UNITED NATIONS
ECONOMIC
AND
SOCIAL COUNCIL

Distr.
LIMITED

E/CN.14/CART/150
1 July 1966

Original: ENGLISH

ECONOMIC COMMISSION FOR AFRICA
Second United Nations Regional Cartographic
Conference for Africa
Tunis (Tunisia), 12-24 September 1966
Provisional agenda item 7

REPORT ON CARTOGRAPHIC ACTIVITY IN KENYA, 1963-1966[1/]
BY THE SURVEY OF KENYA

1. GEODETIC SURVEYS

1.1 Triangulation and Trilateration

During 1965-66 a field party of the Directorate of Overseas Surveys[2/] (DOS) filled a gap in the existing primary and secondary control. The new work covers the Narok District west of Nairobi, and is an essential step in preparing settlement schemes for the pastoral Masai who inhabit the District. In 1966 the same party started a breakdown from primary to secondary east of Nairobi in the Machakos District, as a step towards large-scale surveys for registration of title of the Kamba lands.

During 1963-65 the DOS party put down control for completing the basic topographic mapping of Kenya. The two areas covered lie to the east and north of the existing block of control and 1:50,000 mapping.

1/ Land Survey and Cartographic work in Kenya during the period 1950-1963 was covered by a Report (E/CN.14/CART/43) submitted to the First United Nations Regional Cartographic Conference held in Nairobi in 1963.

The status maps supplementing the reports will be issued as an addendum (E/CN.14/CART/150/Add.1).

2/ A branch of the British Ministry of Overseas Development.

The Survey of Kenya (SK) carried out many small schemes of triangulation and trilateration to control the plotting of blocks of 1:5,000, or 1:2,500 mapping for the land settlement and adjudication programmes.

1.2 Precise Levelling

By 1963 seven circuits totalling 1,900 miles had been observed, from the Mombasa tide gauge to Mau Summit 450 miles inland.

In 1965 - 66 a further circuit of approximately 250 miles was levelled, connecting Mau Summit with the Uganda levelling system.

Uganda uses Egyptian datum. A preliminary reduction of the new link gives a misclose of approximately one foot over the 3,500 miles between Alexandria and Mombasa.

In 1966 a 70-mile line was levelled to connect the Mombasa tide gauge with the Tanzania system which is based on a tide gauge at Tanga.

Two Zeiss automatic levels were used for the 1965 - 66 work, which facilitated faster progress.

1.3 Gravity Observations

The standard station at Survey of Kenya has been used by many observers engaged in checking the First Order World Net, e.g., in 1963 by (a) an American - Argentina team with Gulf and La Plata pendulums; (b) Italian and English teams, with Filotechnica and Cambridge pendulums, and (c) other parties with gravimeters. The accepted value of "g" at the station continues to be 977.540 gals.

1.4 Magnetic Survey and Seismology

The University College, Nairobi, now maintains a continuous recording magnetic station and a seismological station. It is hoped that a connexion will soon be observed between the former and one or more of the 1959 Magnetic Survey stations, established under the United Nations Technical Assistance Programme.

1.5. Computing

Increasing use has been made of electronic computers. The SK acquired a Friden EC 130 which is very much faster than a mechanical calculator of the same capacity. Punched tapes and punched cards are also prepared for use on large computers (ICT or IPM) which are available in Nairobi. Computer Programmes for various standard processes (e.g. transformation of co-ordinates) have been acquired or designed.

2. INTERNATIONAL BOUNDARIES

In 1963 - 64 a Boundary Commission was on the ground making three agreed adjustments to the 1951 - 55 Kenya - Ethiopia Boundary demarcation. The adjustments were surveyed by an Ethiopian ground party and air-surveyed by the Survey of Kenya which produced revised editions of the 30-sheet boundary map series, which will be published when the Boundary Agreement is ratified.

3. TOPOGRAPHICAL MAPPING

3.1 1:50,000 scale

The basic mapping programme at 1:50,000 scale was completed. This series covers 40% of Kenya, and includes all the areas of settled population which are situated in the Coast Province and the south-west quarter of the country.

The series comprises over 300 sheets, $\frac{1}{4}^{\circ}$ (15') square, of which about 140 are contoured. Height control for a further 45 sheets has been completed by DOS, which is preparing the contoured editions. New revised editions are prepared by SK at the rate of 15 - 20 each year.

3.2 1:100,000 scale

The remaining 60% of Kenya covers the semi-desert areas of the north and east, with sparse nomadic population. This has been mapped at 1:100,000. The series comprises about 130 sheets $\frac{1}{2}^{\circ}$ square, of which the last 11 are in hand at DOS. There is little reliable height

information, and only eight sheets covering the Tana River are partially contoured. With little development taking place, few revised editions of these maps are to be expected.

3.3 1:250,000 scale

Kenya is now fully covered by standard $1\frac{1}{2}^{\circ}$ x 1° sheets at this scale. SK maintains 41 sheets, while some part of Kenya near the borders fall in sheets published by Uganda and Tanzania.

3.4 1:1,000,000 scale

The two-sheet map of Kenya prepared by SK has been revised and extended northwards to cover all the Turkana grazing grounds south of the undefined Sudan-Kenya administrative boundary agreed in 1935.

Kenya is covered by parts of seven sheets of the I.M.W. series published during World War II. Revision of these has been in progress since 1963; Uganda has published NA-36 and DOS has published SB-37 (Dar-es-Salaam) and SA-36 (Mwanza), and has in hand NA-37 and SA-37, using the 1.250,000 series as compilation material. This will only leave a small area of Kenya falling in sheets NB-36 and NB-37 (i.e. north of 4°N. latitude) not covered by recent editions of this series.

3.5 Special Maps

The following have been published since 1963:

East Africa 1:4,000,000 (by SK)
Nairobi-Machakos Area Soil Survey, two sheets at 1:100,000 by DOS.
Mt. Kilimanjaro. 1:100,000 (by DOS)
Mt. Kenya 1:25,000 Edition 3 (by DOS).
Nairobi and Environs 1:100,000 (by SK)
Nairobi City Centre 1:15,840 with key to principal buildings (by SK).
Mombasa. 1:14,000 Town Map and Guide (by SK).

3.6 Other publications

Atlas of Kenya: - a second edition was published in 1963, and individual sheets have since been revised. A new edition is planned for publication in 1968/69.

Gazetteer: - The Survey of Kenya supplied material, and the U.S. Board on Geographical Names published, in 1964, Gazetteer No.78 containing some 16,000 Kenya place-names.

Map Catalogue: - The SK publishes a revised edition each year.

3.7 Local Government Boundaries

There is an increasing demand for maps showing administrative boundaries for various purposes, e.g., census units, election constituencies, local government, etc. These tend to overload a topographical map, and reluctance to add them is increased when their positions are not accurately known.

However, in an attempt to meet the demand, such boundaries are being overprinted in violet on a limited number of copies of the 1:50,000 series sheets.

4. AERIAL PHOTOGRAPHY

The Survey of Kenya continues to use its own camera and camera crew. The camera can now be mounted in either an E.A. Directorate of Civil Aviation DC3 (Dakota) or a Kenya Air Force 'Caribou', or a local charter firm's Cessna 'Skynight'.

Most of the photography obtained is at contact scale 1:12,500 and is taken for one of the following purposes :

Land Adjudication - planning.
Land Adjudication - boundary surveys for title.
Land Settlement - 1:2,500 scale base mapping.
Land Settlement - boundary surveys for title.

Road Planning.
Water Development Planning.
Agricultural Schemes Development Planning.
Urban Re-Development and Extension Planning.

The photogrammetric equipment used for plotting the surveys was detailed on page 13 of the SK Report to the 1963 Nairobi Conference.

5. REPRODUCTION AND PHOTOGRAPHIC EQUIPMENT

Lithographic printing is done on Crabtree rotary two-colour and one-colour presses. A Dufa flat-bed automatic proving press is used for short-run editions and for training. A Gestetner offset duplicator is used for printing forms, catalogues, etc. Letterpress for maps is prepared by Hohlux and Monotype phototypesetting machines. The Lithographic section includes the usual range of ancillary equipment such as whirlers, printing-down frames, grainer, process cameras, photostat, and electric dyeline printers, etc.

Photographic equipment includes Logetronic printers, a Wild enlarger, a diapositive printer and a normal range of other processing equipment.

6. CADASTRAL SURVEYS

6.1 System

As explained in pages 8 - 12 of the Report to the Nairobi Conference in 1963, cadastral surveys have continued to operate under two systems:

(1) by normal ground methods (mainly theodolite and steel-band) in the following lands: -

all urban areas,
freehold land at the Coast and approximately
10,000 sq.miles of former State Land in the Highlands
alienated mainly for agricultural development; and

(2) by photogrammetric mapping of visible boundaries in the Trust Lands (areas of traditional land tenure). This is a "mass-production" method which can only be used when a large area is being surveyed for initial registration of title. Subsequent mutations in individual parcels must be surveyed by ground methods.

6.2 Legislation

A new Registered Land Act came into force in 1963. This applies to all titles in areas mentioned under (2), but transfer of titles to the new Register is likely to require many years to complete in areas mentioned under (1). A start has been made with Mombasa Island, and the areas of Agricultural Settlement Schemes (see 6.3).

6.3 Settlement Schemes

Approximately 1,500 square miles of alienated State Land (area (1) above) has been repurchased by Government and divided into small parcels (approx. 40 to the square mile) for settlement of landless persons. SK produced contoured base-maps at scale 1:2,500 for planning settlement schemes over most of this area, and has now begun to carry out title surveys by photogrammetric methods.

6.4 Adjudication Surveys

A special Mission was appointed in 1965 to recommend how to complete the adjudication, survey, and registration of holdings in the Trust Lands, covering about 35,000 sq.miles. About 4,000 sq. miles of this is completed or in hand, 275,000 titles having been registered. Nearly half the remainder is only suitable for stock-raising, and, therefore, property units in it would be large; but in the areas of subsistence agriculture there may be as many as 100 holdings to one square mile. However, the recommended target is 1,000 sq. miles a year of agricultural holdings to be registered for the next four years.

6.5 Survey Methods

It is proposed to photograph the agricultural areas, in many of which the boundaries of holdings are visible, and in flat areas to prepare a Preliminary Index Diagram by tracing from enlarged photographs. The use of an Ortho-projector for rectifying the photographs is under consideration. This would eliminate the necessity for base-mapping in areas of high relief. The PID would later be replaced by a Registry Map prepared by photogrammetric plotting.

7. TRAINING

The Survey of Kenya Training School has continued to operate technician Training Courses at various levels for survey assistants and cartographers. Personnel from other government departments (e.g. Works, Forests, Agriculture, etc.) have been admitted to those Courses. Some Survey Assistants are studying for the Kenya Land Surveyors Licence, which is a full professional qualification, but there are no Training Courses for this examination.

Technological and professional training outside the Survey of Kenya has been arranged as follows:-

(a) For Surveyors:

(i) Graduates from the University of East Africa in Geography, Mathematics, etc., have been sent to England; four have spent a year at the School of Military Survey, and one a year at Cambridge University Department of Geodesy.

(ii) Candidates with Higher or Advanced Level School Certificate passes in Mathematics and Physics have been sent to the University College, Nairobi, or to the S.W. Essex Technical College in England on Courses leading either to B.Sc. (Survey) or the A.R.I.C.S. A Survey Degree Course in Canada is also under consideration.

(b) For Cartographers:

One candidate with Advanced Level Goeography is at University College, Nairobi, on a Geography Degree Course.

(c) For Photogrammetrists:

Selected recruits are sent to the International Training Centre, Delft, the Netherlands. Three have returned with the Photogrammetric Engineers Diploma.

(d) For Photo-Lithographers:

Four selected recruits were sent to Twickenham College of Technology, England, for 3 years. Two obtained recognized qualification (The City and Guilds Certificate), one of whom obtained a Silver Medal for being the best overall candidate in the final examinations.

8. INTERNATIONAL CONFERENCES AND AGREEMENTS.

The Heads of the three East African survey departments (Kenya, Tanzania and Uganda) have for several years had regular twice-yearly meetings to discuss matters of common interest. They now have a statutory obligation to hold meetings since they are members of the Board controlling the examinations for, and issue of, the new East African Land Surveyors Certificate.

The three countries operate a map exchange agreement, with special arrangements for sheets falling across their common boundaries. Kenya also has exchange agreements with some other countries.

Since the date of the First United Nations Regional Cartographic Conference for Africa, delegates from SK have attended the following meetings:

Commonwealth Survey Officers Conference, Cambridge,... August, 1963.
International Cartographic Association : 2nd General Assembly,
London,.... July, 1964

Technical Symposium, Edinburgh,.. August, 1964.

ECA Meeting of experts on Regional Training Centres for Training in Photogrammetry, Photo-interpretation and Airborne Geophysical Surveys, Addis Ababa,.. October, 1964.

Nairobi will be the venue of an ECA Seminar on Basic Cartographic Services in November, 1966.

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