

**THE VEGETATION AND SOILS OF SOMALIA**

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**Pages 23-52. In: Birds of Somalia. 1998. J.S. Ash & J.E. Miskell (Editors). Pica Press, Sussex**

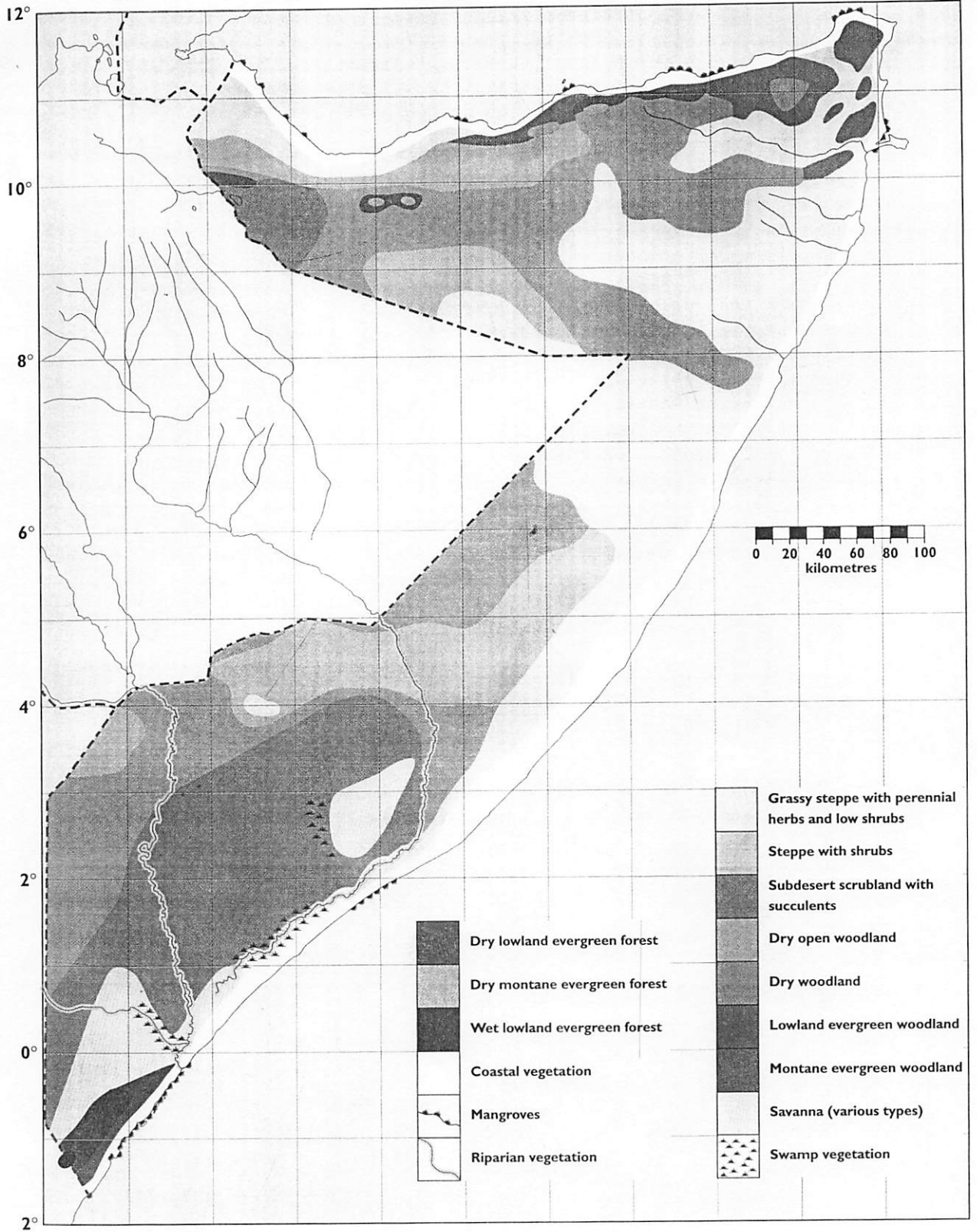


Figure 3. Vegetation zones in Somalia. Adapted from Carta Geobotanica Dell'Africa Orientale (Rodolfo E. G. Pichi-Sermolli, 1957).

the vegetation + soils of Somalia -

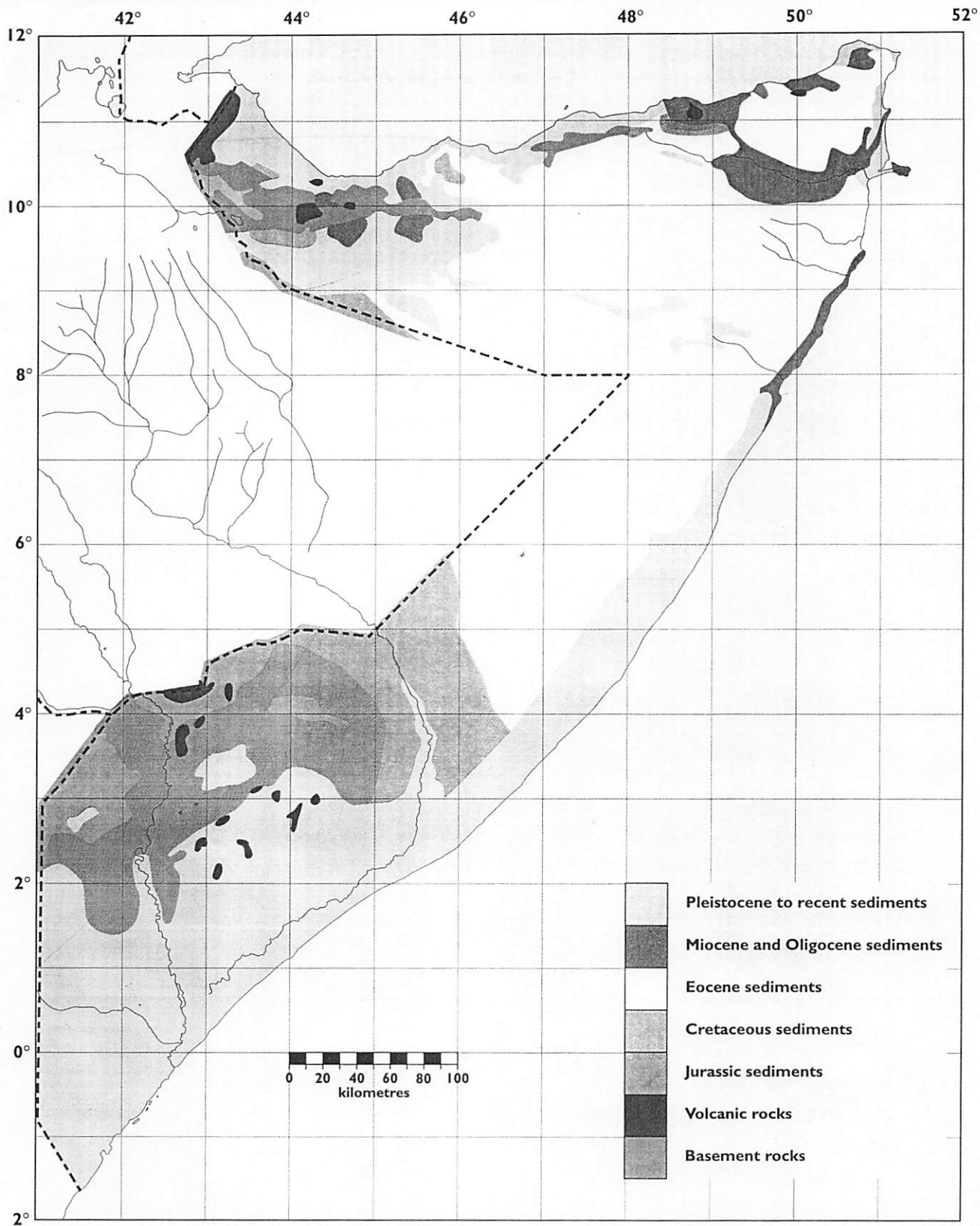


Figure 4. Geological map of Somalia. Drawn and simplified by C. Nyamweru.  
Sources: Merla *et al.* 1973 (N. of 2°N) and Barnes 1976 (S. of 2°N).

# THE VEGETATION AND SOILS OF SOMALIA

by

Christopher F. Hemming

## Introduction and previous work

Only one attempt has been made to produce an overall map of the vegetation of Somalia. That was by Pichi-Sermolli in 1957. His map, which also includes a large section of Eastern Ethiopia, is too simplified to be of much use to the ornithologist who tends to be more interested in the birds' habitat than broad-scale classification.

Apart from this excellent map the vegetation of Somalia has been studied very extensively and a mass of information exists in unpublished reports of the agricultural and forestry departments of the former colonial powers. There are also numerous reports which have been produced by a range of organisations such as the Food and Agriculture Organisation of the United Nations, the World Bank and a number of consultancies.

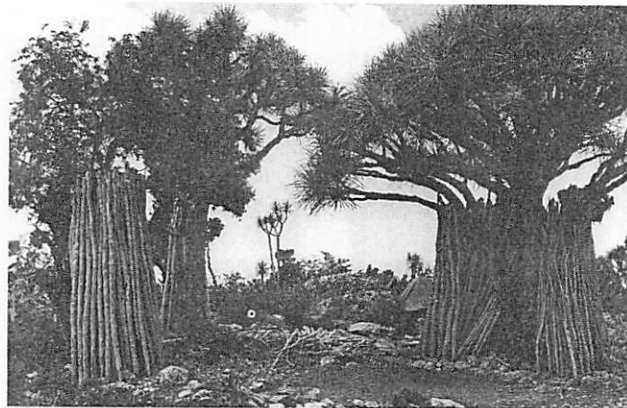
Resource Management & Research undertook surveys in the 1970s and 1980s covering the whole of the Republic. Their surveys, conducted on behalf of the Somali Government were financed by the World Bank and USAID and took several years to complete. They were undertaken in three sections, the Northern, Central and Southern Rangelands. As the name implies, these surveys, which included detailed stock census figures, were designed, as were several earlier reports, to assist with range management and development. Unfortunately, most of these reports are not readily available to the general public.

During the field work associated with the above surveys, enormous numbers of plant specimens were collected all over the Republic. These collections have borne fruit and in 1993 the first volume, Volume One, of the Flora of Somalia, edited by Mats Thulin, was published by the Royal Botanic Gardens, Kew, and the second volume, Volume Four, in 1995. The present author published a detailed map and description of the zonation of plant communities in the northern region of the Somali Republic, formerly the British Somaliland Protectorate (Hemming 1966).

## Ecology: General considerations

Very little vegetation in Somalia could be described as climax vegetation. A few climax relicts remain but are not regenerating themselves. Examples are provided by the *Juniperus* trees which still form a thin line along the edge of the escarpment in the north. Throughout the *Juniperus* zone, grazing pressure is so intense that no seedlings can survive to replace the ageing trees. Also the ground cover has been destroyed and the shallow soil badly eroded to reveal much of the underlying limestone. The only successful plant in this area is *Hypoestes hildebrandtii*. This small species is unpalatable to stock and is no respecter of ecological zones. It is found over an altitude range of over a thousand metres.

Below the *Juniperus* relicts, which occupy the edge of the escarpment on the north-facing slopes, there is a belt of mature box trees (*Buxus hildebrandtii*). For many years they were extensively cut and exported to the states of the Persian Gulf for use as scaffolding poles.



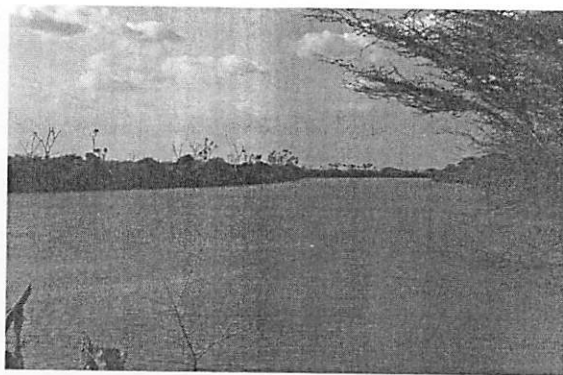
*Buxus*, for export as scaffolding poles to the Persian Gulf, with *Dracaena* on escarpment below Ceerigaabo in 1960 (Photo: Christopher Hemming).

There are also a few areas of extremely interesting riparian forest on the southern Jubba. These forest relicts are generally now restricted to the levees close to the river and are being intensively cut down on the side away from the river to produce areas suitable for cultivation. There is also considerable grazing pressure which prevents much regeneration, although grazing is restricted while crops are growing.

At one site on the southern Jubba a dense tall forest of *Acacia robusta* in 1984 seemed to be a quite stable community, although all areas of reasonable quality vegetation are under intense pressure for agricultural use or from commercial interests who seek to satisfy Muqdisho's insatiable demand for firewood. In some areas the wood is cut to make charcoal but much of this is so badly made that it is even more wasteful than its use as firewood.



Jubba River with remnant riverine forest, Bu'aale 1982 (Photo: R. J. Douthwaite).



Jubba River with almost totally destroyed riverine forest, 1979 (Photo: J. S. Ash).

The demand for fuel is such that all woody species are under severe attack. For example in 1987, large areas of bush and low woodland were being cut to the ground, since when during years of civil strife and insurrection the hunt for firewood has continued on a free-for-all basis. There has also been an almost total destruction of all woody vegetation for several kilometres around all the numerous refugee camps, in which only large shade trees have been preserved. This destruction of woody vegetation must have had a devastating effect on roosting and nesting sites as it is generally accepted that destruction of the habitat is the main reason for the disappearance of animal species. For the ornithologist of the future the prospects are bleak in Somalia.

As Somalia is such a large country (630,000 square km) and the vegetation is so varied, it has been decided to describe the vegetation and the soils under four distinct regions: the north-west (formerly British Somaliland Protectorate), the arid Horn of Africa (formerly the province of Migiurtinia of Italian Somaliland), the Mudugh (Somalia lying to the east of the Ethiopian Ogaden), and southern Somalia (south of 5°N). These areas will be discussed progressively starting in the NW, close to Djibouti, then eastwards to Raas Casey, and then southwards to the Kenyan border.

The new Somali orthography, together with the efforts of the last government, have resulted in a high rate of literacy. It has also resulted in many place names being written in such a way that an outsider is likely to be unable either to pronounce or recognize them. The new spelling introduced here will make this work as up to date as possible and readily usable by Somali ornithologists. However, as many readers will be more acquainted with previous literature than with current orthography, a list of place names occurring in the text will be found in the Gazetteer at the end of the book. This not only gives the current spelling but also different spellings and quite different names that may be found in previous literature and on older maps. As many readers will not have current large scale maps showing every small village, co-ordinates have also been listed. The greatest need for a gazetteer will be from those requiring identifications of the localities used in the older literature.

## I THE NORTH-WEST

Former Somaliland Protectorate: Awdal, Waqooyi Galbeed, Togdheer, Sanaag, Sool and the northern part of Nugaal



150m high coastal dunes 50km north-east of Berbera in 1960 (Photo: Christopher Hemming).

### Introduction

In this brief outline we will consider this region clockwise. The reader may refer to Hemming (1966) for a more detailed description of the geomorphology, climate and vegetation of the former Somaliland Protectorate.

The whole of this area may be divided broadly into three zones:

1. a low-lying coastal and sub-coastal zone
2. the escarpment
3. the more inland plateau above, generally sloping gently to the SE

### 1. THE COASTAL AND SUB-COASTAL ZONE

#### a. Non-saline areas

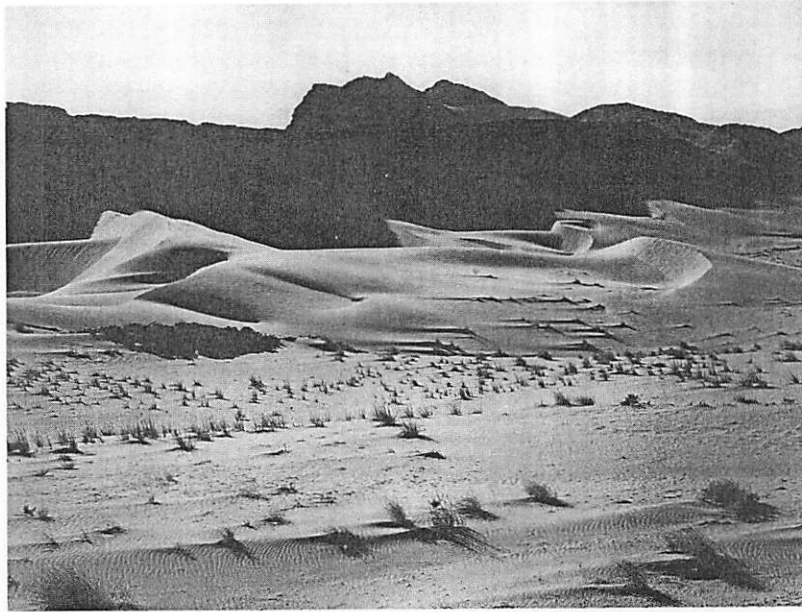
##### (i) The western sands

In the west there is a large area of some 5200 square km of sand. These sands are calcareous and generally consolidated and somewhat cemented, though, locally, there are areas where the surface is covered by a shallow layer of loose mobile wind-blown sand. This sandy area reaches to quite near the sea where it overlies deep deposits of alluvium which are revealed in the incised banks of seasonal watercourses. On the actual shoreline these alluvia are saline and during the rains form deep slippery mud. This extensive sandy area in the west is an exceptionally homogeneous area whereas the east of the coastal and sub-coastal zone, which extends eastwards, for more than 750km, to Caseyr, is extremely variable and the soil/vegetation communities often vary every few metres.

The basic vegetation of this large area of more or less consolidated sand consists of scattered clump grasses. The most important is *Lasiurus scindicus*. Overgrazing and wind erosion have produced a superficial layer of loose sand and, where this occurs in the form of shallow wind-blown dunes, *Panicum turgidum* is more important.

After rain quite a number of annual grasses appear, such as *Aristida adscensionis*, *Cenchrus ciliaris*, *Ochthochloa compressa*, *Eragrostis* sp., *Leptothrium senegalense* and *Tragus racemosus*. Rain also produces seedlings of the perennial grasses *Panicum* and *Lasiurus* but the quantity and duration of the rains, together with grazing pressure, determines whether or not they ever grow large enough to become established as perennials.

In addition to the grasses there are occasional wide strips of scattered *Balanites orbicularis*, a small tree to 3-4m. These tree belts may be a kilometre or so in width and may be several kilometres long. In the most easterly section of the western sands, the scattered woody vegetation is more mixed. *Acacia tortilis*, *Boscia minimifolia* and *Dobera glabra* are to be seen in addition to *Balanites orbicularis*.



The southern inland edge of the loose blown sand area 50km north-east of Berbera in 1960 (Photo: Christopher Hemming).

(ii) Wind-blown sands

On the coastal plain, about 65km east of Berbera, there is a considerable area of wind-blown sands which occur not only as large dunes lying parallel to the shoreline but also as a chaotic sand sea extending inland for a distance of some 30km. The largest of the dunes parallel to the coast is approximately 15km in length rising to a height of 150m. It is devoid of vegetation.

The more chaotic sands on the inland slopes support sparse non-woody species: *Cyperus* sp. (a tallish species to 0.75m.), *Dipterygium glaucum*, *Indigofera* sp. and the perennial grasses *Panicum turgidum* and *Odysea mucronata*.

**b. Halophytic coastal and sub-coastal area**

This area is too complex to describe in detail in the introduction to an ornithological book but one thing that must be stressed is its heterogeneity. A soil/vegetation type may extend a few hundred metres but, in some areas, it can be restricted to a few metres by edaphic factors which, in the coastal and sub-coastal areas, are much more important than the climatic ones.

Genera which are typical of saline sands include *Salsola*, *Limonium*, *Atriplex* and low *Acacia edgeworthii*. Along the coastline there are occasional stretches of ancient raised coral reefs. These are now overlain by a shallow layer of saline alluvium. The vegetation depends on the depth of the alluvium and the resulting soil salinity at root level.

Along the coastal strip, seasonal watercourses draining the sub-coastal area are flooded by sea-water, in the dry season, and these temporary estuarine sea-water pools are occasionally closed by bars of sand or marine gravel. The edges of some of these pools support the mangrove *Avicennia marina* with stands of *Tamarix nilotica* on the drier saline sand.

The true mangrove *Rhizophora mucronata* is reported from Saacada Diin Island, but, even before 1947, it was being extensively cut for poles (Glover 1947).

Coastal salt flats, which are so common on both sides of the Red Sea, are limited on the north coast of Somalia. They occur on raised coral reefs less than one metre above sea-level. These areas, depending on salinity and the presence or absence of any overlying wind-blown sand, are either bare or support halophytic genera such as *Suaeda*, *Limonium* and *Salsola*. The inland edge of such salt flats disappears under the more stony pediments of the sub-coastal area and in this transitional zone low *Acacia* spp. may be found.

Mt Elmis, which is in the sub-coastal area 25km west of Bullaxaar, is an unusual local phenomenon in this area as it is composed of Pliocene or more recent lava (Macfadyen 1933). It rises to a little over 600m. Owing to its altitude it apparently attracts some extra orographic rain. Both *Acacia mellifera* and *Delonix elata* are found

there, neither of which could grow on the sub-coastal plain where the mean annual rainfall is less than 100mm. These species are more typical of the Hawd to the south where, though the rainfall is only 300mm, the sandy soils enable the plants to make the best use of soil water.

## 2. THE ESCARPMENT

In the west, the gradation from the sub-coastal area to the plateau is gentle, whereas in the east there are dramatic vertical limestone cliffs. To the north-west of Ceerigaabo, the highest land is almost 2400m. In these high areas the edge of the escarpment supports a relict strip of *Juniperus procera* which also fringes the plateau above. In the Ceerigaabo area grazing is particularly heavy and all palatable seedlings are quickly eaten and the soil is so eroded that the underlying solid limestone is exposed over wide areas. These highlands, with varying quality *Juniperus* forest, extend eastwards almost as far as 49°E. According to information supplied by the Forest Office at Ceerigaabo in 1960 the finest unspoiled forest was, at that time, to be found on the eastern section of the Cal Madow, between 48° and 49°E.

In some areas, for example north of Ceerigaabo, there are vertical cliffs of several hundred metres exposing the lower Eocene limestone (Somaliland Oil 1954).

Rainfall records in these areas are sparse but, to the north of Ceerigaabo, the mean annual rainfall is 833mm. In addition to rainfall, mist is of importance to the survival of *Juniperus* and a rich growth of the hanging lichen *Usnea articulata* is common. There are no temperature records for the *Juniperus* zone but it is generally cool and frost occurs once or twice a year north of Ceerigaabo.

On the escarpment, below the *Juniperus*, there is an evergreen bush zone, consisting mainly of *Buxus hildebrandtii*, *Cadia purpurea* and *Dodonaea viscosa*. This zone is particularly well developed on the scarp to the north of Ceerigaabo on the road to Maydh. Here *Buxus* forms a low closed forest, the trunks of the larger trees being up to 15cm thick and 9m high.

At this altitude (1690m), on the scarp face, the vegetation, except for the limited area of homogeneous closed *Buxus* forest, is quite mixed. The larger species include *Aloe eminens* (a tree *Aloe* to 15m), *Cussonia holstii*, *Dracaena ombet*, *Euphorbia abyssinica*, *Sideroxylon buxifolium* and *Rhus somalensis*. An important element of the climate is that the scarp face is frequently in the clouds, and an air of dampness prevails, although the rainfall is not more than 650mm per annum.

As has been mentioned earlier, the steep scarp area is composed of Eocene limestone. Further to the west the steep escarpment is absent and on the road from Hargeysa to Berbera a ridge of basement complex rocks, including quartz and pegmatites, is exposed. Acidic sandy soils extend westwards to Boorama. These quartzite outcrops slope down gently to merge with the extensive western coastal and sub-coastal sands.

## 3. THE PLATEAU

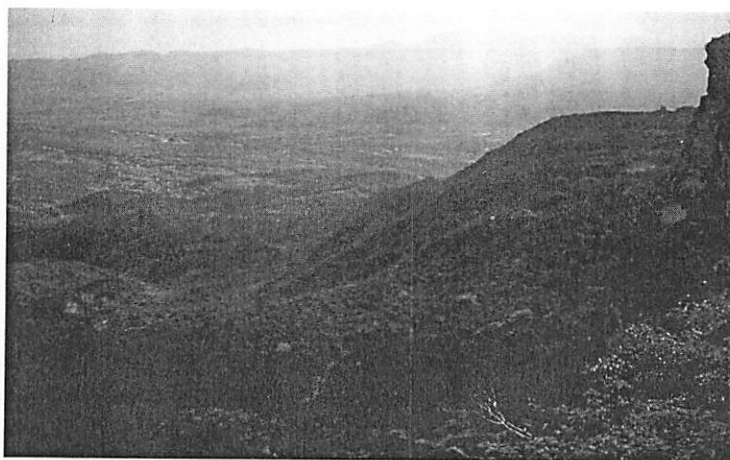
To the south of the escarpment, the land is rather flat and slopes gently south-eastwards. For the purpose of a rather simple outline of the vegetation, this plateau area can be divided into five zones:

- a. The evergreen zone
- b. *Acacia etbaica* bushland and open woodland
- c. The Tog Wajaale clay plain
- d. *Acacia bussei* open woodland
- e. The gypseous area of the Nugaal Valley
- f. Hawd-type mixed bush

### a. The evergreen zone

Evergreen vegetation has been described above on the upper part of the escarpment, just below the *Juniperus* zone. There, *Buxus hildebrandtii* grows particularly well. It is, however, found much more often as a major constituent of the evergreen scrub that fringes all sections of the relicts of *Juniperus procera* forest. For most of this century the evergreen zone has been expanding into areas formerly occupied by *Juniperus*.

The most important species in the evergreen scrub are *Buxus hildebrandtii*, *Dodonaea viscosa*, *Cadia purpurea* and *Euclea schimperi*. Just west of Shiikh there is a large area of evergreen scrub and it is interesting to note that *Buxus* and *Dodonaea* are not mixed up together but grow in large groups where one species is clearly dominant.



Remnants of the montane juniper forest at Gacan Libaax, May 1988 (Photo: Fabio Cassola).

Photographs of this area in Drake-Brockman (1912) and Hemming (1966) show the same grouping as is found to-day. On the edge of the evergreen scrub, at Gacan Libaax, *Acokanthera schimperi* var. *ouabaio* (the source of arrow poison) is common. At the beginning of the century there were *Juniperus* trees between the *Acokanthera* trees (Hemming 1966).

#### b. *Acacia etbaica* bushland and open woodland

The *Acacia etbaica* belt is relatively narrow from north to south but extends eastwards from the Ethiopian border in the west for almost 6° of longitude, approximately 650km. This zone lies below the evergreen zone and above the *Acacia bussei* zone, and is found on quartzite basement soils, limestone-derived highly calcareous soils and on gypseous soils. It can therefore be described as a truly climatically controlled type, whose total area has been estimated to be 20,000 square km. (British Commonwealth Forestry Conference 1957), with a mean annual rainfall in the range of 300 to 550mm.

##### (i) On basement-derived soils

The main area of these coarse quartzite soils stretches westwards from a little to the north-west of Hargeysa to Boorama. The original dominant vegetation was *Acacia etbaica* but now, over large areas, no full-grown specimens are to be found. The area is used for cultivation and, for the most part, grazing is prevented in order to protect crops and all available wood is cut. The absence of grazing pressure has, however, allowed small *A. etbaica*, together with grasses, to grow between the fields.

The best developed *A. etbaica* open woodland seen on a visit in 1966 was in the Boorama area close to the airstrip. Occasional evergreen shrubs of *Acokanthera schimperi* var. *ouabaio* found here indicated that the best developed open woodland is at the wetter limit of the *A. etbaica* zone. The mean annual rainfall at Boorama is 515mm. *Acokanthera* is also found at the lower edge of the evergreen zone at Gacan Libaax (see a. above).

##### (ii) On limestone-derived soils

The areas south of Hargeysa and the hills to the west of Shiikh are composed of limestone which has weathered to form a calcareous soil. There are some areas of residual soil but it is prone to erosion and the underlying rock is often exposed. In these areas near Hargeysa, grazing pressure has obviously been intense for many decades. Surprisingly a few *A. etbaica* seedlings escape destruction and become established but the only species that do well, and indeed multiply, are unpalatable ones such as *Aloe megalacantha* and the smaller but very widespread *Hypoestes hildebrandtii*. In some areas clumps of aloes are so dense that there is no bare ground to be seen between the plants.

In the lower areas of *A. etbaica* near Hargeysa there is a wide ecotone with *A. bussei*, while near Shiikh (1300-1500m) there is a wide ecotone with the higher evergreen zone.

##### (iii) On gypseous soils

In the Ceerigaabo district, at about 1700m, there are vast areas of gypseous soils derived from the weathering of the underlying anhydrite. In some areas the anhydrite still occurs in the form of paving stones, locally covered

by a shallow gypseous soil. In this area the mean annual rainfall is about 310mm.

Despite the grazing pressure, *A. etbaica* open woodland has survived but regeneration is poor. As on the limestone-derived soils, an aloe is very important and occupies the bare areas resulting from the extreme grazing pressure. Near Ceerigaabo there are large areas where the lower layer is dominated by *Aloe scobinifolia*. In the flowering season, September to November, the flowers, which vary from yellow to scarlet, provide an attractive blaze of colour (Reynolds 1966).

Occasionally, within this highland area of gypseous soil, there are very shallow depressions several hundred metres wide. Soil from nearby areas is washed into these in the rainy season and temporary shallow lakes are formed. Within such seasonally flooded areas, *Acacia tortilis* trees occur. This is a deep-rooted species and is common on alluvium on the seasonal river banks over a wide altitude range.

### c. The Tog Wajaale clay plain

This clay plain, close to the Ethiopian frontier, consists of deep clay soils at least 3.3m deep and constitutes a purely edaphic variant of the *Acacia etbaica* zone. Scattered *Acacia etbaica* up to 50cm can be found around the grass plain and further away from the plain *A. etbaica* grows taller; it is clearly a matter of drainage.

Such clay plains only support grasses, but which particular species is present depends on the pressure of grazing and fire. Hemming (1966) made an attempt to put together the past history of the dominant grass species of these plains since the first reports were published by Burton (1856). Since the late 1950s, there have been large-scale schemes to plough up these plains and use them for the production of wheat or sorghum. Such schemes have had a chequered history and the plains no longer consist of open natural grassland. However, it is possible that, in the chaos of recent years, some of the areas previously occupied by agricultural schemes may have reverted to some kind of secondary grassland.

### d. *Acacia bussei* open woodland

This *A. bussei* vegetation type is very widespread on the plateau to the south of the *A. etbaica* open woodland that fringes the evergreen and forest belts. Its area has been estimated to be 50,000 square km. (British Commonwealth Forest Conference 1957).

#### (i) Open woodland

The mean annual rainfall is quite low varying from 150 to 300mm. The root system of *A. bussei* consists of an extensive system of lateral roots not more than 30 cm below the surface; an arrangement designed to make rapid use of water in the top soil soon after rain (Glover 1951). Over wide areas this zone can better be described as 'dead *A. bussei* open woodland'. Owing to overgrazing, the perennial grasses of the ground layer below the trees have been destroyed and now the rain runs off the bare soil before it can penetrate, so the trees die of drought. The only living *A. bussei* trees to be seen occur in areas where the perennial grass cover has survived. The result of this water loss is that, from the plants' point of view, the zone is effectively drier than the mean annual rainfall suggests.

As mentioned earlier, all the vegetation of Somalia, from riverine forest to that of dry saline areas, is under incredible pressure from both grazing and the un-ending demand for firewood. Even as long ago as the late 1950s, no unspoiled *A. bussei* open woodland was seen anywhere. Drake-Brockman (1912) reported millions of acres covered with 'Daremo', the grass *Chrysopogon plumulosus*. This grass, probably the most attractive fodder grass in northern Somalia, is always heavily overgrazed and can not survive this pressure.

It results in the reduction of the perennial grass cover and the establishment of vegetation arcs. From the air the land appears to be patterned by crescent or half-moon shaped patches of vegetation, with bare soil between them. They are situated mainly in the south-eastern part of the former Somaliland Protectorate within the *Acacia bussei* open woodland zone. Maps at a scale of 1:125,000 made from air photographs by the Colonial Survey in the late 1950s indicated that vegetation arcs occurred on 37 of their 71 mapping sheets.

Within the arcs there is dense grass, *Andropogon kelleri* up to one metre high. This grass requires more rain than is locally available but is supported by runoff from the bare areas between the arcs. In one arc studied the slope was only 1:166, permitting gentle sheet flow, which is stopped by the next arc down the slope. This is not the place to describe the dynamics of vegetation arcs but a detailed study was made and supports the ideas stated above (Hemming 1965).

(ii) Treeless plains ('bans')

Throughout the flat sections of the *Acacia bussei* zone there are occasional extensive treeless areas. It appears that they fall into two categories: those which are natural and those which are induced by overgrazing.

One of the largest bans is Ban Tuyu. It is centred at about 83km east-south-east of Hargeysa and covers about 670 square km. In late 1961 its vegetation consisted mainly of grasses: *Chrysopogon plumulosus*, *Dactyloctenium scindicum*, *Sporobolus ruspolianus* and *S. somalensis* (Hemming 1966). Of these grasses only *Chrysopogon* is a perennial, which attracted such heavy grazing that it was likely to disappear; indeed it may already have done so.

The presence of numerous small *Acacia tortilis*, growing along the edge of old vehicle tracks, where water stands for some time after rain, is an example of how natural grasslands under strong grazing pressure are invaded by woody species. Over a large part of Ban Tuyu the grass clumps are arranged in a characteristic pattern described as vegetation stripes by Boaler & Hodge (1962).

There is evidence that the existence of such bans and the vegetation stripes are due to quite small differences in the clay content of the soil. A ban can be regarded as a mild edaphic variant of the surrounding wooded area. However, as the differences are small, the grassland can only survive under light grazing pressure.

The Aroori plain, situated to the south-west of Burco, covers about 570 square km. Glover (1947) stated that this ban is increasing in size as severe tree destruction occurs at the edge. On this plain there is a much wider range of species than on a natural grassland such as Ban Tuyu. Woody species noted included *Euphorbia cuneata*, *Grewia erythraea*, *Jatropha rivae* subsp. *parvifolia* and *Ipomoea donaldsonii*; smaller plants included *Indigofera ruspolii* and several species of the *Acanthaceae*. In one area two smaller grasses, *Sporobolus ioclados* and *S. ruspolianus*, were dominant but, in two sites sampled over 50 years ago, the recorded ground cover was only 5% or less.

One open natural almost pure grass ban situated south of Hargeysa was first observed in the 1950s and again in 1961. During the intervening years of heavy grazing the grass cover had been severely reduced and the *Acacia etbaica* from the next wetter zone to the west had invaded the denuded area to form dense low bushland. Bush encroachment on degraded grassland is an all too common phenomenon.

**e. The gypseous area of the Nugaal Valley**

The gypseous areas on the plateau to the south of Ceerigaabo have already been described (section 3 b (iii)). The Nugaal Valley is situated in the south-east of this north-western region. It was formed by a series of faults of the Red Sea trench. The valley to-day contains no major river system and thus represents the drainage system of a former wetter climate. The floor of the valley lies between 410-610m and the mean annual rainfall is probably no more than 100mm.

The Middle Eocene deposits of anhydrite of the Nugaal Valley are enormous. They extend over an area of at least 70,000 square km and their average depth is 300-350m. They are believed to be the largest deposits of anhydrite anywhere in the world and they are unusual owing to the almost total absence of salt. Anhydrite is an evaporite formed by the evaporation of a shallow sea. These deposits represent 210 times the amount of calcium sulphate dissolved in the present Red Sea (Macfadyen 1933).

On the surface, the anhydrite has weathered to form a poor quality gypseous soil which has been largely moved by the action of both wind and rain. When dry, it is readily powdered by the feet of grazing stock and, in the rainy season, it forms a deep mud.

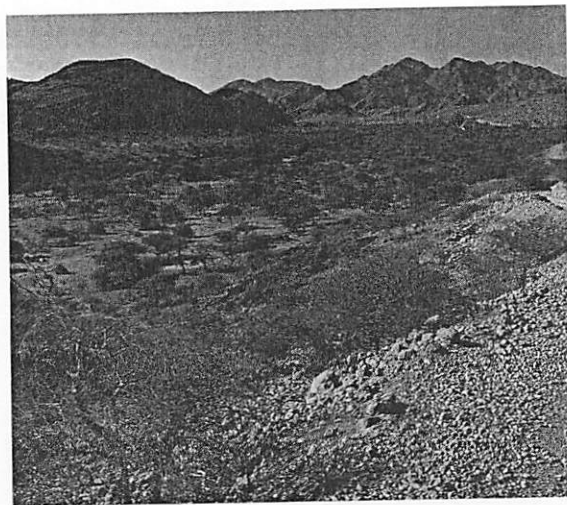
One interesting feature of the anhydrite is the presence of sink holes, some of which constitute wells of plentiful but poor quality water. Some of these cave-like holes were used by early man as shelters (Clark 1954). Lines of *Acacia tortilis*, a deep-rooted species, occur on the valley floor and suggest underground water. In general the vegetation is sparse, often no more than a thin patchy cover of grasses, such as *Sporobolus ruspolianus* and *S. somalensis*. The dense evergreen shrub *Cadaba heterotricha* is also characteristic of these gypseous soils and often occurs in groups as do *Euphorbia robecchii*, *Salvadora persica* and several species of *Commiphora*. *Commiphora* is particularly common at the edge of the valley where more recent limestone overlies the gypsum.

Areas of re-deposited gypsum soils in slightly low-lying areas, which have a better water supply, support low (30cm) *Disperma eremophilum*. Along the south side of the Nugaal Valley there is a broken line of low flat-topped hills. The vegetation of this area largely consists of endemic species, many of which have only been described in recent decades, e.g. *Kirkia bugeri* ssp. *somalensis*.

There are areas of gypseous soils, principally in the central part of the Nugaal, that support plants which are

generally classified as halophytes. However, as has been stated above, the anhydrite deposits of the Nugaal are notable for the absence of salt. Nevertheless, the weathering of the anhydrite to form gypseous soils sometimes has the same effect as a saline soil. These soils could therefore be described as 'saline' from the plant ecology point of view. These 'saline' soils are often puffed up and secondary gypsum formations are to be seen. The typical vegetation consists of more or less evenly spaced halophytes such as *Sevada schimperi* and *Atriplex nogalensis*. Other halophytic species include the grass *Urochondra setulosa* and *Limonium axillare*, both of which also occur on raised coral reefs at sea-level.

A valley with *Acacia tortilis* along the Maydh road 50km north-west of Ceerigaabo in 1960 (Photo: Christopher Hemming).



#### f. Hawd-type mixed bush

The most southerly vegetation type of the northern plateau is Hawd-type mixed bush. It is so named after the southern area of the old Somaliland Protectorate. The name originally comes from the Somali for stoneless area.

This type lies to the south of the *Acacia bussei* zone and occupies only a small proportion of the former Somaliland Protectorate, but it extends eastwards into the two main north-eastern regions of Somalia, the Bari and the Mudugh, and southwards through the Ogaden of eastern Ethiopia to include much of north-east Kenya and the western part of southern Somalia. Its area is vast and does not fit into any general arrangement of climatic zones. It must therefore be regarded as an edaphically controlled zone. The soils are mainly of calcareous reddish loamy sands, with concretions below, over solid limestone.

The mean annual rainfall in this northern section varies from 300mm in the west to 150mm in the east. Erosion by rain and the effects of animal hooves has gradually loosened the top few centimetres of the soil so that the surface is now covered by a mantle of relatively coarse sand. This stops runoff and gives rain water time to percolate.

Throughout the Hawd there are areas where shallow pools form after rain for periods varying from several days to several months. These pools called 'ballehs' provide water for stock and the Hawd has long been heavily grazed during the rains, with the stock leaving when the 'ballehs' dry out, as wells are few and far between.

Grazing stock used to be brought in only during the rainy season, and the Hawd-type mixed bush has thus escaped overgrazing for decades, if not centuries, and is extremely rich in species, many of which are endemic. This protection from grazing in the dry season is the main reason that this vegetation type has survived better than other types. But with the construction of cement-lined tanks along the border the Hawd is now under more intense grazing and browsing pressure. The effects of overgrazing are now readily to be seen in the south of the North-west Region but, further south, in the Ethiopian Ogaden, well away from the tanks, the vegetation remains unspoiled.

The main vegetation of the Hawd is a mixture of *Acacia* and *Commiphora*, having a general height of up to 5m with occasional trees up to 10m. Within the general area of *Acacia* and *Commiphora* there are taller trees of *Albizzia anthelminthica*, *Delonix elata*, *D. baccal* and *Gyrocarpus hababensis*. Genera in the lower height layer include *Acacia* spp., *Grewia*, *Cordia*, *Cordyla*, *Boswellia*, *Cordeauxia*, *Sterculia*, and *Terminalia orbicularis* which often forms quite dense thicket clumps. Within the general distribution of species some do better than others so there are many areas where one single species is locally dominant. The popular grazing grass *Chrysopogon plumulosus* has a sparse but widespread distribution, but it is clear that it was once far more abundant.

## II THE ARID HORN OF AFRICA

Migiurtina (Italian), Mijertein (English), Boosaaso Region, Bari.

### Introduction

The area covered in this section extends from 49°E to 51°17'E at Raas Casey and from 12°N to 8°N. Some of the vegetation types are the same as those found further west and described in earlier pages. In particular there are large areas of gypseous soils and *Acacia bussei* open woodland to the east of 49°E which are extensions of those to the west. Further eastwards, the *A. bussei* and *A. etbaica* zones are absent.

Botanically the most interesting areas are the driest ones and this north-east corner of Somalia is prone to endemism. In the north, apart from the extreme eastern end of the Cal Madow, there are two hill masses: the Cal Maskaad, rising to 2,200m and, further to the east, the much smaller Cal Bari rising to only 1,400m.

The eastern end of the Cal Madow and the Cal Maskaad are separated by the Karin Gap. Much of the floor of this gap is made of impermeable conglomerates which result in underground water in seasonal river beds being forced to the surface, where there are tall trees, permanent streams, open pools and even a small waterfall. Such sights are a surprise in north-eastern Somalia, especially in areas where the mean annual rainfall is under 100mm.

To the north-east of the Cal Maskaad, and the south-east of Qandala, there is an area of lava. These lava flows are either of Pliocene or even of Pleistocene age; they were canalized mainly along two river beds, the Tog Weyne and the Tog Middleho, indicating that these major drainage lines pre-dated the flows.

The upper reaches of the Nugaal Valley in the gypseous areas, described earlier, do not contain a major watercourse, but in the lower reaches, there is a major river which seasonally flows into the Indian Ocean at Eyl through a steep-sided gorge.

This region is here described under three main sections:

1. the mountains
2. the sub-coastal zone
3. the coastal areas

The sub-coastal zone and coastal areas include many sub-types which are described separately.

### 1. THE MOUNTAINS

The Cal Maskaad was explored by Professor Scortecchi in 1953 and 1957 (Scortecchi 1955, 1959). Above about 1650m, *Juniperus procera*, *Olea africana* and *Dracaena ombet* were said to be common. However, no published account is known of the Cal Bari which lies just to the east.

Evergreen vegetation is found at a lower altitude than the *Juniperus* forest relicts. A considerable area of *Buxus hildebrandtii* was noted to the east of the Cal Maskaad at an altitude of 750m. Species found with *Buxus* did not include other evergreens as described on the Cal Madow far to the west (Section I.3 a), but, rather, species normally associated with drier and lower areas, such as *Acacia edgeworthii*, *A. horrida*, *A. mellifera*, *A. reficiens*, *A. senegal* and *Boscia minimifolia*.

Evergreen scrub was also found near Galgalo on the eastern extremity of the Cal Madow, at 1130m. Above this there is a windswept plateau with sparse *Dracaena* while the low *Euphorbia balsamifera* ssp. *adenensis* is dominant. It is interesting to note that *E. balsamifera* is also locally dominant on the limestone plateau, above Mukalla, 500km to the north, across the Gulf of Aden.

### 2. THE SUB-COASTAL ZONE

The areas included in this category are extensive and varied. They extend far inland from the sea. They are placed together here because they occur at lower altitudes and in areas mainly with less rainfall than *Acacia bussei* open woodland.

The position of this sub-coastal zone in the ecological succession is different from that further west, below the main escarpment of the Cal Madow. In the west, it lies below *A. bussei* open woodland, but in the more easterly areas, there is no *A. bussei* or *A. etbaica* zone. The upper limit of the sub-coastal zone is evergreen scrub. Where this succession occurs, *A. mellifera* is common in the transitional area.

Another feature of this so-called sub-coastal zone is that it extends to the sea along much of the coastline. The mean annual rainfall is approximately within the range 75-250mm while the altitude varies from sea-level to 700-800m.

This zone is by far the largest in this region and it is only possible to describe here some of the larger and more interesting variants.

#### a. The Karin Gap

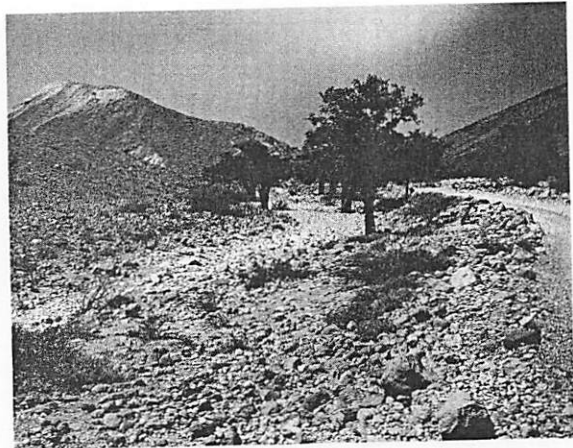
This gap is a low lying area that separates the eastern end of the Cal Madow from the western end of the Cal Maskaad. The gap has been cut into deep beds of Oligo-Miocene conglomerate and considerable areas of the derived rounded cobble stones have been covered by a 30cm layer of more recent limestone.

There are no meteorological records from this area but it is generally hot and dry, and a temperature of 38°C in September 1959 has been noted.

The main feature of the conglomerate is that it is impermeable and water, that elsewhere would be draining northwards to the sea underground, is forced to the surface. The largest watercourse is up to 100m wide but it is only during exceptionally heavy rain that the flow would extend from bank to bank; normally, the flow is restricted to a narrower and more incised section.



Surface water due to impermeable rocks, with tall *Conocarpus* trees, at Badole, near Boosaaso in 1959 (Photo: Christopher Hemming)



A seasonal watercourse with *Mimusops* trees near Karin, where all their seedlings are grazed out (Photo: Christopher Hemming).

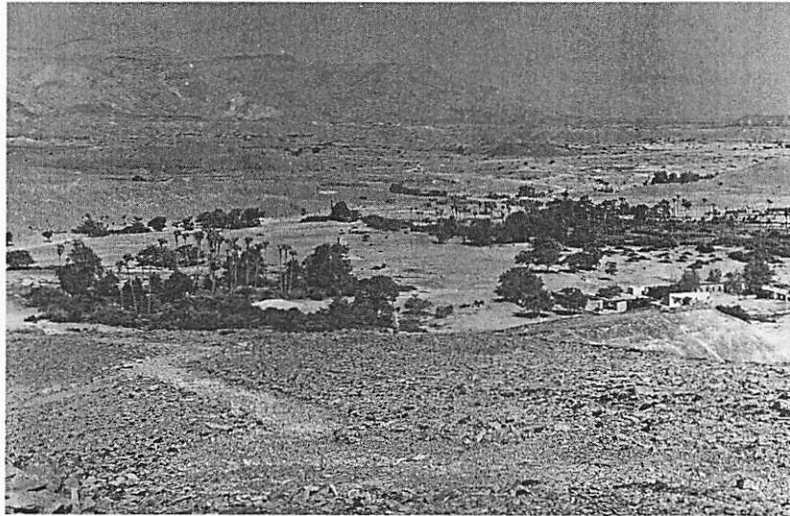
These watercourses are characterised by tall *Conocarpus lancifolius* up to 25m high. Numerous seedlings were seen growing on fine gravel at the edge of the permanent pools. (This species is the main cultivated tree in the streets of Muqdisho where it never attains its full height.) Other species of large trees include *Zizyphus mauritiana* and *Acacia tortilis*. *Moringa peregrina* is also common but only grows to about 3.5m in height. Gravel banks near the watercourses often support *Balanites* sp., *Salvadora persica* and *Zizyphus hamur*.

This low-lying permanent water is seasonally fed by watercourses up to 10m wide which have been incised down to the bedrock of conglomerate. The larger of these seasonal watercourses support spaced *Mimusops angel* along their edges. This species grows up to 10m in height. It is a slow-growing hardwood and the girth of the trunks is commonly of the order of 4.5m. No seedlings were seen so these fine trees may become another casualty of grazing pressure.

The main group of limestone hills near and to the south of Karin are generally devoid of vegetation except along seasonal watercourses. Even those incised only a centimetre or two into the stone-mantle surface can support low bushes of *Caesalpinia erianthera* and, where two or three of these very small watercourses join together to form one up to 1m wide, with a bed containing a little colluvial soil, there are low grass clumps of *Cymbopogon schoenanthus* with a few bushes of *Curroria migturtina* to 1.5m. Some areas of the hills have a rather saline soil and support halophytes such as *Limonium carinense*, *L. axillare* and *Salsola rubescens*. These species would normally be associated with coastal saline areas.

To the north of the Karin Gap there are large areas of re-deposited alluvial gravel derived from the weathering of the conglomerate beds. These areas also support the halophytes mentioned above. The re-deposited gravels have, in their turn, been dissected down to bedrock and normally contain some water and support dense stands of the palm *Phoenix reclinata* with *Salvadora persica* and *Acacia tortilis* a little further from the water.

Close to the oasis at Karin, the water-table is generally within one metre of the surface which is puffed-up and somewhat saline. The most characteristic plant is the 30m tall unbranched palm *Livistona carinensis* (*Wissmannia carinensis* in previous literature). The low palms *Phoenix reclinata* and *Hyphaene reptans* are also common. Other important species include *Tamarix nilotica* and 3m high grass clumps of *Saccharum ravennae*. *Livistona carinensis* is an endangered species in Somalia. About 50 trees were seen in 1986 but in 1995 only 11 survived. It has long been a popular tree for house building (Thulin 1995).



An oasis at Karin, 35km inland from Boosaaso with the endangered palm *Livistona carinensis* (Photo: Christopher Hemming).

#### **b. The Daror Depression**

The Daror Depression lies to the south of the Cal Maskaad. This depression slopes gently downwards to the south-east from 640m to 400m. It is largely composed of lagoonal sediments deposited in the Miocene together with other later deposits. There is also a gypseous area near Meleden.

The mean annual rainfall has been established at 100-150mm but the northern side also receives some runoff from the Cal Maskaad to the north. It is noteworthy that this runoff has not created watercourses so it must be assumed that the water is absorbed below the surface.

The main soil of the depression is a highly calcareous fine sandy alluvium containing stones. In some areas this has been deflated to form a fine wind-stable stone-mantle of small stones and wind-blown quartz sand.

The depression is characterised by grassland but this is mainly restricted to areas of loose sand and shallow drainage lines. Where there is no loose surface sand, sheet flow is general and colonisation is difficult.

The most common grass in the depression is *Dactyloctenium robecchii* growing in clumps up to 50cm high and one metre wide. In 1959 the popular grazing grass *Chrysopogon plumulosus* made up 12.9% of the plants in a transect. The area provides a huge grazing area and it is likely that *Chrysopogon* was more important before the present era of heavy grazing pressure.

Overgrazing has been particularly important near Ufeyn to which water is piped from a spring in the mountains 10km away. Such a source of water results in the permanent establishment of herds of cows which are unable to migrate from area to area owing to their need for daily watering. In 1959 there were few signs of overgrazing but, when the area was re-visited in 1970, there had been a noticeable deterioration in the intervening eleven years, presumably brought about by the continuation of the above process.

#### **c. The eastern lowlands**

This section of the sub-coastal zone includes the lowest and hottest areas with the least rainfall. The occurrence

of *Boswellia carteri* and *B. freereana* only a few metres above sea-level, on the cliffs that mark the inland edge of the coastal plain at Bargaal, supports the view that, in the Boosaaso Region, even at these low altitudes, mist, dew and condensation play a significant role in ameliorating the arid climate.

In general terms the Eastern Lowlands consist of low hills, undulating plains and dissected areas where stone-mantles alternate with flat areas of soil which vary from a few hundred metres to many kilometres in width. The vegetation of this area is composed of low woody genera, such as *Acacia* and *Caesalpinia*, on the stone-mantles, and, where there is soil, grasses, such as *Dactyloctenium*, *Chrysopogon*, *Sporobolus* and *Andropogon* are found. These genera characterize all the more extensive grasslands of the Boosaaso Region. Within the grassy areas there is a much greater degree of homogeneity and a smaller number of species involved than in the stony areas.

#### d. Stone-mantle areas

Stone-mantles have developed over wide areas and, here, three principal types are described, two being characteristically found on plateaux, while the third is developed from stony alluvium deposited in lower-lying areas. Some stone-mantle types have already been described in the account of the Karin Gap because the Karin Gap is an important geomorphological unit.

Stone-mantles fall into three types:

##### (i) Residual limestone plateau stone-mantles

To the north-east of the Daror Depression there are large stretches of low limestone plateau at altitudes between 200 and 300m. Beneath the stone-mantle there is a fine dusty calcareous soil which is readily blown away where the mantle is disturbed along animal or vehicle tracks.

It is an area of low rainfall, estimated to be between 100 and 150mm per annum. Much of the surface is devoid of vegetation but there are scattered low *Acacia edgeworthii*, *A. horrida* ssp. *benadirvensis* and *A. tortilis*. Numerous grass clumps of *Dactyloctenium robecchii* are frequently found with the low *Acacia* shrubs.

##### (ii) Alluvial stone-mantles

Two principal types are to be found. The first overlies the residual plateau types described above and the second has been derived from fine gravelly alluvium. The vegetation, on the alluvial stone-mantles overlying the residual plateau types, is similar to that described above but with a few additional species such as *Boscia minimifolia*, *Euphorbia cuneata* and *Turraea parvifolia*.

In the areas of gravelly alluvium, the vegetation is sparse and mainly restricted to woody bushes along drainage lines: *Boscia minimifolia*, *Caesalpinia erianthera*, *Commiphora* 2 spp., *Euphorbia cuneata*, *Grewia erythraea* and *Zizyphus hamur*. On a larger watercourse, flowing through a coarser alluvial gravel, *Acacia tortilis*, *Lannea malifolia* and *Terminalia polycarpa* trees were seen.

##### (iii) Lava stone-mantles

Lava flows are restricted to two major watercourses, that were clearly formed before the flows, the Tog Weyne and Tog Middleho to the north-east of the Cal Maskaad. The lava has been weathered and most of the lava derived soil has been eroded away. Generally the lava boulders and stones lie on top of a limestone derived soil.

The vegetation is sparse and restricted to small watercourses which support broken lines of *Caesalpinia erianthera* bushes with low *Acacia tortilis* and *Commiphora* sp.

### 3. COASTAL AREAS

True coastal vegetation is rare owing to the fact that, along much of the long coastline, sub-coastal vegetation reaches almost to the shoreline.

#### a. Raised coral reefs

The two most important occurrences of exposed raised reefs are on the north coast near Boosaaso and on the east coast near Bargaal.

On these exposed sections there is no real soil but the coral has been planed level and the interstices have been filled with broken coral, shell fragments and marine sand. There has been only very little rotting of the rock and hence very little real soil formation. It is essentially a saline habitat and supports only very sparse vegetation of *Limonium* spp. *Limonium cylindrifolium* is the commoner species on both coasts but, in the Boosaaso

area, *L. axillare* is also found.

These raised coral reefs are generally overlain with some alluvial soil. This overlying layer determines the vegetation and the edaphic factors vary rapidly in spatial terms. Where there is an overlying colluvial gravel the vegetation depends upon its depth; if thin, one finds the usual *Limonium* dominated halophytic vegetation.

Near Qandala and Bargaal, the raised coral reef is overlain by a locally transported soil from nearby higher inland areas which is frequently mixed with wind-blown sand. These areas are very heavily overgrazed and locally the vegetation is dominated by *Sclerostephane adenophora*, a low, strongly smelling, unpalatable composite. Where this species has not reached dominance the vegetation is generally sparse, the largest species being *Acacia edgeworthii* which is found either where the overlying soil is deep enough to provide protection from the underlying salinity or along small drainage lines.

The most distinct type of overlying soil consists of a saline alluvium where bare salt flats are to be found. Where there is a little wind-blown sand on the salt flats *Arthrocnemum macrostachyum* is found. Drainage lines from more inland and less saline areas support low clumps of *Pluchea* sp.

The salt flats are occasionally cut by seasonal watercourses and some non-saline soil is deposited and here *Tamarix nilotica* growing to 4-5m high, large clumps of *Lycium europaeum* to 2.5m and some *Arthrocnemum* are to be found.

#### **b. Ancient aeolian sand remnants**

On the coast to the south-east of Caluula there are two dissected remnants of ancient windblown sand which have become consolidated and slightly cemented. The vegetation is sparse and the salinity of the sand is indicated by the presence of *Limonium* sp. with some *Iphiona rotundifolia*. Where the sand is a metre or more in thickness, there are low *Acacia tortilis* trees together with the shrubs *Cadaba glandulosa* and *Maerua sessiliflora*.

#### **c. Silty coastal plains**

In the Bandar Murcaayo-Geesaley area (11°42'N, 50°27'E) there is 13.5km of coastal plain with a pallid cement-coloured, fine, dusty, silty, alluvial soil. The water-table is only about 1 to 1.5m below the surface and, as both temperatures and evaporation rates are high, there has been some salinification of the soil, due to upward movement of water and salts. This area supports large plantations of date palms, separated from the sea by only a few metres. Along the shoreline there is a fixed dune of whitish quartz sand supporting *Iphiona rotundifolia*, *Salsola spinescens* and *Ruta tuberculata*. Inland from the dune there is a saline zone of hummocky sand up to 300m wide which supports *Suaeda monoica*. In one locality this saline zone is about 100m wide and *Suaeda* is replaced by *Arthrocnemum macrostachyum*. Further inland lie date cultivations, which, in neglected areas, are being invaded by *Limonium cylindrifolium* and *Pluchea pinnatifida*, both growing well to form clumps 60cm high.

#### **d. Estuaries and inlets**

Estuaries are sometimes cut off from the sea by steep banks of gravel built up by wave action. This results in the formation of stagnant pools of sea-water on the inland side which may support the mangrove *Avicennia marina* with dense stands of *Suaeda monoica* on the banks. Upstream from these sea-water pools, *Tamarix nilotica* forms a transitional zone to non-saline areas with *Acacia tortilis* and *Zizyphus hamur*.

The estuary of the Tog Kalwein, just east of Caluula, is flooded with sea-water for 1.5km. The whole watercourse is deeply incised into the limestone of the coastal plain and the riverine alluvium has become saline owing to the evaporation of sea-water. This area now supports *Tamarix*.

In an estuary near Qandala the sea-water extends 4km inland but is not cut off from the sea by a gravel bank. At the inland end of the sea-water there are muddy flats which support scattered low *Suaeda monoica* and bushes of *Tamarix*. The last unflooded section of the riverbed supports a small date plantation.

#### **e. Nugaal Gorge at Eyl**

The Nugaal valley, which runs WNW-ESE for more than 300km, only contains a substantial watercourse for the last 100km before it reaches the Indian Ocean, through a deep gorge, at Eyl.

The river is seasonal but, in the dry season, a number of pools remain in scooped out sections of the riverbed near the sea. The edges of these pools support the grass *Paspalum vaginatum* and there is often a patchy sward of *Sporobolus spicatus*. The smaller pools do not survive the whole dry season but around the larger ones

there are dense stands of *Tamarix nilotica*.

The vegetation on the slopes of the valley is very varied. Woody species include *Acacia reficiens* ssp. *misera*, *Caesalpinia erianthera* with a few taller *Dobera glabra* and *Salvadora persica*. These slopes are quite heavily grazed and the unpalatable composite *Sclerostephane adenophora* is locally abundant.

The cliffs at the top of the gorge show signs of exposure to the full force of the south-west monsoon and are generally bare rock but, along cracks, dense cushion-like plants are found; two such species are *Pulicaria* sp. and *Oldenlandia saxifragoides*. There is also a very small prostrate *Jatropha* sp. and a prostrate *Commiphora* sp.



An inlet from the sea (khoodi), several kilometres long, with *Tamarix* and *Salvadora* and containing brackish water, east of Boosaaso in 1959 (Photo: Christopher Hemming).

### III THE MUDUGH

Southern Nugaal, Mudugh, Galgadug and Northern Hiraan

#### Introduction

The Mudugh is that part of Somalia lying to the east of the eastern part of Ethiopia known as the Ogaden. The vegetation of the Mudugh region does not fall into well defined and distinct types. There is low grassland along the fixed dune areas close to the coast and rich mixed shrubby bushland with scattered trees inland to the west, toward Ethiopia. Between these two extremes there is generally a gradual increase in the height of the vegetation with increasing distance from the sea. Superimposed upon this are variations which can be attributed to local soil conditions.

The mean annual rainfall varies from 100mm in the north to a little over 200mm in the south. This small variation, together with the fact that the Mudugh is relatively flat, means that there are no clearly defined, rainfall determined, plant formations.

It is, however, possible to distinguish six major soil and geomorphological types:

1. gypseous areas,
2. pliocene coastal fixed dune sands,
3. Hawd-type reddish loamy sands,
4. shallow orange-toned sand over limestone,
5. fine loose sand over limestone and
6. limestone ridges and colluvial valley soils.

#### 1. GYPSEOUS AREAS

Extensive gypseous areas are to be found around Gaalkacyo, between Dhuusa Marreeb and Ceel Buur and near the coast 150km east of Gaalkacyo. Gypseous areas have always been subject to grazing pressure owing to the relative ease with which water can be found and wells can be dug.

The vegetation is restricted mainly to sparse grassland; the most important species are *Chrysopogon plumulosus* and *Sporobolus ruspolianus*.

#### 2. PLIOCENE COASTAL FIXED DUNE SANDS

The coastal areas of the Mudugh region from its southern border, south of Ceel Dheere, northward to beyond Garacad, are covered with a deposit of ancient dune sand which is now fixed by low vegetation consisting mainly of grasses and sedges. This sand, which has lost much of its former dune slopes and now only undulates gently, overlies pinkish-toned limestone. Bare limestone ridges are also characteristic of these areas; two such ridges are to be found to the north and north-north-east of Hobyo and another inland from Garacad.

Scattered along the NNE-SSW axis of these sands there are occasional large barchans (crescent-shaped sand-dunes). The shape of the dunes, their orientation, and a study of the surrounding vegetation suggest that their dominant direction of movement is approximately north-east. On the south-west side of the dunes there is very little loose fine sand. All the sand has been blown into the dune and the surface is either stony or consists of very coarse sand which is too heavy to be wind-blown. The vegetation is sparse and consists mainly of broad-leaved plants. An examination of the north-east side of the dunes showed that the advancing arms of the crescent-shaped dunes kill the grasses and sedges that normally fix the sand.

The presence of large active dunes indicates what could happen if grazing pressure were to increase. The maintenance of the grass and sedge cover is essential. When last seen by the author in 1979 the situation was relatively stable. In the political instability of recent years, it is unlikely that new boreholes have been drilled and it is likely that many are out of action. This may have reduced grazing pressure and helped maintain the dune-fixing grasses and sedges. This type of vegetation often reaches to within 100-200m of the shore so there is no real 'coastal' vegetation, just a narrow strip of salt-tolerant species.

Some 20km south of Hobyo there is a gradual increase in dicotyledons in the grassland. The sandy soils become more silty owing to the weathering products from the edge of the sub-coastal limestone plateau, which rises to about 300m. The road turns west towards the plateau and rises through a gorge before arriving at the village of Goween. The vegetation, in this gorge, is of extreme botanical interest. There is a large number of

species including *Buxus hildebrandtii*. This species is an important constituent of the evergreen zone, both on the plateau in the North-West Region (section I.3 a) and around the mountains of the Bari Region (section II. 1). Its presence here at its most southerly recorded site (J.B. Gillett pers. comm.) must indicate that this gorge benefits from considerably higher rainfall than would be expected so near the coastal plain. This area is described here not because it is to be related to the Pliocene coastal fixed dune sands but because it lies very close to them and is too small to be described as a separate zone; it is, however, far too interesting not to be mentioned somewhere.

### 3. HAWD-TYPE REDDISH LOAMY SANDS

Earlier it was mentioned that the Hawd-type vegetation (section I.3f) extends southward to the Ethiopian Ogaden and from there eastwards into the Mudugh. The Hawd-type bushland is continuous along the Mudugh border with the Ogaden and varies in width from 20 to 50km. The main characteristic of the vegetation is its richness and diversity. Many species which achieve dominance over a few hundred yards are hard to find elsewhere. The reddish loamy sand varies greatly in depth. In some areas, pits reveal several metres of sand, with calcareous concretions increasing with depth. Away from boreholes, the vegetation is protected against excessive grazing by the absence of water in the dry season but, on the Ethiopian border, there are two villages with two boreholes each; these have attracted non-migratory stock and, around these villages, the soil is completely devoid of vegetation. Apart from the grazing pressure, these settled populations greatly increase the demand for firewood. Around these two villages grazing pressure is reduced, from time to time, due to political tension between Ethiopia and Somalia. The pumps also breakdown frequently.



A balli in flood in red Hawd-type sands north-west of Buuhoodle in 1960 (Photo: Christopher Hemming).

### 4. SHALLOW ORANGE-TONED SAND OVER LIMESTONE

Shallow orange-toned sand over limestone is a very widely distributed soil type. It occupies most of the area lying between the Hawd-type mixed bush along the Ogaden border and the Pliocene fixed dune sands near the coast. It could be regarded as the main soil type of the Mudugh.

Over wide sections, the vegetation is less than 0.5m high, whereas, in other areas, there are occasional widely spaced small trees.

The thickness of the sand over the limestone varies considerably and this is probably the main factor controlling the vegetation. Grazing pressure is, as always, at its worst near boreholes. In the centre there are no boreholes and there has been no notable increase in unpalatable species; the only sign of grazing pressure is the poor grass cover. The grass *Chrysopogon plumulosus* is widespread but nowhere is it dense. Smaller annual grasses such as *Aristida* spp. are more common. In some areas *Indigofera ruspolii* is abundant.

The woody species include *Acacia edgeworthii*, *A. reficiens* ssp. *miser*a and several species of *Commiphora*. Unpalatable species are, as usual, predominant near the boreholes.

## 5. FINE LOOSE SAND OVER LIMESTONE

This type is to be found in the southern part of the Mudugh. The sand is derived from the Pliocene fixed dunes. In some areas the sand is fixed by vegetation but in others it is mobile, forming high dunes which move slowly and threaten villages. Boreholes are numerous and, because the rainfall is over 200mm per annum, areas have been cleared of vegetation and enclosed for crops but, in most years, the rainfall is too low and, in these large bare areas, the sand is blown into dunes that cross the enclosures, sometimes making nearby roads impassable. This soil type occupies only a small proportion of the Mudugh but it includes the largest deposits of wind-blown sand in the region; the largest dune seen was very close to the village of Baargaan.

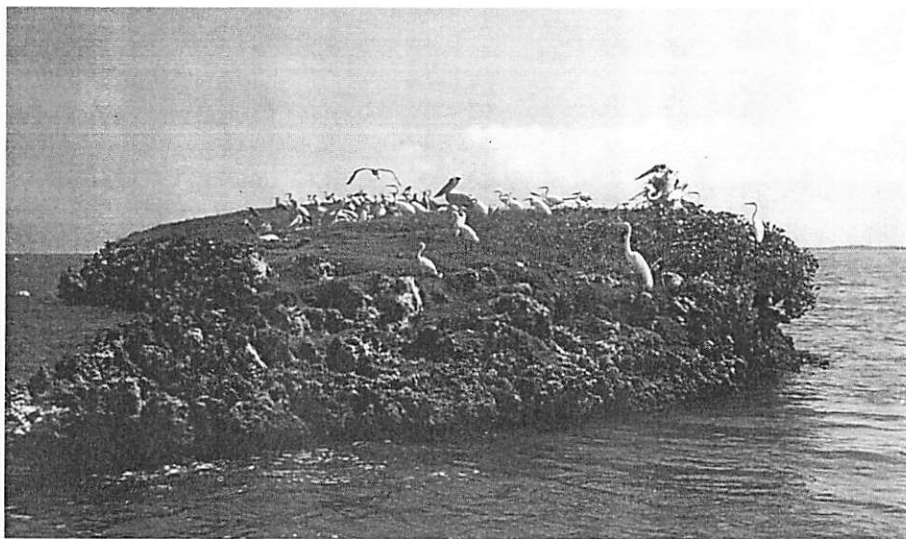
The vegetation varies greatly from one place to another. The main genera responsible for fixing the sand are *Acacia* and *Commiphora*. In some areas there are thickets of *Dichrostachys cinerea* so dense that they cannot be penetrated either by man or his grazing stock. Where grazing has been heavy, the more palatable species have locally been replaced by bushes of a large *Solanum* sp.

## 6. LIMESTONE RIDGES AND COLLUVIAL VALLEY SOILS

This type is to be found in the north-east of the Mudugh and it lies astride the Gaalkacyo-Buur Tinle road. It is characterised by parallel limestone ridges, practically devoid of soil which has been washed down the slopes and deposited on the valley floors between the ridges.

The soil consists of loamy quartz sand to which has been added the weathering products of the limestone ridges. Twisting along the valleys, there are small seasonal watercourses. Locally there are accumulations of alluvial clay soils which support less woody vegetation.

The vegetation of the sandy valley floors is generally similar to that found on the Hawd-type reddish loamy sands to the west. Tree species include *Delonix elata*, *Acacia tortilis*, *Terminalia orbicularis*, with smaller species such as *A. mellifera* and *Dobera glabra*. Grazing pressure appears to be moderately heavy as evidenced by the small amount of grass, both on the valley floors and on the limestone slopes.



Bajun Islands – a coral rag islet in this group (Photo: R. J. Douthwaite).

## IV SOUTHERN SOMALIA

Most of Hiraan, Bakool, Bay, Gedo,  
Middle and Lower Shabeelle and Middle and Lower Jubba

### Introduction

This covers all Somalia south of the south-eastern border of the Ethiopian Ogaden just south of 5°N.

The main feature of this part of Somalia is that it is traversed by the two major rivers, the Jubba and the Shabeelle, both of which rise in the Ethiopian highlands. The Jubba runs into Somalia at Doolow, passing Luuq, and then almost directly southwards to flow into the Indian Ocean at Goob Weyn, just north of Kismaayo. The Shabeelle, lying to the east of the Jubba, fails to reach the sea and ends in swampy lands to the north of the estuary of the Jubba. However, there is some evidence to suggest that it formerly did reach the sea.

The west of this southern area lies along the Kenya border and the mixed open woodland is crossed by an east-west belt of saline sands, and the whole of it is the wettest part of Somalia. The mean annual rainfall in the north along the Ethiopian border is less than 300mm and along the N-S Kenya border less than 400mm. However in the main *Sorghum* growing area near Baydhabo the mean annual rainfall is more than 600mm. In the extreme south in the middle of the NW-SE section of the Kenya border at Kolbiyow the mean annual rainfall is just over 800mm. As a result of this higher rainfall, southern Somalia is extensively cultivated, especially along the two rivers. However, despite this agricultural production, stock raising, particularly beef is important; goats and sheep to a lesser extent.

The vegetation is extremely varied and locally very rich. The original fringing forests of the Jubba and Shabeelle have been savagely depleted to clear land for agriculture, much of the wood cleared being burnt locally and not even used for firewood or charcoal. The remaining areas have however been largely protected from overgrazing and continue to be so due to a serious infestation of tsetse. In the extreme south, along the NW-SE Kenya border, there is a small area of evergreen forest. This lies just to the north-east of the Boni National Reserve in Kenya.

Along much of the coast of this southern region there is a line of fixed sand dunes lying a little distance from the sea. They rise to a considerable height and support a rich mixed bushland with scattered trees. On the coast, between the equator and the Kenya border, there are a number of bays and inlets supporting mangroves.

The central part of this southern region consists of various types of clay soils. This area includes the main sorghum producing agricultural land. Some of the clays are, however, too impermeable for agricultural use and these support mixed and locally dense bushland.

In this southern section of Somalia, the following ten major types can be distinguished:

1. Coastal zone including mangroves
2. Fixed dunes parallel to the coast
3. Riverine vegetation
4. Moist and dry evergreen forest
5. Agricultural areas
6. Reddish loamy sands on N-S Kenya border
7. The saline sands of the ancient Uaso Nyiro drainage system
8. The inter-riverine area
9. Basement inselbergs and derived soils
10. Geological variants in the north-west

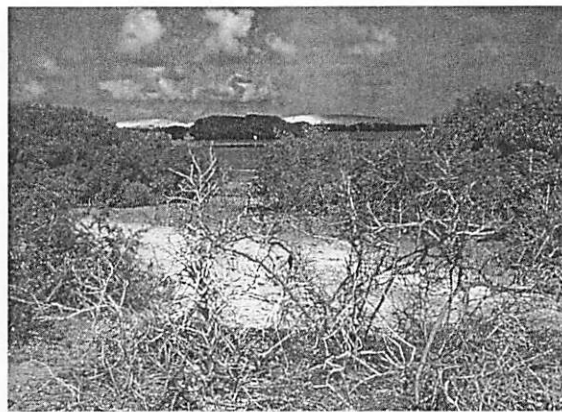
### 1. COASTAL ZONE INCLUDING MANGROVES

Along most of the shoreline there is a sandy beach and there is an area of soft mobile sand extending inland as far as the reddish-toned fixed dunes.

The plant found on sand nearest the sea, locally forming a dense cover, is low *Ipomoea pes-caprae*. As would be expected, halophytes such as *Atriplex farinosa*, grasses such as *Sporobolus spicatus*, and *Halopyrum mucronatum* are typical. Sedges are also frequently found in saline sand very close to the shore, for example *Cyperus chordorrhizus* and *C. macrorrhizus* a little more inland and on the dunes.



Jasiira lagoon with mangroves and coastal fossil coral, near Muqdisho in 1982 (Photo: R. J. Douthwaite).



Mangroves *Avicennia* at Jasiira, 20km south-west of Muqdisho, April 1987 (Photo: Fabio Cassola).

In one place there are low cliffs 4-6m high, and right on the edge, where vegetation is affected by sea spray, the succulent *Scaevola plumieri* (Lobeliaceae) was found. The author saw only one of these plants, which are mentioned in all the earlier botanical works; one wonders, therefore, whether this species is in decline.

South of the equator there are several shallow inlets where mangroves occur. Some of these areas seem marginal for their survival. In one area examined mature specimens of *Avicennia marina* were seen although no young plants were found. Three species of true mangroves have been recorded along this southernmost section of shoreline, *Rhizophora mucronata*, *Ceriops tagal* and *Bruguiera gymnorrhiza*, and Pichi-Sermolli (1957) reported that, in some places in the south, mangroves occurred as dense woodland up to 10-15m tall.

## 2. FIXED DUNES PARALLEL TO THE COAST



Consolidated coastal sand dunes near Marka, May 1987 (Photo: Fabio Cassola).

These dunes are composed of quartz sand but on the seaward side there are occasionally smaller dunes of coralline sand. The sands look like dunes, when seen from the shore, but in places the sand levels off into a deep deposit of fixed sand on the inland side. These fixed dune sands may extend far inland from the coast. The widest deposits are to be found in two belts; one, 80km long, is centred approximately 110km north-east of Kismaayo, the other extends north-eastwards from Muqdisho for more than 240km and in its northernmost section these sands occur inland as far as 60km from the sea.

The vegetation of these sands, where not unduly affected by man, consists of a rich mixed *Acacia-Commiphora*

bushland with taller trees at a very variable spacing. The more important tree species are *Acacia tortilis*, *Delonix elata* and *Gyrocarpus angustifolius*. The lower shrub layer includes *A. mellifera*, *Gardenia* sp., *Balanites* sp., *Sesamothamnus* sp., *Cordia* sp., *Terminalia* sp. and several species of *Grewia*.

Baobab trees *Adansonia digitata* occur in small numbers over a wide area south of the equator, the most northerly specimen was seen at 1°N.

In this most southerly section the vegetation consists of wide clumps of several species, including some evergreens, with open grassland between them. The presence of evergreens on dune sands, now fixed, indicates very considerable climatic changes in the not too distant past.

### 3. RIVERINE VEGETATION



Shabeelle River, Balcad Nature Reserve, with narrow riverine woodland and nearby bush (Photo: R. J. Douthwaite).

The vegetation on the banks of the Jubba and Shabeelle varies from almost undisturbed forest to absolutely bare soil. The construction of a barrage and power station at Fanoole on the Jubba, north of Baardheere, has caused large areas to be flooded unintentionally, while bunds constructed on the banks upstream have resulted in other areas being less regularly flooded.

In some of the recently flooded areas, there are now permanent pools which support water-lilies (*Nymphaea* spp.). Around the edges of these pools, tall grasses are normally found, but in some places they have been cleared to plant bananas near the water's edge.

Along much of the southern Jubba, levees several hundred metres wide have developed over time and it is on these that some of the best sections of unspoiled forest are to be found. Further from the river, beyond the levees, there are numerous wide and relatively shallow depressions. The origin of these depressions, known as 'dhesheegs', is unknown, to the author at least. When the river floods, these dhesheegs fill and, later, when the water-level goes down, they are planted on the receding flood with crops such as maize.

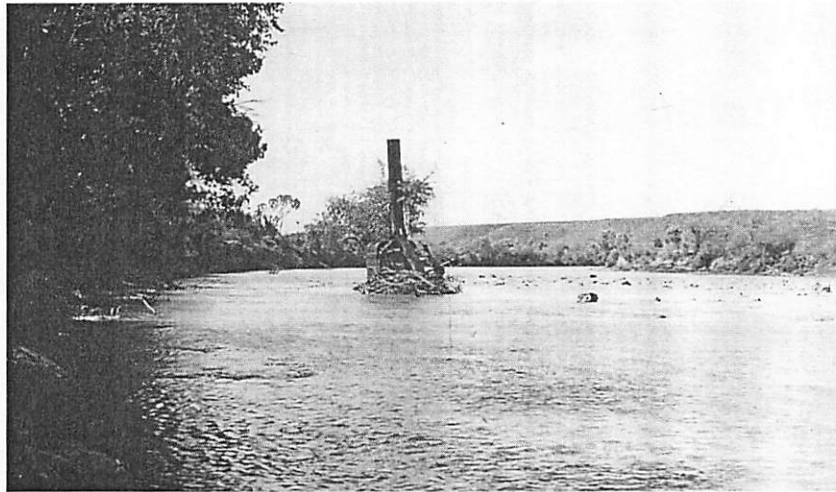
In unspoiled areas the forest may reach more than 30m in height, the main tall species include *Ficus sycamorus*, *Azelia quanzensis*, *Acacia robusta*, *A. goetzei* and *A. roovumae*, *Newtonia erlangeri*, *Parkia filicoidea*, *Sorindeia madagascariensis*, *Pachystela brevipes*, *Garcinia livingstonei*, *Bridelia cathartica* and *Mimusops fruticosa*.

It is impossible to describe all the variations that occur but one rather interesting one seen was high closed forest of almost pure *Acacia robusta*; in another section of the forest there were almost pure stands of *Acacia roovumae*. A particularly interesting account of the surviving remnants of unspoiled riverine forest is given in the Somalia Research Project, Final Report (Madgwick *et al.* 1986).

In another section of the Jubba there was no tall forest but a clear zonation could be observed on the banks. On the river side of the levee there was dense *Tamarix aphylla*, on the inland edge of the levee there was dense *Salvadora persica* and, further from the river, on seasonally flooded flat land, there was dense *Acacia zanzibarica* closed woodland. All these zones were remarkably pure. *A. zanzibarica* is extremely common in the seasonally flooded areas, which are extensive along the rivers. For the traveller, in the dry season, the presence of numerous large more or less round shells of the aquatic mollusc, *Pila* sp., is indicative of seasonal flooding.

In general the densest and most unspoiled vegetation found on the banks of the Shabeelle is narrower and not so luxurious as that found along the Jubba. The Shabeelle, in years of poor rainfall in Ethiopia, can even run dry in its lower stretches. Dhesheegs along the Jubba are also found further upstream where considerable areas along the river banks have been cleared and the crops irrigated by privately owned pumps.

Finally, the once proposed Jubba dam project deserves a mention. The site envisaged was a few kilometres upstream from Baardheere where the river passes through a low rock gorge. If the dam is ever built, which seems unlikely at the moment, it would drown all the cultivations on the river banks upstream and its flood control function would destroy cultivations in the dhesheegs below the dam by preventing adequate flooding. The proposed dam site is called Markabley. It is named after the wreck of an old river patrol boat owned by the well-known explorer Baron Claus von der Decken, of hornbill fame, wrecked in 1869. The boiler and funnel are still to be seen above the non-flood water-level.



Jubba River with almost totally destroyed riverine forest, Baardheere 1983; the remains of Baron Claus von der Decken's 1869 wrecked steamship still exists (Photo: R. J. Douthwaite).

#### 4. MOIST AND DRY EVERGREEN FOREST

In the extreme south there is a small area of evergreen forest, which can be regarded as the northern tip of the similar vegetation of northern coastal Kenya. It is more extensive in Kenya, and includes the Boni Forest Reserve. Certainly in Somalia access is difficult due to dense ground cover and muddy conditions in the rains.

It is known that the northern section of Kenya's Coast Province has higher rainfall than southern Somalia. A little south of Somalia, at 2°30'S on the Kenya coast, annual rainfall is in excess of 1,000mm, whereas in Somalia, just north of this evergreen area, the mean annual rainfall is probably approximately only 300-400mm.

Pichi-Sermolli's (1957) map indicates that the small area of moist evergreen forest is surrounded by a larger area of dry evergreen forest. This list of species for the moist evergreen forest is taken from Pichi-Sermolli (1957), who in turn took it from Dale (1939). This is because the flora of the northern Kenya Coast Province has been better studied than that of the southern tip of Somalia. The names given below are frequently not the same as those listed by Pichi-Sermolli as they have been updated, wherever possible, to take modern taxonomic changes into account.

The taller species often reach 30m but *Atiaris toxicana* is reported to grow to 45m. Other species in the upper storey in the range 25-30m include *Nesogordonia holtzii*, *Azelia quanzensis*, *Erythrina suaveolens*, *Cussonia zimmermanii*, *Combretum schumannii*, *Majidea zanguebarica*, *Sorindeia madagascariensis* and *Milicia excelsa*.

In the lower section of the upper storey, 15-25m, species include *Tamarindus indica*, *Trichilia emetica*, *Memecylon* sp., *Sterculia appendiculata*, *Manilkara* sp., *Gyrocarpus americanus*, *Kigelia africana*, *Neotonia erlangeri*, *Oldfieldia somalensis*, *Hormalium abdessammadii*, *Lonchocarpus bussei* and *Cassipourea euryoides*.

This is an extremely rich list and it may be noted that some of the species have already been listed in Riverine Vegetation (Section IV.3).

In the dry evergreen forest, which Pichi-Sermolli (1957) says surrounds the moist evergreen forest and forms an intermediate zone between it and the drier areas, some of the same species are found but are generally not so tall, for instance *Azelia quanzensis*, *Cassipourea euryoides* and *Oldfieldia somalensis*. Specifically from the Somali section of the dry evergreen forest, Senni (1935) also lists *Cecchia somalensis*, *Diospyros cornii*, *Salacia* spp., *Sideroxylon inerme*, *Delonix elata*, *Parkia filicoidea* (in Kenya, this species has been recorded up to 30m high), *Brachylaena huillensis*, *Manilkara mochisia*, *Tabernaemontana* sp. The underlayer is reported to include the liana *Combretum illairii* and the climber *Landolphia kirkii*. *Croton pseudopulchellus* is also an important element of the understorey.

## 5. AGRICULTURAL AREAS

The staple grain crop is sorghum but maize is also popular in the heavier rainfall areas. The centre of the main agricultural area is Baydhabo, which is somewhat over 400m above sea-level. Agricultural production is rain-fed and, therefore, yields vary enormously from year to year. News of crop failures and the resulting famines are a feature of recent years. The mean annual rainfall is generally over 500mm and, locally, up to a little over 600mm. The actual rainfall in any single year is very variable and maize is therefore a marginal crop.

The soils in this area vary considerably from dark grey clays to much more silty soils. When dry and uncovered by vegetation, the soil is generally somewhat puffed up and the surface is generally cracked. In the rainy season, the soil rapidly changes to a sticky mud. Around Baydhabo, and southwestwards to Baardheere, the silty and clayey soils overlie limestone. This is the main area of rain-fed cultivation; it has been estimated at over 400,000ha.

Southeast of Baydhabo, around Buur Hakaba, the underlying rocks are basement complex and, near the buurs, where the rock is exposed, there are no cultivations. The cultivated area overlying the basement rocks is considerably smaller than that overlying limestone and has been estimated at about 130,000ha.

The origins of these soils are mixed, although it appears that much can be related to ancient alluvia from the Jubba, but there is some evidence, where clayey soils are perched on low limestone plateaux, that the soil is locally derived. In such areas numerous stones (limestone) are to be found on the surface. Before being cleared for agriculture, this land supported mixed *Acacia/Commiphora* woodland. Very little of the original vegetation remains but occasional low trees and shrubs of a wide range of species are to be found. After the sorghum crop has been harvested, the stalks having been removed for fodder reserve, the fields are generally used for communal grazing and browsing.

In addition to this large area of rain-fed sorghum production, there is extensive cultivation along both the Jubba and the Shabeelle. Although the Shabeelle is the smaller river, and may occasionally run dry, it has been favoured for cultivation ever since the eastern part of Somalia was colonized by the Italians soon after the opening of the Suez Canal in 1869.

On the Shabeelle, apart from almost continuous small-scale cultivations, a number of plantations have been developed. These include coconuts, sugar and rice. There are also extensive banana plantations which have always been subsidized by Italy. Sugar is, perhaps, the greatest success story and Somalia was at one time self-sufficient. A recent survey (1996 pers. comm.) of the Middle Shabeelle has shown that considerable stretches of the bunds, designed to prevent flooding, have collapsed and now agricultural production close to the river is at risk. The potential flooding season is long and crops, almost ready for harvesting, may be destroyed.

On the Jubba, plantations of rice and sugar have been established and on its banks, towards its estuary, there is a considerable number of very large old mango trees which are too tall to harvest. When the fruit falls, it is locally available in quantity at a nominal price.

In the northern section of the Jubba, near Luuq, crops are planted on the receding flood and in this area crocodiles are a serious predator of stock and occasionally of man. A little south of Luuq, the flood plain next to the Jubba is about 400m wide and it is all cultivated and irrigated with water pumped from the river. In 1987 the whole crop was lost due to untimely flooding. The estimated crop losses were 35 tonnes of maize, 5 truck-loads of onions and a considerable quantity of tomatoes. When the flood went down, small areas were hastily replanted with sesame and maize (pers. comm.).

North of the Fanoole dam on the Jubba, there are bunds built along the banks to protect the surrounding area where, in the past, no agriculture was possible because of regular flooding. Now these cultivations are

being constantly expanded. Crops include maize, tobacco and sesame. The clearance of natural vegetation to make agricultural land is already cutting into the outside edge of the riverine forest and many tree stumps are often to be seen in the cultivated fields.

The stabilized sand dunes, parallel to the coast, cover a very large area (see Section IV.2). Numerous patches have been cleared and are used for rain-fed agriculture. They total over 100,000ha. The fields are generally less than 0.5ha, and fenced. Crops such as water-melons, beans and cowpeas, sesame, peppers, pumpkins and sweet potatoes are usually grown for cash and transported to Muqdisho or other centres for sale. Crops such as sorghum, maize, finger millet and cassava may be stored in the farmers' village, either for his own use or for local sale.

## 6. REDDISH LOAMY SANDS ON NORTH-SOUTH KENYA BORDER

In the west of this region, along the southern section of the N-S Kenya border, there is a belt of sandy soil over limestone, resembling the Hawd-type soils occurring in the south of the North West Region (Section I.3f) and in the west of the the Mudugh (Section III.3). This area is really the eastern limit of a geomorphological-botanical type which is much more extensive in the north-eastern part of Kenya and in the Ethiopian Ogaden.

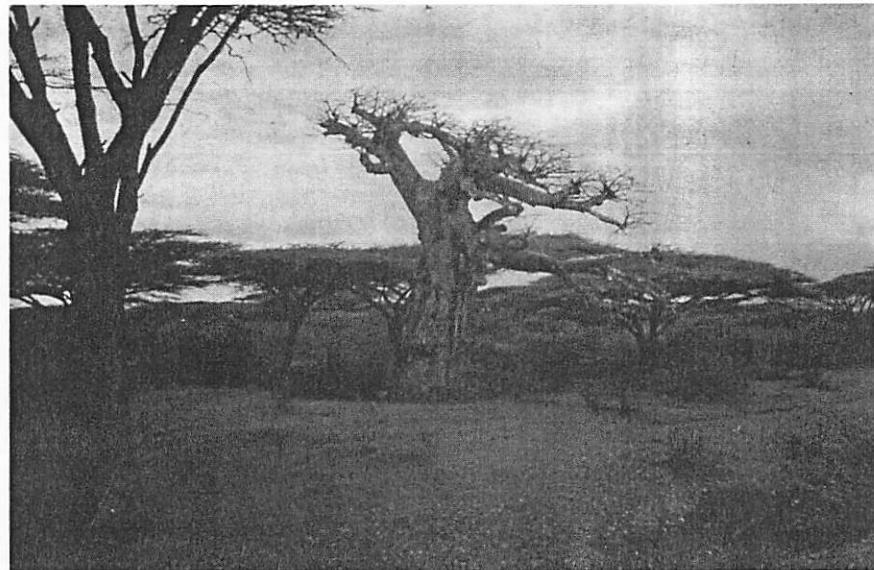
The soils could generally be described as a loamy sand over limestone but the precise amount of clay in the soil is critical in determining the vegetation. Where the clay content is low, there are trees and scattered shrubs. Where it is a little higher, there are only scattered trees in open grassland. Where it is still higher, flooding may occur in the rainy season and only grassland is found.

In this area, particularly where there are sections of open grassland, much game is present. In 1984, Giraffe, Lesser Kudu, Oryx, Soemmerring's Gazelle, Gerenuk, and one small carnivore, a Caracal, were seen. Ostriches were also common.

In the more sandy areas the vegetation consists of spaced trees, *Acacia tortilis*, *Delonix elata* and *Terminalia* sp. The shrub layer is composed of a considerable number of species including *Cordia sinensis*, *Sesamothamnus* sp., *Grewia villosa*, *G. tenax*, *Sterculia* sp., *Boswellia* sp., *Platycelyphium voense* and several species of *Commiphora*.

The grass layer includes *Chrysopogon plumulosus* and a number of other species which were too dry to be collected or identified. This area is attractive for both browsing and grazing animals and is under considerable pressure. In some areas the increase in unpalatable species is all too evident and, locally, impenetrable clumps of *Commiphora* sp. have developed.

There are also small areas where the clay content is high enough to cause serious drainage problems and, small-scale seasonal flooding can occur in years of good rains. The flood tolerant *Acacia zanzibarica* is typical of such areas and locally forms quite dense woodland.



Open *Acacia* woodland south of Kismaayo in southern Somalia, May 1987 (Photo: Fabio Cassola).

## 7. THE SALINE SANDS OF THE ANCIENT UASO NYIRO DRAINAGE SYSTEM

Much of the southern section of the N-S border between Somalia and Kenya consists of reddish loamy sands (Section IV.6) but, between latitudes 0°45' N and 0°30' S, there is a considerable area where the soil is somewhat saline and very badly drained. It is suggested that this area is related to the central axis of the Uaso Nyiro drainage system. In former pluvial times this probably reached the Indian Ocean, not far from Goob Weyn, where the Jubba now has its estuary.

Due to gradual deflation, the surface, when dry, appears to be generally sandy but, below, the soil is more clayey. The surface has small depressions up to a metre or so deep. During the rainy season this area changes dramatically from a rather desertsic aspect with lots of bare soil to one of large expanses of water, generally shallow, with occasional ponds where the depressions have filled.

The area supports a number of aquatic animal genera such as the crustacean *Apus*, which abounds in shallow pools and a number of aquatic molluscs including *Lanistes carinatus*, *L. purpureus*, *Cleopatra hemmingii* and one species of the Giant African Landsnail, *Achatina fulica hamillei*. All these aquatic species are able to survive below ground for several years between floods.

The main trees to be seen in this area are widely spaced *Acacia tortilis* and lower trees and shrubs include *Dobera glabra*, *Terminalia parvula* and occasional clumps of *Salvadora persica*, but none of these species occur densely. Among the smaller species, halophytes are typical, for instance *Suaeda* sp. and *Salsola africana*. Other species which characterize this area include *Sansevieria* sp., *Sporobolus spicatus* and *Cyperus rubicundus*.

The shallow ponds are generally more saline than the deeper ones formed in the depressions. Species favouring the edges of the more saline ponds include *Euphorbia breviararticulata*, *Strophanthus mirabilis*, *Calyptrothea taitensis* and the grass *Tragus racemosus*.

On the less saline soils, the specific range of small plants is greater, including *Heliotropium* sp., *Mormordica trifoliolata*, *Pedaliium murex*, *Chascanum hildebrandtii*, *Pupalia lappacea*, *Leucas urticifolia*, *Cleome gynandra* and the grasses *Dactyloctenium scindicum* and *Eragrostis ciliaris* (Hemming and Verdcourt 1956).

In a year of above average rains, when it is extensively flooded, thousands of sandgrouse, hundreds of Egyptian Geese and other species, are attracted to this area.

## 8. THE INTER-RIVERINE AREA

The inter-riverine area is extremely varied, and not only includes the silty clays mentioned above, but also, in the extreme north, gypseous areas (Section IV.10 a). There are also quite extensive areas of reddish loamy sands further to the east (Section IV.6), which are to be seen in patches between Wanlaweyn, some 90km NNW of Muqdisho, and Luuq.

Basically south of the fringe of gypseous areas, close to the Ethiopian border, there is a vast area of limestone overlain by various soils. In the more northerly section, the soils tend to be residual or locally transported colluvial soils of limestone origin while, further south, there are the very extensive areas of rain-fed agriculture, where the silty clays overlie either limestone or basement complex (Section IV.5).

The cultivation of the inter-riverine clayey soils depends upon their silt content. Where this is too low, the soils are too impermeable for agricultural use. These clayey soils vary considerably in colour from greyish, almost black, to an orangey-red. In these areas, which are virtually impassable in the rainy season, there is mixed bushland of *Acacia* and *Commiphora* and many other genera.

The once proposed dam at Markabley, just north of Baardheere, had originally been intended to provide electricity to Muqdisho. The World Bank, however, thought that it might also be used to irrigate unused land in the inter-riverine area downstream. A soil survey was undertaken by the United States Department of Agriculture, to assess the suitability of these soils for irrigation, and came to the conclusion that they were just about suitable. The present author, with experience in the Indo-Pakistani area, is of the opinion that irrigation would sooner or later lead to salinisation. The Somali authorities also took the view that another valuable function of the dam would be flood control. It has to be asked at what price, as the dam would have resulted in the dhesheegs downstream not being flooded, thus ending their agricultural production, and, upstream of the dam, in all the present riverside agriculture being drowned.

An area of special interest in the inter-riverine vegetation is to be found 40km north of Baardheere, where the road to Baydhabo passes through very dense closed woodland up to about 10m tall. No detailed botanical

investigation has been conducted but numerous *Parkia filicoidea* were seen. This species is typical of evergreen forest and riverine forest, where it can grow to 30m high and its presence here seems to indicate an area of extra rainfall or, perhaps, less clayey soils, but where the work involved in clearing the land for agriculture might be more than it is locally thought to be worth.

In another area, silty clay soils had been cleared of *Delonix baccal*, *Acacia zanzibarica*, *A. seyal*, *Elaeodendron aquifolium*, *Terminalia* sp., *Dobera glabra* and *Terminalia* sp. and subsequently have not been cultivated. The first stage of the re-colonization of such cleared areas by local plants has resulted in a dense low impenetrable thicket of *Dichrostachys* sp.

## 9. BASEMENT INSELBERGS AND DERIVED SOILS

Buur Hakaba, which lies on the road from Muqdisho to Luuq, is perhaps the best known of a considerable number of granitic inselbergs. They are relatively closely grouped and are not found elsewhere. Around Buur Hakaba there is an extensive shield of granitic type basement complex from which arise four small inselbergs. This area suggests that the buurs are somewhat like the tip of an iceberg and that there is a vast block of basement complex rocks below the surface. Both Burr Hakoba and Burr Heybo have large areas of steep smooth bare rock. Soil and rock fragments have, however, accumulated in cracks and crevices and anywhere that is more or less level. Owing to runoff from the bare rock surface, these crevices are relatively better watered than the mean annual rainfall of approximately 250mm would suggest. Somalis believe that Burr Heybo was visited by Mohammed and that his son Qasim is buried there; it is, therefore, a site for pilgrimage. Buur Kuulow is small and, in 1983, was being cut up into blocks of two to three cubic metres for export to Italy as decorative granite facing for buildings.

Around the base of both Buur Hakaba and Buur Haybo, there are well-developed baobabs, *Adansonia digitata*. Large *Zizyphus spina-christi* and the occasional enormous fig-tree, *Ficus bussei*, up to 25m, are also to be found in the narrow habitat belt which benefits from very considerable runoff of rain from the slopes of these buurs.

*Euphorbia tirucalli* is probably the commonest species, with a thick trunk, found in crevices and other soil accumulating sites. The list of the shrubs and smaller species collected on the two buurs is long, very varied and of little interest. More interest lies in the larger trees, normally found in riverine woodland or forest, which are supported by runoff at the foot of these buurs. Examples are *Bridelia cathartica*, *Acridocarpus zanzibaricus*, *Ricinus communis*, and *Azelia quanzensis* which is typical of evergreen forest.

There are also small areas where water accumulates to form small pools which support grasses and sedges. These are tough species as the pools often dry out. The bare rock surface also provides a site for xerophytes and small species are occasionally found growing on virtually smooth rock. At the foot of some buurs, where the underlying granitic shield forms an impermeable layer, runoff can fill a pool and provide the local inhabitants with a valuable source of water in a site where it is impossible to dig wells.

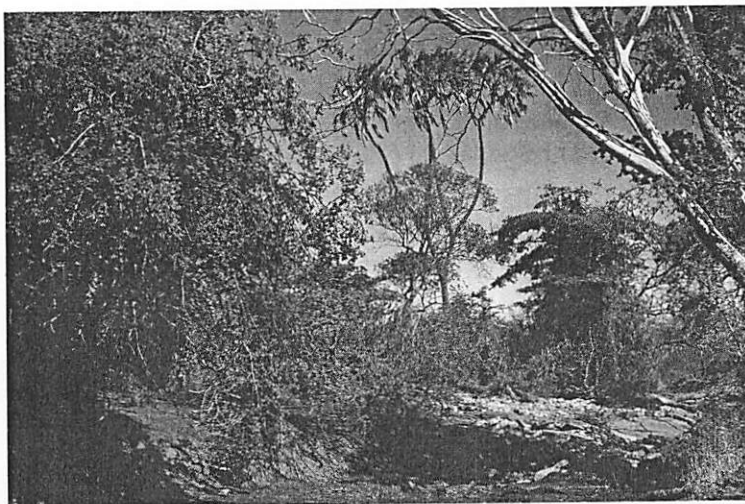
## 10. GEOLOGICAL VARIANTS IN THE NORTH-WEST

The underlying geology is complicated in the north-west of this southern section. Four types can readily be distinguished:

- a. Gypseous areas
- b. Limestone and gypseous transitional areas
- c. Lava stone-mantles
- d. Sandstone outcrops and soils

### a. Gypseous areas

About 4km up the east bank of the Jubba from Luuq there are thick solid deposits of anhydrite and derived gypseous soils. In places there are almost vertical 10m cliffs, which must have been cut in more pluvial times, when the river flow was much greater than today. The top of the cliffs is more or less plain anhydrite, all loose soil having been either washed or blown away. In places, the foot of the anhydrite cliff is lapped by the Jubba, at its present day flood level, and there are deposits of riverine alluvium on the banks. On this alluvium, *Tamarix aphylla* and *Ricinus communis* are common. A single palm, *Hyphaene* sp. was seen. Other species noted were *Moringa ruspoliana* and *Euphorbia jatrophioides*. The smaller bright yellow-flowered *Cassia longiracemosa* was also common.



Mixed woodland with *Hyphaene* palm in a dry tributary of the Jubba River near Baardheere, July 1987 (Photo: Christopher Hemming).

On the top of the cliffs, one of the plants most typical of this habitat is the yellow-flowered *Kelleronia* sp. Larger shrubs included *Commiphora sphaerocarpa*, *C. sessiliflora* and another *C.* sp., as yet undescribed, *Sesamothamnus* sp., *Balanites aegyptiaca*, *Ipomoea donaldsonii* and *Lindaea speciosa*. Smaller species included *Cadaba glandulosa*, *Boscia coriacea*, *Jatropha rivae* and *Reseda ellenbeckii*. Two genera of succulents were noted, *Aloe* and *Caralluma*.

Further away from the anhydrite cliffs, the gypseous soil has not been eroded away. The vegetation is controlled mainly by the degree of the saline effect of the gypsum. The less 'saline' of these gypseous soils support trees and shrubs such as *Acacia tortilis*, *A. horrida*, *A. reficiens*, *Terminalia* sp., *Boscia minimifolia* which are all widespread on other soil types. Species which are more specific to gypseous areas include *Euphorbia robecchii* and clump-forming species of *Commiphora* and low clumps of *Sericocomopsis pallida*. Locally, quite large clumps of *Salvadora persica* are common. In the more 'saline' areas a number of specialised halophytes such as *Limonium cylindricum*, *Kelleronia* sp. and the salt tolerant grass *Sporobolus spicatus* are typical. The total area of these gypseous soils is quite limited, being in the order of only 2,000 square km, but it could have some importance for insectivorous birds because of its special fauna.

#### b. Limestone and gypseous transitional areas

This type is found to the west of Luuq, as far as the Kenya border, and lies to the south of the true gypseous area described above (IV.10 a). As might be expected this type is very varied. In one area there are parallel limestone ridges where most of the soil has been eroded from the slopes and re-deposited to form a narrow silty valley floor in which there is usually a narrow shallowly incised watercourse. The shallow soils of the limestone slopes support very open low mixed bush including *Commiphora* spp., *Acacia reficiens*, *Boswellia neglecta*, *Boscia coriacea*, *Lannea* sp. and *Jatropha* sp.

Quite frequently the slopes from the massive limestone down to the valley floor cross exposures of anhydrite and gypsum. In these cases the gypseous soil of the valley floor supports scattered trees and shrubs including *Boscia mazzochii* (6m), *B. coriacea*, *Dobeya glabra* (3m), and lower *Acacia stuhlmannii*, *A. seyal* var. *fistula* and *Commiphora* sp. Several grass species were noted including *Schoenefeldia transiens*. As most of the woody species provide poor quality browse, grazing pressure is also light.

#### c. Lava stone-mantles

Near Luuq there are areas where the surface consists of a layer of lava stones. The stones are basalt and are generally rounded. They represent an ancient alluvial deposit of Ethiopian origin. The individual stones are smooth, exhibiting a desert polish; they are brown and shiny on the outside but, if broken, are grey inside. This stone-mantle is a stable surface through which rain water can penetrate and quite deep soils have developed below. Erosion occurs only where the stone-mantle and the underlying soils are cut by a watercourse. The soil, which is a sandy clay loam, is very variable in colour in the range whitish, yellow-beige, purplish-brown.

The vegetation is open *Acacia-Commiphora* bushland. *Boscia mazzocchii*, a tree up to 15m, was observed a number of times in this area. Other smaller species include *Gardenia fiorii*, *Sterculia* sp., *Euphorbia cuneata*, *Dalbergia commiphoroides*, *Cordia sinensis* and *Grewia tenax*. The spaces between the bushes are wholly covered with a thin layer of the annual grass *Aristida adscensionis*.

In another area, also near Luuq, the same kind of lava stones are found overlying an ancient deposit of sandy-silty riverine alluvium.

#### d. Sandstone outcrops and soils

Between about 2°20' N and 3°20' N, on the Kenya-Somali border, and stretching eastwards towards the limestone areas lying to the west of the Jubba, there are areas of exposed sandstone. These comprise low but solid outcrops and sandstone pavements. There are incised watercourses and extensive sandy infillings.

The vegetation of these areas is similar to the sandy non-saline areas along the border further south and could be described as medium to dense *Acacia-Commiphora* bushland with occasional taller trees.

The tree species include *Delonix elata*, *Gyrocarpus hababensis*, *Acacia tortilis*, *Kirkia tenuifolia*, *Platycephyllum voense*, and the occasional taller *Boscia mazzocchii* and *Melia volkensii*. The bush layer comprises several species of *Commiphora*, *Acacia mellifera*, *A. senegal*, *A. reficiens*, *Combretum* sp., *Cordia sinensis*, *Dalbergia commiphoroides*, *Grewia tenax*, *G. villosa* and the somewhat lower *Ipomoea donaldsonii*.

The grass and herb layer is also quite rich. The more important grasses seen included *Chrysopogon plumulosus*, *Andropogon kelleri*, *Chloris roxburghiana* and *Tetrapogon cenchriformis*. The less important grasses included *Leptothrium senegalense*, *Eragrostis* sp. and *Aristida* sp. On some of the larger sandstone outcrops the odd evergreen, such as *Acokanthera* sp. occurs.

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