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CARTOGRAPHIC ACTIVITIES IN ETHIOPIA

**CARTOGRAPHIC ACTIVITIES IN ETHIOPIA/
(SUBMITTED BY THE GOVERNMENT OF ETHIOPIA)**

SUMMARY

The Ethiopian Mapping Authority is an autonomous government organization responsible for surveying, mapping, remote sensing and geographic studies. It provides cartographic services to government and private organizations. To provide basic control data, the national geodetic network consisting of first, second and third order is uniformly extended over an area of 400,000 sq. km. to the regions of relatively high potential in natural resources. Extension and intensification of the national control network is being accomplished on a continuing basis at an average of 30,000 km² per year using classical approaches and satellite surveys.

Since 1957 Ethiopia has been covered by 1:50,000/1:40,000 scale wide angle aerial photographs for the preparation of 1:50,000 and 1:250,000 scale topographic maps. Large scale photographs ranging from scales 1:8000 to 1:20,000 are also flown for various project implementation.

Ethiopia is almost entirely covered at 1:250,000 scale. These maps were published from 1965-1972. since 1971 EMA has been involved in the production of 1:50,000 scale national topographic map series which is found to be quite adequate for multi-purpose use. To date about 32% of the country and mainly those of the central and southern areas have been covered.

A large number small scale maps ranging from 1:500,000 - 1:2,000,000 scale dealing with various topics are also available. Among these are 1:1,000,000 and 1:2,000,000 topographic, land use, tourist, road network and other similar maps.

In addition to the topographic and special purpose mapping, thematic maps covering a wide range of topics are prepared based on geographic research for projects such as national and regional atlases. The multi-colour National Atlas is now completed and is in circulation. Work on a geographic gazetteer to facilitate the location and identification of feature names is in progress.

To increase the capacity and improve the production of thematic maps and related materials a remote sensing unit has been established in the Authority with the long range aim of expanding the services to be given to development oriented ministries and agencies. To start with, the Authority has acquired some basic equipment, Landsat and SPOT imageries.

1/ By the Ethiopian Mapping Authority.

The territory of Ethiopia covers over 1.2 million square kilometres of land mass with terrain and areas of varying altitude and climatic condition.

Because of these situations to cover the whole country with one basic scale or applying one standard map production method may not be feasible.

Ortho-photo map production is in progress at EMA. The advantage of such maps over line maps is the rapid speed of production.

At present EMA has over 400 employees about 70% of whom are technical staff. It has modern surveying, photogrammetric, cartographic, map reproduction equipment, ortho-photo system and medium capacity electronic computers. However, the demand for mapping services and the available equipment and trained manpower do not correspond.

To overcome the problem of trained manpower in the field of surveying and mapping in the country EMA holds a six-months training programme. This is further supplemented with higher level training abroad.

1. INTRODUCTION

Great emphasis is given to surveying and mapping activities in Ethiopia in order to accelerate the overall socio economic development efforts. The country is potentially rich in natural resources but development of these resources could not be carried out fully partly due to unavailability of geo-information data which can be used as a basis for planning and development. The existing surveying and mapping data base is far from adequate for planning in the field of rural development.

Surveying and Mapping activities undertaken by the Ethiopian Mapping Authority (EMA) includes the carrying out of different kinds of mapping suitable for agriculture, forestry, water and mineral resources, road construction and other fields of development.

The Ethiopian Mapping Authority is an autonomous government organization responsible for surveying, mapping, remote sensing and geographic studies. It provides cartographic services to government and private organizations.

Its surveying and mapping activities mainly involve the execution of geodetic survey, all scales topographic and planimetric maps, orthophoto maps, thematic maps and atlases, geographic and other related research work for rural as well as urban development purposes. The Remote Sensing Unit within the Authority is under the process of establishment and when it becomes capable of carrying out some activities it is hoped that it will contribute much towards the production of thematic maps and advancement of other fields of development.

In the past the Authority has played a modest but useful role by providing various cartographic and aerial photographic products to different private, government and non-governmental organizations. Even though it has still a long way to go to become fully capable of handling all sorts of mapping activities, since the past fifteen years its capacity of producing maps of varying scales and type has modestly been improved.

Presently EMA executes its task by using modern geodetic survey, photogrammetric, Cartographic, map reproduction equipment and medium capacity electronic computers. It conducts pre-service and in-service training both at EMA and abroad for higher and specialized training.

Following are the status of activities carried out by EMA:

2. GEODETIC SURVEY

To provide basic control data, the national geodetic network consisting of first, second and third order is uniformly extended over an area of 400,000sq km. to the regions of relatively high potential in natural resources (ANNEX 1).

Extension and intensification of the national control network is being accomplished on a continuing basis at an average of 30,000 km per year using classical approaches and satellite surveys. However, some isolated areas are mapped using local control depending on the application of the end products. Geodetic control nets are also extended as required to regions where large scale mapping and engineering survey data are required. The controls for these types of work are of the second and third order necessary for isolated surveys for irrigations, hydroelectric dam construction, town planning and other related development schemes.

3. AERIAL PHOTOGRAPHY

Since 1957 Ethiopia has been covered by 1:50,000/1:40,000 scale wide angle aerial photographs for the preparation of 1:50,000 and 1:250,000 scale topographic maps. Other large scale photographs ranging from 1:8,000-1:20,000 covering major towns, agricultural, hydroelectric dam sites, railway and highway construction projects are also available. From 1980-91 photographs covering an area of 300,000 km has been flown at 1:50,000/1:40,000 scale augmenting the existing relatively recent coverage of the country (ANNEX 2). The small and large scale photographs are used for topographic mapping of various scales and for different photo interpretation works.

4. TOPOGRAPHIC MAPPING

Ethiopia is almost entirely covered at 1:250,000 scale (ANNEX 3). These maps were published from 1965-1972. Due to development activities being carried out in the country there is wide demand for this product although most of the maps are fairly old and need revision. However, because of other priorities, it has as yet not been possible to update these maps. Since 1971 EMA has been involved in the production of 1:50,000 scale national topographic map series which is found to be quite adequate for multi-purpose use. To cover the whole country at this scale over 1700 map sheets of fifteen minutes by fifteen minutes quadrangle are required. To date about 32% of the country and mainly those of the central and southern areas have been covered (ANNEX 4). The choice of priority areas for mapping depends on economic potentials primarily based on the need for agriculture and mineral resources development.

A large number of small scale maps ranging from 1:500,000-1:2,000,000 scale dealing with various topics are also available. Among these are 1:1,000,000 and 1:2,000,000 topographic, land use, tourist, road network and other similar maps. There is also an ongoing mapping at scales ranging from 1:2,000 to 1:10,000 for town planning, irrigation and hydroelectric dam sites and other engineering projects.

5. THEMATIC MAPPING

In addition to the topographic and special purpose mapping, thematic maps covering a wide range of topics are prepared based on geographic research for projects such as national and regional atlases. The multi-colour national atlas is now completed and is in circulation. Work on a geographic gazetteer to facilitate the location and identification of feature names is in advanced stage of production.

To increase the capacity and improve the production of thematic maps and related materials a remote sensing unit has been established in the Authority with the long range aim of expanding the services to be given to development oriented ministries and agencies. To start with, the Authority has acquired some basic equipment, Landsat and SPOT imageries.

EMA has produced thematic maps covering a wide range of topics. Recently it published the first National Atlas in colour with very high professional standard and covering wide range of topics such as the economical, political and historical facts of the country. It consists of 76 maps and graphs with the relevant explanatory text and gazetteer. To date several thousand copies of the atlas have been distributed and the Authority is receiving encouraging comments.

6. MANPOWER AND EQUIPMENT

At present EMA has over 400 employees about 70% of whom are technical staff. It has modern surveying, photogrammetric, cartographic, map reproduction equipment, ortho-photo system and medium capacity electronic computers. However, the demand for mapping services and the available equipment and trained manpower do not correspond. Among the major equipment that the Authority is lacking at present are GPS systems, aerial cameras and aircraft. To date these activities are supplemented by acquiring services on rental bases. Presently available equipment include:

Surveying:

- Theodolites and levels
- Electronic distance measuring equipment for long and short range distances
- Radio communication outfit for field parties.

Photogrammetry:

- Analogue and analytical plotters such as A10, A8, B8s, PG2, C8, BC2, and DSR15
- Orthophoto equipment (OR1)

Cartography:

- Scribing and engraving tools
- Coordinatograph and optical enlarger
- Computerized type setting machine

Map reproduction:

- Contact printers and vacuum frames for aerial photographs and manuscripts
- Process cameras
- Offset presses (single and double colour)

Remote Sensing:

- ERDAS
- Scanner
- PC with digitizer
- Procom 2
- Optical projector
- Diazo exposure with developer
- Spectro Radio Meter
- Interpretoscope
- Zoom Transferelescope

Computers:

- Prime

- Other supporting computers

7. PRESENT CAPABILITY

- Currently EMA renders services in the following fields

Survey:

- Geodetic Surveys

- Topographic Surveys

- Engineering Surveys

- Cadastral surveys

- Computations

Mapping:

- Aerial photography

- Processing of aerial photographs

- Aerial triangulation and adjustment

- Map compilation by photogrammetric methods

- Map printing by colour presses

- Orthophoto mapping

Atlas preparation and Geographic names study:

- Preparation of thematic maps

- Preparation of regional and national Atlases

- Preparation of geographical publications

Research and development:

- Carrying out research in geography and map preparation techniques

Remote sensing:

- Photo interpretation using aerial photos and/or satellite imageries

- Data analysis using aerial photo or satellite imageries by ERDAS and other systems for various application.

- Computers: handling large data sets, automatic plotting, etc.
- Survey computation: staff reduction, more accurate data, etc.
- Aerial triangulation adjustment and computation
- Digital Mapping
- Other technical and financial data processing

8. FUTURE ACTIVITIES

8.1 Technical Activities

The territory of Ethiopia covers over 1.2 million square kilometres for land mass. As mentioned above under paragraph 4, ninety-seven map sheets of the 1:250,000 scale standard series and over 1700 maps of the 1:50,000 series are required for full national coverage. There is total coverage with the former and about 32% with the latter.

Ethiopia is a land of varying terrain features having areas as high as 4500 meter above sea level and as low as 128 meters below sea level. Due to this varying range of altitude the climatic condition is also different from one area to the other. To study the economic potential of the country data based on accurate topographic maps are essential.

Because of these situations to cover the whole country with one basic scale or applying one standard map production method may not be feasible. An alternate scale or method has to be applied. It is found that the application of satellite imagery is the fastest and most economical way of producing medium and small scale maps. This method have been tested in some rugged terrain as well as in flat and inaccessible areas and the result is found to be encouraging.

So far, proportionally, very limited part of the country has been mapped at the basic scale of 1:50,000. The demand for large and medium scale maps is also beyond the production capability of the Authority. In order to cope with these problems the fastest and modern methods of production have to be employed. For this purpose two analytical plotters are installed and four of the existing analogue plotters are being converted to digital systems. It is believed that digital mapping could be carried out efficiently with the help of these equipment. The available computerized remote sensing equipment and computer systems and others are also to be used for digital image processing and analyses. The Authority is now considering the possibility for establishing national Geographic Information System (GIS) which presupposes the fulfilment of trained manpower requirement and acquisition of equipment.

To initiate the essentials map revision works, cyclic aerial photography and/or satellite imaging are required. At the moment EMA itself does not own aircraft capable of aerial photography, it acquires such service either locally or from abroad depending on the photo scales. To remedy this situation, EMA is planning to acquire its own aircraft in the long term. Satellite imageries could be acquired from established sources using standard procedures.

Ortho-photo map production is in progress at EMA. The advantages of such maps over line maps is the rapid speed of production. In addition these maps are more desirable than line maps for irrigation, forestry and town planning purposes.

Since there is only about 32% national coverage with standard series 1:50,000 maps there is a shortage of supply. To meet adequately the growing demand for maps, more accelerated production of the 1:50,000 maps or acceptable substitutes are required. The present rate of production is about 40 maps annually and mapping is carried out continuously.

A national remote sensing centre is established in EMA. At the beginning, activities focused on the acquisition of basic equipment and training of personnel both locally and abroad. Initial production stages involved only pilot projects. At present the centre is well strengthened with trained manpower and has tremendously developed its production capability. It is now entering the stage of large scale production involving the interpretation and classification of aerospace data using both analogue and digital processing techniques and produces resource maps at the desired scales.

It functions as user facilities centre providing service in data processing, data interpretation, consultancy and training. Depending on the interest of users, various remote sensing application projects are executed. These include landuse and landcover studies, specie identification, geological studies, crop yield forecast, forest inventory, map revision, water pollution studies, river valleys development studies and water and soil conservation.

8.2 Training of Manpower

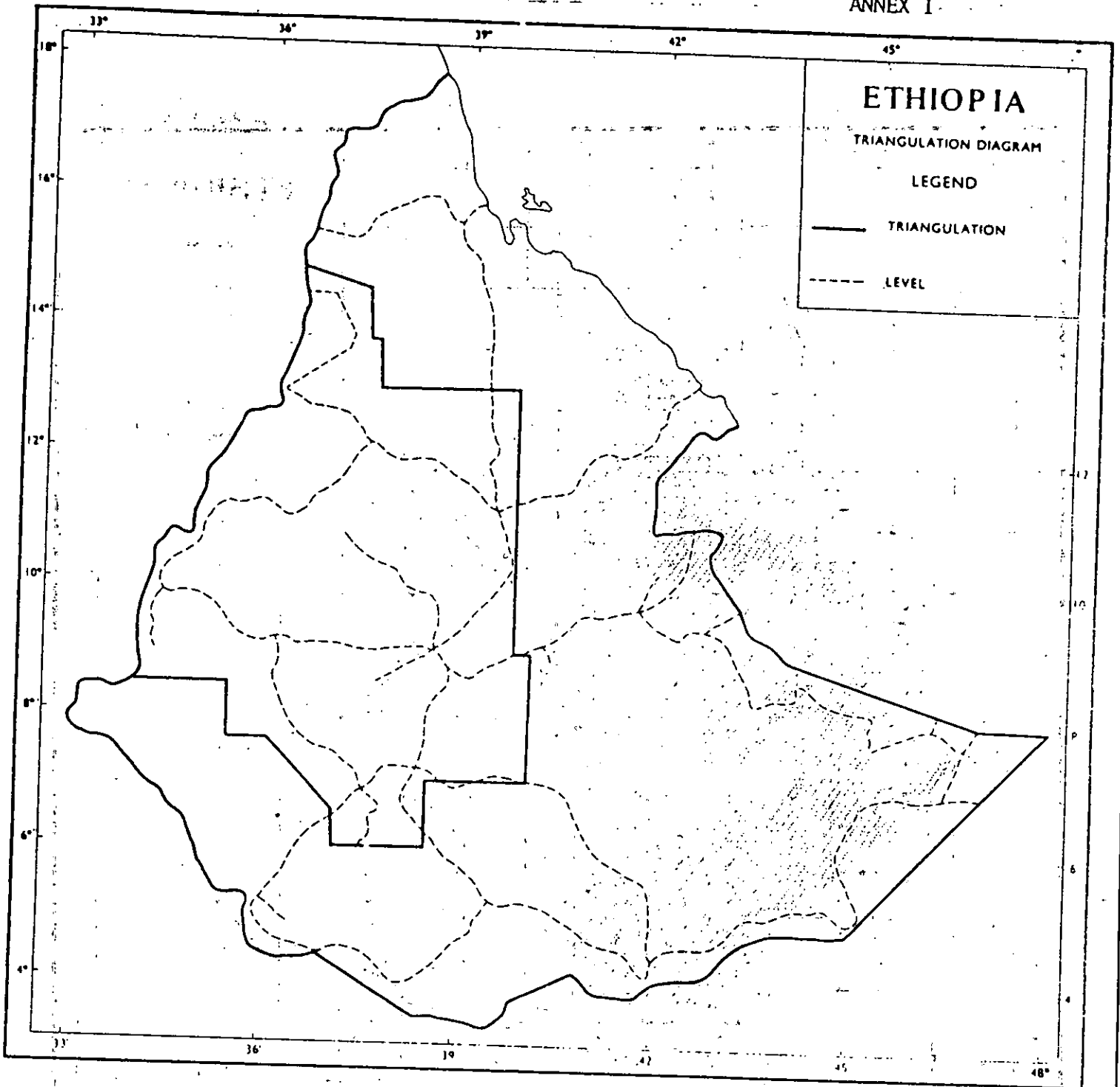
To overcome the problem of trained manpower in the field of surveying and mapping in the country EMA recruits for lower level work those students who completed technical schools or comprehensive high schools specializing in drafting and surveying or from other secondary schools with backgrounds in maths, english and geography. These employees are given a six month intensive training both in theory and practice in the office. For the job requiring higher qualification EMA recruits either geography or science university graduates who are then given on-the-job training in the fields of surveying, photogrammetry, cartography and later on are sent abroad for higher qualification and specialization.

Training is carried out to satisfy the demand of EMA primarily. Besides a few people are also trained at the Authority for other Organizations at the technician level. Mainly the emphasis is in the pre-service, in-service and advanced levels. The first and second are carried out by EMA while the third is done abroad.

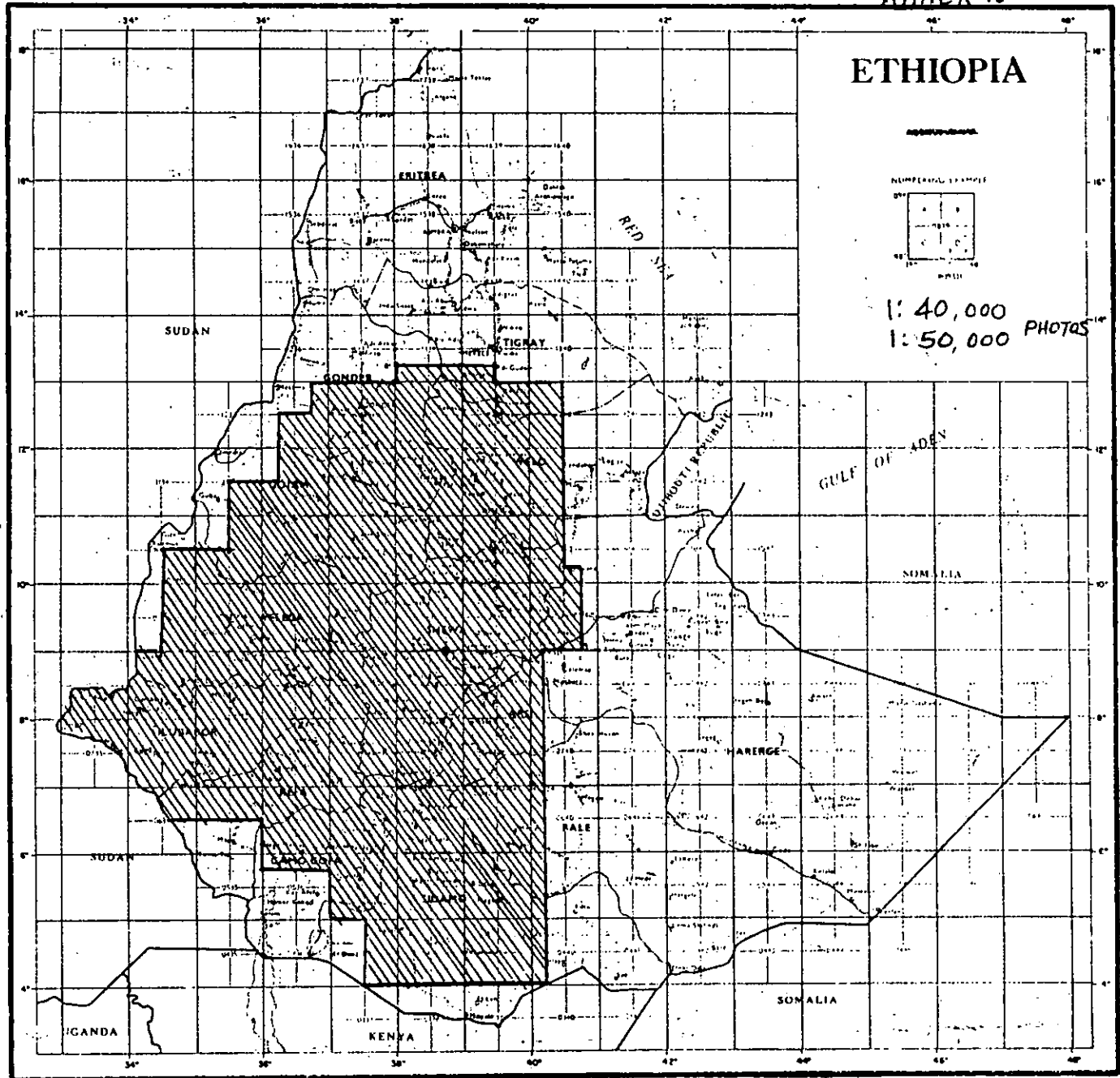
Areas of priority at present are remote sensing and computer applications. Besides sending employees abroad, short term engagement of consulting instructors is envisaged for the organization of workshops and training courses.

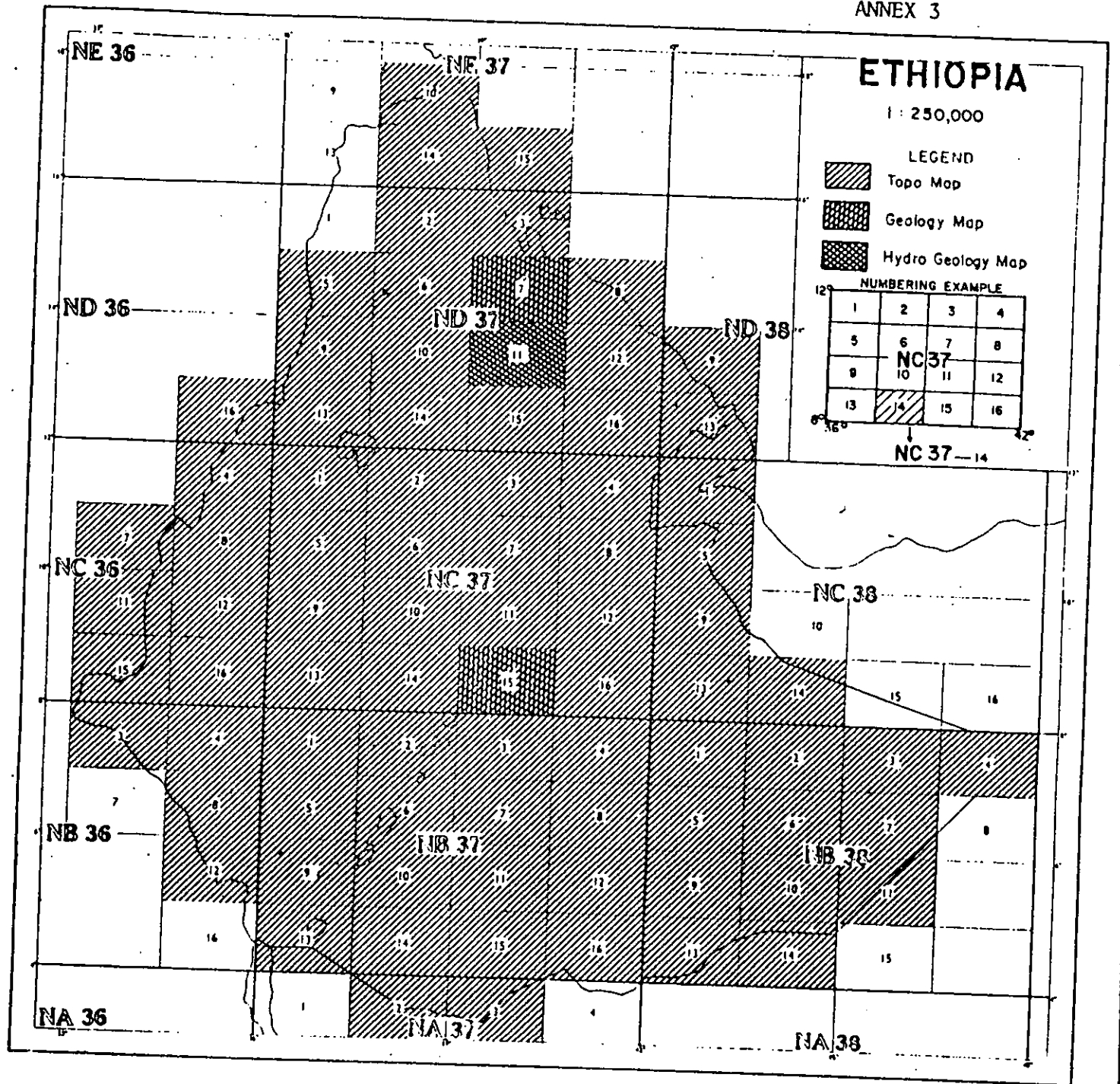
Finally, to cope with the growing demand for service and maintenance of instruments by the Authority, there is plan to train people in preventive maintenance and establish a small workshop at the initial stage.

ANNEX I






ANNEX 2





ETHIOPIA

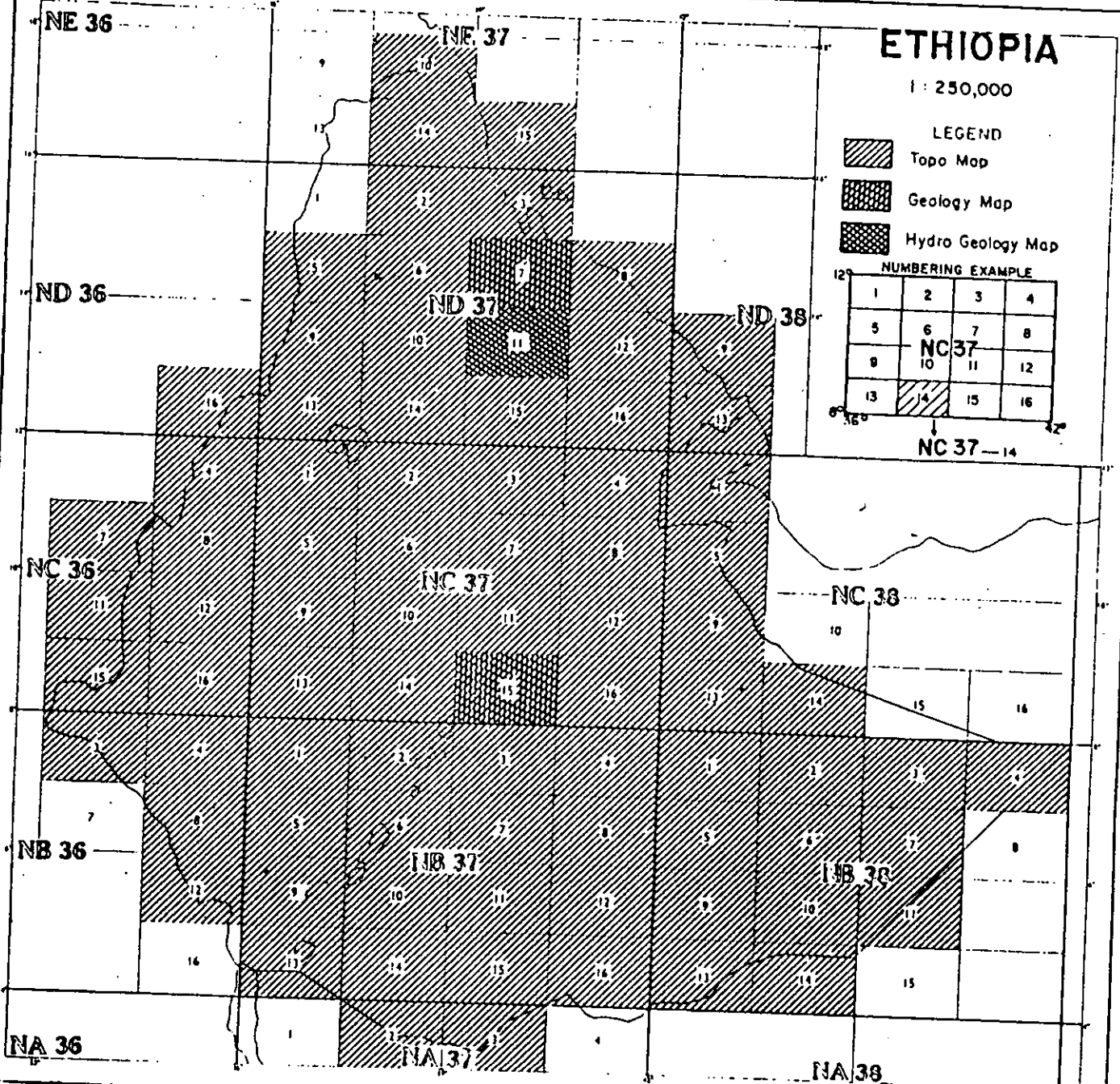
1 : 250,000

- LEGEND
-  Topo Map
 -  Geology Map
 -  Hydro Geology Map

NUMBERING EXAMPLE

1	2	3	4
5	6	7	8
9	NC 37	11	12
13	14	15	16

NC 37-14



ETHIOPIA

