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# KENYA SOIL SURVEY

## A PRELIMINARY EVALUATION OF THE SOILS AROUND NYANGOMA MISSION, BONDO DIVISION, NYANZA

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SITE EVALUATION REPORT

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# A PRELIMINARY EVALUATION OF THE SOILS AROUND NYANGOMA MISSION, BONDO DIVISION, NYANZA

by

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Contents:

## 1. Introduction

At the request of Dr. Joan Campbell, consultant to the UNEP Bureau of Programme Division III, Settlement, Nairobi, a site evaluation of the soil conditions around the Nyangoma Mission in Bondo Division, Siaya District, Nyanza was carried out on 29th and 30th October, 1974. The request was made in relation to the feasibility of conducting a pilot project in ecodevelopment in the above mentioned area (Harrison, 1974).

The area is situated between 34° 05' and 34° 15' East longitude and 0° 05' and 0° 15' South latitude. The altitude is between 1140 and 1220 m above sea level. The nearest major town is Kisumu which lies approx. 80 km away.

The area is rather densely populated. The majority of the population exist through subsistence farming involving some cattle herding (mixed farming) and some fishery. The centre of the area is dominated by the Catholic Mission Post at Nyangoma where there is a complex of schools, including a nursery school, primary school, secondary school and a technical school for deaf children. The mission also contains a dispensary and a medical post. There is a high incidence of disease in the area.

No soil data were available until present, although the area is covered by the "Land System Atlas of Western Kenya", scale 1:1.000.000 (Scott, Webster, 1971) which is based on photointerpretation with only a minimum of field data. This document is on a reconnaissance scale and does not give sufficient data for the area under consideration.

Prior to the visit, a photo interpretation was carried out using good quality aerial photographs of scale 1:50.000 approximately. It should be stressed that the attached map, scale 1:50.000 is a map based on photo-interpretation with only a few supporting field observations, gathered during the 1½ day stay in the area. Only a few soil samples were taken, for analysis in the laboratory of the National Agricultural Laboratories in Nairobi.

Due to the limited time available for the site evaluation, only a part of the area covered by the Nyangoma Mission could be investigated. The area around Abiero Hill could not be covered. From the photo-interpretation it however seems likely that some stretches of "black cotton" soils occur in the valleys near Abiero hill. These stretches are highly cultivated and may have possibilities for further improvement and further action. If the need arises, this particular area could be covered during a second visit.

The co-operation and assistance of the staff of the Nyangoma Mission, in particular Mr. Brian Harrison and Mr. Louis Spoelstra, during the visit was of great help and is very much appreciated.

...../3

## 2. Climate

Rainfall data are available for Usigu (27 years), Bondo (23 years), Asembo (30 years) and Nyangoma Mission (6 years, of which only 4 years have the data for all the months). See E.A.M.D., 1971 and earlier reports.
The data for Usigu and Asembo should be comparable with the ones for the missio as both are situated near the lake shore.
The following table gives the average rainfall for the four stations by season and year and the evaporation figures for the area.

Average seasonal and annual rainfall in mm

| Station | March - May | June - Aug. | Sept. - Nov. | Dec. - Feb. | Yea |
|---|---|---|---|---|---|
| Nyangoma 4 to 6 yrs. | 409* | 159* | 190* | 193* | 96( |
| Usigu 27 yrs. | 402 | 113 | 168 | 173 | 861 |
| Asembo 30 yrs. | 476 | 184 | 238 | 186 | 1085 |
| Bondo 23 yrs. | 416 | 198 | 301 | 163 | 1085 |
| Average Potential Evaporation ($E_o$) in mm. | | | | | |
| Area | 470 | 430 | 490 | 490 | 1880 |
| Average evapotranspiration ($E_t$) = 2/3 x $E_o$ | | | | | |
| Area | 315 | 285 | 325 | 325 | 1250 |

From these data it can be seen that there is only one real rainy season, March - May. The remaining months have a very limited amount of rainfall, which in general is too low for crops to survive. From the data on rainfall and $E_t$ the balance per season between rainfall and $E_t$ should be positive.
It is therefore clear that in the area around Nyangoma Mission only one crop per year can be grown, provided that the rainfall during the months March, April and May is evenly spread. If this rainfall is concentrated in a too short period, losses due to run-off and seepage are high because the shallow soils have a rather low moisture storage capacity.

* adjusted average using 6 years data of Nyangoma Mission and the same years plus the long-term average of Bondo.

The rainfall in Bondo is slightly higher than in the other three stations, especially in the September - November period.

3. Geology:

The area under consideration consists mainly of volcanic rocks of Precambrian age, belonging to the Nyanzian volcanic series, (Pulfrey, 1938). These series comprise mainly andesites and trachyandesites (fine grained, "intermediate" volcanic rocks) and in the south west part of the area (west of Nango) mainly of rhyolites (fine grained, "acid" quartz rich-volcanic rocks). In the valleys thin deposits of alluvial material (laid down by running water) and -colluvial material (carried by slopewash into the valleys) are found.

4. Geomorphology:

The area is one of relatively low relief, ranging from 1140 m near the lake shore up to 1280 m (Serawongo hill). The average elevation is around 1180 to 1200 m, giving in the average, 40 to 60 m above lake level. It consists of undulating land with a widely spaced dendritic drainage pattern, long gentle slopes and rather flat topped interfluves on which at places residual hills occur. The area is part of a peneplain which has been slightly incised. No perennial water courses exist; dry valleys characterize the landscape during the greater part of the year. After heavy and continuous rains however, several of the larger valleys carry some water. The valleys are in places wide, with bottoms which in places are filled up by alluvium-colluvium. The slopes rise gently to the rather flat divides; the lower slopes of the valleys are often covered by a mantle of colluvial origin. The area belongs to the Bukiri landsystem (Scott and Webster, 1971)

5. Description of the land units

The area indicated on the map can be divided into four landunits:

- hills
- undulating uplands
- valleys
- papyrus swamps

Hills: These have very shallow, stony soils over bedrock with many rock outcrops.

Uplands: These are gently undulating to undulating and have slopes ranging from 3 to 8%. The soils in this unit are well drained. They consist of dark reddish brown gravelly and stony clay and are dominantly very shallow to shallow (less than 50 cm deep) over petroplinthite (murram)

...../5

and/or ironstone. The ironstone crust is no longer being formed (fossil); it consists mainly of iron and manganese oxides mixed with soil and small rock fragments.
Most of this unit is covered with a low scrub vegetation. Only those places where the soil is somewhat deeper are cultivated (mainly maize and millet).

Valleys: In general two kinds of soils can be encountered;
a) the soils of the valley slopes, are mainly developed in colluvial deposits and consist in general of moderately deep, dark red to dark reddish brown clay, which in places is slightly fine gravelly. They are moderately well drained. In few places some reddish mottling was found lower down in the profile. At this scale of investigation the extent of these soils cannot be indicated on the map, but they occur in bands near unit 2.
The soils are relatively good in comparison to what is available in the area. A relatively high percentage is cultivated in the rainy season.

b) the soils of the valley bottoms are derived from alluvial-colluvial deposits and consist dominantly of deep, dark greyish brown to dark reddish brown, heavy clays. Mottling was observed, indicating that at some time of the year waterlogging occurs. From information gathered in the area it is understood that after heavy rains these valley bottoms are flooded. At present these soils are under grass and are extensively used for grazing. A rather big area of this unit was found west of Wambara school near the papyrus swamps. This area will certainly be flooded every year after the rains.

Papyrus swamps: Soils in this unit were not investigated but they certainly consist of peat overlying heavy clay. Most of the year this area is swampy situated as they are next to the lake. No use is being made of this area at present.

## 6. Conclusions:

1. It is clear from the site evaluation findings that the area as a whole is rather unfavourable for arable agriculture: most of the area consists of shallow to even very shallow soils and the climatic conditions are such that at the most only one crop can be grown in a year and even then failures occur.

2. The proposed pipeline (for proposed alignment, see map) is mainly meant for supply of drinking water for people and cattle. It seems that even if substantial water may become available for any minor irrigation scheme, prospects for irrigation development are bleak, because there are only a few areas where soils are deep and do not suffer from waterlogging.

...../6

If in future any minor scheme is proposed, it will be necessary that a topographic survey and a detailed soil survey, at a scale of 1:5000, is carried out in selected areas (mainly mapping unit 3).

3. Some bigger stretches of the valley bottoms may be suitable for rice growing, provided that adequate drainage is provided.

4. Minor irrigation development near the lake shore with the help of small windmills seems only feasible in a few stretches (see map).

5. The papyrus swamps may be drained and developed in future, for example with the help of windmills. This may take into account the experience gained in the reclamation of the Yala swamp, where a feasibility study was recently carried out by a consulting firm (ILACO) at the request of the Kenya Government.

6. The installation of the pipeline may allow an improvement in the small scale animal husbandry in the area (together with the introduction of drinking places, cattle dips and the introduction of controlled grazing etc.). Suitable areas for grazing are the valley bottoms which, due to floodhazard, are at present none to marginally suitable for any cultivation.

7. Possibilities for growing melons and pineapples as suggested by the staff of the Mission seem to be rather limited. Both crops need freely draining, permeable, deep soils and for both a regular supply of soil moisture is essential. Furthermore pineapples need a high level of capital input, among others heavy application of nitrogenous fertilizers (Acland, 1971).

## 7. References:


Acland, J.D. 1971 — East African Crops, Longman.

East African Met. Dept. 1973 — Summary of rainfall in Kenya for the year 1971, Nairobi.

Harrison, B. 1974 — Socio-economic plan, Nyanza Province: Outline report

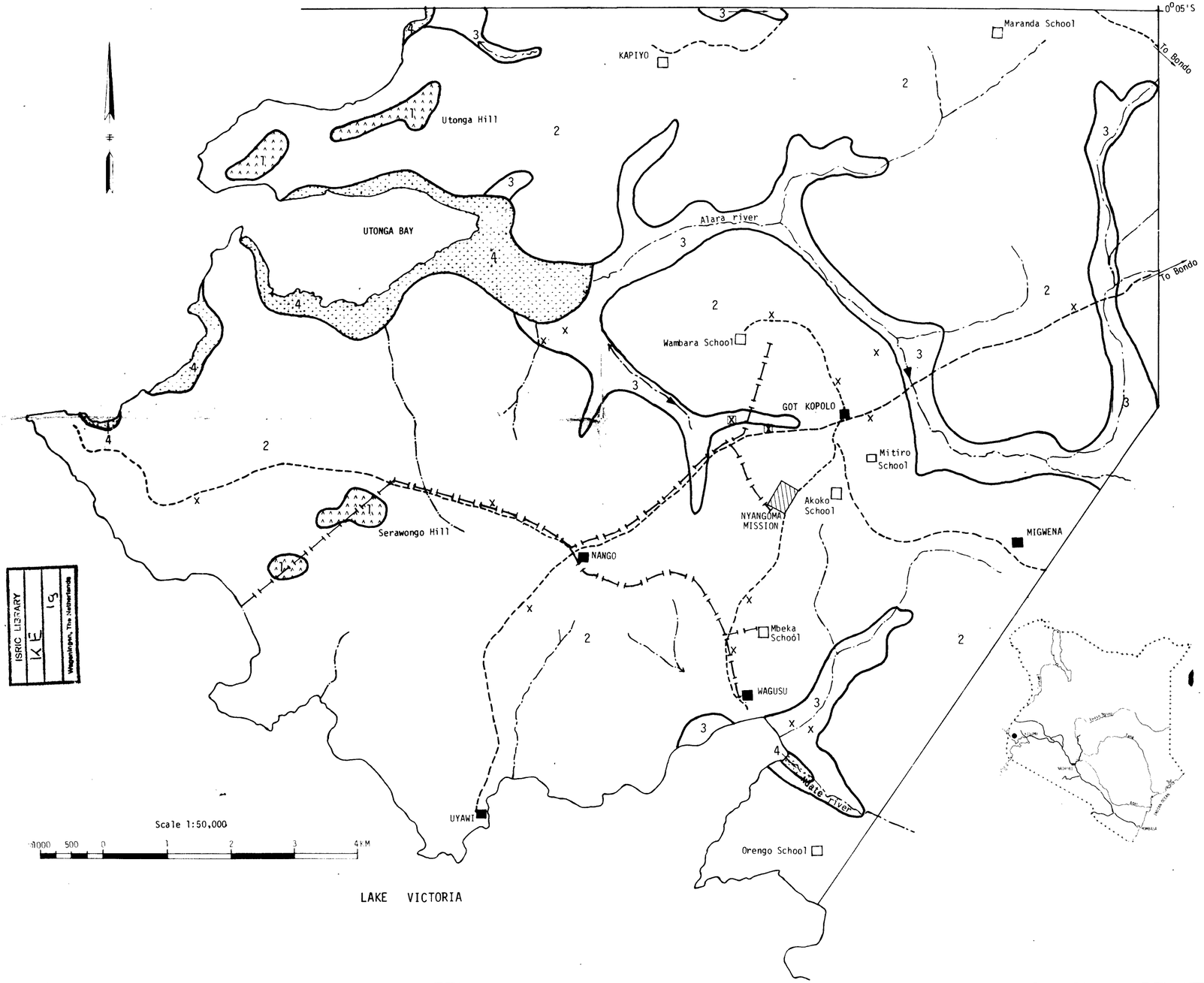
Scott, R.M./ Webster, R. 1971 — A land system atlas of Western Kenya, M.E.X.E., Christchurch, England.

Survey of Kenya 1970 — National Atlas of Kenya, third ed. Nairobi.

Pulfrey, W. 1938 — Geological Survey of No. 2 Mining area, Kavirondo (interim report and map of the S.W. Quadrant) report no. 7, Geology and Mines department, Nairobi.

Woodhead, T. 1968 — Studies of potential evaporation in Kenya, Ministry of Natural Resources, Water Development Dept. Nairobi.

# LAND UNIT MAP OF NYANGOMA MISSION AREA






Legend

| land unit | physiography | geology | soils | vegetation/ land use |
|---|---|---|---|---|
| | hills and low ridges slopes: >16% | rhyolite | rock oucrops | sparse scrub |
| 2 | gently undulating to undulating uplands with long slopes and widely spaced drainage pattern slopes: 3-8% | dominantly andesite, in S.W. rhyolite | dark reddish brown, gravelly to stony clay, dominantly shallow to very shallow over petroplinthite (murram) and/or ironstone well drained | scrub with patches of cultivation |
| 3 | a) valley slopes slopes: 1-3% | colluvial deposits | moderately deep, dark reddish brown, at places fine gravelly, clay well to moderately well drained | at places cultivated, |
| | b) valley bottoms slopes: 1% | alluvial-colluvial deposits | deep, dark greyish brown, mottled, calcareous, heavy clay imperfectly drained, seasonally flooded | grassland/grazing |
| 4 | papyrus swamps | alluvial deposits | peat over heavy clay | papyrus |

KEY

- drainage way, dam
- road/track
- land unit boundary
- proposed pipeline
- Village
- school
- augering with sampling
- X augering, roadcut

KEY TO DEPTH CLASSES

| thickness soil in cm | symbol: over rock | symbol: over petro-plinthite | name |
|---|---|---|---|
| 0-25 | ▭ | | very shallow |
| 25-50 | ▭ | | shallow |
| 50-80 | ▭ | ▭ | moderately deep |
| more than 80 | ▭ | ▭ | deep |

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