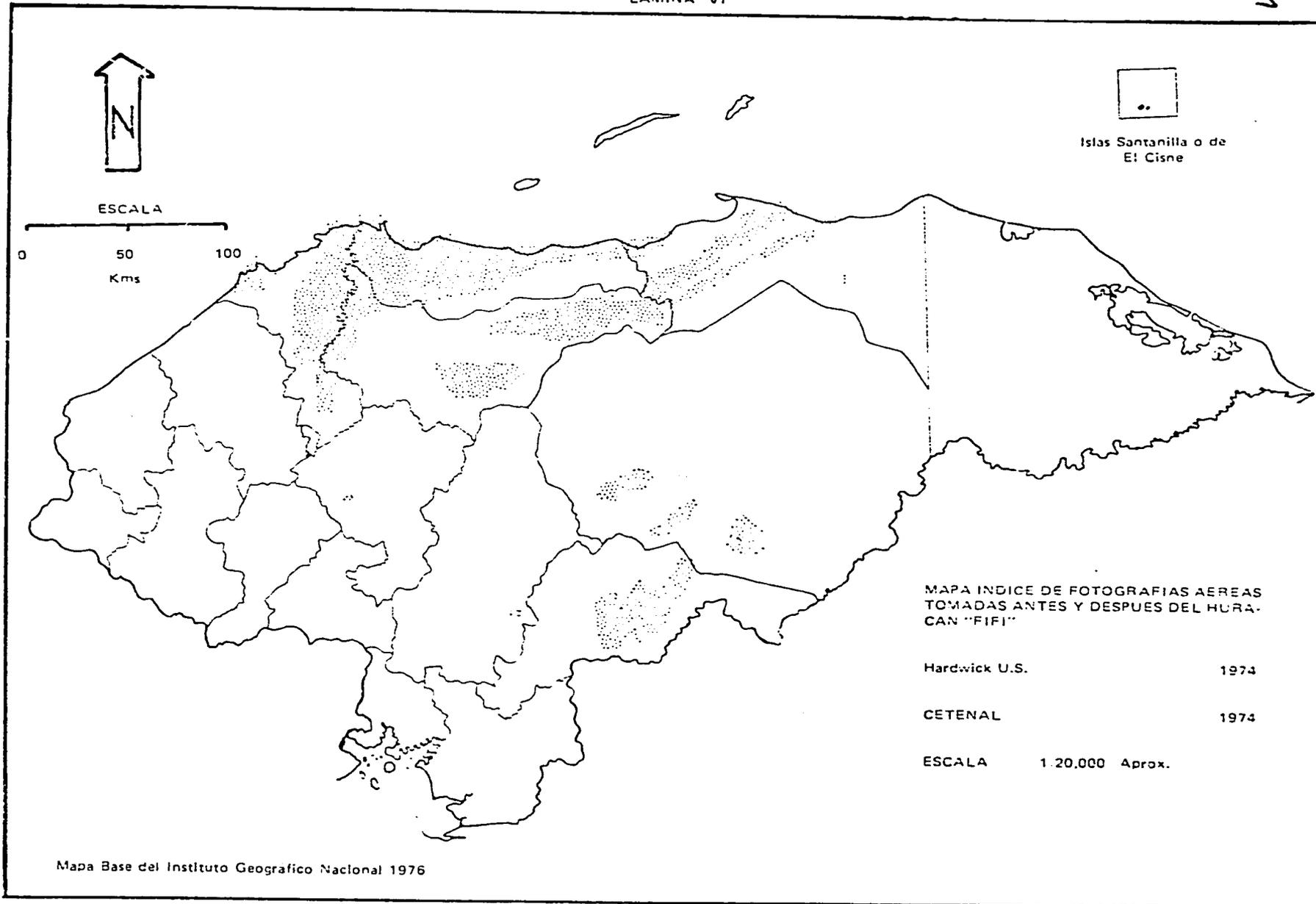
Catastro Demostrativo 1973

COHDEFOR 1975

Aero Foto Mexicana 1975 - 1976

ESCALA 1:20,000 Aprox.

Mapa Base del Instituto Geográfico Nacional 1976



Islas Santanilla o de El Cisne

ESCALA
0 50 100
Kms

MAPA INDICE DE FOTOGRAFIAS AEREAS TOMADAS ANTES Y DESPUES DEL HURACAN "FIFI"

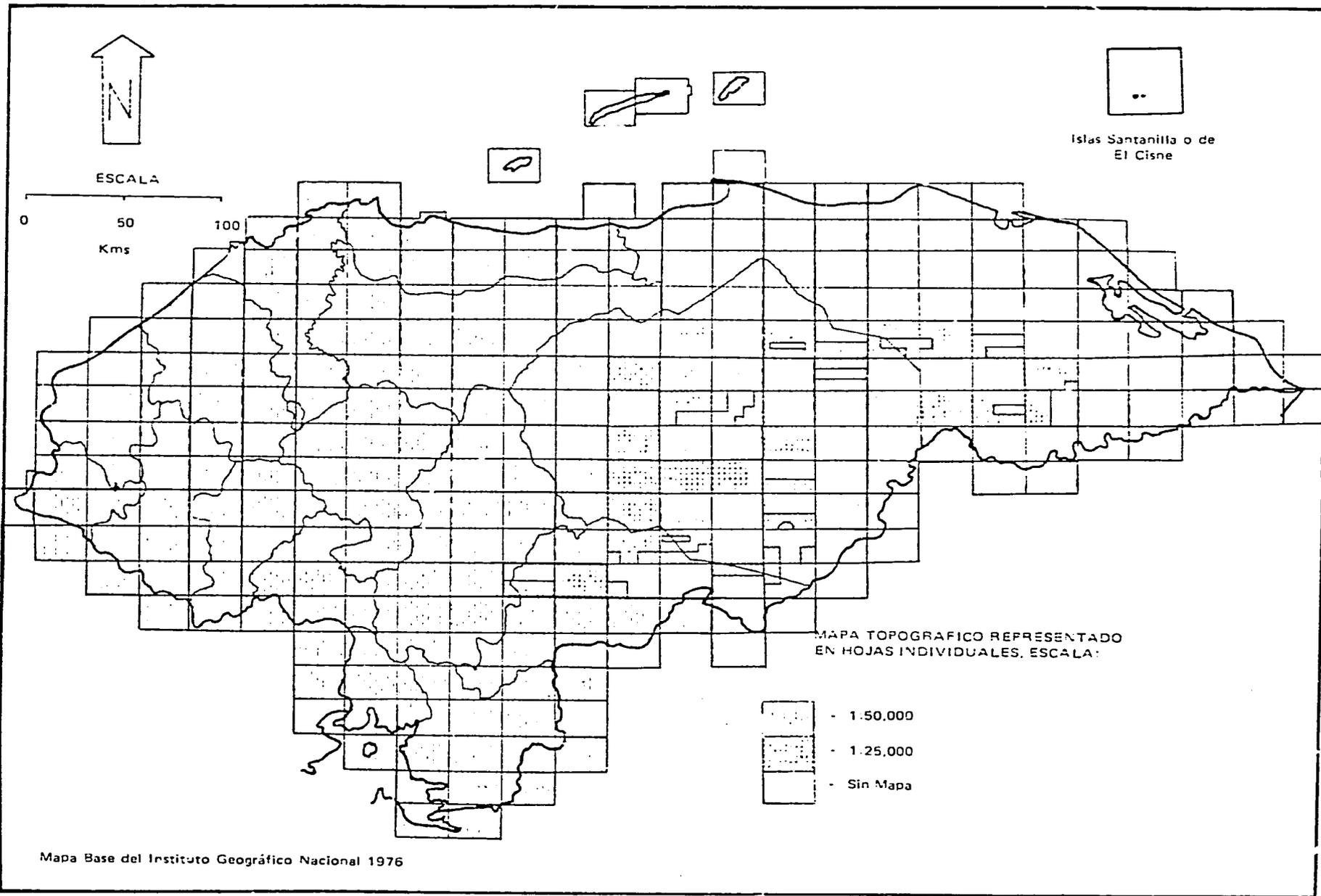
Hardwick U.S. 1974

CETENAL 1974

ESCALA 1:20,000 Aprox.

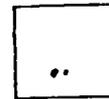
Mapa Base del Instituto Geografico Nacional 1976

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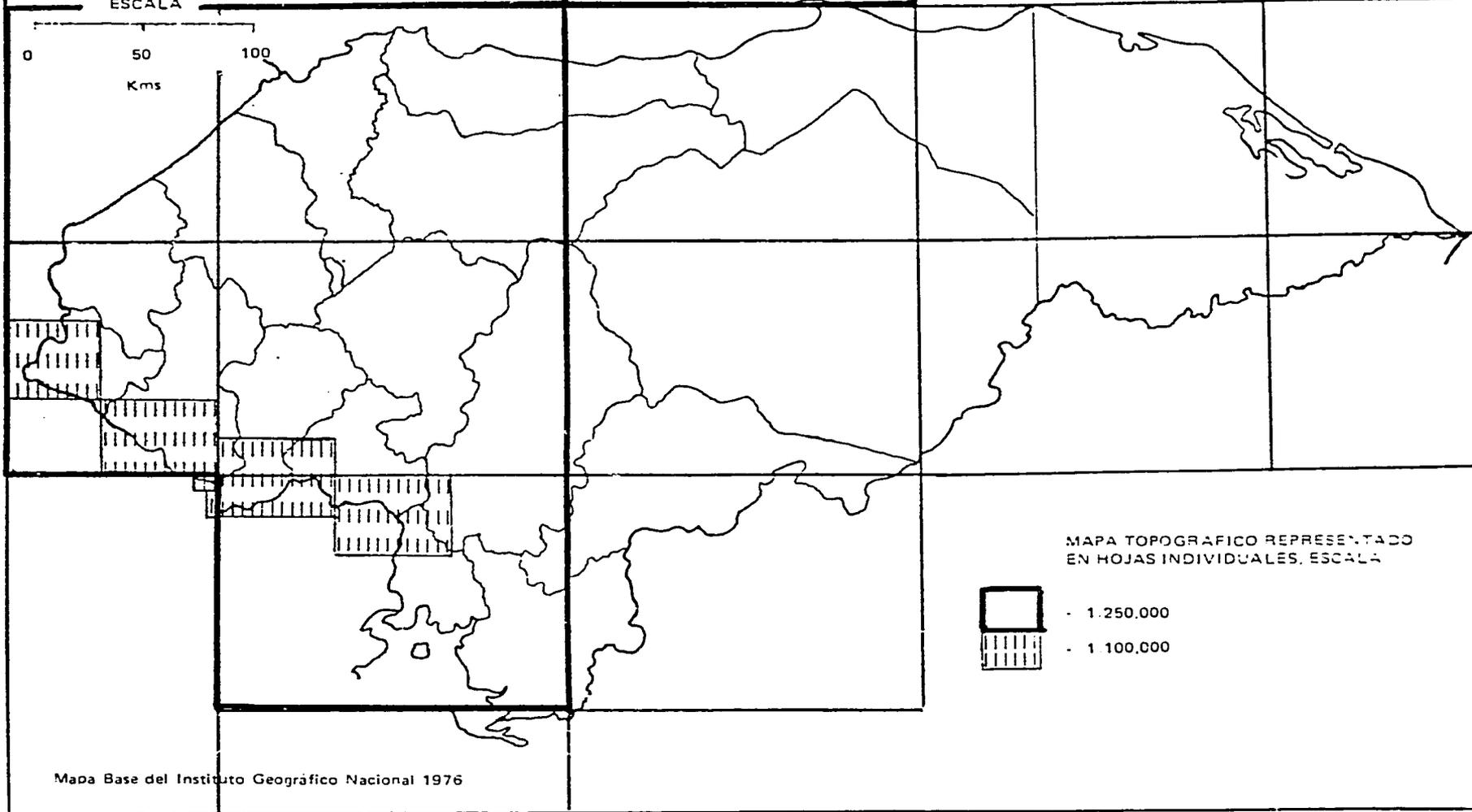




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Islas Santaniña o de El Cisne



MAPA TOPOGRAFICO REPRESENTADO EN HOJAS INDIVIDUALES. ESCALA



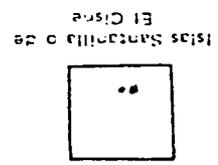
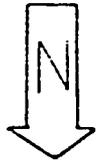
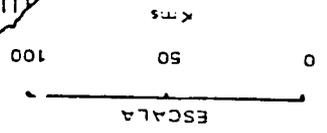
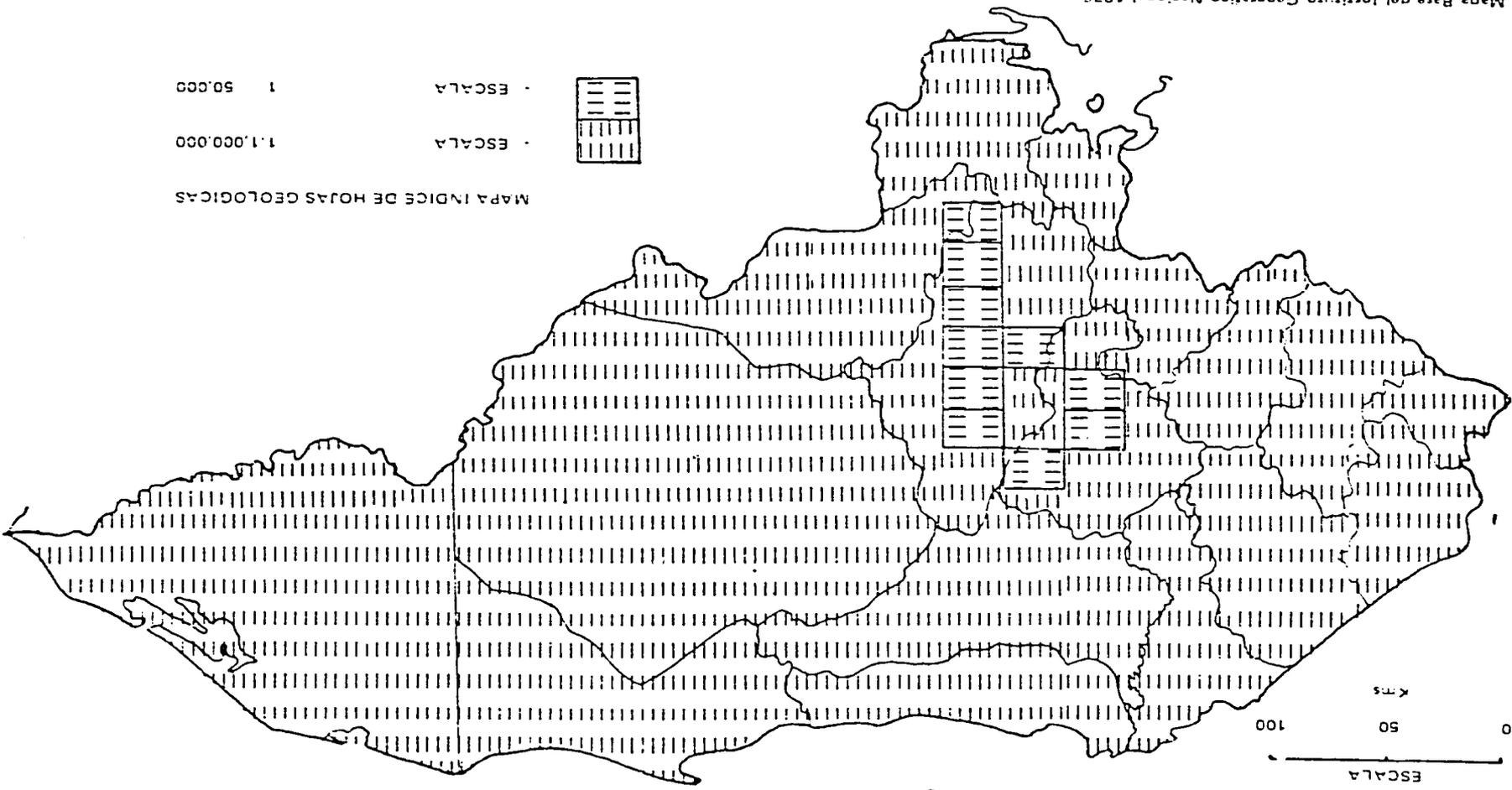
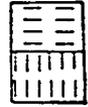
- 1.250.000

- 1.100.000

Mapa Base del Instituto Geográfico Nacional 1976

Mapa Base del Instituto Geografico Nacional 1976

MAPA INDICE DE HOJAS GEOLOGICAS
- ESCALA 1:1.000.000
- ESCALA 1:50.000

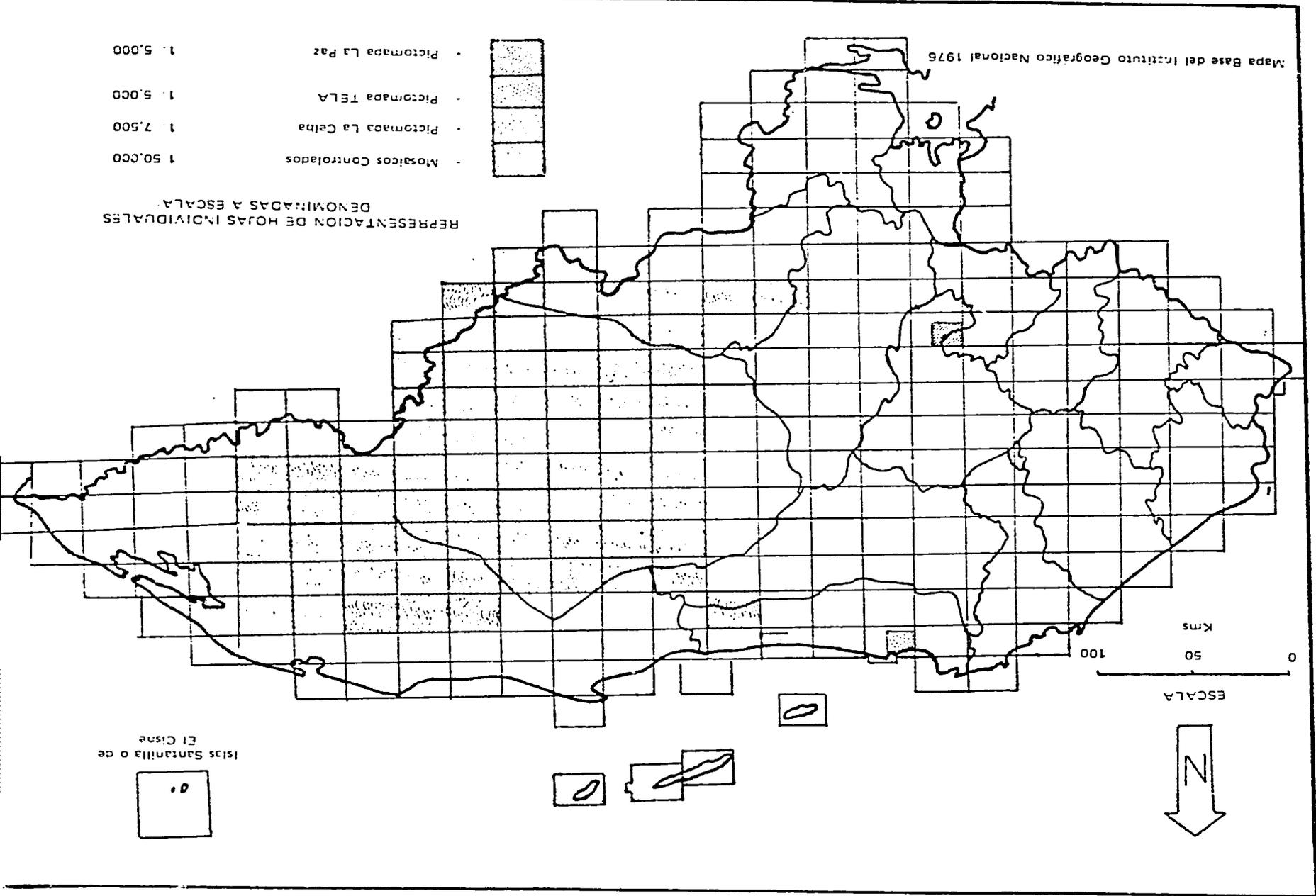


LAMINA IX

43

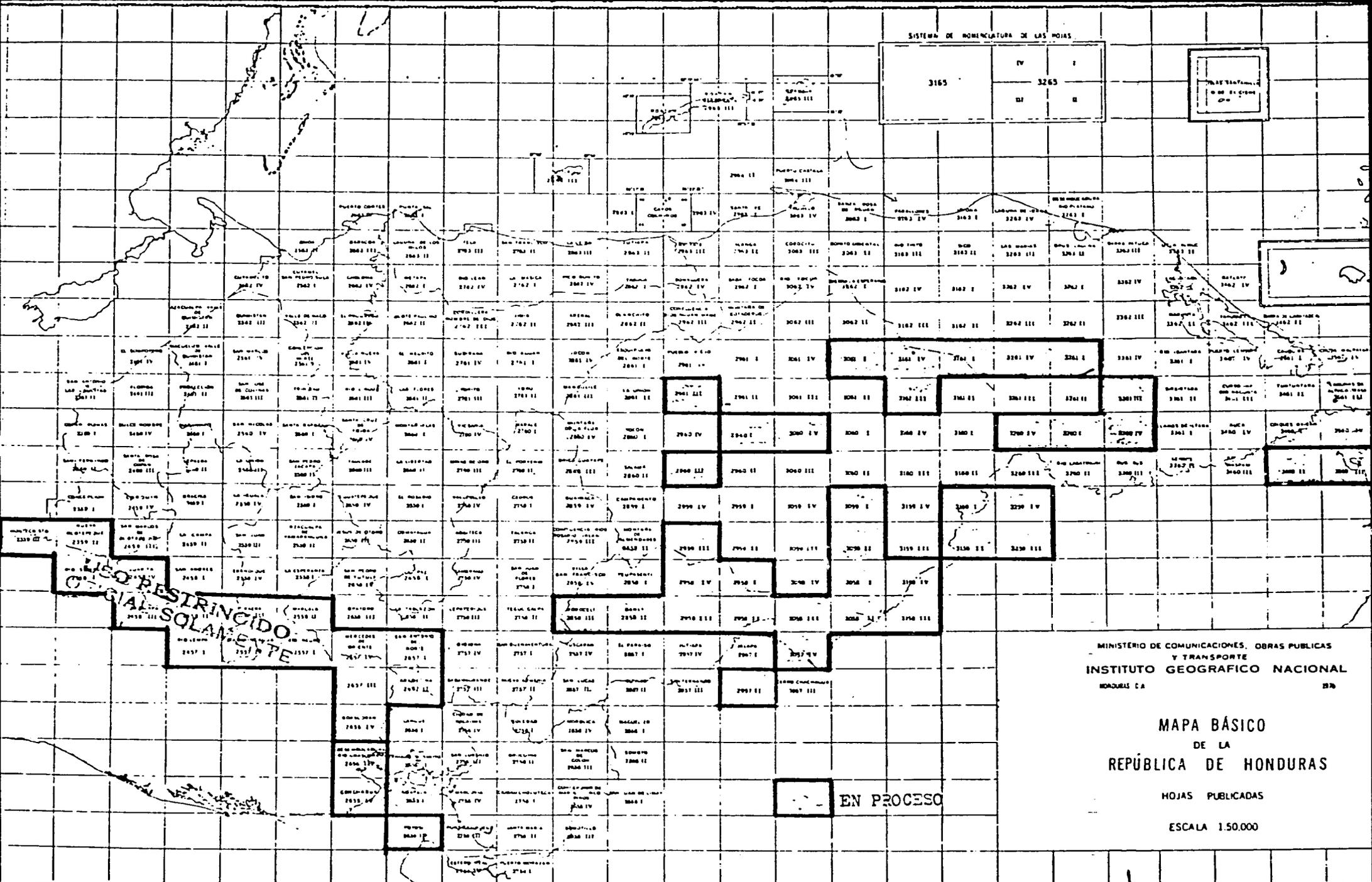
44

LAMINA X



3165	IV	I
	II	II

HOJA 3165 IV I



MINISTERIO DE COMUNICACIONES, OBRAS PUBLICAS Y TRANSPORTE
 INSTITUTO GEOGRAFICO NACIONAL
 MANAGUA, C.A.

MAPA BÁSICO DE LA REPÚBLICA DE HONDURAS

HOJAS PUBLICADAS

ESCALA 1:50,000

EN PROCESO