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REPUBLIC OF KENYA

MINISTRY OF AGRICULTURE — NATIONAL AGRICULTURAL LABORATORIES

# KENYA SOIL SURVEY PROJECT

REPORT OF A SITE EVALUATION OF THE PROPOSED

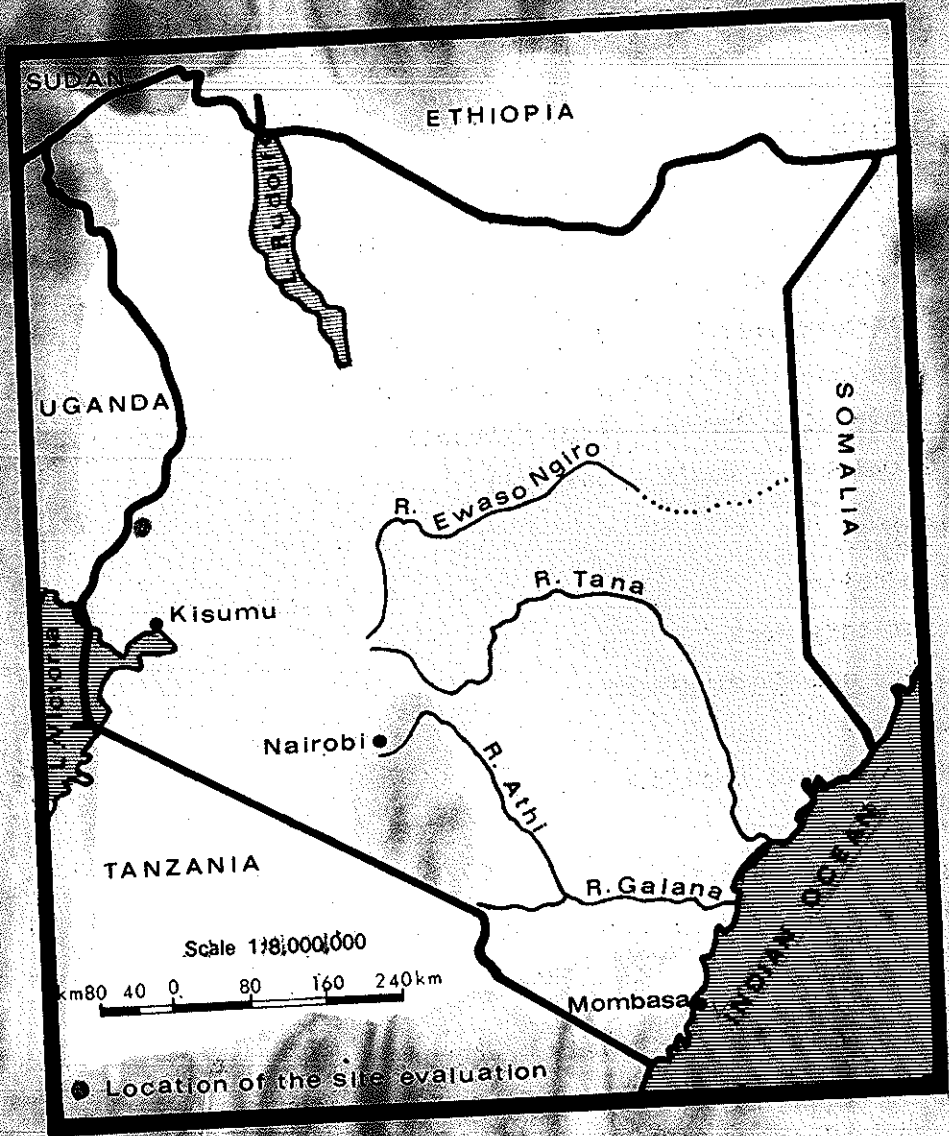
LOCATION OF ALUPE SUBSTATION

By H.F. Gelens and G. Ngari

SITE EVALUATION

No: 4

Date: NOV, 1972.



Kenya Soil Survey Project  
S11/1/OW/HFG/GN - 5th Jan. 1973  
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LOCATION OF ALUPE SUBSTATION

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November, 1972

ITINERARY:

The trip was made by Land-rover  
9th October (afternoon) : Nairobi - Kisumu.  
10th October (morning) : Kisumu - Kakamega (Agricultural Research Station)  
and further travel to Alupe and Busia  
10th October (afternoon) and 11th October : Field observations at the  
proposed site for the Alupe substation.  
11th October : Busia - Nairobi.

CONTENTS:

Introduction  
Preparatory work.  
Geology and Physiography  
Climate.  
Vegetation and Land Use.  
Soils.  
Comparison with neighbouring areas.  
Conclusions and recommendations.

INTRODUCTION:

As a result of a relative request a brief trip was made to Alupe near Busia in Western Province (see topographical map 1:50.000, sheets 87/3 and 101/1) in order to evaluate the site for a proposed substation of the Agricultural Research Station, Western Province. At Alupe, about 9 kilometers N.E. of Busia, approximately 1000 acres of land have been acquired for this purpose. Formerly the land was part of the Alupe Leprosarium and Research Centre.

At Kakamega a meeting took place with Mr. Makatiani, Officer-in-Charge, Western Agricultural Research Station. It was explained that

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the plan was to establish a substation on the land acquired at Alupe. The substation would carry out experiments on crops that are of importance for the area around the substation.

Mr. Makatiani accompanied the party to Alupe to show the location of the 1000 acres available for the substation. Afterwards, at Busia, he arranged the introduction to Mr. Boomstra of the Farmers' Training Centre and Mr. Mafunga, the Agricultural Officer at Busia. Both contacts proved to be very useful.

The field work carried out by the party consisted of making a number of augerings. These augerings together with the information obtained from aerial photographs (see below) gave an impression of the soils and their distribution. In representative places two profile pits were dug, described and sampled.

#### PREPARATORY WORK:

Before the actual trip into the field, photographic coverage of the Busia - Alupe area was obtained. Two coverages were available viz. at scales 1:40,000 and 1:12,500.

The small scale coverage turned out to be extremely useful for making a photo-interpretation of the whole region around the proposed station. Of course it was impossible within the scope of a site evaluation to do the field work needed to arrive at a soil map from such a photo-interpretation map. Nevertheless, the photo-interpretation map is included in this report (annex 1) as it may form an indication of to what extent the experimental data obtained from the future station may be representative for the area around.

The large-scale photography was suitable for a more detailed photo study of the actual station site. It was also used as field map for recording the observation points and the situation of the profile pits. A map derived from these 1:12,500 scale photographs has been included in this report (annex 2). The value of this map as a soil map is being discussed below in the paragraph on soils.

#### GEOLOGY AND PHYSIOGRAPHY:

According to the geological information available (Geological Report No. 5), the underlying formation at Alupe consists of sedimentary rocks of Precambrian age. To the South-West, near Busia, these change into volcanics also of Precambrian age, while just North of Alupe an extensive area of granite intrusions is found.

All these formations are part of a gently undulating to undulating peneplain. This peneplain landscape has a dendritic pattern of small streams. Along these streams there are rather wide zones of poor drainage, which are often referred to as "vleis" or "vleibos". In-between the vleis, low almost flat to gently sloping interfluves are found. These well drained interfluves have under a soil cover of varying thickness, a sheet of hardened plinthite (also called "murrum", or "laterite"). This plinthite may form a massive crust or may consist of loose pebble-like concretions. According to the geological report of the area the thickness of the plinthite sheet may be as much as 15 feet (about 5 meters).

The vleis have a width varying from about 500 to 1200 meters, the well drained interfluves in-between a width varying from about 1000 to 2500 meters. The total slope lengths are therefore from 1000 to 2000 meters. Going from West to East the vleis, first being more incised and rather narrow, become more flat and wider. At the same time the interfluves become more flat.

The area of the proposed station lies at the junction of two streams, the Alupe and the Okame. Its edges therefore consist for two thirds of vlei. At the Western side this vlei is of the narrow more incised type; at the Northern and North-Eastern side it is of the flatter type and of considerable width.

The altitude of the area ranges from 1130 to 1220 meters, the site of the proposed station being crossed by the 1160 m contour.

#### CLIMATE:

No detailed climatic data were obtained, but data from the atlas of Kenya (1970 edition) shows that the area is situated in a zone of equatorial climate, humid to dry subhumid. Annual rainfall is around 1700 mm. showing an increase from West to East. There are no definite rainy seasons, but precipitation reaches a peak in April - May and to a lesser degree in September - October.

Mean annual maximum temperature is between 26° and 30°C. Mean annual minimum temperature between 14° and 18°C.

#### VEGETATION AND LAND USE:

The vegetation map of the Vegetation - Land Use Survey of South Western Kenya (by Trapnell et al.) shows the pattern of vleis along the

streams, mentioned above. The legend unit, "Grasslands and clump grasslands on vlei soils", comes under the heading "Vegetations of soils with impeded drainage". These vleis are not cultivated but the natural grass cover is used for grazing. The interfluves are generally intensively cultivated areas with a variety of crops such as maize, bananas, cassava, cotton, millet, beans and sugarcane. This cultivation is found where the original vegetation was "Lower moist intermediate forest" or a "Combretum Terminalia type of savanna vegetation".

#### SOILS:

In order to get more information on the soils of the proposed site for the substation a limited number of field observations were made. As a result of these it is possible to give a characterisation of those soils which, as regards acreage, seem to be the more important ones.

Annex 2 shows a map of the site area at an approximate scale of 1:12,500. This map has been derived directly from the 1:12,500 scale photographs. For the actual station site it shows in more detail the units which also appear on the photo-interpretation map of the whole adjoining area (annex 1). The same symbols have been maintained but on the basis of the observations an attempt has been made to describe the units in soil terms. However, it should be kept in mind that the work which could be done within the scope of a site evaluation does not justify to consider it a final soil map at the scale presented. It has therefore been called "tentative soil map". The mapping units can be characterised as follows:-

#### A2. Moderately deep soils over loose plinthite:-

Soils mostly of moderate depth (50 - 80cm) but occasionally somewhat shallower or deeper (40 - 90cm). Well drained. The surface layer of about 10cm usually consists of dark brown to dark reddish brown clay loam to light clay with a moderate structure, partly crumb, partly subangular blocky.

Below 10 cm the profile changes into a reddish brown to brown clay. Going deeper the soil becomes mixed with an increasing amount of loose plinthite (murrum) pebbles. This admixture of plinthite at some places starts already at the surface. Usually somewhere between 50 and 80 cm the amount of plinthite increases to about 90%. Occasionally the small plinthite concretions are cemented together to form agglomerates of stone or even boulder size.

The soil does not have a pronounced structure but is quite porous. According to field observations the soil is acid. (pH values between 5.0 and 5.5). The amount of available plant nutrients is probably low.

The unit has locally inclusions of A3 described below. A few such inclusions are indicated on the map but there may be more.

A3 Very shallow to shallow soils over massive plinthite crust:-

The soils of this unit show rather much variation but the unit as a whole seems to consist of very shallow to shallow soils (10 - 50 cm) underlain by a massive sheet of hardened plinthite. The variability in depth was illustrated by a profile pit of about 75 x 150 cm dug in this unit. In this pit the depth varied from 25 to 50 cm. However, the average effective depth of the soils of this unit seems to be about 20 - 25 cm.

The top soil, 10 - 15 cm thick, usually is a very dark grey or very dark greyish brown clay loam to clay. There are, however, also places where the top does not show the dark humic layer and where the colour is brown from the surface downwards. This may find its explanation in local erosion of the top layer.

Often nothing but the top soil is present, but where the soil is somewhat deeper, there is from 10/15 to 20/50 cm a brown clay loam to clay. The soil is acid and has low natural fertility. At a depth varying from 10 to 50 cm, hard massive plinthite is found.

At many places the soils of this unit show signs of impeded drainage, most likely due to the combined effect of the shallowness and the impermeability of the hardened plinthite.

B1 Vlei soils, almost flat to very gently sloping phase:-

This unit constitutes a zone of poorly drained soils along the streams. The soils are not uniform. More detailed investigations probably will show the existence of a regular soil catena going from the A3 unit to the stream. The most striking features in this catena are probably a zone with a quite sandy top soil and a somewhat better drained zone close to the stream.

Nevertheless, a general characteristic of the soils of this unit can be given as follows. They are deep soils with "soft plinthite" (prominently reddish mottled clay) starting at about 1 m depth, but they do not contain hardened plinthite. They have a humic top layer of 10 to 30 cm deep, which is very dark grey or very dark greyish brown, the texture being mostly a clay but, as mentioned, a sandy loam in a

certain zone. Mostly there is brown mottling in this top layer.

Under the top layer there is heavy clay, strongly mottled, the matrix being of grey to grey brown colours. At about 1 m the mottles become red or dark red (soft plinthite).

B2. Vlei soils, sloping phase:-

This unit constitutes only a minor part of the area and no observations have been made in it. It can however, be assumed that, while the topography is different, the soils are mostly comparable to those of the B1 unit.

COMPARISON WITH NEIGHBOURING AREAS:

When the soils of the actual station site (annex 2) are compared with those of the neighbouring areas, there is one striking feature. Although the A2 unit of the photo-interpretation map of the neighbouring areas (annex 1) certainly has many inclusions of shallow soils, there seems to be nowhere such an extensive area of shallow soils as the one mapped as A3 on the station site.

The A2 of the station site, in contrast, seems to be quite representative for the A2 areas of the interpretation map. Some field checks between Alupe and Busia seem to confirm this. No checks were made in the A1 unit but most likely shallow spots are still less frequent in this than in the A2 unit.

The 1:3,000,000 map of Gethin Jones and Scott shows for the area a complex of "light yellow brown sandy loams with laterite horizon" and "dark brown sandy loams". No mention is made of the poorly drained vlei soils, although they constitute about 30% of the area. The areas in as far as checked during this site evaluation, definitely cannot be classified as sandy loams, but are of heavier texture. They also have generally a more reddish colour than Gethin Jones - Scott indicate.

CONCLUSIONS AND RECOMMENDATIONS:

From what has been said in the paragraph on soils, it is clear that the A2 unit (annex 2) is the obvious choice for starting the experiment station. The soils of the A2 unit are representative of most of the neighbouring areas used for cropping. The A3 unit as a whole is too shallow for successful farming and the B1 and B2 areas are too wet and can be considered for grazing only.

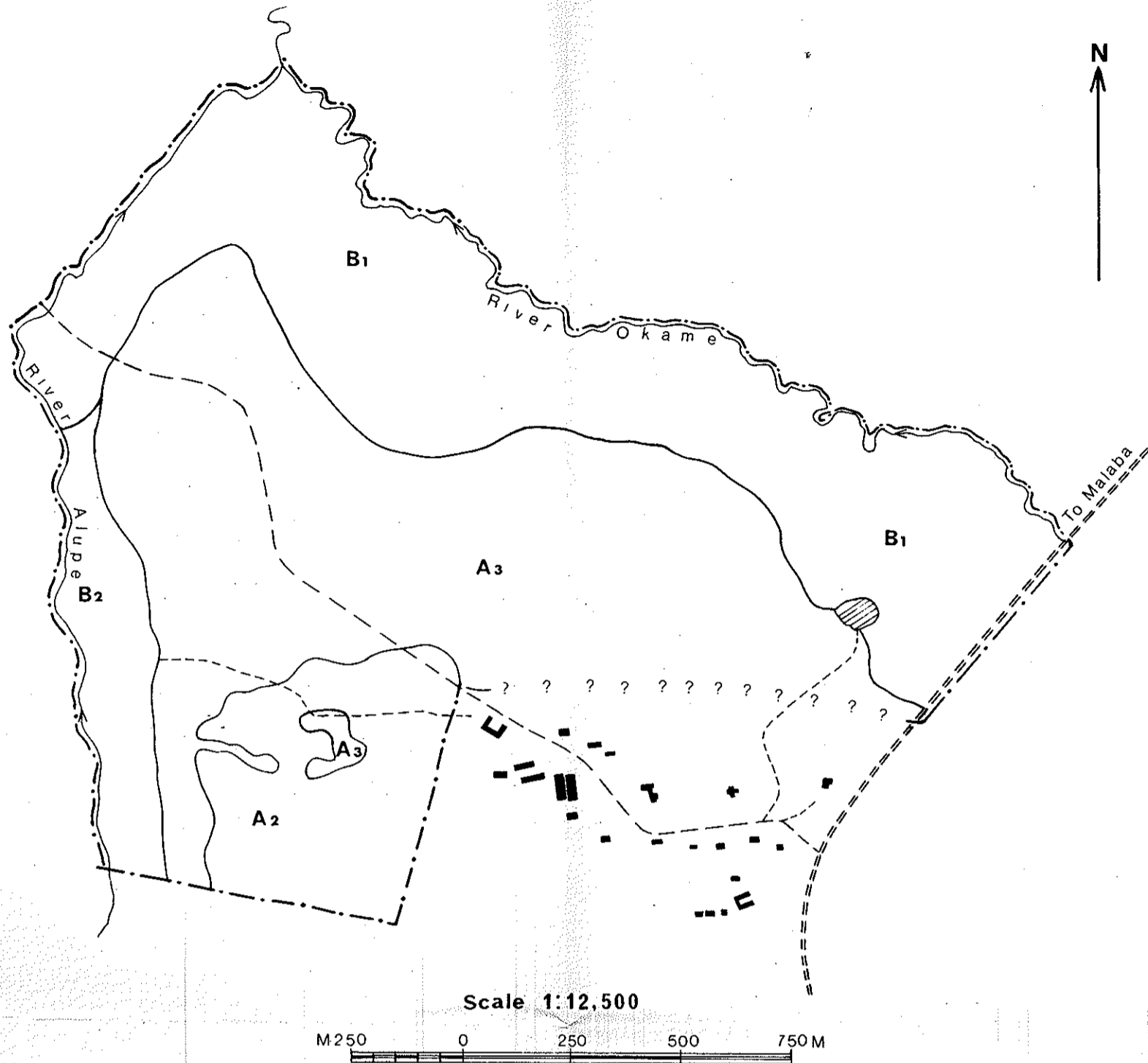


If the substation would widen the scope of its activities and besides experiments on crops would also engage on experiments in the field of grazing, the B1 unit would of course become very useful.

The great drawback of the proposed site for the station is the fact that the A2 unit within the land already acquired is quite small, it is not more than about 60 - 70 acres. This, however, may be big enough for a start, but if in the future a bigger area would be needed, an extension would have to be sought in Southern and South-Eastern direction outside the acquired land.

It is once more stated that this site evaluation does not constitute a soil survey. In order to get detailed information about the soils which will be of importance for the lay-out and evaluation of future experiments, a detailed soil survey is recommended.

TENTATIVE SOIL MAP OF ALUPE SUB-STATION SITE




Scale 1:12,500



LEGEND

- A<sub>2</sub>** Moderately deep soils over loose plinthite
- A<sub>3</sub>** Very shallow to shallow soils over massive plinthite crust
- B<sub>1</sub>** Vlei soils, almost flat to very gently sloping phase
- B<sub>2</sub>** Vlei soils, sloping phase

- ==== Major Roads
- Minor Roads
- Foot Paths
- \_\_\_\_\_ Soil Boundaries
-  Water Storage
- .-.-.-.- Boundary of the area available for the sub-station (partly approximate)
- ■ ■ Buildings

Prepared and drawn by Kenya Soil Survey Project in November 1972.

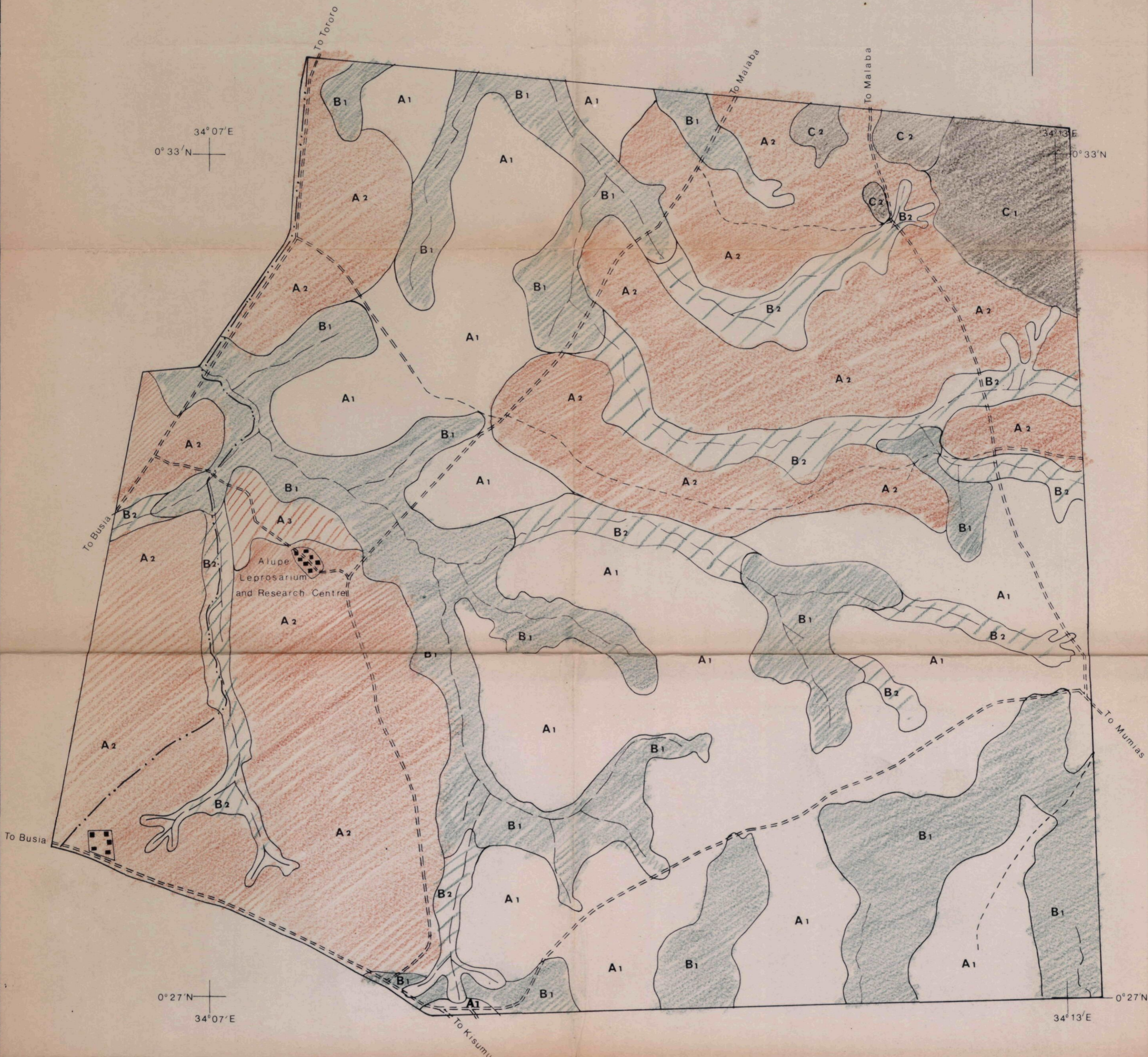
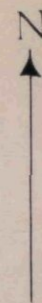
Refer to this map as **W/D/12**

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PHOTO INTERPRETATION MAP OF  
AREA AROUND ALUPE

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LEGEND

Well drained areas between water courses

Poorly drained zones along water courses  
(vleis, dambos)

A1 Almost flat (murrum > 100cm)

B1 Almost flat to gently sloping; and generally wide

A2 Gently sloping (murrum < 100cm)

B2 More incised; sides gently sloping to sloping; generally narrower than B1

A3 Gently sloping with signs of very shallow soil cover (murrum < 50cm)

Areas with rock outcrops

C1 Rocky mountaneous formation

C2 Lower scattered rock outcrops

==== Main Roads

----- Minor Roads

— Soil Boundaries

~ Streams

■ Buildings

*reddish yellow clay*

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in November 1972

Refer to this map as W/D/11