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**PROYECTO CENTROAMERICANO
DE FERTILIDAD DE SUELOS**

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

**Harvey Newton
Petter Duisberg**

Anexo 23



CATIE
CENTRO AGRONÓMICO TROPICAL DE INVESTIGACIÓN Y ENSEÑANZA

SOIL SCIENCE IN PANAMA
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 13-18,
1978.

For review and completion by the Panamanian soil scientists.

Turrialba, Costa Rica
1978

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SOIL SCIENCE IN PANAMA
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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 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 to March 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 for strengthening the field. The field

* Preliminary document for discussion prepared for the "Reunión Técnica Regional sobre Fertilidad y Análogos de Suelos", in San Salvador, El Salvador, March 13-18, 1978.

** Ph.D's - Soil Scientist Consulting, Soil Analog Subproject, CATIE.

of soil science in Central America can not 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 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.

II SUMMARY AND RECOMMENDATIONS

A. Soil classification

Panama has spent considerable money on soil classification but has never succeeded in creating a nucleus of competent surveyers trained in modern taxonomy within the government.

The actual soil units on the 1:20,000 CATAPAN photomosaics and maps are considered to be rather well delineated. In spite of the fact that original samples and data have been lost and the original classification is confusing and apparently contains errors, one or two good soil men working for a year could probably make it compatible with the survey in Nicaragua and suitable for inclusion in the Soil Analog Project.

If these men were given promising counterparts a nucleus for a national capability might be formed.

B. Soil fertility

After a series of ups and downs the soils laboratory seems on the way up. The laboratory is not being used to capacity and it would appear might be developed to serve the needs of soils classification as well as soil fertility.

Little else was known as this report was written concerning soil fertility in Panama, but the Panamanian technicians should fill in the blanks.

C. Soil conservation

Panama has some of the most severe soil erosion on tropical soil in Latin America. The Director of REMARE is well aware of the problem and articulate about it. However, in the field of soil conservation there are not even nearly enough trained technicians to confront the increasing problems of deforestation and soil erosion and sedimentation which threaten the water system of the Panama Canal.

The OAS Project has made a start toward the preliminary classification of the soils of the Darien. However, the region should be photographed from the air and studied at greater detail, since the opening of new links of the Pan American highway will undoubtedly result in pressure on the land and grave ecological and erosion problems. Because of the difficulty in obtaining counterparts the OAS soils men did not train any Panamanian technicians to carry on. A private company of Panamanian technicians (PRESA) was formed and under contract with the government carried out secondary studies in more detail near the Route of the Inter-American Highway using the new taxonomy. The degree of their skill is unknown.

III SUMMARY OF SOILS INSTITUTIONS IN PANAMA

See Table 1. This is merely a format. The Panamanian soil scientists should obtain the needed information on each of their entities to obtain a comprehensive picture of the soils field.

III. SUMMARY OF SOILS INSTITUTIONS IN PANAMA

TABLE I

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

CONT.

III. SUMMARY OF SOILS INSTITUTIONS IN PANAMA
TABLE I

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				

IV EARLY PERIOD OF SOIL SCIENCE

A. Soil classification

The original soil classifying was done in the 1950's with the assistance of U.S. Soils men like Ing. M. Striker and later E. D. Mathews and the geographer L. Guzman who worked for the predecessor agency of AID and mapped the Llanos of Cocolé and Chiriqui Province and the first preliminary soils map of the country.

From 1964 to 1968 soils was a major component of the Catastral and Natural Resources Project financed by AID. This covered all the major settled areas and excluded Eastern Panama Province including the area now covered by the Payano Dam, Darien Province and much of the eastern Caribbean watersheds. The scales were generally 1:20,000 both as photomosaics and as blue line maps. Soils were mapped using a modification of the New Taxonomy. Land Use and Land Capability were also mapped. Among other things, some 25 Panamanian agronomists were trained as soil surveyors. While the photoproducts, maps and soils information has been quite useful no attempt was ever made to complete the rest of the country. Meanwhile, the trained soils personnel was lost and the original profile samples and color photographs and laboratory analyses apparently lost. The original delineations obviously have many errors in classification partly because the consultant soil surveyors were not sufficiently expert in the new taxonomy or experienced in tropical soils. Panama needs a review and a reclassification of this work and a program to fill the gaps. In addition unfortunately, the soils were not classified as soil series and the data is not directly comparable with other Central American countries.

B. Soil fertility

A soils laboratory was operating prior to 1964 for farm samples within the Ministry of Agriculture. At that time the North Carolina State Project began and its analytical methodology was adopted. The laboratory has undergone changes in directors and in location. In the process it lost considerable of its vigor and expertise. It appears to be improving and in addition to its routine analyses has programmed several greenhouse studies.

C. Soil conservation

Over the years there has been very little emphasis on soil conservation. Until recently there were no specialists working in the field.

In recent years, the Dirección de Recursos Naturales has grown and includes Soil Conservation and Management as one of its units. The director, who is a forester, is especially interested in controlling erosion. However, with only three men for the entire field of soils and enormous problems they are limited as to what they can do.

V PRESENT SOILS ENTITIES AND LABORATORIES

A. Instituto de Investigación Agropecuaria de Panamá - IDIAP

1. General

The Institute is autonomous. It was founded in 1975, when the "Departamento de Investigaciones" of the "Ministerio de Desarrollo Agropecuario" was separated and made an independent agency.

The Institute has a Department of Agricultural Sciences, which contains a soils group. This soils group is in charge of fertilizer field trials for soil fertility studies and of soil analyses, both as a service

to the farmer and for research needs.

Field trials are mostly with rice, corn, sorghum, potatoes, onions, tomatoes, sugar cane, beans and soya beans.

Principal areas covered are Veraguas, Chiriqui, Herrera, Los Santos, Coclé and Panama. The Director General is Ing. Agr. Carmen D. Choa.

2. IDIAP - Soils Laboratory

The Laboratory does mostly physical and chemical analyses of soil samples. However, plant tissue samples, fertilizer, and water are also analyzed.

On each soil sample 13 routine determination are made, which include pH, P, Ca, Mg, O.M., Al, Mn, Fe, Cu, Zn. On research samples from field experiments also absorption curves are determined, and when possible greenhouse tests are made. If necessary salinity, carbonates, and limestone can be determined.

The Laboratory analyses about 5000 soil samples per year. However, its capacity is about 20,000. Personnel consists of 2 professionals (the director and the laboratory chief), 4 sub-professionals who do analytical work, one secretary and one dishwasher.

Analytical results are filed by dates and political subdivisions (Province, District, (corregimiento) and name of the farm).

Major pieces of equipment used are an atomic absorption spectrophotometer and flame photometer. The rest is standard laboratory equipment.

A greenhouse of 45 sq. m size is available for pot tests. Studies for which the greenhouse should be used are:

1. Incubation of soils with a high Al saturation.
2. Critical levels of elements. The method used is the one using an optimal fertilization, and including the element under study at different levels.
3. Incubation of P to determine capacity of P-fixation in soils.
4. Study of different rates of S applied to soils with a high P-fixation capacity.

The annual budget of the laboratory is \$27,000 which are entirely supplied by the Government of Panama. The Laboratory was recently moved from Panama City to IDIAP Headquarters in Santiago. In the process, the typical profiles from the soils survey of the Catastral project were apparently lost. This is particularly serious since these samples were carefully obtained located and analyzed. However, many soils should be rechecked because of the methods used by the contractors in applying the new taxonomy and because of their lack of experience in classifying tropical soils.

Panama has another soils laboratory, at the University of Panama. It is strictly used as a teaching laboratory. At the Agricultural Experimental Station at Gualaca, IDIAP has a laboratory for pasture and feed analysis, which could be modified to do soils analysis also.

Fertilizer consumption in Panama is increasing. Major brands sold are FERTICA, BASF, APOCAL.

D. Dirección de Recursos Naturales Renovables (RENARE) MIDA

The Dirección de Recursos Naturales Renovables is not only the official agency in Natural Resources but also includes soil classification and soil conservation. The director is Ing. Forestal Irving Díaz.

RENARE has four principal divisions: Forestry, Agronomy, Water, and Agrometeorology. Its organogram covers most of the essential fields of Natural Resources. In Agronomy for instance, this includes soil classification, soil conservation and management, and land use. However, the total budget is only about \$650,000 (with \$200,000 more for investment in projects etc.). The total staff includes about 22 Forestry or Agronomy Engineers or the equivalent and an equal number of "peritos" or sub-professionals. Considering the number of projects and problems this seems like very thin coverage.

The director has an excellent grasp on the overall situation and a philosophy which permits him to see problems in their total resource and human welfare terms. However, in soils classification for instance, the well trained men from the past, including all those trained in the 1964 to 1970 program of Catastro y Recursos Naturales have gone on to other work. Thus there are only three professionals in soils in RENARE and they could benefit from training in the new taxonomy and in other aspects of soils.

There is a possibility of support for a large program from the World Food Program. This would be a program to revitalize the areas of the worst erosion and the worst poverty by giving employment and food to do conservation practices. It also would try to stabilize family income, through a combination of agricultural and forestry including introduction of tree crops like coffee, and fruits on lands with great slopes. Soil erosion surveys would be important in anticipation of this.

Problems of erosion are becoming very serious and in parts of some provinces like Veraguas it is almost too late.

A highly experienced Hydrographer working on the watershed of the Chagres River for the Panama Canal Company fears even that watershed to be in great danger from sedimentation as a result of recent deforestation and urbanization. This, in spite of a great deal of basic information from the densest network of Hydrological and Meteorological stations in the country.

REHARE is establishing a library. It also has copies of the original documents produced by the Catastro and the maps of agricultural zonation for Panama by IICA.

REHARE has a coordinator of projects in all provinces except Darien and Bocas del Toro. In Chiriqui it has an especially strong program and is reforesting 7 areas with Pinus Caribe. There are three national parks Porto Bello, Campana and Frontera and they are beginning a program to try to protect them. Planning is in progress for a frontier park in the Darien at the Colombian border and the area has been legally designated.

With help from INME and advisory services from IICA, REHARE proposes to make water balances by watersheds.

C. Department of Soils - University of Panama

The Department of Soils of the University of Panama consists of Dr. Reinmar Tejera, Dr. Rodolfo Aleman and Ing. Agr. Richard Au Chu and is part of the School of Agronomy.

About 20 agronomists graduate each year, of whom 5 or 6 specialize in soils. A thesis is required for graduation and at times involves fertility trials mostly on the university farm. The soils department is primarily engaged in research related to specific crops.

D. Proyecto Darien

This project was initiated by the Government of Panama with OAS assistance in late 1974 in order to plan the development of the Darien area. It was recognized that the area would open to planned or spontaneous settlement once the final link of the Inter American Highway between the Darien and Panama City is connected.

A soils study was made by an OAS consultant A. Castillo and a 1:250,000 map to the level of suborders of the taxonomy was made. This was based on only slightly more than 50 samples, most of which were near rivers. Nevertheless, it represents important new knowledge at less than a reconnaissance level of detail. A land capability map was also prepared at a level of 1:250,000. These maps were in part based on small scale radar imagery since the Darien has never been completely covered by aerial photography. A determination of soil and ecological erosion hazard was also made by P. Duisberg. It was very great because of the rough topography, high rainfall and unusual conditions peculiar to the Darien.

E. Comisión de Reforma Agraria

During the years 1964-68 this office was closely connected to the program "Catastro Rural de Tierras y Aguas" under which the major agricultural areas of the country were mapped. The project was financed by a \$ million dollar AID loan. All soils maps and photomosaics produced in this program are now held and distributed through the Comisión de Reforma Agraria. The analytical data logically should be with the Soils Laboratory of IDIAP but it may have been lost because of frequent changes in personnel and a change in location.

In spite of the fact, that a great deal of valuable material remains from the project all the soils specialists trained in the project have left the field.

At present the Agrarian Reform Institute has no unit of soils specialists. However, it has done some practically oriented soils evaluation and land capability evaluation in connection with the establishment of asentamientos.

F. Dirección Nacional de Catastro

Property maps are maintained by the Dirección Nacional de Catastro, Ministerio de Hacienda y Tesoro, in Panama City. These were originally produced for the Catastro Rural between 1964 and 1968. While the Dirección Nacional de Catastro does not do any soils work or have any soils personnel, its photomosaics delineating farms at large scales can be very helpful to soil scientists working at the farm or local level.

VI RELATION OF SOILS TO OTHER NATURAL RESOURCES AGENCIES

A. Instituto Geográfico Nacional - Tommy Guardia

The IGN has covered the major settled parts of the country at 1:50,000 topographic maps. It also has produced 1:250,000 scale maps covering the country even though some areas are based on use of small scale radar imagery. Major areas still to be covered include much of Eastern Panama and Darien provinces and part of the Atlantic watersheds. Most of these areas are covered with humid tropical forest. (Appendix)

The Darien has only partially been covered with aerial photography. Most of the other parts of the country have been covered more than once and at various scales. The Darien was completely covered about 1970 with radar imagery at a scale of about 1:250,000. The IGN also is the custodian of the satellite imagery from NASA.

B. Department of Hydrometeorology of the Division of Planning of IRNE (Instituto de Recursos Hidráulicos y Electrificación)

This Department has grown greatly during the last decade and has steadily been increasing its network of meteorological and hydrological stations. The chief of the Department is Ing. Claudia Candanedo.

1. Climatic data

A map showing the distribution of meteorological stations in Panama is attached.

It shows a fair distribution of stations from the area of the city of Panama to the Costa Rican border, with the exception of the jungle area on the Caribbean side, which are sparsely covered. There are also a few stations and rain gaging stations in the Darien Peninsula and these

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have primarily been installed in recent years during the Hydrometeorological project of the WHO.

A compilation of "Precipitación Mensual por Año en la República de Panama 1890-1972" was published by the Departamento de Hidrometeorología.

No publication on Panama has been prepared by the Utah State University group as yet. However, some data for Panama are included in their publication on the Central American Isthmus.

2. Climatic data from other sources

A 1:500,000 Life Zone map for Panama was done by Dr. J. Tosi, published in 1971 by FAO. This is a revision of earlier maps done by Holdridge and Budowski.

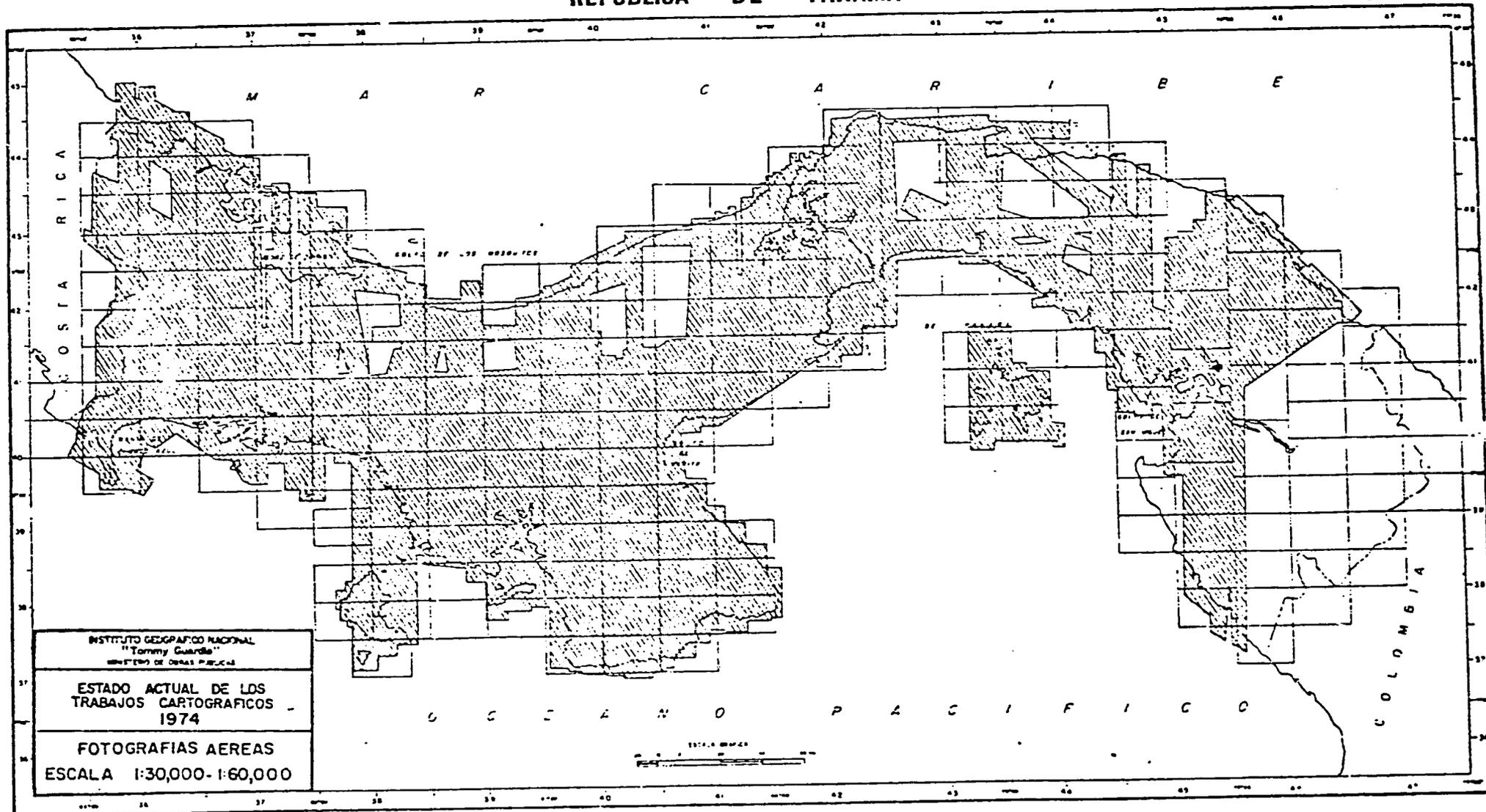
General climatic data are published every year by the Dirección de Estadística y Censo, "Situación Física-Meteorológica".

VII REFERENCES AND MAPS

- a. Bibliografías Agrícolas de América Central: Panamá, IICA-CIDIA. Turrialba 1974. In two parts, the second being a supplement.
- b. Índice de mapas de América Latina y el Caribe existentes en el IICA-CIDIA, IICA-CIDIA, Turrialba, 1975. List of maps of Panama with subject, scale and date.

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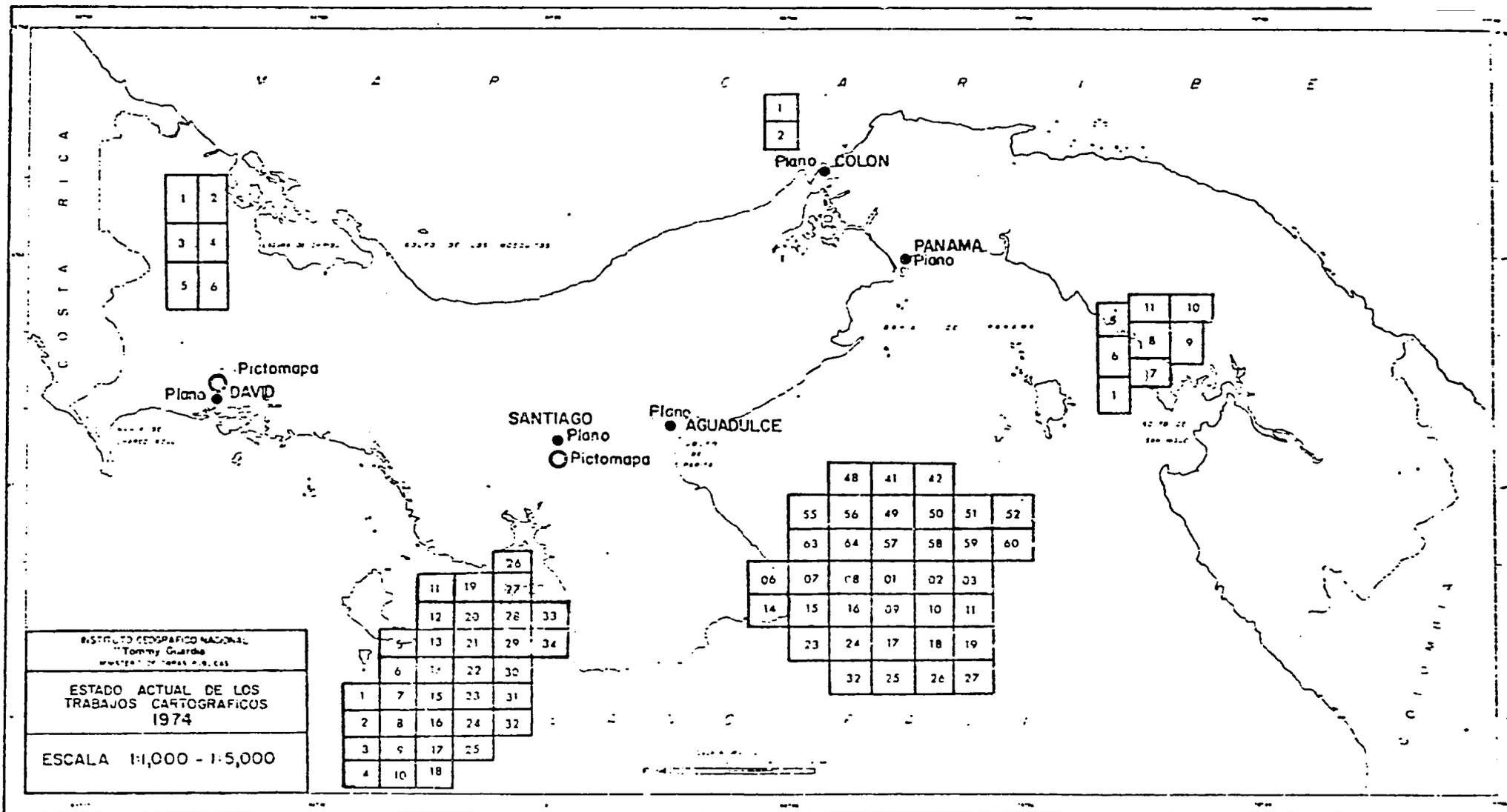
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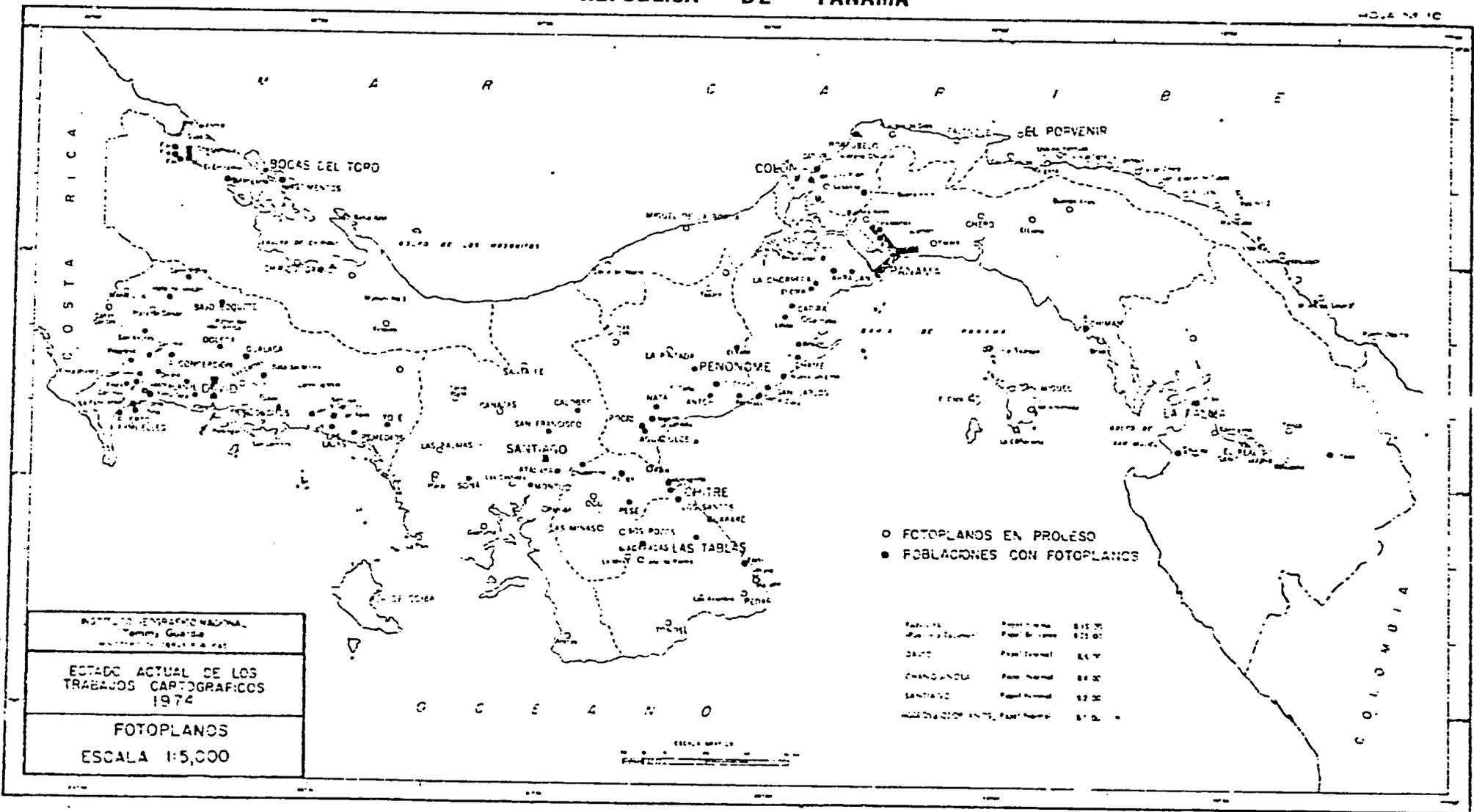
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ESTADO ACTUAL DE LOS
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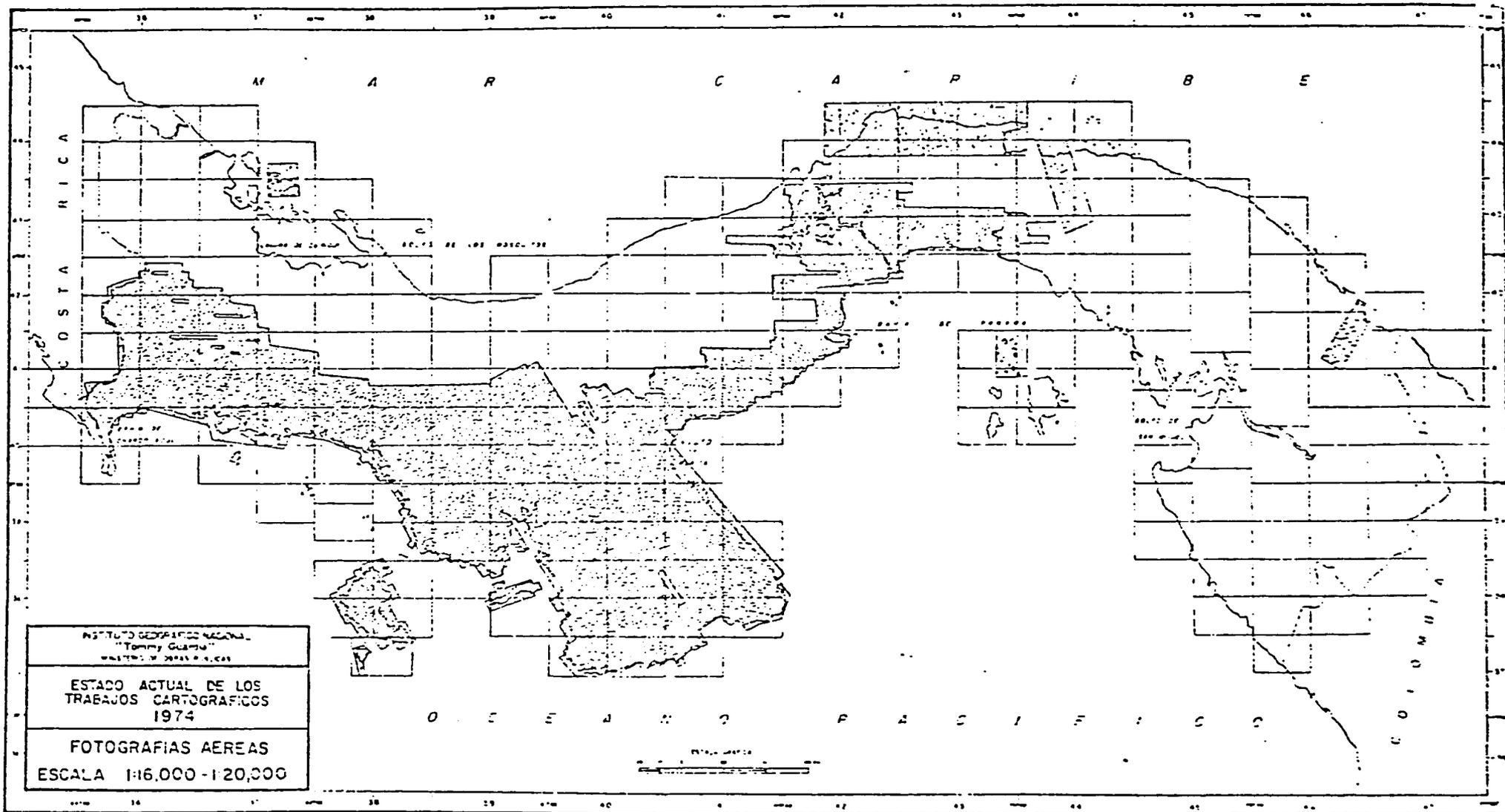
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FOTOGRAFIAS AEREAS
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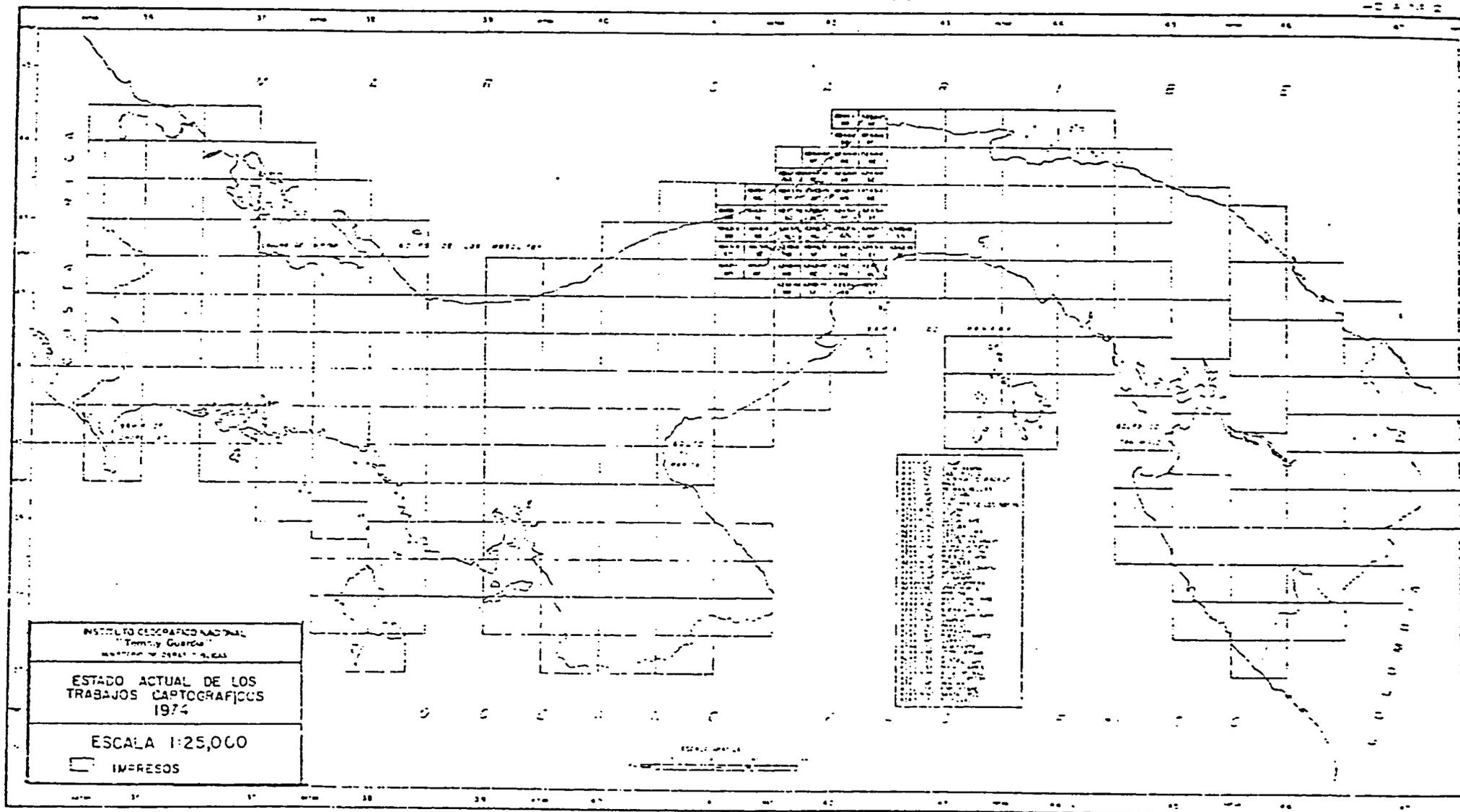
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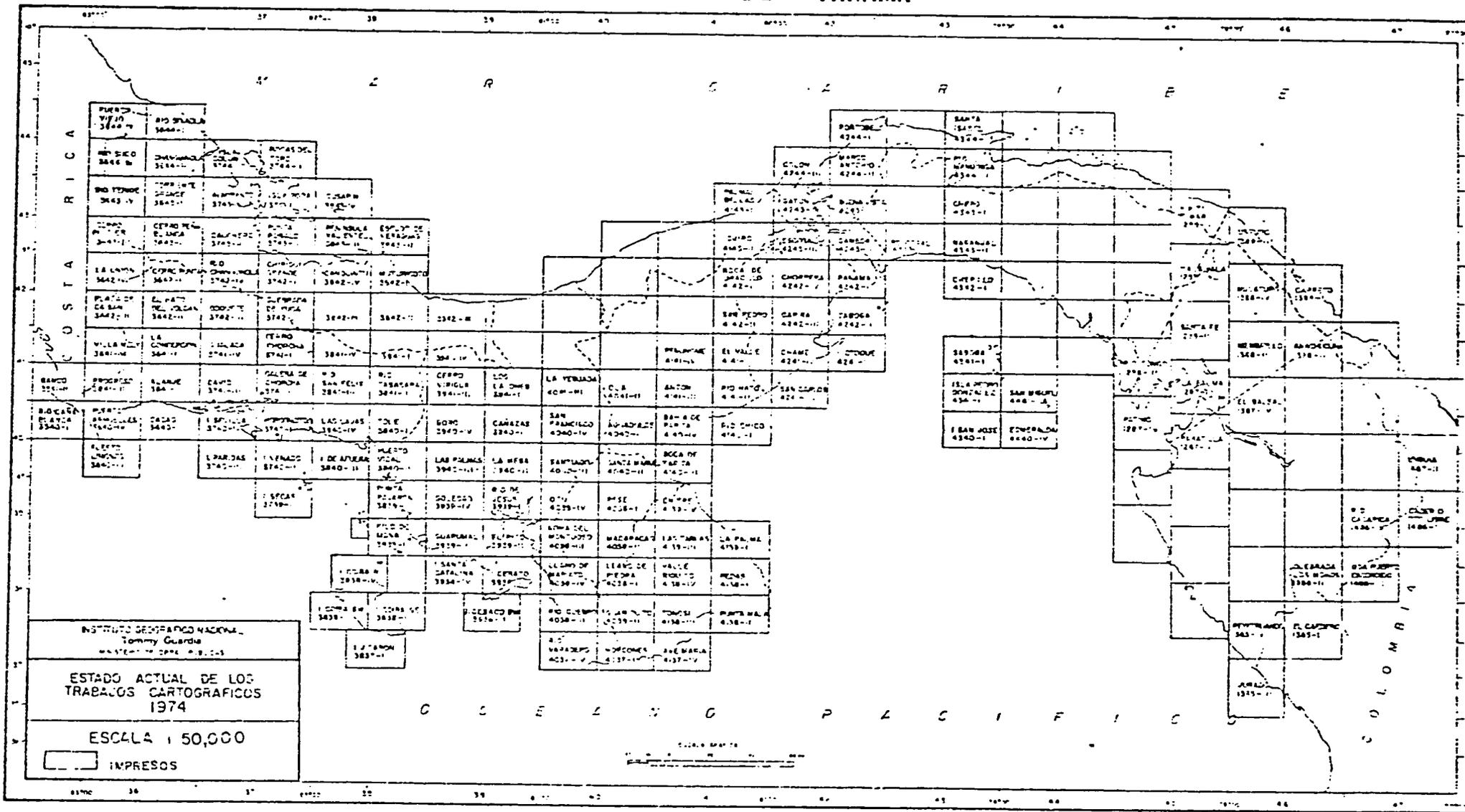


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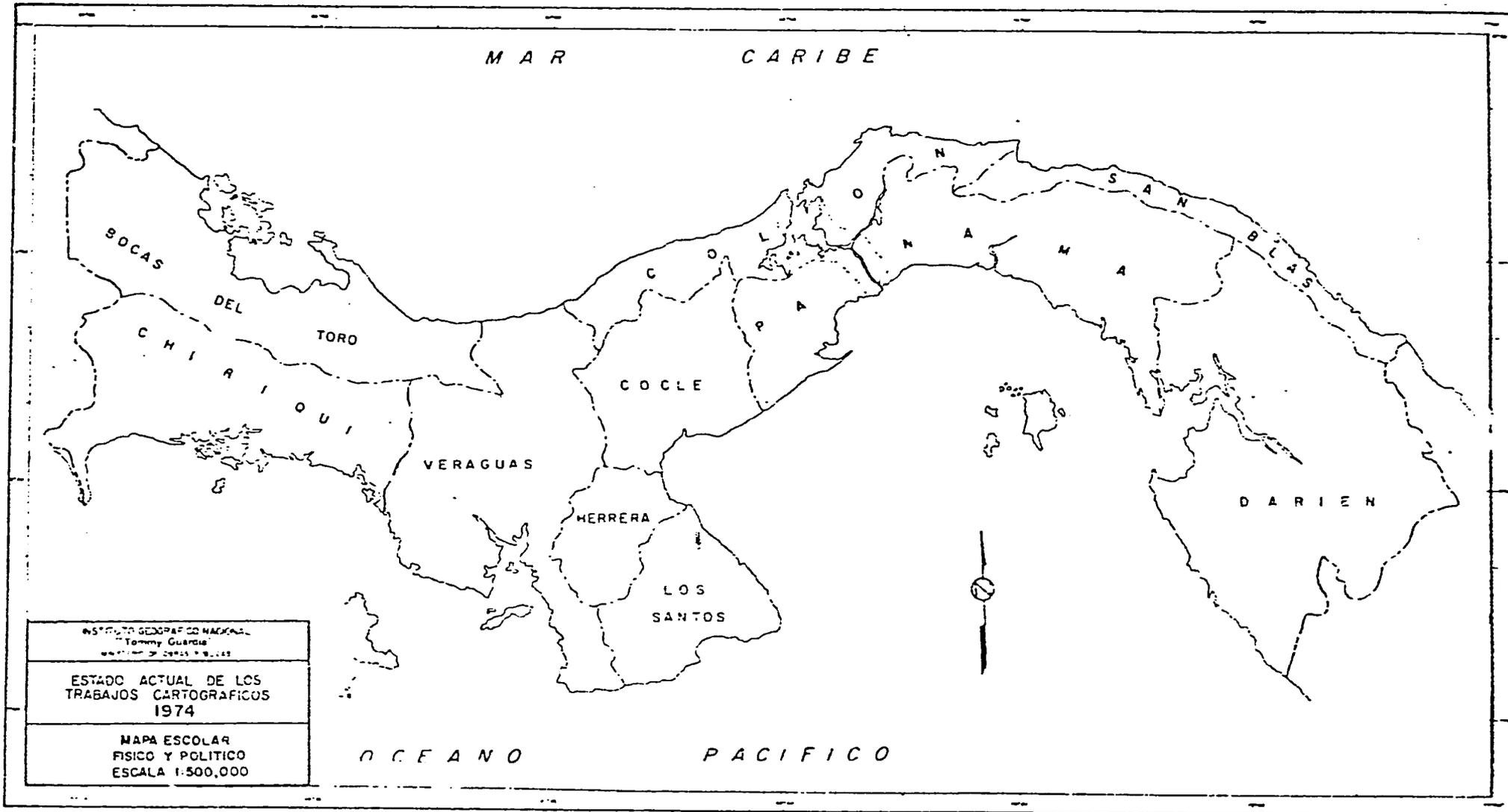
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