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PROYECTO CENTROAMERICANO
DE FERTILIDAD DE SUELOS

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

Harvey Newton
Petter Duisberg

Anexo 22



CATIE
CENTRO AGROHOMICO TROPICAL DE INVESTIGACION Y ENSEÑANZA

SOIL SCIENCE IN NICARAGUA

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 13-16, 1978.

For review and completion by the Nicaraguan soil scientists.

Turrialba, Costa Rica
1978

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SOIL SCIENCE IN NICARAGUA
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I. INTRODUCTION

This is one of six reports on the state of soils work in the countries of the Central American 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 soil 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, 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 strengthening the field. The field of soil science in Central America cannot serve as a basis for improving soil analogs unless it can be strengthened in every country. The analogs which have been possible through the soil analog subproject of CATIE/ROCAP for the

* Preliminary document for discussion prepared for the "Reunión Centroamericana sobre Suelos", San Salvador, El Salvador, March 13-18, 1978.

** Ph.D's - Soil Scientists (Consultants), Soil Analog Project, CATIE.

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 and 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.

III SUMMARY OF SOILS INSTITUTIONS IN NICARAGUA

TABLE I

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

III SUMMARY OF SOILS INSTITUTIONS IN NICARAGUA

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				

II. SUMMARY AND SUGGESTIONS FOR THE FIELDS OF CLASSIFICATION, FERTILITY AND CONSERVATION

Nicaragua has had a major program in modern soil classification, the Catastro and Recursos Naturales Program of 1966-71. Unlike other countries, the basic nucleus of soil scientists has held together and this puts Nicaragua in a particularly favored position not only to continue its own soil program to greater levels of detail but also to lend some of its better trained classifiers to other countries needing support.

The best Nicaraguan soil classifiers have been kept together by interest in their work and good leadership. However, about two thirds of these originally trained have gone to better paying jobs. Therefore, from a regional standpoint it is important not to lose anymore of these valuable human resources for the sake of the country and the region.

One of the major weaknesses of the Cadastro soils group is the limited coordination it has had with the user agencies. At first an attempt was made by the Cadastro office to promote use of its products but gradually this diminished in all fields including soils. This group should be called more to participate in the soils aspects of INTA, IAN and INVIERNO, and other agencies. It is difficult at this time to determine whether these relationships should be developed through DIPSA or whether it would suffice to develop them more informally between technicians.

The soil fertility work in Nicaragua is rather weak. However, INTA has recognized this and hired one new Ph.D. The future will depend upon his ability to establish proper priorities, the degree of support he is given within INTA, the degree of collaboration he develops with INVIERNO, IAN and other agencies and the degrees to which the analytical capabilities

of the laboratories and field trial experiments are made more reliable, expanded and improved.

The laboratories are equipped to do routine farm samples and to classify soils but need support and strengthening. The fertilizer trials of past years have often been lost before harvest or have given erratic results. The Pearson Report of AID/ROCAP recommended that AID/Nicaragua supply an adviser for at least two years to support the laboratory and the fertility trial work in Nicaragua. Since INTA is a relatively new institution it is too early to tell whether it can overcome problems which have crippled the soil fertility effort in Nicaragua in the past.

The field of soil conservation is very weak in Nicaragua. Nevertheless, soil conservation represents one of the greatest needs of Nicaragua, if this basic resource is to be kept from deteriorating further. The Soils Department of MAG is doing a little along with its regular work but has no budget for the work. It has done work on wind erosion in the León area as a public service for civic groups. It has no trained soil conservation specialists.

A Natural Resources Institute has been proposed which would include soil conservation. It has had difficulty being enacted into law. If it passes the situation should improve and a balance between soil conservation and other fields to protect natural resources might be sought. Meanwhile, the only alternatives are continuation of the present unsatisfactory situation or additional resources for the soils department of MAG or inclusion of soil conservation specialists in the work of the Natural Resources Department of MAG.

The sectorial Planning Office (DIPSA) has become very aware of soil conservation problems and has budgeted \$13 million Dollars for two projects by private consultants beginning in 1978.

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IV. EARLY PERIOD OF SOIL SCIENCE

A. Soil classification

Nicaragua soil classification apparently dates from the 1950's and probably was stimulated by the "Servicio" between the Ministry of Agriculture and the U. S. Point 4, Technical Assistance Program.

There were no national surveys but a little detailed soil mapping was done preliminary to irrigation of some small areas and farms.

A separate soils department existed in the Ministry, at least from the early 60's. This department received technical assistance from Ing. Agr. A. Mikenberg and M. Rico of FAO for several years. Major products were one semidetailed Map Sheet at 1:50,000 near Managua (Chiltepe, 1963) and a semidetailed soil survey of the Rivas area with laboratory analysis for the irrigation project later constructed.

In 1966, soils was included as an important part of a ten million dollar AID financed Cadastral and Natural Resources Project. During the period of this project, from 1966 to 1971, some thirty soil surveyers were trained in the new taxonomy. They mapped about 23,000 km² in the Pacific zone on 1:20,000 and 1:30,000 photomosaics to the level of soil series and phase according to the new taxonomy and by land capability classes to the level of capability units. The soils work was under the guidance of two American soils specialists: G. Harper and A. Vessels with consultant services from a Mr. Knyser for the consortium of American companies. Ing. Agr. E. Marin was the Nicaraguan staff leader. A laboratory was organized to do chemical and physical analyses for soil classification.

After the departure of the Consortium in 1971 the department has

continued. Its recent work is described in Chapter V.

Since the beginning of the USAID financed "Catastro e Inventario de Recursos Naturales" Program, the country has been using the new soil taxonomy of the USDA. Substantial portions have also been delineated on mosaics for land use and land capability and estimates made of crop yields and management units especially in the Pacific area.

B. Soil fertility

Soil fertility work in Nicaragua was begun at the time of the USAID "Servicios". Some rather good analytical laboratory work was done for the Rivas Project and early soils classification.

About 1964, Nicaragua entered the North Carolina State Soil Fertility Project and this resulted in the much of the present methodology. Together with the Cadastro, the Soil Fertility Project stimulated the development of the soil testing and soil classification laboratories at the Agricultural School at La Calera. These exist at present.

C. Soil conservation

The soils technicians who surveyed and produced the 1:20,000 and 1:30,000 photomosaics of soils for the Cadastral and Natural Resources Project delineated the degree of erosion as light, moderate or severe for each soils unit.

Soil scientists and foresters have repeatedly pointed out the increasing hazard on the Pacific side, in the central watersheds to the Pacific and recently the threat of erosion from the migration of poor farmers toward the Atlantic side. However, no specialists were trained and no official programs financed.

Ing. Marín and his soils department cooperated with a local group of concerned citizens of the León area and found that wind and water erosion had created such grave problems in the short time since the initial survey work was done for the Cadastral and Natural Resources Project that one soil series could no longer be identified.

The Department of Natural Resources, Forestry Section has been concerned with deforestation and soil erosion since the early 60's but because of low budget and lack of personnel has not been able to make proper studies or exert effective control. Recently it has obtained funds for a project in the Nueva Segovia area even though it is almost too late. It has an advisor from FAO and has obtained new 1:20,000 aerial photography. It does not have anyone trained in the field of soil conservation.

V. PRESENT SOILS ENTITIES AND LABORATORIES

A. Soils Department of the Ministry of Agriculture and Cadastro and Natural Resources

Soil classification and soil surveys in Nicaragua are part of the "Programa de Catastro Nacional y Recursos Naturales" but is financed largely by the "Ministerio de Agricultura". Head of the Soils Department is Ing. Agr. E. Marin.

Ing. Marin has done an outstanding job in holding his key personnel and in spite of budget problems and competition from new agencies with higher salaries and has a core of 10 experienced soils men and about 10 in junior capacities. His group constitutes the best nucleus for soil classification by modern methods in the Central American Isthmus.

The group is doing reconnaissance level mapping in the Atlantic zone using helicopters to increase accessibility and have covered a large portion since 1971. They combine soil survey with the ecological life zone method of Holdridge in a creative way.

The group is also doing soils studies on two irrigation projects of Tahal. Tahal is an Israeli consulting company of mixed Government and private capital. They are developing these projects under contract with the Nicaraguan Government. These include 30,000 ha at prefeasibility level and 8,000 ha at a feasibility level in the Nandaime - Rivas area and 22,000 ha at prefeasibility level and 8,000 ha at feasibility level in the Sebaco area.

They are also making an "Estudio de las Tolvereras de León" or of eolic erosion. They have found that one productive soil series the

León series, mapped in 1966 has almost been completely destroyed by this erosion in less than a decade and now must be given a new name.

They also are comparing changes in land use from 1954, 1968 and 1976 in the León area for the Comité Prodefensa de León.

A more detailed report on work accomplished is included as Appendix "A" in this document. This report was presented by Ing. E. Marín for the "Soil Analog Workshop" at Turrialba, Costa Rica in October 1977.

B. Instituto Nicaraguense de Tecnología Agropecuaria (INTA)

Of the approximately 2.2 million people in Nicaragua roughly half live in rural districts, and over 750,000 are employed in agriculture and related fields.

INTA started operation in January 1977. Its stated objectives are "El Instituto tendrá como objetivos primordiales la investigación, adaptación, divulgación de la tecnología agropecuaria y la capacitación del personal necesario para impulsar el desarrollo agropecuario del país".

To carry out these objectives the Institute carries out

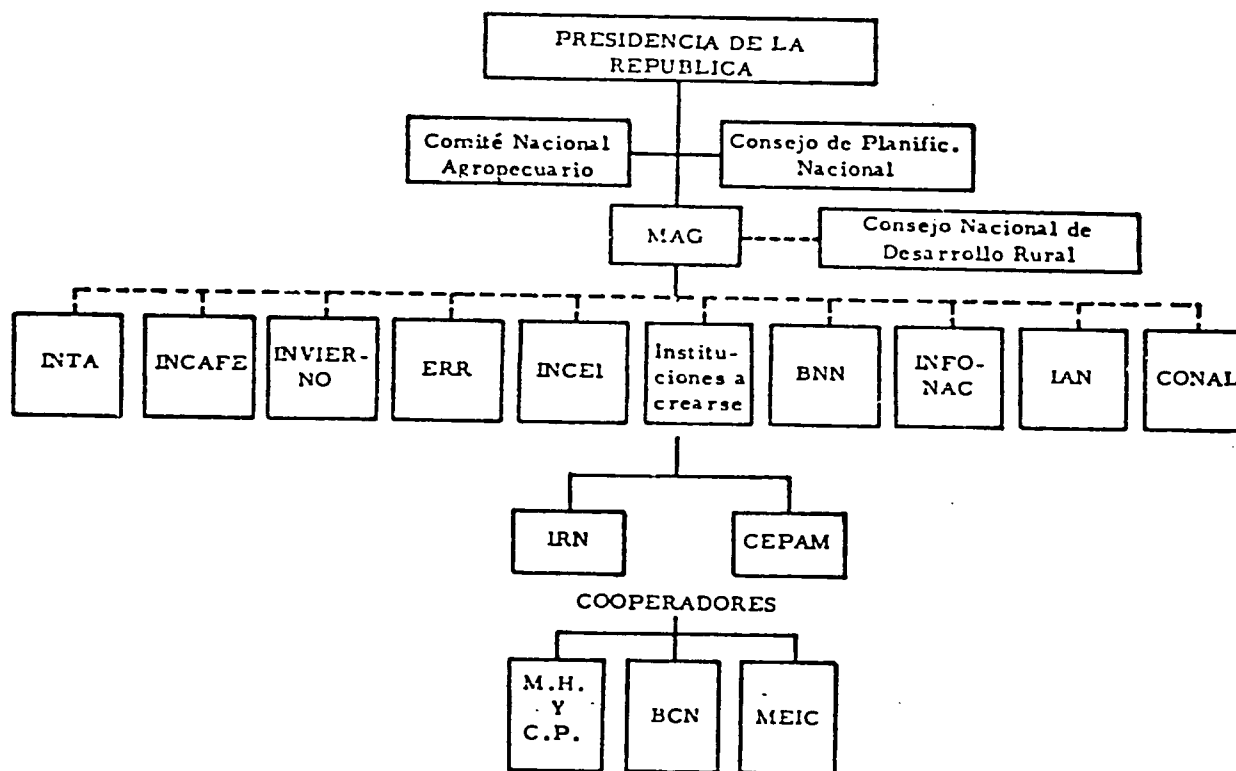
1. Research to improve the production of agriculture and related industries
2. The transmittal of the results of its research to prospective users
3. Training of specialists in agriculture and animal husbandry at various levels.

INTA is a separate entity, but within the Ministry of Agriculture (MAG).

INTA's relative position in the "Sector Público Agropecuario" can be seen in "Cuadro N° 1" and "Cuadro N° 2". Its organization Chart

CUADRO No. 1

SECTOR PUBLICO AGROPECUARIO
(REORGANIZADO)

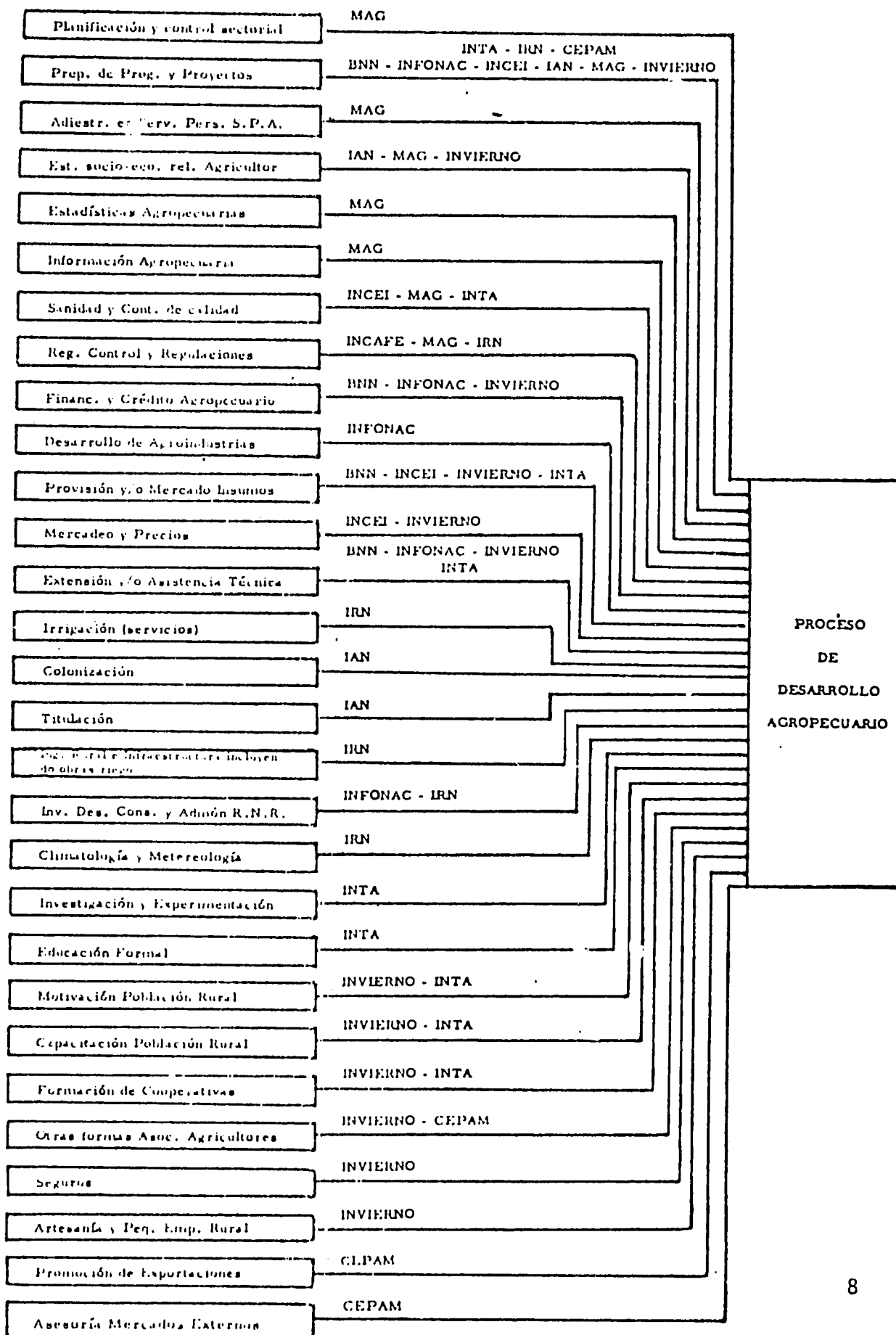


IDENTIFICACION DE SIGLAS

- | | | | |
|----------|--|---------|---|
| MAG | : Ministerio de Agricultura y Ganadería | IAN | : Instituto Agrario de Nicaragua |
| INTA | : Instituto Nicaragüense de Tecnología Agropecuaria | CONAL | : Comisión Nacional del Algodón |
| INVIERNO | : Instituto de Bienestar Campesino | IRN | : Instituto de Recursos Naturales Renovables |
| INCAFE | : Instituto Nicaragüense del Café | CEPAM | : Centro de Promoción y Asesoramiento para el Mercado Mundial |
| ERR | : Empresa de Riego de Rivas | MH y CP | : Ministerio de Hacienda y Crédito Público |
| INCEI | : Instituto Nacional de Comercio Exterior e Interior | BCN | : Banco Central de Nicaragua |
| BNN | : Banco Nacional de Nicaragua | MEIC | : Ministerio de Economía, Industria y Comercio |
| INFONAC | : Instituto de Fomento Nacional | | |

Dentro del Proceso de Desarrollo Agropecuario, las instituciones que forman el S.P.A., tienen bajo su responsabilidad los Programas y servicios descritos en este cuadro.

CUADRO No. 2



is in "Cuadro N° 3".

INTA has a total of 463 (1977) employees of which 94 (20%) are professionals and 181 (40%) are sub-professionals. Of the 94 professionals 67 work in the central offices and the remaining 27 are in the field. Sixty professionals are Agronomy Engineers and most of the remainder in related sciences.

The professional degrees are about 2% Ph.D's, 15% M.S., 50% Ing. Agr., and the remainder Veterinarians, Chemists and Zoologists.

Existing stations, field agencies and projected field stations can be seen on attached map (Cuadro N° 4).

The work program is organized along crop lines as corn, beans, sorghum, rice, coffee, root and tuber crops, vegetables and fruit crops. There is an animal husbandry program which includes work on milk and beef cattle, pastures and forage crops. Departments to support the main program, include statistics, a physical and chemical laboratory, rural engineering, and food technology.

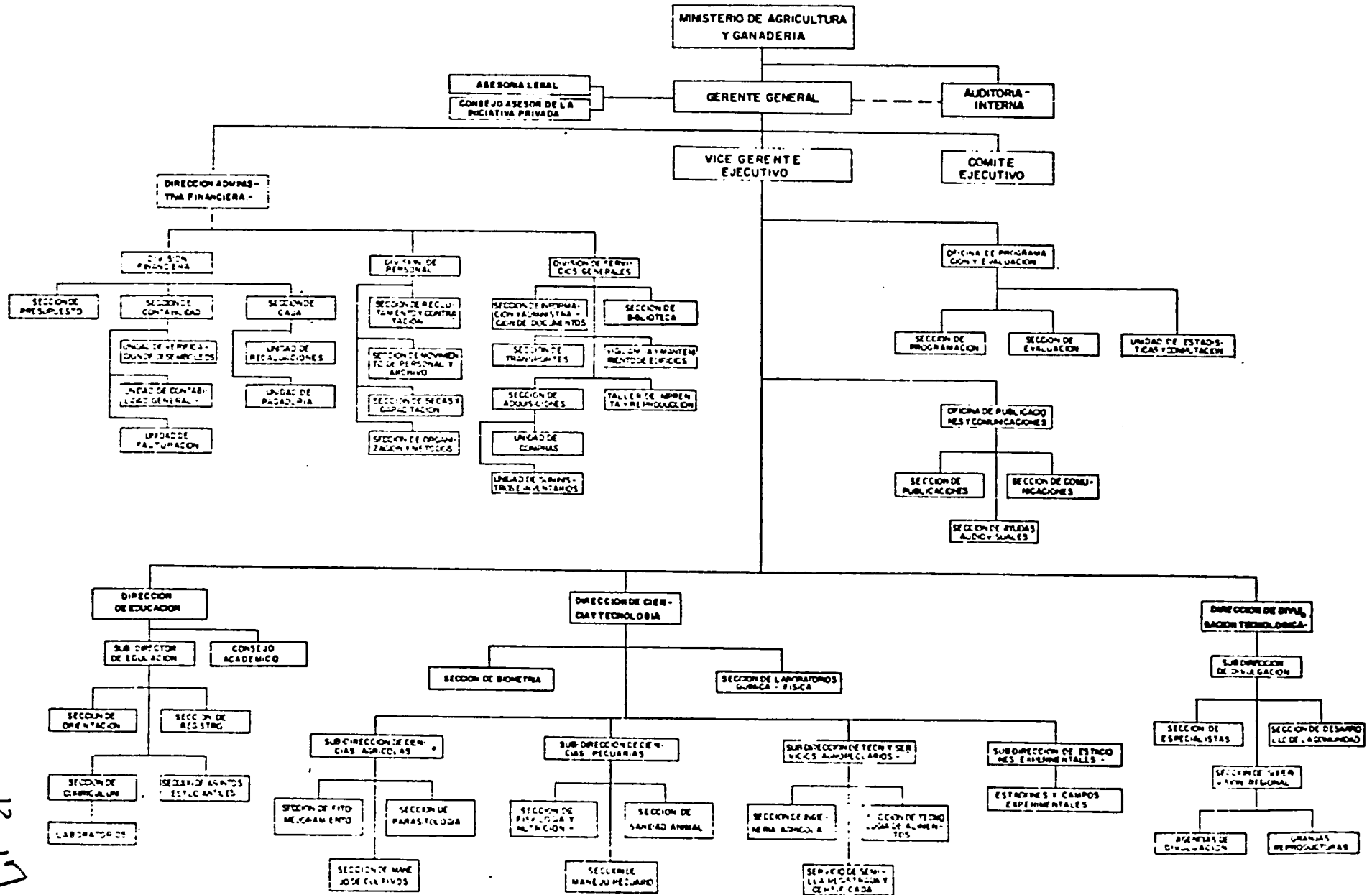
Except for the laboratory doing soils analysis INTA started without any soils program. However, in late 1977 a soils Ph.D. for soil fertility work was added to INTA's staff. It is planned that a soil fertility program in the Nueva Guinea area will be developed by him as the first project. Also part of INTA is the university level agricultural school described below.

C. Laboratories - INTA

Since January 1977, several laboratories which existed in several organizations have been combined as a laboratory section (Sección Química)

CUADRO No. 3

INSTITUTO NICARAGUENSE DE TECNOLOGIA AGROPECUARIA



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CUADRO No. 4

NICARAGUA
 MAPA 1 REGIONES BIOFISICAS
 COMITE NACIONAL AGROPECUARIO
 UNIDAD DE ANALISIS SECTORIAL

- ESTACIONES EXISTENTES
- ▲ ESTACIONES ACTUALES
- ESTACIONES PROYECTADAS

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of INTA. Following are the names and major functions of its units:

1. Soil fertility Laboratory
 - a. Soil testing for farmers
 - b. Soil testing for research
 - c. Analysis of irrigation water
2. Soil Survey Laboratory
 - a. Physical and chemical analysis of profile samples for soil classification
 - b. Physical and chemical analysis of surface soils for farmers
3. Agro-chemical Laboratories
 - a. Quality control analyses of fertilizers
 - b. Quality control analyses of fungicides
 - c. Quality control analyses of other pesticides
 - d. Other control analyses
4. Food Science Laboratory
 - a. Analysis of humidity, fat, crude fiber, protein, carbohydrates, calories, and minerals in commercial animal mixed feeds
 - b. Feed analysis for research program
5. Laboratory for toxic residues

Soil Fertility Laboratory

The Soil Fertility Laboratory is charged with the interpretation of analytical results and specific fertilizer recommendations for farmers. It completed the following work for the first half of 1977:

Soil samples: 3,792 with 11,561 analyses. Of these the bulk of samples came from individual farmers. About 300 from Cadastro and an equal number from research.

The following analyses were made:

pH, P, K, Ca, Mg, Cu, Zn, Mn, Fe, extractable acidity, C.E.C., Na, electric conductivity. The Laboratory uses the modified Olsen extracting solution for P, K and trace elements and for Ca and K. The major piece of equipment is an atomic absorption spectrophotometer /P. E. 290BZ. The capacity of the Laboratory is 120 soil samples per day and about 600 analyses.

Fertilizer recommendations were for many crops, with the most important being cotton, pasture, coffee, rice, plantains, in this order, based on the acreages. The largest number of samples came from coffee growers.

The Laboratory prepares a detailed quarterly report, which indicates also the geographic origin of samples, and the nutrient level found in samples from these areas. The Laboratory files its data by political unit and by crops with the intention of using them for analysis. Such a study for data accumulated from 1967-75 was done by Ing. Guadalupe Chavez de Rivera and Dr. Oscar Hidalgo Salvatierra with the cooperation of the North Carolina State University International Soil Fertility Evaluation Project under Dr. J. Walker in 1976 under the title "Estudio Preliminar sobre la Fertilidad de Suelos de Nicaragua".

Soil Survey Laboratory

The Soil Survey Laboratory received about 700 soil samples during the first half of 1977 and made about 5,000 analyses. Most of its samples came from the Soils Department at Cadastro with a few from other government entities (IAN, INTA, etc.).

Analyses done in this Laboratory to help in the

classification and mapping of soils are:

Texture; OM; pH, % humidity, bulk density; exchangeable Ca, Mg, Na, K, acidity, C.E.C., total N, free Fe, Cl, actual density, saturation point, field capacity, wilting point, E.C.

This Laboratory also makes a quarterly report indicating the source and geographic origin of its samples.

The Agro-chemical Laboratory

The Agro-chemical Laboratory makes control analyses of fertilizer (and pesticide) samples. They determine, total N, available P and K. They follow A.O.A.C. methods. Their main piece of equipment is a gas chromatograph. There are 2 professionals and 2 helpers in this Laboratory.

D. Escuela Nacional de Agricultura y Ganadería (ENAG)

This Institution has been part of INTA since 1976. Technical agricultural education supported by the government started in Nicaragua in 1929, and for 27 years was at a subprofessional level. The first group of ingenieros agrónomos was graduated in 1960. Presently the Institution graduates about 20 ingenieros agrónomos each year of which about 70% major in Plant Sciences, which includes any student interested in soils. The only other field of concentration is animal husbandry.

Soils related courses offered are:

Soil Physics

Soil Chemistry

Soil Morphology, genesis and classification

Fertilizers and soil amendments

Plant Physiology

Irrigation and Drainage

All courses are one semester long, and are obligatory for all students including those in Animal Sciences.

The Faculty consists mostly of regular staff members of INTA plus 3 part time professors for soil chemistry, fertilizers and soil classification.

There are 17 theses by agronomy engineers in soil chemistry, fertility and plant nutrition.

Other institutions offering studies in soils are the Universidad Autónoma de Nicaragua and the Universidad Centroamericana.

E. Dirección de Planificación Sectorial

(DIPSA) - Ministerio de Agricultura y Ganadería (MAG)

This is the national planning office for the agricultural sector. It has one soil scientist on its staff, Ing. Agr. Orlando Vasquez Morori, whose task it is to help in the evaluation of renewable natural resources.

DIPSA has several projects proposed which require input from soils. They are:

1. Proyecto de Ordenamiento de la frontera de desarrollo agrícola
 - a. Ubicación: Centro del territorio nacional
 - b. Organismo ejecutor del estudio: Ministerio de Agricultura y Ganadería. Dirección de Planificación Sectorial
 - c. Tipo de proyecto: Desarrollo Regional
 - d. Area del proyecto: 4,116,511 ha
 - e. Fecha de inicio de los estudios: 1977
2. Proyecto: Plan de manejo y conservación de tierras algodonerías
 - a. Ubicación: Departamentos de León y Chinandega
 - b. Organismo ejecutor: Firma consultora
 - c. Tipo de proyecto: Conservación y manejo de suelos
 - d. Fecha de iniciación del estudio: 1978
 - e. Presupuesto: Estudios y ejecución: C\$72,000,000

3. Proyecto Plan de manejo y conservación de la Cuenca Managua
 - a. Ubicación: Departamento de Managua, Municipio de Managua
 - b. Organismo ejecutor: Firma consultora
 - c. Tipo de proyecto: Conservación y manejo de suelos
 - d. Fecha de iniciación del proyecto: 1978
 - e. Presupuesto: Estudios y ejecución C\$19,000,000

4. Proyecto Plan de manejo y conservación de suelos de los alrededores de Nandaime
 - a. Ubicación: Departamento de Granada
 - b. Organismo ejecutor: Firma consultora
 - c. Tipo de proyecto: Conservación y manejo de suelos
 - d. Presupuesto: Estudios y ejecución C\$24,000,000

5. Proyecto de riego márgen oriental del Lago de Nicaragua
 - a. Ubicación: Márgen oriental del Lago de Nicaragua
 - b. Organismo ejecutor: Ministerio de Agricultura
 - c. Tipo de proyecto: Riego
 - d. Área del proyecto: 91,600 ha
 - e. Fecha de iniciación de los estudios: 1982
Fecha de finalización de construcción: 1987
 - f. Presupuesto: Estudio e inversión C\$237,000,000

6. Proyecto de Riego Valle de Jalapa
 - a. Ubicación: Departamento de Nueva Segovia
 - b. Organismo ejecutor: Firma consultora
 - c. Tipo de proyecto: Riego
 - d. Área del proyecto: 5,000 ha
 - e. Año de iniciación: 1980
Año de finalización: 1982
 - f. Costo de estudios: C\$150,000; obras C\$175,000

7. Proyecto de riego Pantasma y la Vigía
 - a. Ubicación: Departamento de Jinotega
 - b. Organización ejecutora: Firma consultora
 - c. Tipo de proyecto: Riego
 - d. Área del proyecto: 1,700 ha
 - e. Año de iniciación de los estudios: 1981
Año de finalización de obras: 1984
 - f. Costo de los estudios: C\$195,000
Costo de las obras: C\$4,850,000

VI. RELATION OF SOILS TO OTHER NATURAL RESOURCES AGENCIES

The relationship of soils work in Nicaragua to other natural resources agencies is illustrated in the following diagram (Figure N° 1)

There has been a proposal for a natural resources institute. For more than a year little progress has been made in obtaining the necessary legislation. However, there is little disagreement concerning its necessity. Meanwhile, policy and activities related to natural resources remains fragmented and inefficient.

A. Catastro y recursos naturales

The original AID Cadastral and Natural Resources Program ended in 1971 with some 23,000 km² of properties delineated in the most populated part of the country, the Pacific area. There is now a possibility of a new 3 year property delineation program which, would cover some 60,000 km² of less densely populated areas. Urban areas like Managua are being revalued and the catastro is said to be fairly well maintained.

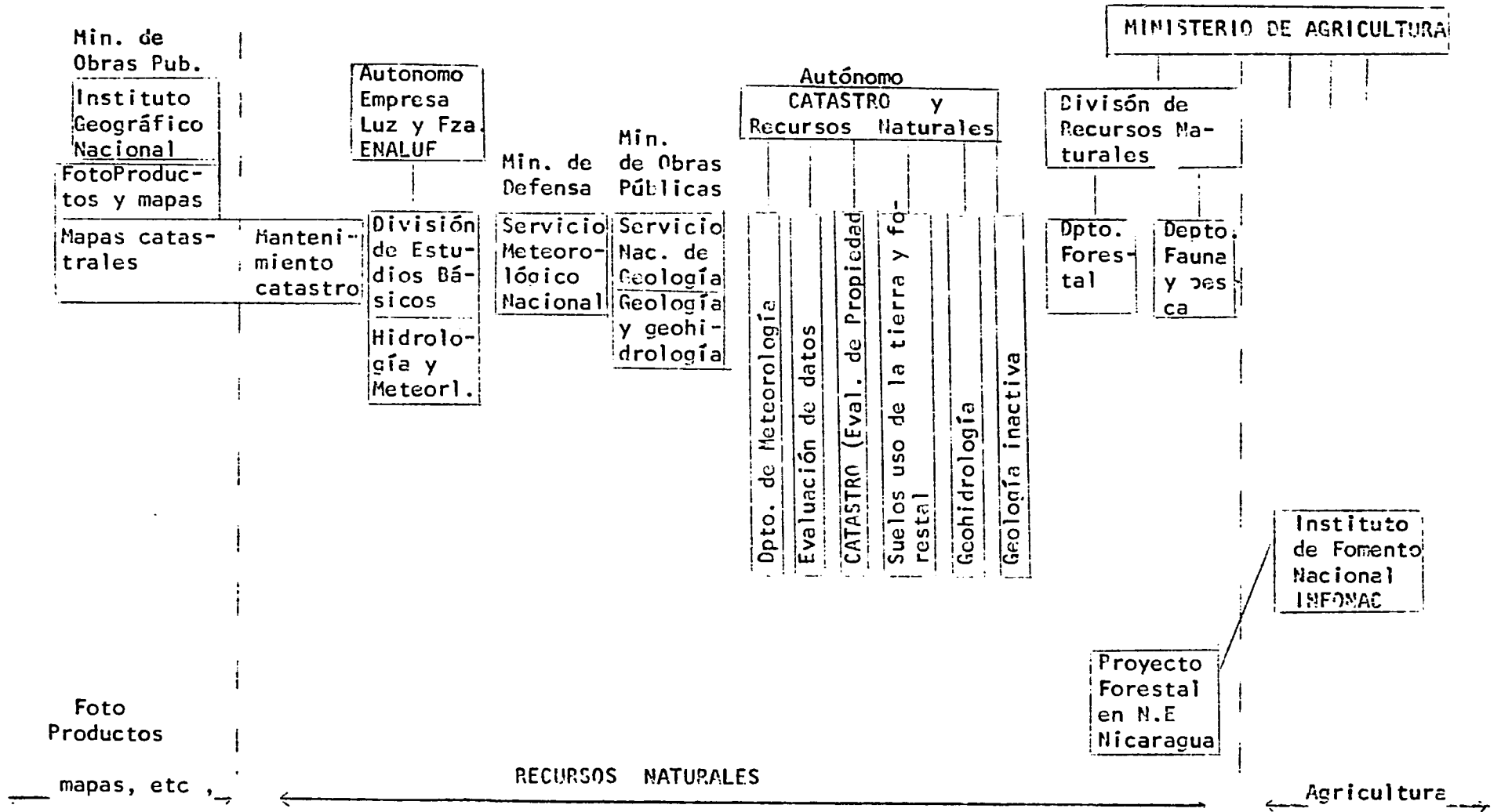
A department called EVADATA was formed in 1971 to evaluate and use the great quantity of natural resources and cadastral information and maps collected during the project. This unit was created with the guidance of Dr. P. Duisberg then of the IAGS (Servicio Interamericano Geodésico). Its head is Ing. Agr. Claudio Gutiérrez. Under Ing. Gutiérrez the EVADATA section of Cadastro has used resources information to identify development projects for the Pacific Region and are working in the Central Region. They evaluate the physical and socioeconomic information in order to characterize an area. This process is closely allied to how a more sophisticated computerized data system could be used.

In addition the unit has identified areas for conservation and

Figure 1

N I C A R A G U A

Organigrama preliminar para Recursos Naturales



* Hay un proyecto de ley para crear un Instituto de Recursos Naturales
 NOTA: Se debe ampliar y corregir este diagrama.

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national parks. It developed a master plan for a national park at the Masaya Volcano which is being implemented.

It also collaborated with an OAS team which developed a decentralization and development plan for the Pacific area and will return for a development study in the Atlantic area.

B. Departamento de Recursos Naturales - MAG

The Natural Resources Department of MAG is growing but is still quite weak. It consists of a silviculture department with 2 graduate foresters and 5 student aids. It also has 15 technical level men primarily to mark trees and 10 inspectors to cover the country. The wildlife department includes a graduate biologist and an agronomist, 3 biology students and seven inspectors. The Department under Ing. Forestal V. Ortega is assisted by a British Mission of 3 persons who have been making species trials since 1972 and a recent FAO program in the pine area of Nueva Segovia under Dr. Borgo.

The Department big recent accomplishment is a "Ley de Emergencia sobre Aprovechamiento Racional de los Bosques y Reglamento de Defensa Contra Incendios Forestales".

C. Instituto Fomento Nacional (INFONAC)

INFONAC is a national agency to help finance certain kinds of industries including resource industries from marine life to forests. It has mixed national and private capital. In recent years it carried out a large re-seeding and fire control program of pine forests in the Northeast Atlantic area north and west of Puerto Cabezas to the border with Honduras with the idea of reestablishing the pine forest industry. This had almost disappeared due to clear cutting and fire. INFONAC has a wide

range of other activities from stimulation of agriculture and small irrigation projects to establishment of food and natural resources processing industries. It has some specialists in small irrigation projects and agronomists but no soil specialists.

D. Bienestar rural

(Nicaragua specialists should complete this section)

E. INVIERNO

(Information should be supplied by Nicaraguan soil scientists in their revision)

F. Instituto Agrario de Nicaragua (IAN)

The Institute has 23 settlements in existence in the Pacific zone, which cover a total area of 17,702 ha, 1,673 families have their farms in these settlements. (This gives an arithmetical average of 10.6 ha per family. However, no information on the actual sizes has been supplied)

The following projects are being developed by IAN and are in different stages of development at the moment.

Name	Location	Year started	Total area ha	Families settled* N°	Arithmetic average of lot size ha
P. Cabezas	Zelaya	1970	400,112	2,824	141
Somoza Q.	Jinotega	1967	29,316	1,208	24
La Cruz de Río Grande	Zelaya	1973	487,665	437	1,116*
Siuna	Zelaya	1969	<u>592,935</u>	1,715	346
TOTAL			1,510,028		

* Apparently settled until the end of 1977, but not the total number planned (Source: IAN Carta N° IAN-2-004-78, January 13, 1978)

IAN has no soil scientist in its organization, nor a special budget for this type of study. Any soils studies needed are done by the Soils Department of Cadastro.

In planning any settlement the 1:50,000 topographic maps and the 1:20,000 or 1:50,000 soils maps are consulted, depending on the region. Cropping patterns are determined on the basis of inquiries in the field, soils information, ecologic adaptability of certain crops and economic studies of possible profitability.

G. Instituto Geográfico Nacional (IGN)

1. Topographic base maps

a. General

The National Geographic Institute of Nicaragua has excellent base map coverage available in several scales. The maps have been reproduced in litho copy form and materials are available to produce stable base transparencies.

A copy of the bulletin "Publicaciones del IGN" Julio 1976 is attached as Appendix B.

b. 1:250,000 Series

Almost complete coverage has been produced. See Appendix E, page 7.

c. 1:100,000 Series

The entire eastern and northern area of the country has been produced from side-looking Radar techniques. The remainder of the country has been covered by standard topographic maps at 1:100,000 scale.

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A planimetric 1:100,000 series has been initiated. See Appendix B, page 6.

d. 1:50,000 Series

Complete coverage has been produced; 286 map sheets are completed. See Appendix B, page 5. (The index does not show all sheets completed. Coverage is now complete)

e. Other maps

The National Geographic Institute has published other maps as shown in Appendix B, pages 2, 3, 4. This includes 712 rural cadastral maps, 680 urban cadastral maps, City Plans, Highway maps, FAO Forestry maps and Hydrographic Charts.

2. Conventional aerial photography

The National Geographic Institute has aerial photography negatives on hand and complete laboratory facilities available to produce enlargements, rectifications or contact prints of the negatives. Appendix B, pages 8, 9, 10, 11 show the film library holdings. Additional recent 1:20,000 scale photography, not shown on page 11, is available in the central part of the country.

3. Satellite imagery

The National Geographic Institute maintains 70 mm film copies of the four frequency bands of ERTS, Skylab and LANDSAT satellite photography. The Institute receives catalogs and film copies on a regular basis from NASA through the IAGS Distribution Center. Although IGI does not have adequate equipment for image manipulation, some work has been accomplished in Nicaragua, using satellite imagery, to produce land use and forestry

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maps. One professional at IGN has completed a four-month course in Remote Sensing and two men have been given on-the-job training. Ing. Franco Penalba of the Central Bank has obtained an equivalent of a Masters Degree in Remote Sensing at ITC in Delft, Holland and has accomplished interpretation of satellite imagery for specific projects in Nicaragua.

H. CATASTRO

1. Soil and land capability maps

This work is discussed in Appendix A and elsewhere in this document.

I. OTHER STUDIES

1. Potential land use

A potential land use map at 1:500,000 scale was prepared for the entire country by Dr. V. Plath, FAO, in the 1960's.

2. Life zone maps

Life zone maps, using the Holdridge method, were prepared for the 40,000 square kilometer cadaster area at 1:100,000 and 1:500,000 scales. These life zones have been projected on to the 1:20,000 soils maps of the "catastre".

3. Ground water studies

General ground water studies have been carried out within the western 35,000 square kilometer area of Nicaragua. The productive area of 5,500 sq Km was studied in detail with pumping tests, recharge calculations and quality tests being accomplished. See attachment N° 7

4. Various

Within the 40,000 square kilometer Cadaster area, all properties and tenure has been mapped. In addition to the studies mentioned above, Geology, Geomorphology, Vegetation, Forest Potential and Land Use have been mapped. The cadaster Office has an Evaluation Section that is gathering socio-economic data and performing preliminary analyses.

Maps at 1:100,000 scale were prepared from radar photography of all the area outside of the 40,000 sq km cadaster area. Special maps of Geology, Geomorphology, Vegetation and Land Use were prepared for the entire area.

5. Meteorology and hydrology

The two remaining institutions are the Servicio Meteorológico Nacional and the División de Estudios Básicos - Hidrología y Meteorología, Empresa Nacional de Fuerza y Luz (ENALUF). The Proyecto Hidrometeorológico de Centro América of the World Meteorological Organization was successful in Nicaragua and resulted in a great expansion of the network and the improvement of quality and processing of data. It was only possible to achieve partial consolidation of units which were duplicating effort during the WMO Project of 1966-1976.

Nicaragua has 13 type A meteorological stations (complete) or one for every 11,000 sq km. As in other Central American countries, the density is higher in the more heavily populated Pacific region and very low in the Atlantic zone. There are 69 types B stations (precipitation and temperature) and 277 type C station (precipitation only). The attached map shows the approximate distribution of these stations. There is one publication by the Utah State University group "Monthly Precipitation

and Moisture Availabilities for Nicaragua, U.S.U. 1976, by George H. .
Hargreaves.

COMPILATION OF REFERENCES AND MAPS

- A. Bibliografías de América Central --Nicaragua, IICA-CIDIA, Bibliografía N° 12, Turrialba, 1972.
- B. Índice de Mapas de América Latina y el Caribe, existentes en el IICA-CIDIA. IICA-CIDIA, Turrialba, 1975.

APPENDIX

- A. Estado del Inventario de Suelos en Nicaragua. Managua, D. N., 6 de octubre de 1977. (Prepared by Ing. Agr. E. Marin, but unsigned)
- B. Publicaciones del IGN. MOP, Managua, Julio 1976.

APENDICE A

ESTADO DEL INVENTARIO DE SUELOS EN NICARAGUA*

INTRODUCCION

El Departamento de Suelos del Ministerio de Agricultura, integrado al Programa de Catastro, inició el levantamiento sistemático de los suelos del país en 1968.

Se ha cubierto hasta la fecha una superficie de 93,150 km² de estudios a diferentes niveles de intensidad, que representa el 76% de la superficie del territorio nacional excluyendo los lagos.

Además se han efectuado estudios especiales para proyectos de riego y un estudio detallado en el área afectada por la erosión eólica de la ciudad de León.

A continuación se hace una breve descripción del tipo de estudio efectuado en cada región del país.

1. Región Pacífica

Esta región fue estudiada de 1973 a 1971, en una superficie de 16.000 kilómetros cuadrados.

El nivel del estudio fue detallado en las áreas de alto valor agrícola y semidetallado en área montañosas y de menor importancia agrícola y socioeconómica.

El material cartográfico utilizado fueron fotografías aéreas pancromáticas a escala 1:20.000, tomadas por la Compañía Mark Hurd en 1968 y 1969.

* Presented by Ing. Agr. Eduardo Marín, at the Regional Soils Workshop at CATIE, October 18-20, 1977

El estudio se basó en los conceptos del Soil Survey Manual, handbook N°18; Land Capability Classification, Manual N°210 y Soil Taxonomy, handbook N°436 del U.S.D.A.

La unidad taxonómica utilizada fue la serie de suelos, correlacionada con la familia y el subgrupo de suelos. La unidad de manejo utilizada fue la unidad de capacidad de uso de la tierra.

Se preparó el informe final en inglés y español, y cuenta de tres volúmenes: a) Uso y Manejo de los Suelos, b) Descripción de Suelos y c) Génesis y Clasificación de Suelos.

Los mapas finales fueron publicados a escala 1:20.000 (Ortofotomapas) y constan de un set de 167 mapas.

1A. Estudio para Fines de Riego "Proyecto SINECAPA-VIEJO"

Dentro de la Región Pacífica se efectuó un estudio especial en 1974 para fines de riego a nivel de semidetalle en una superficie de 150 Km². Se utilizaron además de los conceptos anteriores, las normas establecidas por el Volumen V del Bureau of Reclamation.

Se publicó el informe final en español y los mapas (Suelos, Uso Potencial y Riego) a escala 1:20.000 en Ortofotomapas.

1B. Estudio para Fines de Riego "Proyecto TIPITAPA-MALACATOYA"

Estudio especial efectuado en 1976 a nivel de semidetalle en una superficie de 483 km², basado en los mismos conceptos del estudio anterior.

Se publicó el informe final en español y los mapas (Suelos, Uso Potencial y Riego) a escala 1:20.000 en Ortofotomapas.

1C. Estudio de la Región afectada por la erosión eólica en "LEON"

Estudio especial llevado a cabo a nivel de detalle en una superficie de 500 km².

Este estudio consiste en determinar los daños que están sufriendo los suelos por los efectos de la erosión eólica acelerada que se producen en esa región, produciendo daños en los cultivos y en la población.

Los resultados del estudio y mapas serán publicados en los primeros meses del año de 1977.

1D. Estudio para fines de riego "PROYECTO NAIDAME--RIVAS"

Estudio especial realizado en 1977 a nivel de reconocimiento en una superficie de 250 km² y a nivel de semidetalle en una superficie de 119 km².

Esta información sirvió de base para la planificación agropecuaria del área estudiada a nivel de prefactibilidad (250 km²) y del área seleccionada para la implementación de un programa de agricultura diversificada bajo riego (119 km²) que comprendió el estudio de factibilidad técnico-económica.

El informe final comprendió la descripción de ambos estudios. Los mapas (suelos, riego y uso potencial) fueron publicados en hojas topográficas a escala 1:50.000 (Reconocimiento) y en fotomosaicos 1:20.000 (Semidetalle).

1E. Estudio para fines de riego "PROYECTO VALLE DE SEBACO"

Estudio especial efectuado a dos niveles (similar al anterior) en 1977. Reconocimiento en una superficie de 200 km² y semidetalle en 80 km².

La información fue preparada para determinar la prefactibilidad y factibilidad de un proyecto de riego con cultivos agroindustriales.

El informe final consistió en la descripción de ambos estudios y los mapas finales fueron preparados en la misma forma que el estudio anterior.

2. Región Central Oeste

Fue estudiada de 1970 a 1972, y cubrió una superficie de 15.000 km².

El nivel de estudio fue semidetallado debido a la predominancia de áreas montañosas y detallado en pequeñas áreas como los Valles de Sébaco y Estelí.

El material cartográfica y los conceptos utilizados fueron los mismos que se usaron en la Región Pacífica.

No se ha publicado el informe y existen mapas aún no finales en Overlays y Chronaflex a escala 1:20.000.

3. Región de la Cuenca del Río Escondido

Fue estudiada en el año de 1972 a nivel de reconocimiento de alta intensidad y cubrió una superficie de 12,700 km².

El material cartográfico utilizado fueron fotografías aéreas a escala 1:60.000, tomadas por la USAF entre 1959 y 1961.

Se utilizaron los conceptos de Soil Survey Manual y Soil Taxonomy y la unidad taxonómica fue el subgrupo de suelos y/o la asociación de éstos.

Se publicó el informe final y se prepararon los siguientes mapas a escala 1:250.000: Suelos, Uso Potencial, Clases de Drenaje, Unidades de Pendiente, Materiales Litológicos, Fisiografía y Vegetación. Los mapas bases de suelos se prepararon a escala 1:50.000 en material estable y reproducible (Sepins).

4. Región Sureste (Río San Juan)

Fue estudiada durante los años de 1973 y 1974 a nivel de reconocimiento y cubre una superficie de 12,200 km².

El material cartográfico y los conceptos utilizados fueron los mismos del estudio anterior (3).

El informe final está en imprenta y los mapas de suelos y uso potencial fueron publicados a escala 1:250.000, estando los mapas bases de suelos 1:50.000 en material estable y reproducible (sepias).

5. Región Central Este (Matiguas)

El estudio de campo se efectuó en 1975 a nivel de reconocimiento y comprende una superficie de 6.250 km².

Fue hecho de acuerdo a los mismos patrones establecidos para estudios de reconocimientos en zonas húmedas.

Solamente se han preparado los mapas borradores de suelos a escala 1:50.000 y los resultados se integraron a la publicación del estudio que se hará en la región vecina.

6. Región Central Noroeste (Nueva Segovia)

Los estudios de campo se efectuaron en 1976, siendo el nivel del estudio de reconocimiento semidetallado y cubre una superficie de 6.000 km².

El material cartográfico utilizado fueron fotografías aéreas 1:60.000 y mapas topográficos 1:50.000.

La unidad taxonómica utilizada fue la serie de suelos o asociación de series de tipo amplio, separando fases por unidades de capacidad, para determinar el uso potencial de las tierras.

Actualmente se están preparando los mapas borradores y el informe será publicado en 1977.

7. Región Siuna-Río Grande de Matagalpa

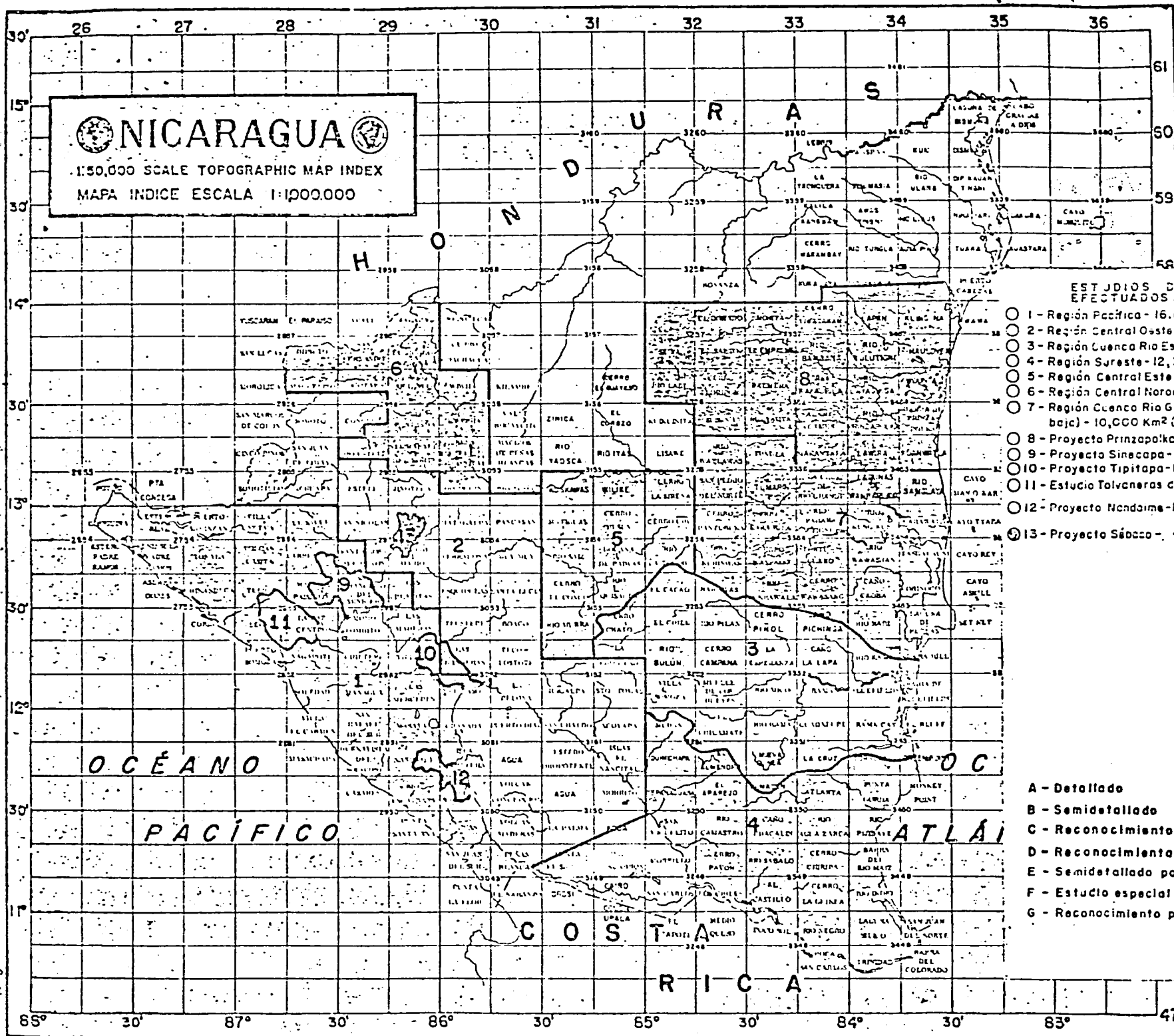
Los estudios de campo se efectuaron a principios de 1977 y se concluyeron a mediados del mismo año, el nivel utilizado fue de reconocimiento de baja intensidad y se cubrió una superficie de 25.000 km².

El material cartográfico utilizado fueron fotografías pancromáticas escala 1:50.000, mapas topográficos 1:50.000 y mapas de radar 1:100.000.

La unidad taxonómica utilizada fue el subgrupo de suelos y sus respectivas fases.

Se prepararon mapas de fisiografía, suelos, fertilidad y uso potencial de la tierra, a escala 1:50.000 (mapas de trabajo) y 1:250.000 mapas finales en material heliográfico.

El informe final se encuentra en proceso de redacción y será concluido a mediados de noviembre del presente año.



ESTUDIOS DE SUELOS EFECTUADOS A DIC. 1977

- 1 - Región Pacífica - 16,000 Km² (A)
- 2 - Región Central Oeste - 17,000 Km² (B)
- 3 - Región Cuenca Rio Escondido - 12,700 Km² (C)
- 4 - Región Sureste - 12,200 Km² (C)
- 5 - Región Central Este - 6,250 Km² (C)
- 6 - Región Central Noroeste - 6,000 Km² (B)
- 7 - Región Cuenca Rio Grande de Matagalpa (parte baja) - 10,000 Km² (D)
- 8 - Proyecto Prinzapolka-Rosita - 15,000 Km² (D)
- 9 - Proyecto Sinecapa-Vieja - 150 Km² (E)
- 10 - Proyecto Tipitapa-Malacatoya - 483 Km² (E)
- 11 - Estudio Tolveneras de León - 500 Km² (F)
- 12 - Proyecto Nandaime-Rivas - { 260 Km² (G)
119 Km² (E)
- 13 - Proyecto Sábaco - { 200 Km² (G)
80 Km² (E)

- A - Detallado
- B - Semidetallado
- C - Reconocimiento de alta intensidad
- D - Reconocimiento de baja intensidad
- E - Semidetallado para riego
- F - Estudio especial
- G - Reconocimiento para riego

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RESUMENEstudios Sistemáticos

1. Región Pacífica	16.000 km ²
2. Región Central Oeste	15.000 km ²
3. Región Cuenca del Río Escondido	12.700 km ²
4. Región Sureste (Río San Juan)	12.200 km ²
5. Región Central Este (Matiguas)	6.250 km ²
6. Región Central Noroeste (Nueva Segovia)	6.000 km ²
7. Región Siuna-Río Grande de Matagalpa	25.000 km ²
TOTAL	<hr/> 33.150 km ²

Estudios Especiales

1A- Proyecto de Riego "Sinacapa-Viejo"	150 km ²
1B- Proyecto de Riego "Tipitapa-Malacatoya"	483 km ²
1C- Proyecto Tolvaneras de León	500 km ²
1D- Proyecto Mandaime-Rivas	220 km ²
1E- Proyecto Valle de Sebaco	200 km ²
TOTAL	<hr/> 1.553 km ²

PUBLICACIONES DEL I.G.N

MINISTERIO DE OBRAS PUBLICAS



JULIO -- 1976

LISTA DE PRECIOS DE LAS COPIAS DE FOTOGRAFIAS

AEREAS Y AMPLIACIONES

Fotografía por contacto	9" x 9"	₡ 15.00
Ampliación	8" x 10"	35.00
Ampliación	11" x 14"	50.00
Ampliación	16" x 20"	75.00
Ampliación	20" x 24"	100.00

Para fotomosaicos, trabajos fotomecánicos, fotografías aéreas, control geodésico y suplementario, restitución fotogramétrica y trabajos especiales visitar nuestra Dependencia situada en:

Km. 6 Carretera Norte
Instituto Geográfico Nacional
Ministerio de Obras Públicas

Managua, D. N.

1976

MAPAS BASICOS, SERIES NORMALES

	<u>Escala</u>	<u>Año Public.</u>	<u>Costo</u> \$
Serie Topográfica, cinco colores, de los Cayos del Atlántico, 4 hojas publicadas	1:25,000	1965-1967	5.00
Serie Topográfica, cinco colores, 255 hojas publicadas (15 hojas agotadas)	1:50,000	1956-1971	5.00
Serie Planimétrica, zona del Pacífico	1:100,000		
1a. Edición 19 hojas publicadas		1956-1958	2.00
2a. Edición 11 hojas publicadas		1963-1965	3.00
2a. Edición 3 hojas publicadas a 5 colores		1968	5.00
Serie Topográfica a cinco colores, zona del Pacífico, 8 hojas publicadas	1:250,000	1965-1968	8.00
3 hojas publicadas en relieve		1968	50.00
Serie Planimétrica, zona del Atlántico			
4 hojas publicadas a 5 colores	1:250,000	1968	8.00

MAPAS CATASTRALES, SERIES NORMALES

Rurales, Zona del Pacífico			
copias heliográficas de 2' 5 x 3' 75			
712 mapas publicados	1:10,000	1968-1971	18.00
Urbanos, Zona del Pacífico			
copias heliográficas de 15" x 22" 5			
680 mapas publicados	1:1,000	1968-1971	18.00

MAPAS ESPECIALES

1. - Mapa Oficial de Nicaragua-Edición Preliminar	1:500,000	1968	30.00
2. - Mapa Masaya y Vecindad-Topográfico	1:5,000	1966	10.00
3. - Mapa Granada y Vecindad-Topográfico	1:5,000	1968	10.00
4. - Mapa Managua y Vecindad-Topográfico	1:10,000	1964	10.00

	<u>Escala</u>	<u>Año Public.</u>	<u>Costo</u>
5 - Pictomapa de Masaya	1:5,000	1976	\$10.00
6 - Pictomapa de Chinandega	1:5,000	1970	10.00
7 - Pictomapa de Diriamba	1:5,000	1971	10.00
8 - Pictomapa de Jinotega	1:4,000	1971	10.00
9 - Pictomapa de Estelí	1:8,000	1971	10.00
10- Pictomapa de Managua 4 hojas valor cu \$10.00	10,000	1973	10.00
11- Pictomapa de Masatepe	1:4,000	1974	10.00
12- Pictomapa de Masachapa	1:5,000	1974	10.00
13- Pictomapa de Bluefields	1:5,000	1974	10.00
14- Pictomapa de Juigalpa	1:5,000	1974	10.00
15- Pictomapa de Jinotega	1:4,000	1973	10.00
16- Pictomapa de Rivas	1:5,000	1973	10.00
17- Fotomapa de Managua	1:10,000	1973	10.00
18- Mapa Geológico de Nicaragua	1:1,000,000	1973	10.00
19- Departamento de Masaya-Topográfico	1:50,000	1967	10.00
20- Departamental Chinandega-Planimétrico	1:150,000	1967	10.00
21- Departamento de Chontales	1:250,000	1974	10.00
22- Nicaragua Mapa Político	1:1,000,000	1966	5.00
23- Nicaragua Mapa Hipsográfico	1:1,000,000	1966	5.00
24- Nicaragua Mapa Hidrográfico	1:1,000,000	1966	5.00
25- Red Vial Carreteras	1:500,000	1967	5.00

	<u>Escala</u>	<u>Año Public.</u>	<u>Costo</u>	
26	División Política-Municipios	1:1,000,000	1965	¢ 2.00
27	Puerto Somoza	1:5,000	1968	10.00
28	Little Corn Island	1:10,000	1968	10.00
29	Corn Island	1:10,000	1969	10.00
30	Puerto Corinto y Vecindad	1:5,000	1969	10.00
31	Puerto Cabezas	1:10,000	1969	10.00
32	Isletas de Granada	1:10,000	1969	10.00
33	Ciudad de León	1:10,000	1970	10.00

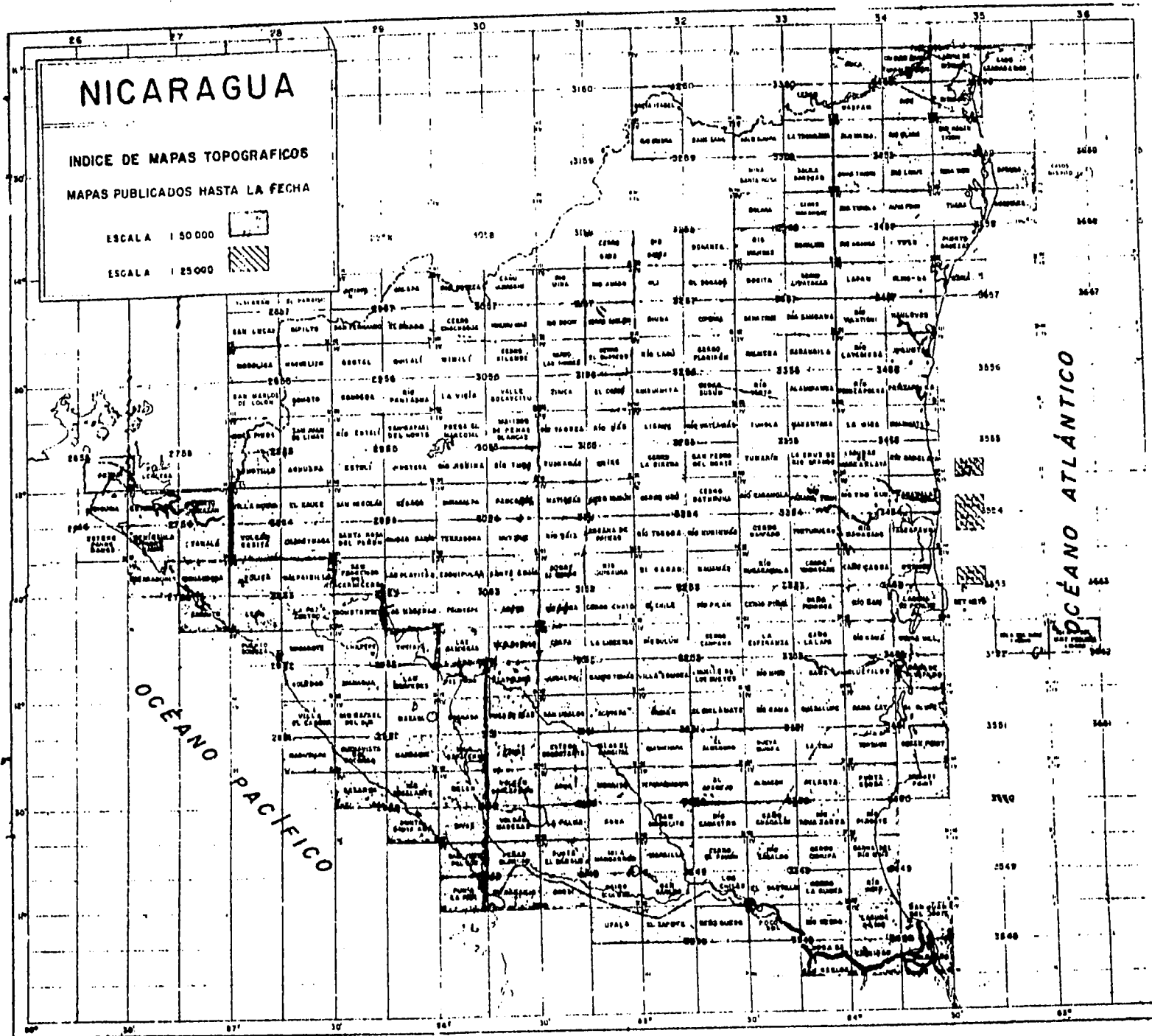
MAPAS FORESTALES PARA FAO

34	Puerto Cabezas	1:100,000	1967	4.00
35	Awastigni	1:100,000	1967	4.00
36	Wounta	1:100,000	1967	4.00
37	Cabo Gracias a Dios	1:100,000	1967	4.00
38	Waspán	1:100,000	1967	4.00
39	Alamicamba	1:100,000	1967	4.00
40	Bambana	1:100,000	1967	4.00
41	Prinzapolka	1:100,000	1967	4.00
42	Mapa de Caminos (Coco-Wawa)	1:250,000	1966	4.00

HIDROGRAFICO DE LA NAVOCEANO

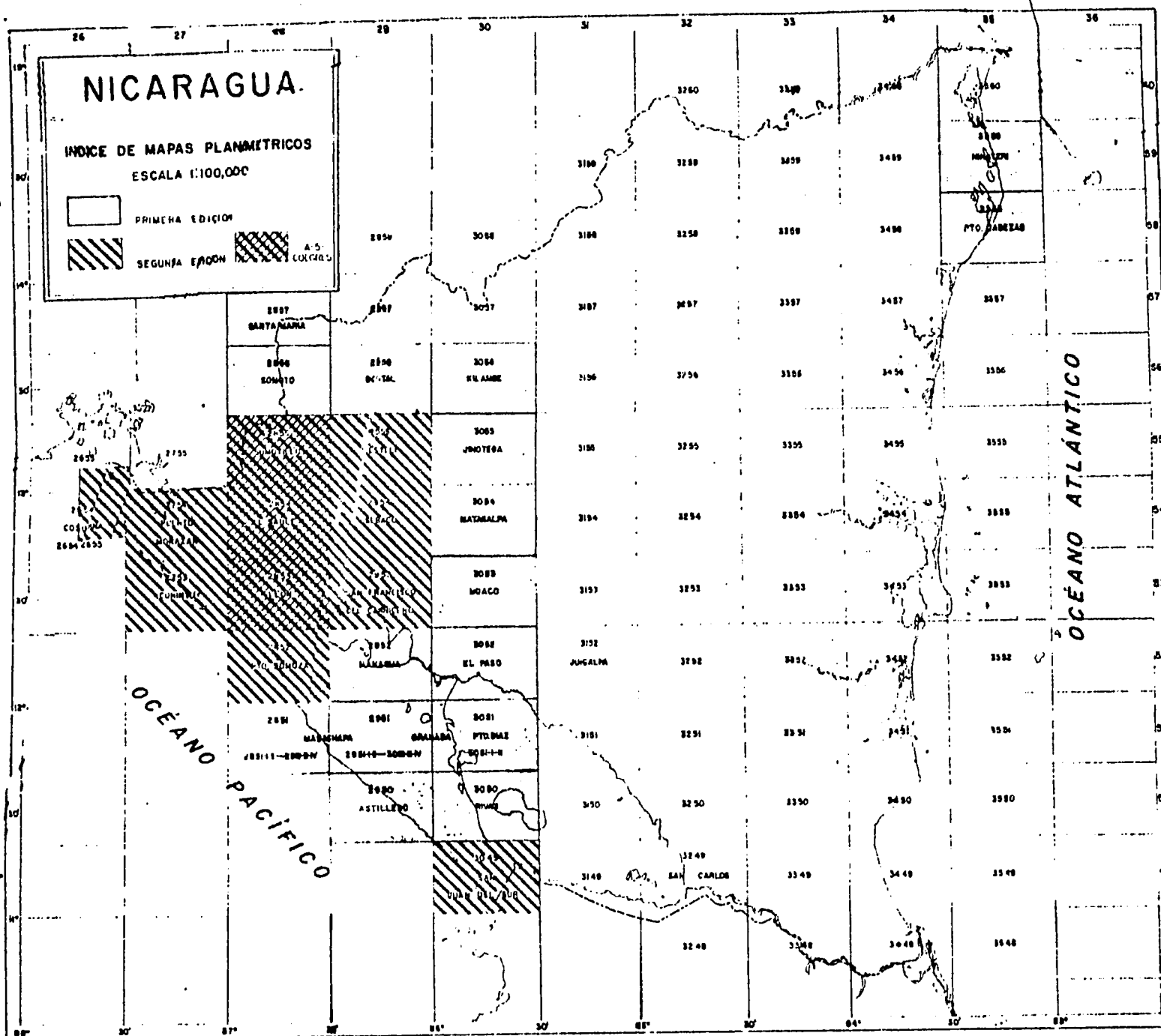
43	Bluefields		1968	22.00
44	Puerto Somoza		1969	22.00
45	Corinto Harbor and Approaches		1967	22.00

* AGOTADO

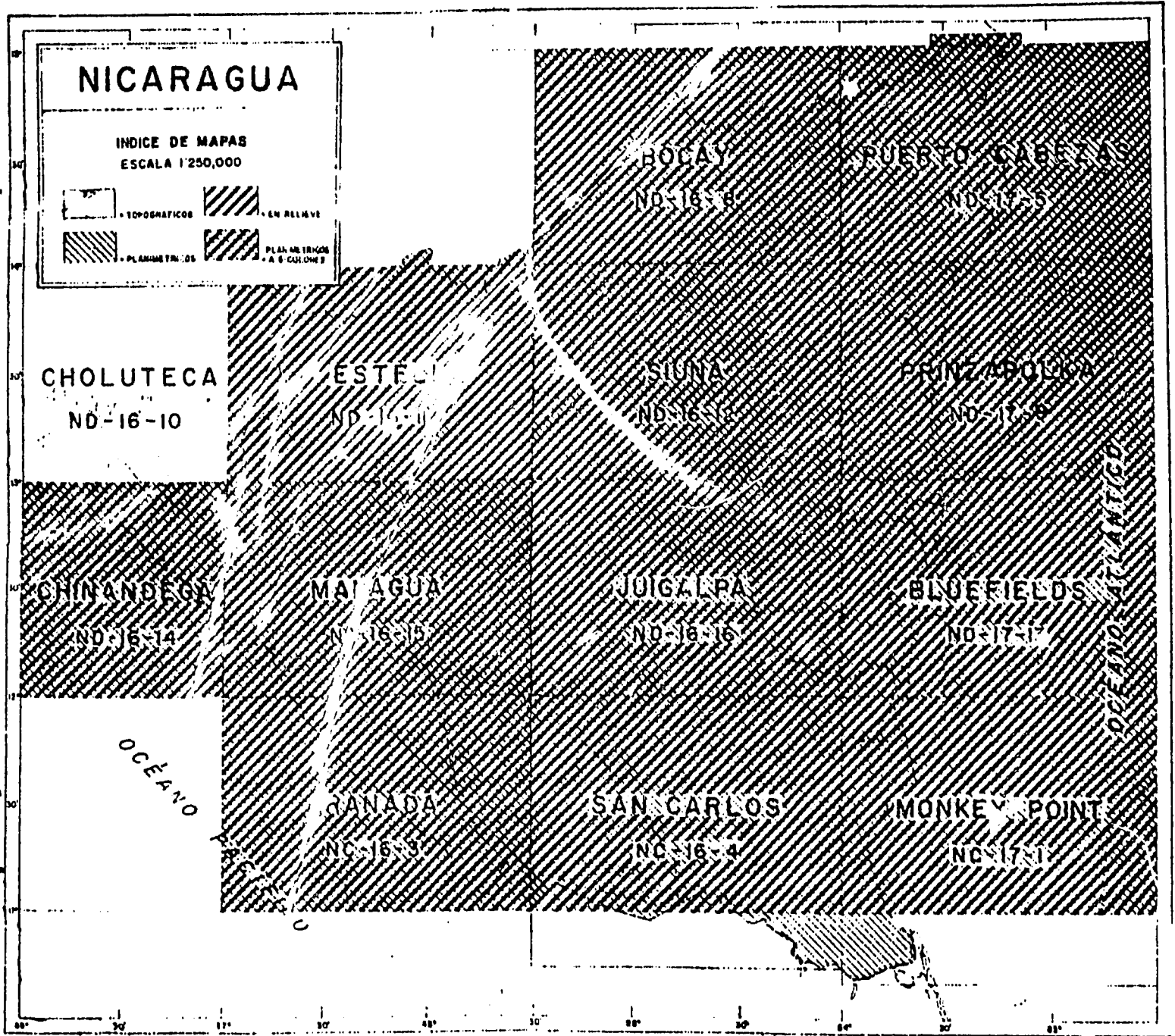


Best Available Document

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Best Available Document



NICARAGUA

INDICE DE FOTOGRAFIAS AEREAS

ESCALA 1:60,000

TOMADOS POR LA U.S.A.F EN 1953-1961

