AGRICULTURAL AND WATER SURVEYS

SOMALIA

FINAL REPORT

Volume III

LANDFORMS AND SOILS

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

The Final Report on Somalia consists of the following volumes:

Volume I - General

An account of the objectives, work and findings of the entire project is given in this volume. The recommendations arising from the findings of the survey are summarized, and the volume concludes with an estimate of the total returns for all the development projects proposed. A summary of the report on the FAO Livestock Development Survey of 1966 in Somalia is included in the volume as an appendix.

The following technical reports were prepared by the Lockwood Survey Corporation, which carried out the corresponding surveys under the supervision of the Food and Agriculture Organization of the United Nations:

Volume II - Water Resources

The volume deals with climate, surface water and groundwater, and investigates the potential groundwater supplies for irrigation, and for the use of livestock, herdsmen and small communities. The text of the volume is abundantly supported with figures, tables and maps and with statistical appendixes.

Volume III - Landforms and Soils

Nineteen landforms are identified, some with subdivisions, in the first part of the volume, and the soils associated with each landform are described and classified. Landforms and soils are then discussed on the basis of the natural regions. The text concludes with a summary and with recommendations. Soil profile descriptions and the methods and results of chemical and physical soil analysis are given in appendixes.

Volume IV - Livestock and Crop Production

The volume describes the surveys carried out on agricultural production and on rangeland in the project area. Details are given of regional farm practices, of present land use from region to region, and of recommendations for crop improvement. There are conclusions and recommendations on the potential of rangeland and on problems in its development. The final chapter deals with the livestock count made during the project. Species and ground cover characteristics of the ecological formations are given in an appendix.

Volume V - Engineering Aspects of Development

The volume discusses in detail the possibilities of irrigation development on the Shebelle river. It also examines briefly the possibilities on the Juba river. Surface water supplies for human and animal consumption and the possibilities of development for small streams are investigated. An account of the topographical survey and mapping work carried out and extracts from the results of reconnaissance soil survey in the Bulo Merta area are included in the volume.

Volume VI - Social and Economic Aspects of Development

The volume deals with land tenure conditions and agricultural economics in Somalia. A sample of economic returns to agriculture in the project area in 1963 is given, and the typical returns of banana plantations are included in the typical farming returns given for the various regions and sub-regions. The volume concludes with a detailed estimate of the total returns for all the development projects suggested. A revised recommendation for a rural development project for the improvement of traditional agriculture is given in an appendix.

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AGRICULTURAL AND WATER SURVEYS

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Final Report

Volume III

Landforms and Soils

Report prepared for the
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by

Lockwood Survey Corporation Limited

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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CHAPTER 1

PURPOSE, SCOPE AND METHODS

PURPOSE AND SCOPE

1. The UNSF/FAO Plan of Operations called for (1) a reconnaissance soil survey of a standard sufficient to permit definition of the areas offering prospects for agricultural improvement and development, and (2) the preparation of soil classification maps for the areas thus defined for use in planning such improvements and developments. Prior to the survey, knowledge of the land resources of the project area was scanty, except in the lower Juba area, where a survey had been carried out by the International Cooperation Administration.* For this reason the scope of the studies was broadened, and the purposes were redefined to include the following:

1) an inventory of the landforms of the area, involving the classification, mapping and description of the various surface features of the land.

2) an investigation and description of the main landform-soils associations and a classification of the soils according to an internationally accepted system.

3) a statement on the potentialities and limitations of each landform-soil unit for agriculture, range land and forest development.

2. The landform mapping determined the allocation of time and effort for the soil investigations and mapping, and provided guide-lines for the evaluation of surface and ground water, range ecology, present land use, and agro-economic conditions. In addition, the landform map was used to establish the boundaries of the natural regions, shown on Map 1.

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*Inter-River Economic Exploration, the Somali Republic, International Cooperation Administration, Washington 25, D.C., January 1961.

3. The mapping of landforms and soils was based on air photograph interpretation supported by field traverses and site investigations. Preliminary landform mapping was done by stereoscopic examination of the 1:60,000 scale aerial photographs taken by the R.A.F. in 1960. Field traverses were planned so as to utilize all available access roads and jeepable trails and many cut-lines. An effort was made to sample all extensive landform-soil associations as revealed by study of the photo-patterns. Soil observations were made mainly by auger to depths of at least two meters. Pits were dug in selected locations. At each profile site, comprehensive descriptions were made of surface relief, vegetation, depths of horizons, moist colours according to the Munsell Colour Chart, texture, consistence, salts, carbonates and other features. Soil samples from selected pits and bores were collected for physical and chemical analysis.

4. The chemical and physical analyses were carried out at the Afgoi U.S. AID/S.R. Soils Laboratory. The methods and results are presented in Appendix 2 at the end of this volume.

5. The locations of all observation sites were marked on the backs of the aerial photographs. The field notes and the aerial photographs are now filed at the offices of the Surveys and Mapping Department, Mogadiscio.

6. The landform and soil boundaries were established by stereoscopic interpretation of the photo patterns and by field observation. The minimum unit mapped was about 100 hectares. In the case of a landform consisting of several soil components too small to map individually, the components were grouped as a complex.

7. The boundaries interpreted on the aerial photographs were transferred by eye to uncontrolled mosaics having a scale of 1:60,000 and then, in fairdrawn form, to the base maps prepared for the project. These maps were

reduced photographically to an approximate scale of 1:100,000 and a clear positive of each map sheet was made. The 81 map sheets covering the project area can be reproduced from the master positives held at the offices of the Surveys and Mapping Department.

8. Areas of landform and soil units were measured by the line transect method and are presented in Chapter 3 of this volume.

9. A generalized landform and Great Soil Group map having the scale 1:500,000 was compiled from reductions of the 1:100,000 map sheets and accompanies this volume.

THE SURVEY PROGRAM

10. The landform-soil survey program commenced during July 1962. Suitably qualified personnel did not exist in Somalia. Two agricultural technicians having intermediate school qualification were selected for instruction in basic survey principles, in the use of aerial photographs, in soil terminology, in the field identification and description of soils, and in the technique of photo-ground correlation. During the training period a preliminary photo interpretation of the project area was carried out in order to establish a tentative classification of landforms and to facilitate the planning of the field survey proper.

11. It was decided that the basic mapping unit should be the landform. The landform pattern provides a framework for the soils investigations and other studies concerned with surface water, groundwater, range destribution, land use and agronomy.

12. Aerial photograph coverage for the entire project area exist only at a scale of 1:60,000. Mosaics were made from this coverage. In addition photographs having the scale of 1:30,000 were taken in 1962 but covered only an insignificant part of the project area.

13. A program for the landform and soil studies was prepared. It was estimated that photograph interpretation would require 18 man-months, that field investigations would be conducted from 11 field camps and would involve 8 man-months, and that compilation of the data and report writing would require 5 man-months. This program allowed for the reconnaissance mapping of the entire area with emphasis to be placed on the areas found most suitable for development.

14. Field work commenced in January 1963 and continued through to February 1964. More than 650 soil sites were investigated and described. Numerous surface observations were also made and brief notes compiled. Some 732 soil samples were taken for analysis in the laboratory.

15. The field party consisted of two teams working from the same camp; the Senior Soils Expert alternated between the teams. As the two trainees, Omar Said Ali and Mohammed Rufai, became proficient, they were able to make proper soil descriptions, select sample sites and carry out mapping. The final classification and mapping was done by the soils expert.

16. The survey benefitted from the advice and participation of several individuals and groups. Dr. Harvey P. Newton, Soils Advisor, U.S. AID/S.R. and his staff carried out the physical and chemical analyses and Dr. Newton helped to interpret the results. Dr. R. Dudal, F.A.O. World Soil Correlator visited the project area twice and provided guidance in soil classification. Officers of the Somali Gulf Oil Company and the Sinclair Somal Oil Company provided useful geological information. Officials of S.N.A.I. made available data concerning irrigation and sugar cane.

CHAPTER 2

LANDFORM AND SOIL DESCRIPTIONS

BASIC PRINCIPLES

1. For purposes of the present study, a landform is defined as a unit of land area that is either homogeneous in its origin and morphology (including surface terrain configuration) or heterogeneous with a repetitive pattern of two or more landscape elements. Each landform has its own characteristic soil pattern. The landform-soil correlations were established by field survey and photograph interpretation techniques.

2. Each soil has distinctive characteristics of its own with respect to such features as horizon differentiation, colour, texture, structure, and consistence; the list is by no means complete. The term "soil morphology" is used to designate the arrangement of these characteristics within the soil profile. Soil morphology reflects the nature of the parent material and the soil forming processes (i.e., pedogenesis). Morphological characteristics form the basis for soil classification.

LANDFORM AND SOIL CLASSIFICATION

3. Nineteen landforms have been identified and mapped in the project area. Some of these landforms were subdivided on the basis of geological materials or formational process, topography, soil depth and erosion. Complex symbols have been adopted to designate the various landforms, landform subdivisions and associated soils on the maps.

4. The soils found in association with each landform or landform subdivision were classified into ten Great Soil Groups following an internationally accepted system. No further subdivision into orders and suborders was made. The placing of a soil in one or another of the Great Soil Groups

was determined by its morphology and physical and chemical characteristics. Some of the soils are only provisionally classified.

5. Table 1 shows the classification system adopted for mapping purposes. Table 2 provides a classification of sorts according to parent material. Table 3 presents a provisional pedogenic classification.

DISSECTED UPLAND

Definition and General Characteristics

6. The term "Dissected Upland" is used to designate a highly dissected peneplain surface. Dissection and erosion have created a rolling to undulating plain with scattered erosional remnants. In some places streams have cut into the surface, forming incised patterns. The topography is irregular and both long and short slopes of varying gradients are found. Some of the valley tracts within this landform have a shallow wash of fluvial materials.

Location and Extent

7. This landform has been mapped extensively in the area between Bardera and Lugh Ganana in the Mandera - El Wak Uplands region. It is found on both sides of the Juba River in this section, intermixed with areas of the landforms Dissected Plateau, Dissected Scarp Slope, and Ridge. Dissected Upland has been mapped over 899,500 hectares.

Soils

8. Most of the soils are shallow and bedrock outcrops are common. However deeper soils have developed in places where the surface is less

susceptible to erosion.

Land Use and Observations

9. Virtually no areas of this landform are used for cultivation; however, there are a few cultivated tracts in valley locations. The predominant vegetative cover is a semi-arid to arid shrub and tree steppe which provides poor quality grazing and browsing. This landform is unsuitable for cropping and has a low agricultural potential because of irregular topography, shallow soils, and low rainfall. It does, however, have a limited potential for grazing and browsing. Some of the drainage channels might serve as sources of water.

DISSECTED SCARP SLOPE

Definition and General Characteristics

10. This term is used to designate the eroded and dissected edge of a plateau or highland area and forms the contact of these areas with lower ground. Despite this dissection, the crest of the scarp slope exhibits a generally uniform summit accordance. The elevation of the scarp base is less consistent. Included in this landform are remnant outliers which have become separated from the scarp proper by erosion and also some areas of where the scarp face has been relatively undissected. The vertical depth of dissection is greatly variable.

Location and Extent

11. Dissected Scarp Slope has been mapped in the Mandera - El Wak Uplands region. The main area of this landform extends from south of Mandera

along the eastern flank of the El Wak Plain. In some sections this landform area is 20 kilometers in width, whereas in other sections it is only a few kilometers wide. The scarp varies in height between 50 and 100 meters. 152,000 hectares of Dissected Scarp Slope have been mapped.

Soils

12. The soils over most of the area are shallow and rock is exposed in the face of the scarp. Bouldery detritus is found at the base of the dissections. There are some mesa-like outliers having a deeper soil mantle on their crests.

Land Use and Observations

13. Although nomadic herdsmen are known to graze their animals at some places within the area, the prevalence of rugged and steeply sloping terrain, shallow soils and sparse vegetation renders the area generally unsuitable for development.

DISSECTED PLATEAU

Definition and General Characteristics

14. The term "Dissected Plateau" is used to designate a former peneplain surface that has been dissected to form a hill and valley landscape. The crests of the hills have a general summit accordance. The valleys are irregular in shape and spacing and have a varying crest to base relief.

60. The Jurassic formation rests on a basement of Precambrian or crystalline rocks, while the Cretaceous formation overlies the Jurassic. In the project area the Jurassic limestones underlie in a broad band extending across the southern part of the Central Uplands Plain region. They have a gentle dip to the northwest and a gentle plunge to the northeast. The Cretaceous limestones extend across the northern part of the survey area from west of Lugh Ganana to the upper Shebelle valley.

61. The contact between the two limestone formations is not always easily discernible and, because of limitations of time and access, its position was not mapped. The gypsiferous soil materials recognized and mapped were invariably associated with the Cretaceous limestone formation.

62. As Table 1 indicates, the landform Mantled Plain Limestone has been subdivided using the criterion of thickness of soil mantle. Three subdivisions have been identified, namely; Mantled Plain Limestone deep (MPLd), Mantled Plain Limestone shallow (MPLs) and Mantled Plain Limestone very shallow (MPLvs). Each of these landform subdivisions has been further subdivided into subgroups on the basis of topography and, in some cases, a combination of topography and erosion. Where these subgroups could be subdivided on the basis of soil, the soil symbol, too, has been shown in the legend and on the maps.

MANTLED PLAIN LIMESTONE DEEP

63. This major landform subdivision comprises level to undulating lands having a soil mantle one meter or greater in thickness. Three