



# KILIFI

## DISTRICT ENVIRONMENTAL ASSESSMENT REPORT



National Environment and Human Settlements Secretariat,  
Ministry of Environment and Natural Resources  
P.O. Box 67839  
Nairobi

December, 1984

KILIFI DISTRICT  
ENVIRONMENTAL ASSESSMENT REPORT

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December, 1984

FOREWORD

The District Environmental Assessment Report for Kilifi is the result of a collaborative effort between the National Environment and Human Settlements Secretariat (NEHSS) of the Ministry of Environment and Natural Resources of the Government of Kenya, the International Development Programme of Clark University and the Southeast Consortium for International Development. This project on District Environmental Assessment was initiated in 1978 with the principal objective of finding ways of incorporating environmental considerations into the process of district planning and decision-making. Funding has come from the Kenya Government and the United States Agency for International Development. The project itself derives its motivation from a number of considerations, chief among them being:-

- (i) that it is a facet of Government policy to bring environmental factors into the mainstream of policy-making in order to optimise use of scarce resources for the overall national good;
- (ii) that the Government has recognised the district as the primary unit of planning in order to effectively bridge the gap between the grassroots and the higher policy-making levels. To this end, the Government has established district development committees and the District Focus to decentralise decision making and policy administration; and
- (iii) that incorporation of environmental considerations at the planning stages of any project or programme would help avoid the costly correction of environmental degradation that would otherwise ensue. This makes clear the need to ensure the integration of development planning and environmental management objectives at the district level.

Thus this report, parallel to others in the series, is geared toward making a contribution to the implementation and future formulation of the District Development Plan for Kilifi District. Its aim is that the development of the District take place without the destruction of the resource base upon which it depends, so as to ensure a sustained and enhanced quality of life for the people of Kilifi. It is hoped that the recommendations contained in this report, and the plan of action adopted by the March Workshop in Malindi (Part III) will form a truly useful basis for the management of the environment of Kilifi District in the dynamic context of the District's development.

The report is divided into four parts. Part I presents a brief overview of the environment of Kilifi District. Part II examines in some detail 21 environmental issues relevant to district planning. Part III summarizes the priority environmental problem in each division. It also includes a summary of the plan of action adopted by a workshop convened in March in Malindi to discuss the draft version of this report. Part IV includes the appendices and reference.

I would like to sincerely thank all those persons who made contributions to the success of this exercise including the following:

The Government Ministries based in Nairobi for basic information and data; Kenya Rangeland and Ecological Monitoring Unit for information and data; the District Commissioner whose enthusiasm boosted the morale of our researchers; the District Officers and their Divisional Officers for their valuable information and data; the Manager and Officers of the Magarini Settlement Project for information and tours; the people of Kilifi who provided insights which helped attune the report to the realities of the district; J. Kimani and J.T. Limiri of the Tana and Athi River Development Authority for useful information on the Authority's activities within the coastal zone; Mohammed Ishamel for information and introduction to useful contacts; Henk Waayinberg for materials on farming systems around Kaloleni; Beryl Kendall for general information and data on the marine ecology of the Kenya Coast; Esmond Bradley Martin for a general overview of the environmental changes within the coastal districts in the last twenty years and useful comments on the draft; B. Ogolla of NEHSS for background information on legislation relating to resource management; J. Otieno of the Ministry of Finance and Planning, for general comments on planning; Kenya Marine and Fisheries Research Institute for their support in identifying and mapping major marine environmental issues; R. Bowry, ETMA for background information; Survey of Kenya for preparation of base maps; M. Muiyuro, NEHSS, for compilation of maps; our twenty-two reviewers drawn from Government Ministries; the ETMA project of USAID for funding and technical assistance; G.N. Wanyonyi and T.E. Downing for directing the NEHSS team and editing the report, C.M. Kamau, M. Karaba and A. Robertson for reviewing the draft report; the DEAP Secretary for typing the report; and finally, the multi-disciplinary NEHSS team whose contribution made this report possible. The NEHSS team who carried out the research and preparation of this report were:

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It is my sincere hope that the work and co-operative spirit shown by the above groups will be sustained during the more important phase of the implementation of the recommendations and findings contained in this report.

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P A R T 1

OVERVIEW OF THE KILIFI DISTRICT

1.0 ENVIRONMENT OF KILIFI DISTRICT

1.1 LAND ADMINISTRATION AND TENURE

Kilifi District is in the Coast Province - North of Mombasa, East of Tsavo East National Park and South of the Tana River Delta (Latitude 2° 16'22" - 4° S. Longitude 39° 5'0" - 40° 14'34"E.) (Figure 1). The District is divided into four Administration Divisions (Table 1.1 and Figure 2). Kaloleni and Bahari Divisions are the most densely populated and along with the Malindi Town, are relatively more developed,

1.1.2 LAND TENURE

Land in Kilifi is under several tenure systems: previously registered land, trust land being adjudicated, state land for settlement, group ranches and government reserves (Table 1.2 and Figure 3).

TABLE 1.2 LAND TENURE IN KILIFI DISTRICT, 1976  
km.<sup>2</sup>

Government land	5,043
Freehold land	233
Trust land	498
Registered land	511
Unregistered land	6,238
Area of water	109
<b>TOTAL</b>	<b>12,632</b>

SOURCE: Central Bureau of Statistics, 1981

Registered Land

The registered land is mainly in the Coastal Belt which was occupied by Arabs and ruled by Sultan of Zanzibar before Kenya's independence. Large parcels were registered by Arabs and Indians, although few of the owners now remain in Kenya. The British and Kenyans have honoured these title deeds and the local people, mostly Giriama who have settled on this land are regarded as squatters. Although they have rights of usufruct, title deeds which prove ownership have not been systematically surveyed. Except for the few who now have registered title deeds from trust lands, most will be considered squatters until the land can be adjudicated under the Registration and Adjudication Act.

TABLE 1.1 ADMINISTRATIVE UNITS, KILIFI DISTRICT, 1979

Division	Location	Size km <sup>2</sup>	Population
Kaloleni	Jibana	35	9,423
	Kaloleni	111	19,921
	Ruruma	84	19,084
	Kambe/Ribe	69	10,184
	Rabai	72	20,987
	North Chonyi	106	15,316
	South Chonyi	96	15,467
	Kayafungo	277	22,562
	Mariakani	203	18,600
		1053	151,544
Ganze	Sokoke	166	6,563
	Ganze	217	10,850
	Vitengeni	637	12,348
	Kauma	171	9,569
	Bamba	1724	26,107
		2915	65,437
Malindi	Ganda	167	45,374
	Gede	102	17,137
	Jilore/Madunguni	282	9,466
	Chakama	2985	2,899
	Magarini/Fundisha	532	33,154
	Marafa	143	4,871
	Garashi	174	7,728
	Hadu	2468	3,698
Bangale/Baricho	577	4,754	
		7410	129,081
Bahari	Mavueni/Takaungu	125	13,805
	Mtwapa	79	16,539
	Junju	119	12,753
	Tezo/Roka	284	35,961
	Kilifi Township	6	5,866
		613	84,924
Kilifi District		12,414	430,986

NOTE: Areas are as reported in source, although the District total is greater than the sum of the Divisions.

SOURCE: Central Bureau of Statistics 1979

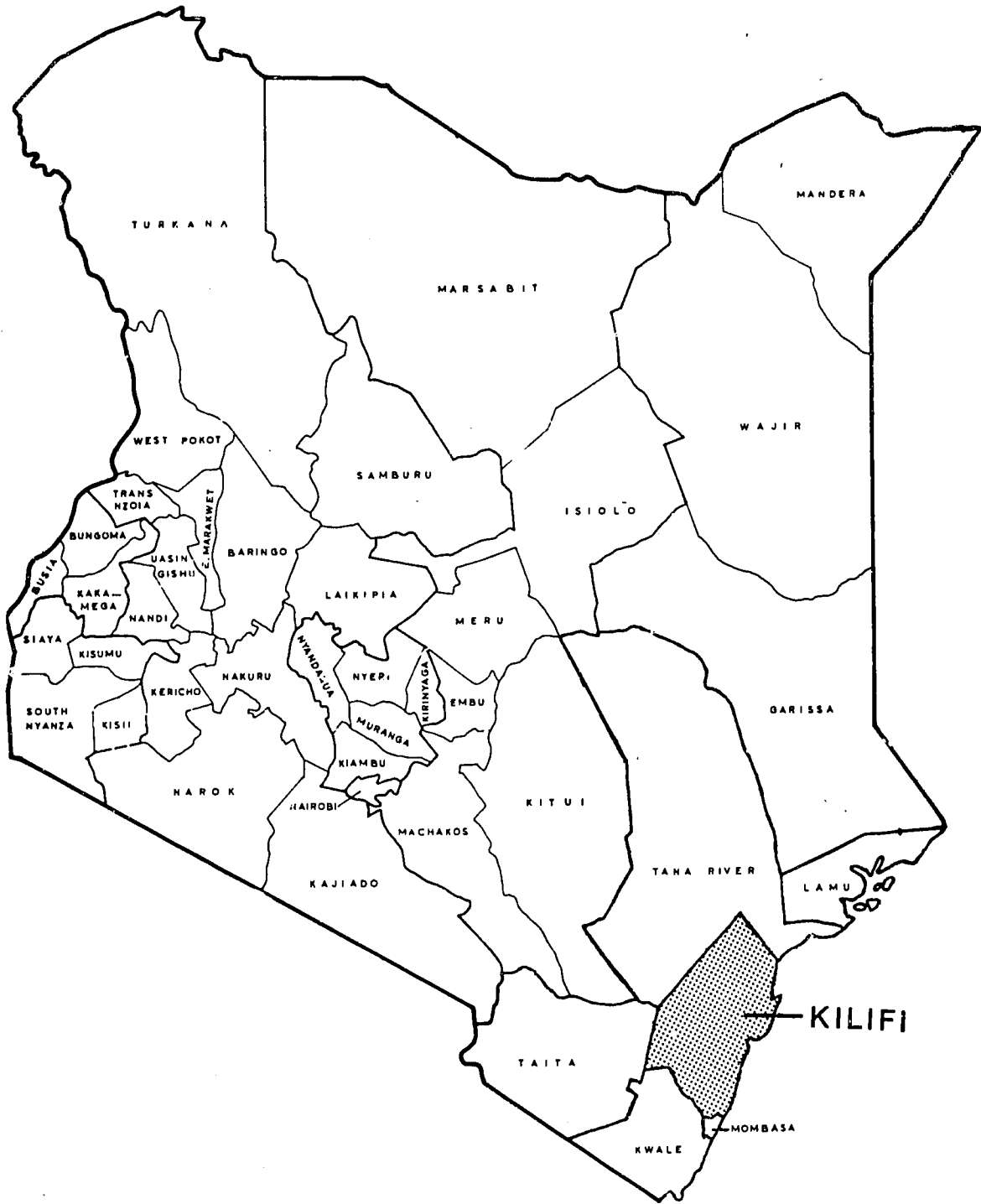


FIGURE 1. LOCATION OF KILIFI DISTRICT

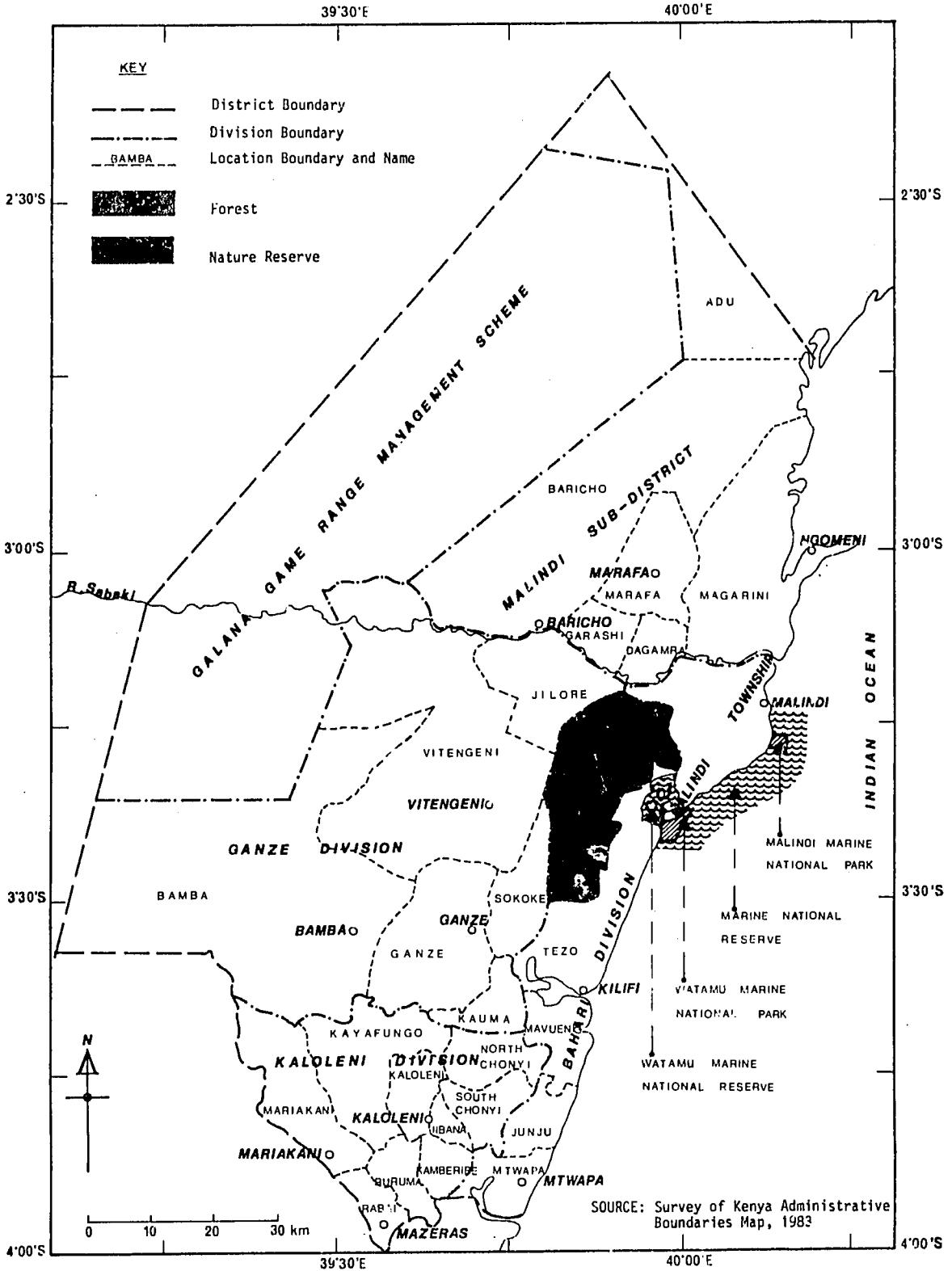


FIGURE 2. ADMINISTRATIVE BOUNDARIES, KILIFI DISTRICT

Some squatters have bought land from Arab and Indian owners and received title deeds but due to this early Registration Law, there are no schemes for land reforms. The policy over the long-term is to allocate plots to the residents although absentee land owners are a constraint.

Trust Land

Trust land is mostly in the high agricultural potential zone, and has a high population density. Earlier people used to farm this land under customary tenure but the Government's aim is to adjudicate and register all the Trust land and give tenure to individuals under the Land Adjudication Act. Adjudication and registered plots are outlined in Section 3.8.

State Land (Settlement Land)

The Government has established settlement schemes in Sokoke, Tezo/Roka, Vipingo, Mtwapa and Magarini etc. (Table 1.3). To the North-West there are group ranches and the Galana Game Reserve. The group ranches are adjudicated and registered under one title deed and are communally utilized. In the settlement schemes people are issued with temporary occupation licences (certificates) which cannot be used to secure loans for farm development. Other state lands include the forest reserve, parks and Galana Game Ranch.

TABLE 1.3 SETTLEMENT SCHEMES IN KILIFI DISTRICT, 1981

Scheme	No. of Plots	Size (Hectares)	When settled
Mtwapa	607	3,986	1969
Vipingo	260	1,052	1974
Ngerenyi	950	5,236	1960
Tezo/Roka	1192	17,000	1962
Mtondia	235	3,000	1962
Magharini	4040	30,274	1979
TOTAL	7284	60,548	

SOURCE: Kilifi Settlement Department, 1981

Unregistered Land

Traditional land tenure in Kilifi includes inheritance of the unadjudicated crop land by families in succession. There is little crop land free for occupation to which these principles do not apply. Newcomers borrow or rent land under a wide range of rent arrangements. Tree crops are subjected to leasing arrangements quite distinct from that of the land.

1.1.3 IMPLICATIONS FOR ENVIRONMENT AND DEVELOPMENT

The uncertainty of land tenancy in the Coastal strip has delayed adjudication and meant farmers have little collateral for loans. Land transactions may be hampered by the need to make arrangements with the tenants for their improvements. Large parts of the district are registered in group ranches, although it has not been followed by significant development. Other large tracts of land are held by province commercial corporations.

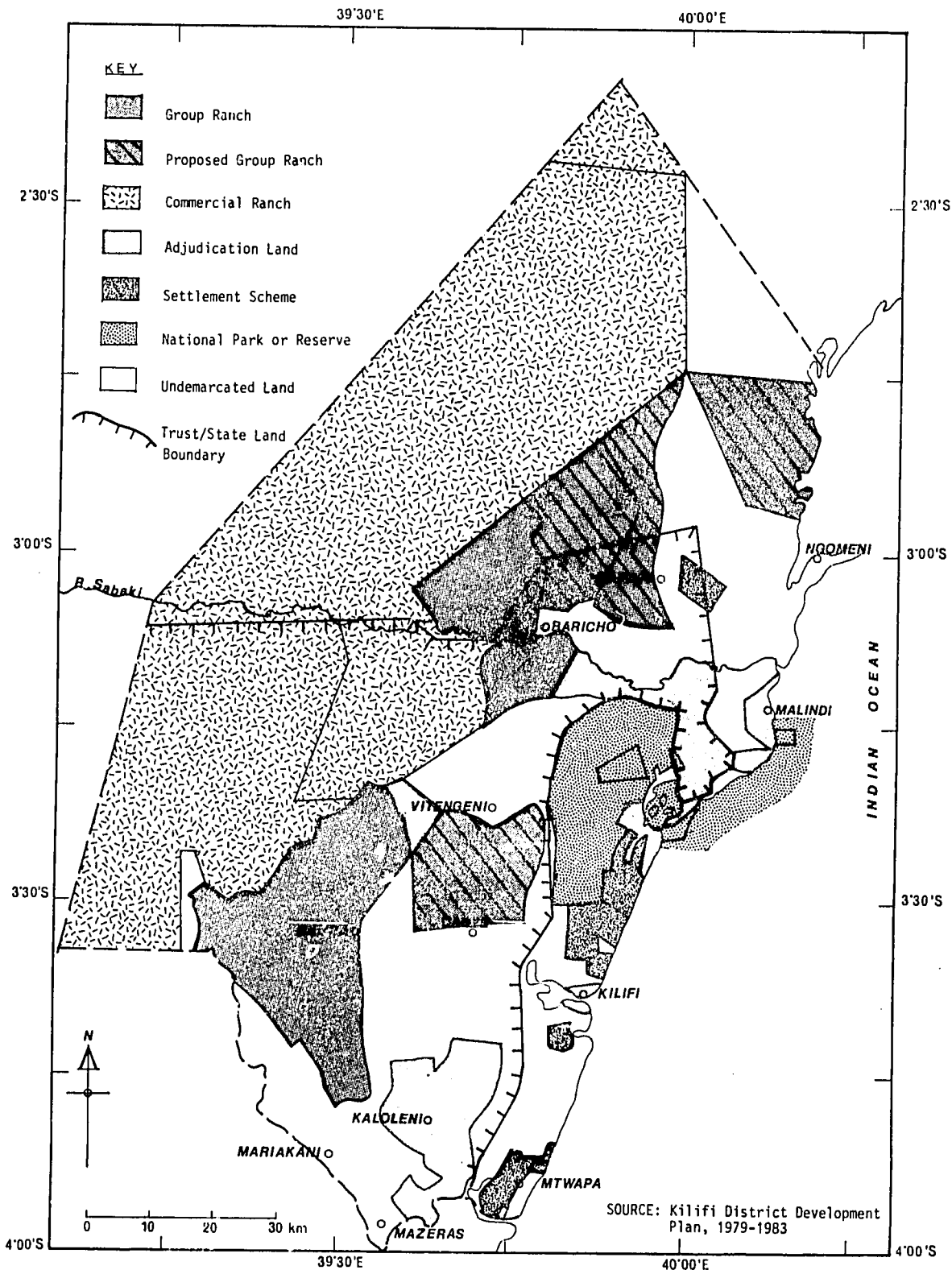


FIGURE 3. LAND TENURE, KILIFI DISTRICT

In all cases tenants have virtually absolute authority over land use, possibly neglecting the long-term consequences or the impacts on other people's property. These topics are discussed in Section 3.8.

## 1.2 TERRAIN, GEOLOGY AND SOILS

### 1.2.1 TERRAIN

The land rises gradually from sea level to 900m on the South-Western side of the District. It can be divided into six physiographic regions (Figures 4 and 5).

#### The Coastal Plain

This region is generally below 30m in altitude except from Malindi northwards where the land rises to 60m in some places. The coastline consists of beaches, mangrove forests, sand dunes north of the Sabaki River, and creeks of which the main ones are Mtwapa, Kilifi, Mida and Ngomeni. The creeks include marine swamps covered by mangrove forests.

#### The Foot Plateau

The western extension of the coastal plain lies between 60m and 135m in altitude. It is characterized by a flat surface except where Mwembe Chungu, Ngoni and Mtuni Hills between Mtwapa and Kilifi rise to over 120m. The Sabaki and Koromi rivers have incised into the plateau, almost obliterating it. Otherwise the region is dissected by several small valleys.

#### The Coastal Range

Several sandstone hills mark the coastal range: Daka Wacha and Gaabo in the northwestern part of the District; Simba (347m), Kiwara (323m) and Jabana in the Kilifi and Mazaras areas; and Mangepa (705m) west of Watamu. The central part is incised by the Sabaki, Koromi and Goshi Rivers, lowering the altitude to below 150m level.

#### The Nyika Plateau

The Nyika plateau is a large lowland west of the coastal range. Altitude is between 150 and 300m except where the rivers have reduced the altitude to below 150m level.

#### The Tana River Basin and Lowlands

This is in the northern part of the District, generally below 300m. It is made up of alluvium and old sediments including sand gravel, silt, clay, marsh and composed of narrow elongated plateaus and lowlands.

#### The Plateau

At an altitude between 300m and 900m, the plateau is formed of ancient rocks, mainly metamorphic of the basement complex.

Flood plains are prominent along the Sabaki river, and in certain areas along the Ndzovuni and Rare (Goshi) Rivers. Bottomland (depressions without visible drainage outlets) occur in the north, drained by the Mukale and Wildeinia Rivers.



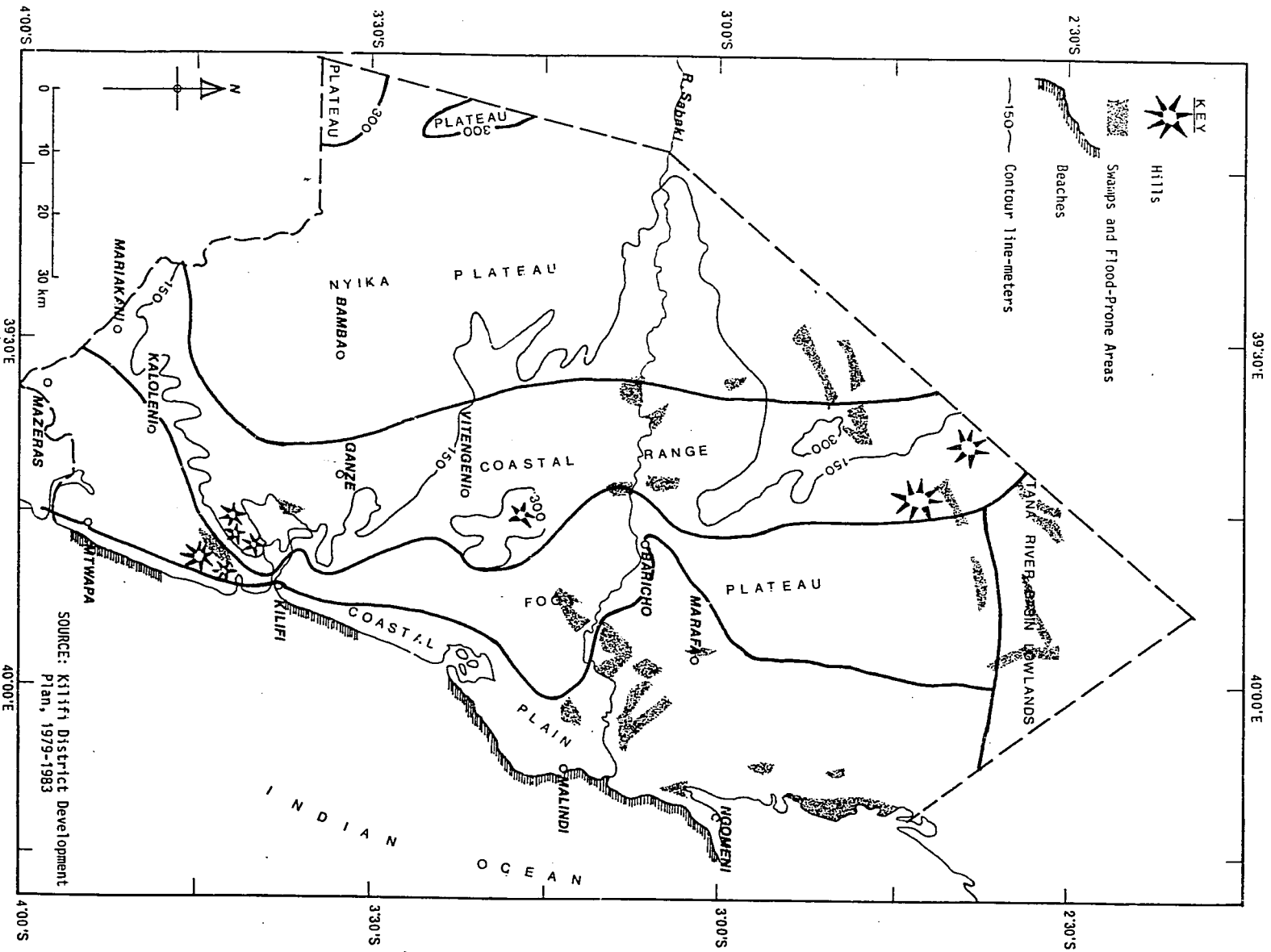


FIGURE 4. RELIEF AND LANDFORMS, KILIFI DISTRICT

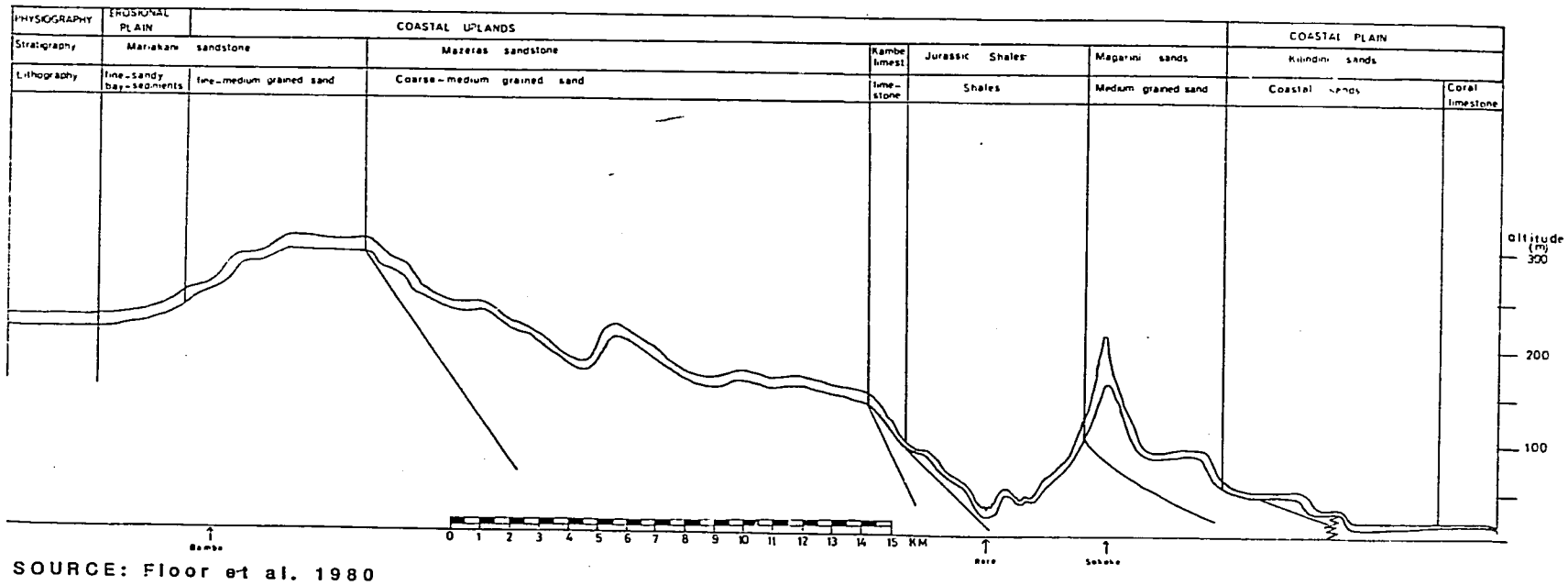


FIGURE 5. SCHEMATIC CROSS SECTION OF KILIFI

### 1.2.2 GEOLOGY

Geologically, Kilifi District is part of a system of sedimentary and basement rocks with a generally NE to SE strike parallel to the coastline. The geology of the District can be described according to the ages of the rocks (Figure 6).

#### Basement System Rocks

These are represented in the western side of the district and are mainly grits, sandstones, shales and limestones that have been metamorphosed. The most abundant are gneisses and schists.

#### Sedimentary Rocks

These are composed of the Duruma Sandstones which are Triassic in age, except for the Taru grits which are in age Carboniferous. The Duruma Sandstones can be subdivided:

- (a) Mazeras Sandstone - coarse-grained sandstone with yellow to purple bands, deposited under continental lacustrine and deltaic conditions. They overlie the Mariakani sandstones often with faulted contacts and contain silicified wood. Outcrops are rare and indistinct - the exact boundary between the Mazeras and Mariakani sandstones is not very clear.
- (b) Mariakani sandstone - fine-grained deltaic and lacustrine sandy deposits. They can be traced from Kaloleni westward to Gotani and further northward towards Bamba.

#### Jurassic Rocks

These include two types of rocks:

- (a) Kambe Limestone - This is capped in several places by reddish, clayey sands representing remnants of a former cover of magarini sands in the north the limestone forms a well-marked escarpment overlooking shales, with altitudes of about 180m and some deeply incised ballyes (Njora 120m, Ndzovuni 130m).
- (b) Jurassic Shales - The shales attain maximum altitudes of approximately 120m and are very susceptible to erosion. Several watersheds at 75m have a flat-topped topography, due to magarini sands. These magarini sands once covered larger area, but as a result of erosion which dissected the shales, only remnants can be seen. The Rare River is incised and has a broad flat valleys bottom showing small levees and backswamps.

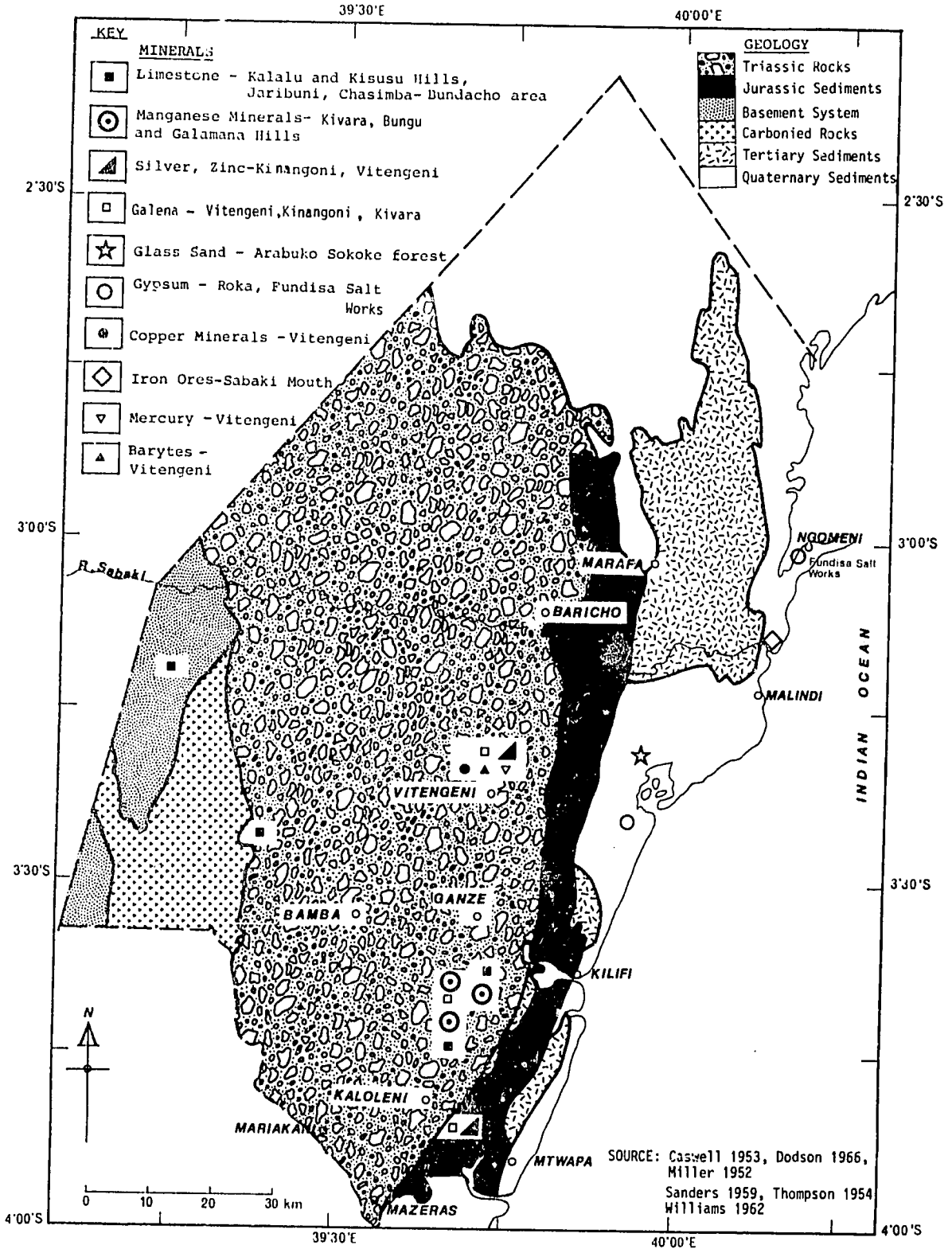


FIGURE 6. GEOLOGY AND MINERALS, KILIFI DISTRICT

### Carboniferous Rocks

Consist of Taru grits, a monotonous series of sandstone and shales, located in the southwestern area of the District.

### Tertiary Sediments (Cainozoic Era)

These are of marine-deltaic origin and consist mainly of marls, limestone, clays, sands, gravel, pebble beds, sandstones and conglomerates.

### Quarternary Sediments

These are of Pleistocene (recent) era and occupy the areas immediately bordering the coastline. They consist of coral reefs, coral breccias, sandstones and sands of alluvial and marine nature.

### Economic Minerals

Minerals exist in the district, and some are currently being exploited. Barytes are found in Vitengeni, gypsum west of Malindi at Roka, limestone east of Mariakani, and crude salt near Ngomeni. Lead, zinc and silver exist near Kinangoni, manganese near Bamba, titanium near Malindi, mercury near Vitengeni, zircon north of Kilifi Township, and monazite between Kilifi and Mombasa.

#### 1.2.3 SOILS

The soils in the district differ widely in depth, texture, physical and chemical properties, mainly because of the underlying geology. The soils are poor in fertility, except where indigenous vegetation remains and a layer of fertile loam soil has developed.

The soils can be grouped into three major units. (letters refer to figure 7):

Coastal Plain  
Coastal Uplands  
Erosional Plain

#### (a) Coastal Plain (D,P,T,2)

These soils here have developed on coral limestone and coastal sands (Kilindini Sands). The former are generally well drained and of loamy sand to sandy clay texture. The latter are also well-drained and are sandy to sandy loamy. Sand dunes and mangrove swamps are also found along the coast.

#### (b) Coastal Uplands (F,H,L,U,W)

The soils here can be subdivided into five different categories:

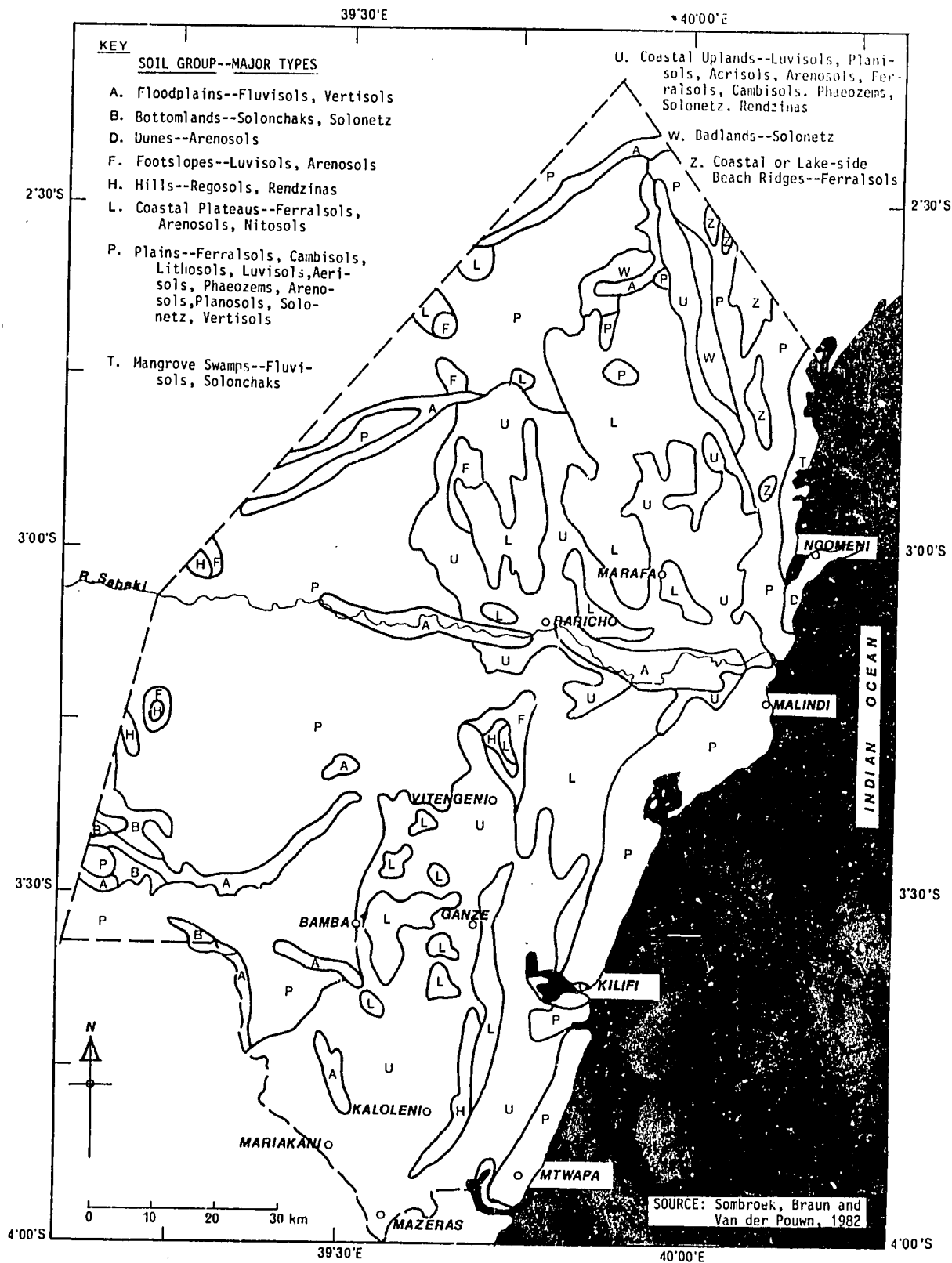


FIGURE 7. SOILS, KILIFI DISTRICT

- (i) Soils developed on Magarini sands are excessively drained to well-drained, very deep soils with a sandy clay loamy subsoil.
- (ii) Soils developed on Jurassic shales are very heavy clay soils.
- (iii) Soils developed on Kambe limestone are well-drained, generally very deep, red, silty clayey to clayey soils.
- (iv) Soils developed on Mazeras sandstone are variable. On the steeper slopes in the southern part and to a greater extent in the northern part the soils are shallow to very deep and generally coarse sandy soils. North of Kaloleni the soils can be graded from a loamy sand topsoil to a sandy clay subsoil.
- (v) Soils developed on Mariakani sandstone are well drained deep, dark brown to yellowish brown, firm, very fine sandy clay loam. In addition there are a few areas characterized as badlands, or related to topography.

(c) Erosional Plain (A,B,P)

The soils here are developed on Pleistocene bay sediments (Marafa beds) and are sandy to clayey soils. Also included are riverine floodplain soils.

1.2.4 IMPLICATIONS FOR ENVIRONMENT AND DEVELOPMENT

The escarpment and high local relief in the foot plateau and coastal range make these areas susceptible to erosion by running water. Consequently all soil conservation measures should be adhered to as much as possible.

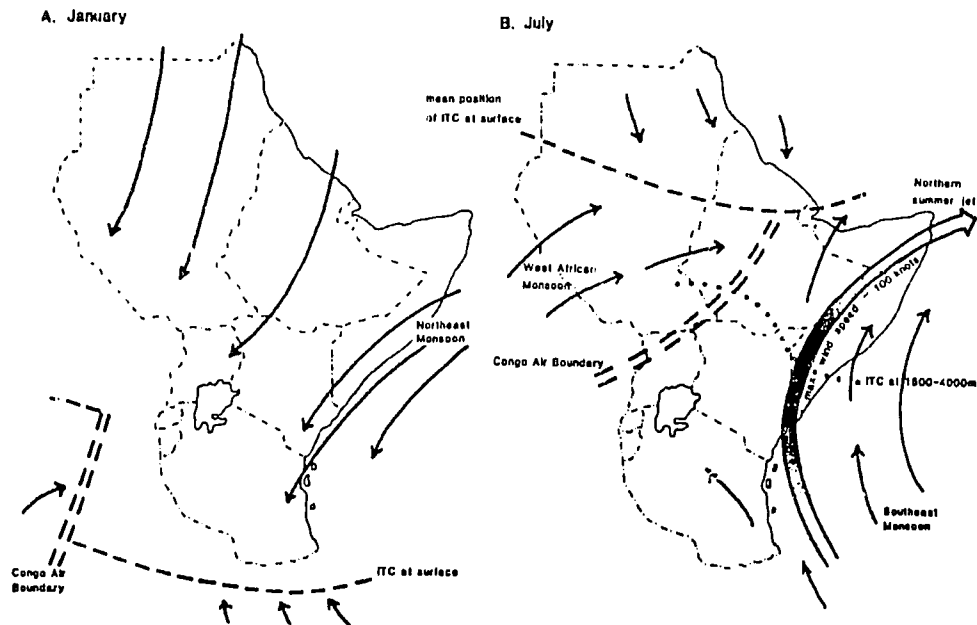
Swamps, waterlogging and flood-prone areas, found near the Sabaki, Marafa, Koromi and Luga Buma Rivers and in areas along the coastline north of Ngomeni and around Mtwapa, Kilifi and Mida Creeks, provide good breeding conditions for mosquitoes.

The sandy soils of the coastal plain have high infiltration rates, which reduce the effectiveness of rainfall. There are no generally reliable aquifers. While the broad pattern of soils is easy to establish, the local variability in fertility is high.

1.3 CLIMATE AND WATER

1.3.1 CLIMATIC CONDITIONS

The monsoonal air currents of the Indian Ocean, coupled with orographic effects of the coastal hills and convectional currents over the hot, dry hinterland immediately to the west, largely control the weather of the Kenya Coast.



SOURCE Downing, 1982

FIGURE 8. REGIONAL CIRCULATION PATTERNS IN JANUARY AND JULY

The moist southeast monsoon, relatively dry northeast monsoon, and the Equatorial trough or Intertropical Convergence Zone (ITCZ), dictate the rainfall pattern of the region. In January the sun is over the Tropic of Capricorn and the ITCZ is centered in Zimbabwe. Thus wind blowing over the Kenya Coast during November to March is dry and northeasterly (Figure 8 A). In July the sun is over the Tropic of Cancer and the ITCZ is centered in Sudan. The wind blowing over the region during May to October is southerly or southeasterly (Figure 8B). Most rainfall occurs in the months between the monsoons, when convection is enhanced.

The north/south shift of the ITCZ is responsible for a bimodal rainfall pattern in Kilifi District, characterised by long rains during March-May and short rains in October-November. The year starts dry and remains so until March rainfall increases. A fairly rapid increase occurs through April and builds up to a maximum of rainfall in May. Then rainfall decrease steadily but significant amounts are still recorded in October and November. During December a decrease is registered that leads to the rainfall minimum in January and February. (Table 1.4)

TABLE 1.4 AVERAGE SEASONAL RAINFALL (mm) IN KILIFI DISTRICT

STATION	JAN-MAR	APR-JUN	JUL-SEPT	OCT-DEC	ANNUAL
BAMBA	78	270	103	226	677
GANZE	87	340	140	265	832
MARIAKANI	125	156	156	273	896
KILIFI	71	342	190	187	955
KALOLENI	99	398	254	337	1088
MAZERAS	104	444	202	344	1094
MTWAPA	103	640	265	268	1267

SOURCE: Floor, et al. 1980



Annual rainfall for Kilifi District averages 1200mm near the sea and 600mm near Bamba, while average annual evaporation is between 2000mm and 2200mm. Generally rainfall in the district decreases from east to west and from south to north. The coastal plains and coastal ranges to the south receive the highest rainfall (about 1250mm). Areas south of Takaunga receive over 1100mm average rainfall while those to the south receive less. There is a great variation in precipitation from year to year and the rainfall is not reliable. (Figures 9, 10 and 11 and Appendix 6.1). Rainfall of 762mm, which is often cited as the minimum necessary for the practice of permanent agriculture, can only be guaranteed, in 90 years out of 100, on a narrow Coastal belt from just south of Kilifi town to Shimoni. Most of the rain in Kilifi falls in heavy showers with peaks reaching up to 100mm per hour at times. Due to Kenya's position across the equator the region is mostly dry and warm, experiencing only slight variations in temperature during the year.

Minimum and maximum average temperatures range from 26 - 30°C in the coastal belt to 30 - 34°C near Bamba. The average relative humidity in the district is 65% at 15,00 hours along the coastal belt, but decreases as one moves westward into the hinterland. Mean annual dew-point at the Coast is 23°.

The Mean wind run in the district is about 160 kilometres per day. The monsoon winds blow from the south and east during May to October and from the north and east from November to March. Light, mostly local winds are associated with the inter-monsoonal periods, November and April. Day length is rather constant and the average hours of sunshine is about 7 to 8 hours/day.

Agro-ecological zones based on moisture indices are described in Section 1.8.

### 1.3.2 WATER RESOURCES

Most of the Kilifi District lacks adequate surface and underground water resources (Figure 12). The Sabaki River is the only perennial river, originating in the central highlands. The other rivers and streams are seasonal due to a variety of reasons, including low rainfall in the interior, small catchment areas, sandy soils which have high infiltration and low runoff rates, and high evapotranspiration rates.

#### Surface Water

The Sabaki River in the northern part of the District is perennial. During the wet season, the river's floods are a hazard to settlements and crops in the flood plain and bring large amounts of silt from up country. Siltation of the beaches around Malindi and the coral reef has been a notable problem since the 1940s. The flow of water during the dry seasons is very low and the river is almost entirely maintained by Mzima Springs via the Tsavo River. The water of the Sabaki River is moderately coloured, soft, well mineralised and slightly alkaline with a seasonal PH range of 7.6 to 8.2. The River contains a fair amount of organic matter and there is substantial amount of algal growth during the dry period.

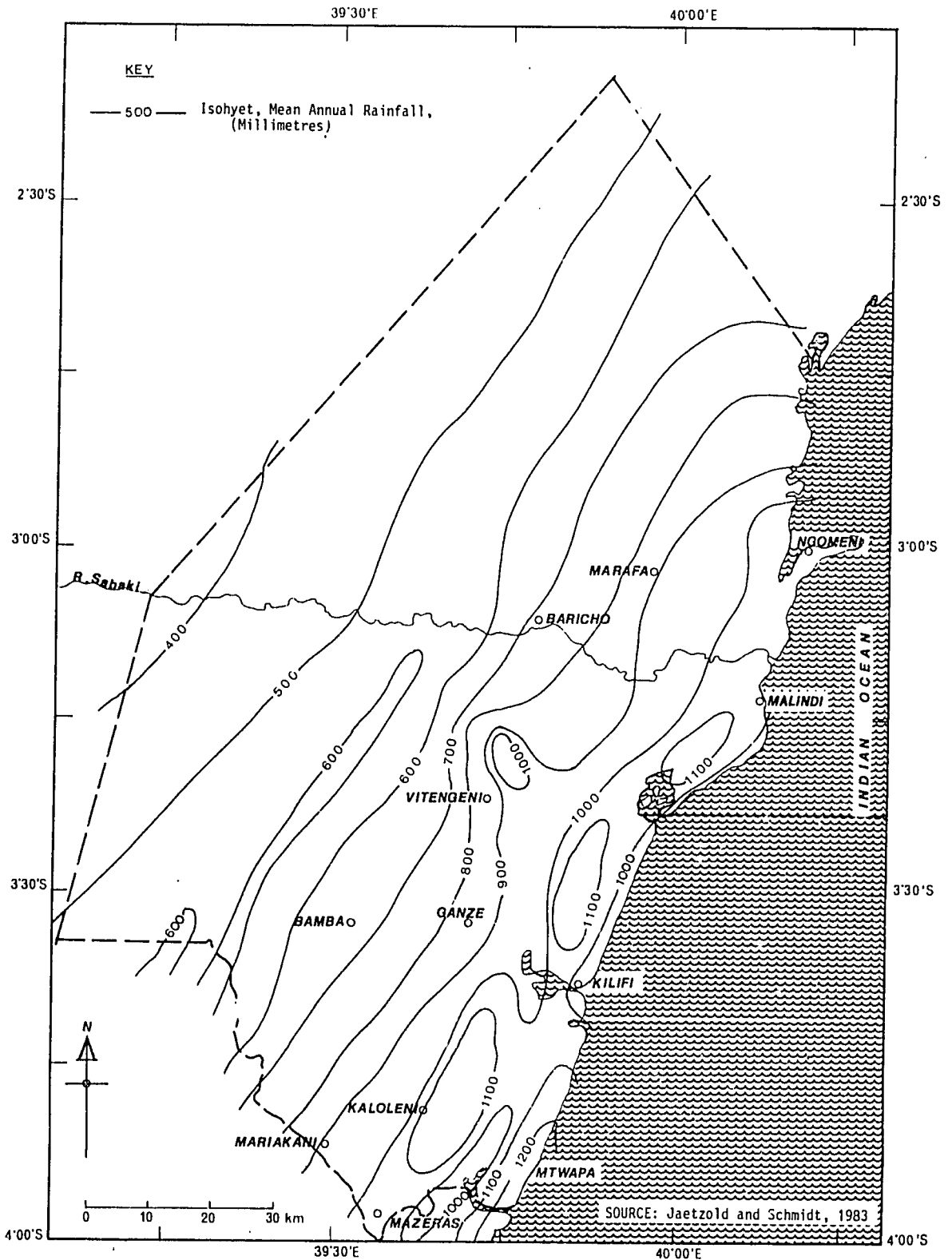
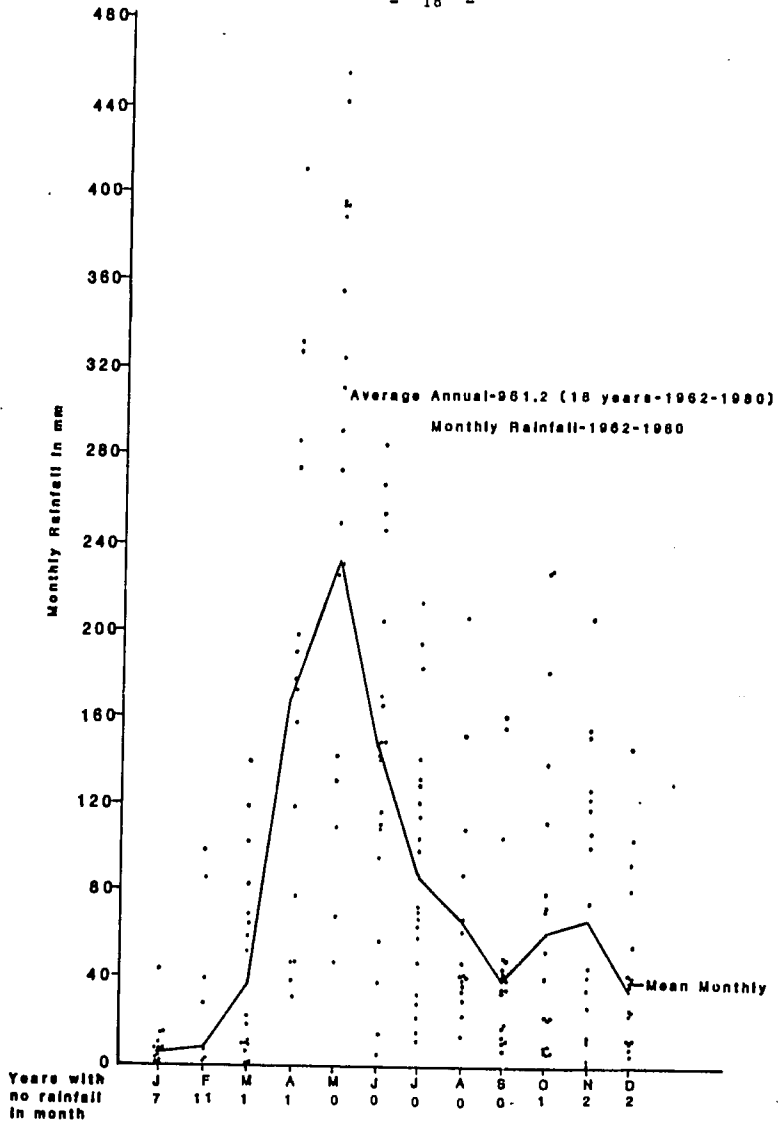
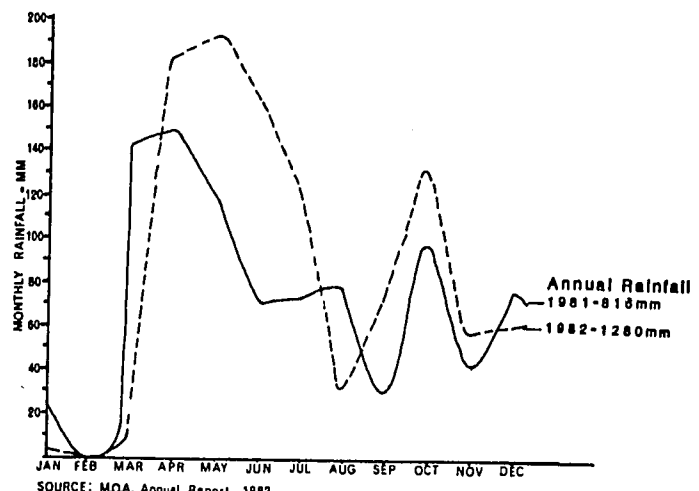


FIGURE 9. MEAN ANNUAL RAINFALL, KILIFI DISTRICT



SOURCE: Meteorological Department

FIGURE 10. VARIABILITY OF MONTHLY RAINFALL AT MALINDI



SOURCE: MOA. Annual Report, 1982

FIGURE 11. AREALLY-AVERAGED MONTHLY RAINFALL FOR KILIFI DISTRICT, 1981 & 1982

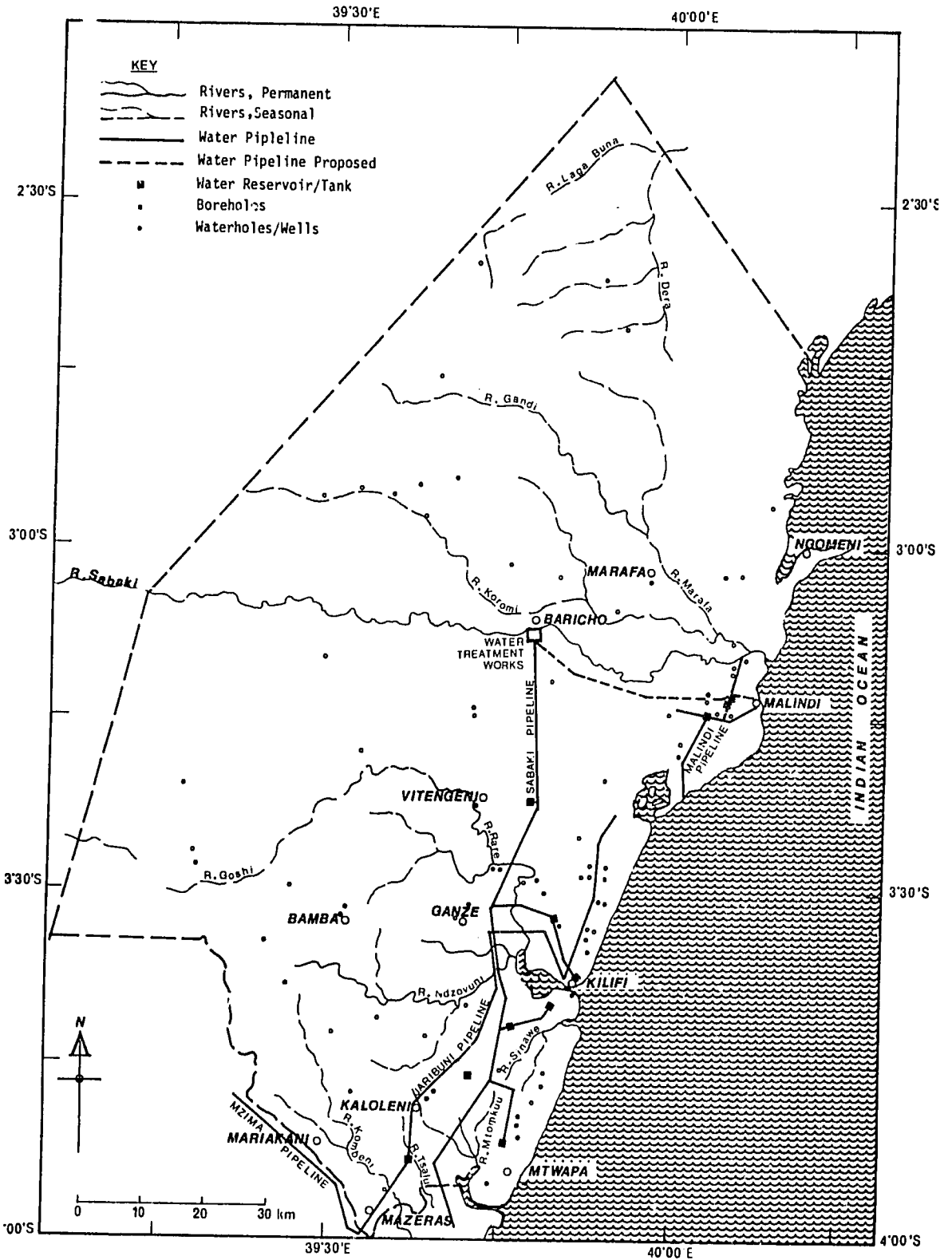


FIGURE 12. WATER RESOURCES, KILIFI DISTRICT

The seasonal Goshi-Rare River is a continuation of the Voi River which originates from the Taita Hills. The Rare River contains moderate amounts of organic matter and the water is generally hard and saline with a PH value of 7.2. Other seasonal streams include Ndzovuni, Gandi, Wimbi and Mto Mkuu. There are also numerous swamps and springs along the coastal plain, and a few wet season ponds in the interior.

#### Underground Water

There are numerous wells along the coastal plain since the water table is shallow. High-yield boreholes along the coast have been successfully drilled. The average test yield of existing wells providing water of acceptable quality is 12m<sup>3</sup>/hr. In the higher, dry hinterland the water table is usually deep. Although there are a few boreholes that have proved successful the yield from most boreholes is low, and many are dry. It is common for the underground water to be of unacceptable quality it is usually hard, highly mineralised and saline, and the quality deteriorates during the dry periods. The low quality and scarcity of underground water has made water supply difficult, especially in the dry hinterland.

#### 1.3.3 IMPLICATIONS FOR ENVIRONMENT AND DEVELOPMENT

Most of the district averages between 508 - 762mm of rainfall, making it suitable for semi-permanent or shifting agriculture and ranching. Rain in Kilifi falls in heavy showers (peaks upto 100mm/hr) with a high intensity and a high kinetic energy. This causes splash erosion in areas where the soil has no cover. The impact of raindrops on the soil causes it to disintegrate, and when/dries the soil surface seals, becoming /it almost impermeable. Much of the rain then becomes run-off. Sheet, rill and gully erosion have been observed in Magarini sands and shales, Mazeras and Mariakani sandstones. Sealing and run-off is moderately severe in Magarini sands and shales where there is an incomplete vegetation cover.

The heavy rains cause prolonged wetness in most areas of the district with the result that access roads, most of which are of loose surfaces become impassable. Prolonged wetness adversely affects crops as well. In 1982 exceptionally high rainfall was detrimental to crop production both for food and cash.

Rainfall reliability is low, thus agricultural practices must be planned considering the frequency of dry and wet years, rather than the arithmetic normal.

The potential for solar and wind energy is quite high, although the high humidity make drying and storage of crops difficult.

The water problem in Kilifi District is a major cause of slow development in agriculture, livestock, ranching, permanent human settlements and infrastructure, especially in the dry hinterland. As a result there is high rural poverty and malnutrition leading to other serious environmental problems like diseases, high mortality rates, low life expectancy, unemployment and illiteracy.

The Athi/Galana/Sabaki River system has not been developed to its fullest extent. It is an important resource, although its high silt content increases the cost of water supply development and has altered the coastal environment.

## 1.4 VEGETATION

### 1.4.1 VEGETATION ZONES

In any given area the natural and cultivated vegetation depends on physical factors such as climate, soil and topography as well as human activities. Depending on the physical factors, Kilifi District can be divided into ten major potential vegetation zones. (Figure 13). The main species in each zone are listed in Appendix 6.2<sup>1</sup>.

#### I. Acacia Thorn Bushland

This area is very dry with less than 600mm rain a year. The most important trees in the area are Dobera glabra and Salvadora persica. Other species include Acacia zanzibarica, Euphorbia tirucalli, Acacia senegal (kikwata) and Adenia globosa (handari). This zone is found west of Bamba and cultivation for fieldcrops is insignificant.

#### II. Lowland Dry Forest

The Arabuko Sokoke Forest is the only major remnant of this type of vegetation. The indigenous trees include Hymenaea verrucarum (mtandarusi), Brachystegia spiciformis (mrihi) and Azalia quanzensis (mbambakofi). The rest of the zone has been cultivated and main crops are cashewnuts, mangoes, coconuts and other food crops.

#### III. Lowland Cultivated Savanna

This type is found on the clayey soils of the Jurassic shales. Some of the natural species are Sterculia rynchocarpa morya, Acacia zanzibarica and Manilkara sansibarensis (mngambo). To the south there is more cultivation of mainly fieldcrops. There also cultivated grasses e.g. Hyparrhenia rufa and Themeda triandra.

#### IV Lowland Woodland

This type of vegetation is found on the drier parts of Mazaras and Mariakani. It is also known as the Brachystegia woodlands which is a general vegetation type formerly common in East Africa and Zaire. The dominant trees are Brachystegia spiciformis (mrihi) and Azalia quanzensis (mbambakofi). Lanea stuhlmannii (munyumbu) is also found here. Degradation and clearing of this rich forest is threatening from settlement attracted by the Sabaki pipeline, charcoal burning, removal of building poles and clearing for agriculture. Grazing is the main landuse in this area although some cultivation (mainly fieldcrops) is carried out in some valleys in the area.

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1: species are named according to the convention: Genus species  
(swahili)

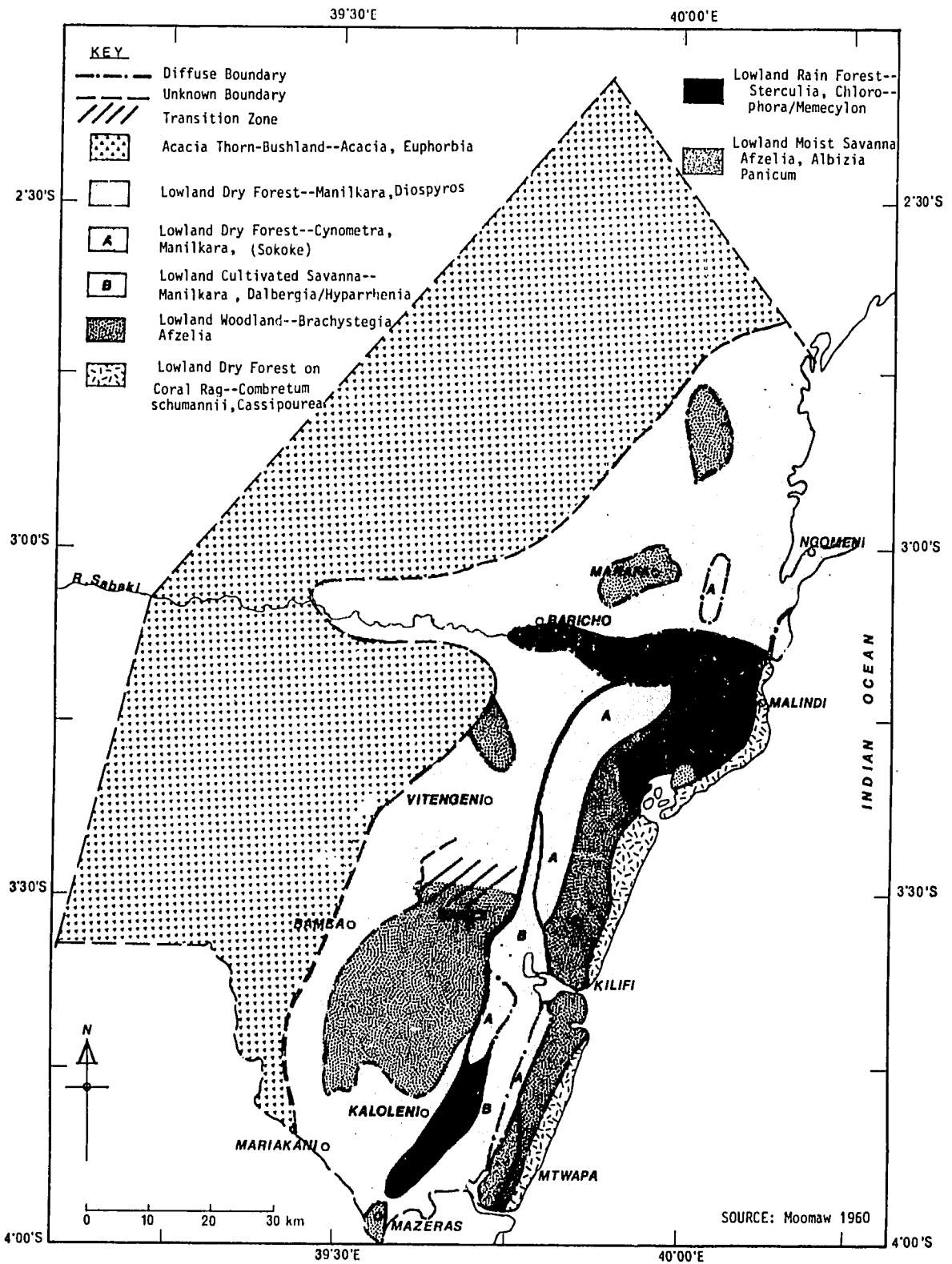


FIGURE 13. VEGETATION, KILIFI DISTRICT

#### V. Lowland Dry Forest on Coral Rag

A natural forest remnant is found near Gede. Some of the indigenous trees include Combretum schumannii (Mgurure), Ficus bussei (mgandi) and Cassipourea euryoides. Otherwise the coral rag is covered by dense thicket often with Lantana camara and with scattered cultivated plots planted mainly with cassava, maize and cowpeas.

#### VI. Lowland Rain Forest

This is found on limestone and wetter parts of the Mazeras sandstone. Today only scattered remnants of the monsoon forest remain because the elders have preserved them as sacred. Locally they are known as kayas or homesteads. Originally the Mijikenda clans took refuge in these forests when they were attacked by other tribes, especially the Masaai and the Galla. When the danger was over, the elders respected the homestead and preserved them for burying respected elders and as holy places for offering sacrifices. The larger trees include Sterculia appendiculata (mfune) and Chlorofora excelsa (Mvule). Memecylon sps. are common shrubs.

#### VII. Lowland Moist Savanna

This vegetation type covers a small area near Mtwapa. It developed on coastal sands and Jurassic shales, and is somewhat wetter than the surrounding area. The main species are Albizia anthelmintica (mporojo) and Hyphaene compressa (mlala or mkoma). The major land use is grazing, although some bush is burned and cleared for cultivation of cassava, maize and cow peas.

#### VIII. Mangroves and Swamps

The major mangrove stands are found at Ngomeni, Mida and Mtwapa creeks. There are only a few species which form dense forest (see section 1.6.3).

#### IX. Coral Rock

A variety of trees and plants grow on exposed coral rock along the coast.

#### X. Beach

Vegetation on sandy areas along the beaches is divided into three classes - the seaward zone, behind the seaward zone and in the sand dunes proper. Although a few trees do well, most of the plants are grasses, shrubs and vines.

### 1.4.2

### F O R E S T S

The total area of land under forests is about 150,000 ha. out of which 48,000 ha are gazetted forest reserves. The rest is ungazetted, mostly on trustlands, and includes the Kaya or (sacred) forests. The main kayas are Kaya Rabai, Kaya Ribe, Kaya Kambe and Kaya Jibana (Figure 14). The composition of the Arabuko-Sokoke forest is listed in Table 1.5.1.



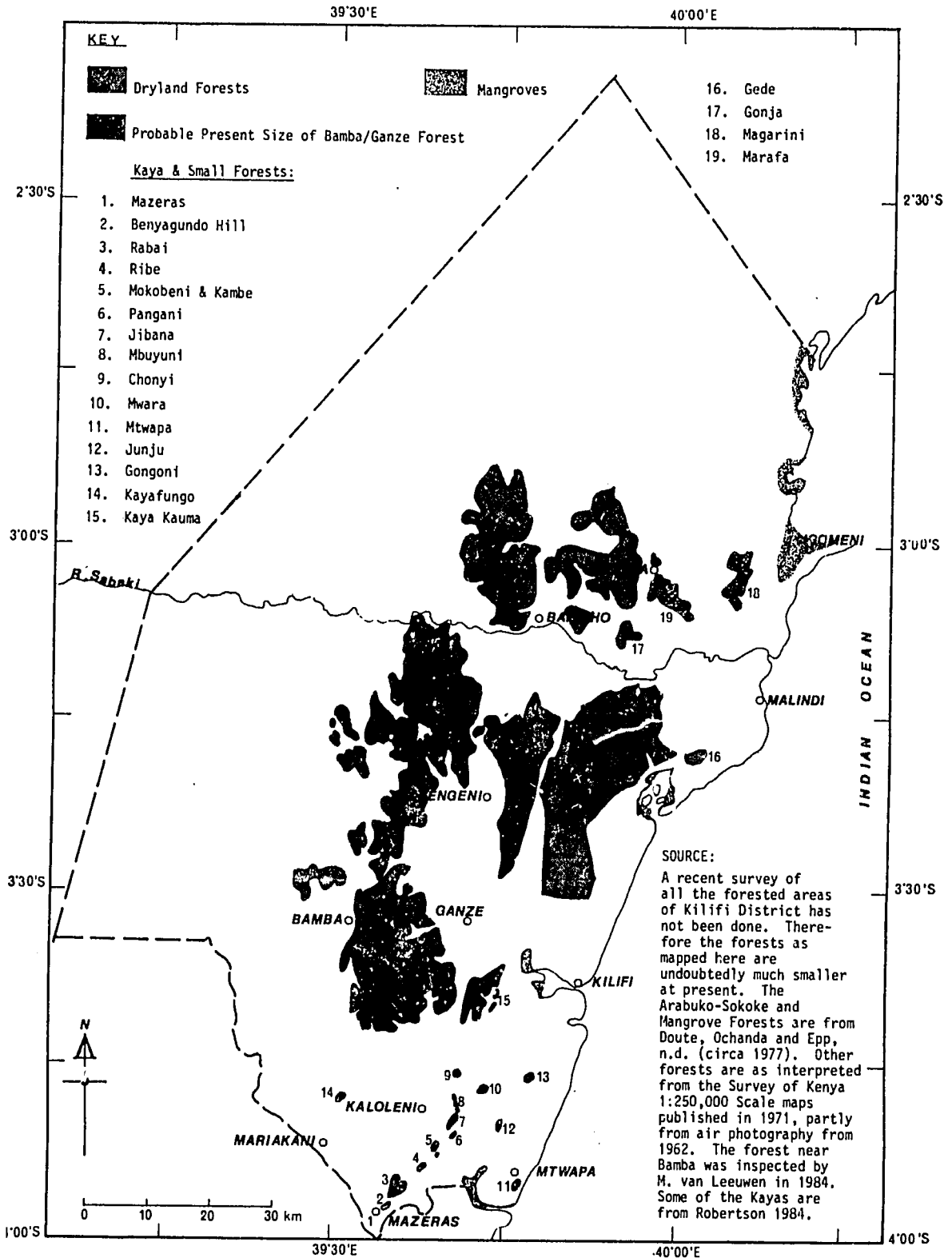


FIGURE 14. FORESTS, KILIFI DISTRICT

TABLE 1.5 COMPOSITION OF ARABUKO-SOKOKE FOREST, 1981

<u>VEGETATION TYPE</u>	<u>HA.</u>
High forest	20,921.5
Bushland	13,882.0
Grassland	6,961.0
<b>TOTAL</b>	<b>41,764.0</b>

SOURCE: District Forestry Office, 1983.

Within the Arabuko Sokoke forest there are 265.7 ha of the dryland forest under plantation trees. The two dominant plantation trees are Casuarina equisetifolia and Eucalyptus camaldulnesia. The Casuarina is planted at 5 to 1 ratio to Eucalyptus. Other planted species include Lommelina arborea, Azadirachta indica, Cassia siamea which have proved to do well in the area. The dominant indigenous species being commercially exploited in the Arabuko/Sokoke area are:

- Brachystegia spiciformis (mrihi)
- Azalia quanzensis (mbambakofi)
- Manilkara sansibarensis (mngambo)
- Hymenaea verrucarum (mtandarusi)
- Combretum schumannii (mgurure)
- Erythrina sacleuxii (mbambangoma)
- Oldfieldia somalensis (mbambara)

The main uses of the forest resources are timber, fuelwood, building poles and fence posts. The main sawmillers are Kwale Saw Mills in Mombasa and Hafswa Saw Mill in Kilifi.

Mangrove forests cover 6,378 ha. in the district. Cutting for local uses takes place and is regulated by the Forest Department.

#### 1.4.3 IMPLICATIONS FOR ENVIRONMENT AND DEVELOPMENT

The conversion of indigenous vegetation communities to agriculture, grazing land or degraded bushland is continuing at a fast pace. The loss of genetic diversity, wildlife habitats, wood sources and watersheds will have immediate and long-term implications for the District. The kayas and Brachystegia woodlands are most threatened. This issue is taken up in more detail in Section 2.3.

## 1.5 WILDLIFE AND FRESHWATER FISHERIES

### 1.5.1 TERRESTRIAL WILDLIFE

Three broad regions of wildlife habitats in the district may be distinguished: 1) The dry hinterland bordering Tsavo East National Park, including the Galana and Giriama ranches; 2) The forested coastal uplands of which the Arabuko Sokoke Forest is typical, but also including the settlement areas; and 3) the coastal marine margin, e.g. near Mida Creek.

Although a detailed census for Kilifi has not been carried out, KREMU's national counts include data for the Kilifi/Kwale and Tsavo eco-units (Table 1.6). The trends indicate that most of the plains herbivores have increased in numbers, particularly in the western part of the district. Elephant number decreased up to 1980, but appear to be increasing now, particularly in the forested areas. Rhinos have been severely poached and are very rare in the district. Lions are numerous in the Galana and Kulalu areas where they have killed a number of livestock; while hippos and crocodiles are common in permanent waterways.

In addition to the large animals the diverse habitats of the district contain many species of birds, snakes, butterflies and insects, small mammals and other animals. The birdlife of Mida Creek and the snake parks, for example, attract many visitors.

### 1.5.2 FRESHWATER FISHERIES

Tilapia, clarias and protopterus, are common in the district. Although there are a few fish ponds, the Sabaki River is the most important fishing area. The total catch in 1980 was 41.5 metric tons (valued at Kshs. 102.719), a 21% decline from the 52.3 metric tons landed in 1979. Freshwater fishing has not been commercialized, and most of the fish are consumed locally.

TABLE 1.6 WILDLIFE CENSUSES IN SOUTHERN COASTAL ECO-UNITS, 1977 - 1980

ANIMALS	KILIFI/KWALE			TSAVO AREA		
	1977	1978	1980	1977	1978	1980
Cattle	157,900	188,300	259,200	58,400	67,200	77,200
Shoats	278,800	211,900	247,600	13,900	27,400	5,500
Donkeys	330	200	0	0	0	20
Elephants	610	0	0	14,200	15,800	6,700
Rhinos	50	0	0	820	160	20
Giraffes	190	540	790	2,800	2,800	3,800
Buffalo	560	0	0	3,900	9,400	9,700
Eland	0	120	1,100	4,500	5,300	3,700
Oryx	0	680	1,500	14,800	17,400	10,900
Kongoni	90	540	1,500	2,400	3,000	6,200
Topi	0	120	0	0	110	0
Hartbeast	0	0	0	0	0	510
Wildbeast	0	0	0	0	0	0
Thompson's Gazelle	0	0	280	1,600	2,600	1,400
Impala	2,000	1,800	4,700	3,800	3,800	3,300
Gerenuk	0	120	150	630	1,200	1,300
Water- buck	0	270	150	1,600	1,000	2,600
Lesserkudu	50	560	150	590	1,500	1,100
Zebra	0	370	580	11,400	19,100	23,600
Ostrich	0	0	0	1,900	1,300	1,400
Warthog	1,700	850	910	5,800	5,600	2,900

NOTE: Standard errors are reported in source document, they are proportional to the size of the population and vary from 15% to 100%

SOURCE: Ottichilo, et al. 1981

### 1.5.3 IMPLICATION FOR ENVIRONMENT AND DEVELOPMENT

Wildlife is an important resource for the district and effort must be continued to limit poaching and preserve the natural habitats. Tourists already travel to Tsavo East from Malindi and visit wildlife sanctuaries along the coast. However land use conflicts involving wildlife and crops, particularly near the forest reserves, continue and should be addressed.

The freshwater fisheries can be greatly expanded, both for commercial markets and as a supplement to the local diet. The success of the Bamburi Cement Company's Baobab Tilapia Farm is indicative of the under-realized potential. Lack of infrastructure and technical assistance are constraints.

## 1.6 COASTAL AND MARINE RESOURCES

### 1.6.1 DESCRIPTION OF COASTAL ZONE

This section describes the ecology and the state of Kilifi's coastal and marine resources- section 2.6 formulates a coastal and marine resources management policy on the basis of available alternatives.

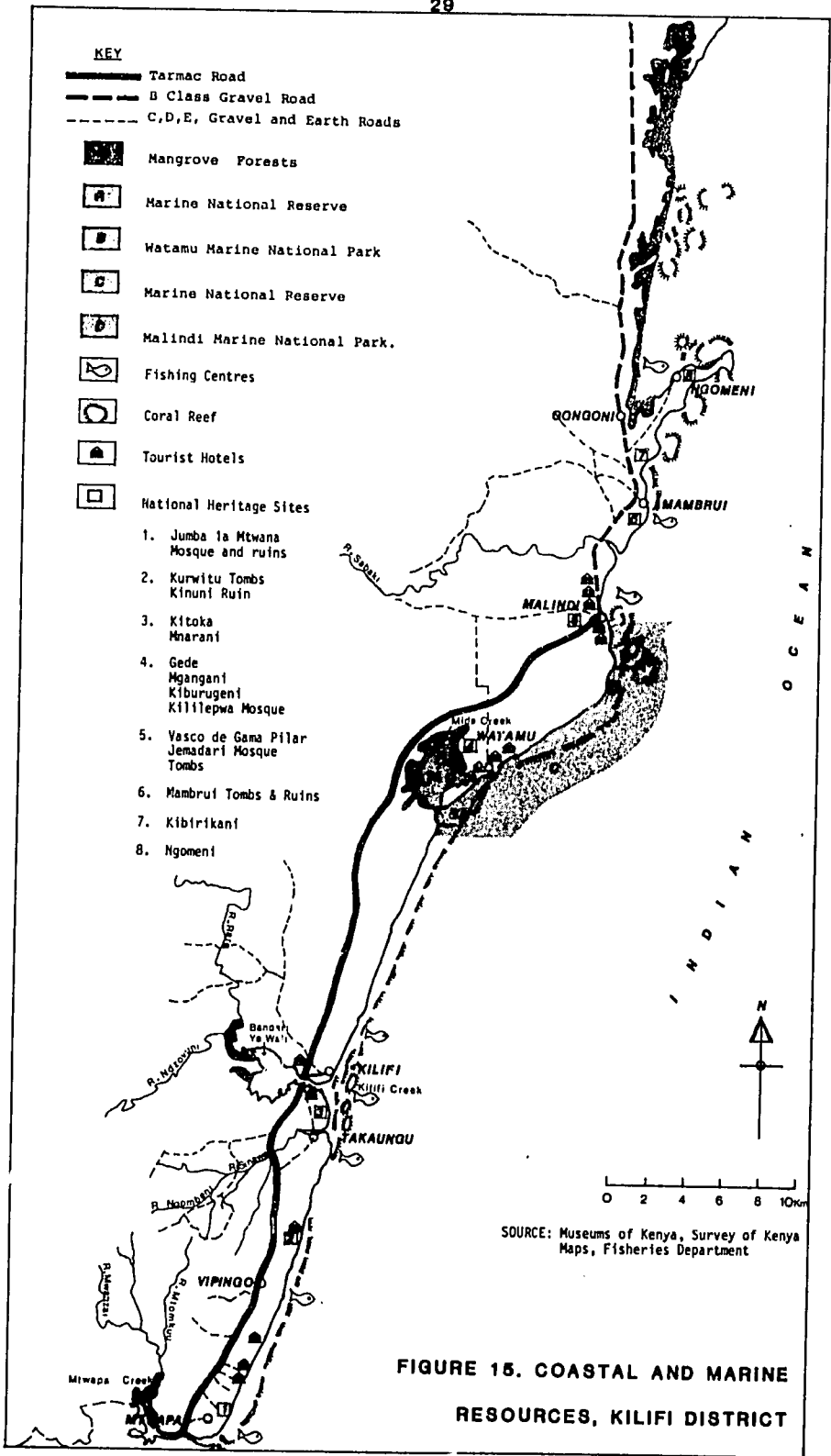
The coastal zone of Kilifi District generally includes a strip of land 180km long and 15 km inland (the Mwambao of the Sultan of Zanzibar's rule). The territorial sea, which extends seawards 12 nautical miles from coastal baseline, the continental shelf, and the exclusive economic zones (200 nautical miles seawards) may also be included. However, the focus here is on the coastline and adjacent marine resources (Figures 15)

The physiography of the coastline includes sand dunes (North of River Sabaki, e.g. at Ras Ngomeni and Ungwana Bay), old coral reefs, raised in places as cliffs, and beaches. Reef formation is to some extent affected by the influx of freshwater from rivers. The seasonal floods of the Sabaki and Tana Rivers have prohibited coral reef formation in extensive areas along the coast near their mouths. The estuaries fed by sedimentation from the rivers, are the sites of the mangrove forests on the shore, and sand banks offshore. Between Mombasa and Malindi there is an almost continuous formation of coral reef and it is in this region that the Malindi and Watamu Marine National Parks and the Watamu Marine National Reserve are found. The Reserve encompasses 95 km<sup>2</sup> surrounding the Parks and including Mida Creek. Traditional fishing, but not shell-collecting, is allowed in the Reserve.

### 1.6.2 CORAL ECOSYSTEM

The coral reef runs parallel to the coastline, at 300 to 1000 metres from the shore, and forms the seaward boundary of a unique and complex ecosystem. While the reefs do not cover a large area, they are very important in protecting the lagoons and beaches and as breeding grounds for marine fish.

There are perhaps 50 different species of coral found along the Kilifi coastline. They are grouped into three different coral forms or shapes: the massive and generally rounded types, branching forms typified by the stags horn coral (Acropora) and the plate-like forms. The Poritidae and Acroporidae are among the most important families of the reef builders, and are well represented in the district.



Corals belong to the fairly large groups of animals known as coelenterates. Living corals are colonies of many thousands of tiny polyps which secrete a cap of lime or calcium carbonate around their bodies. Only the coral surface is occupied by living polyps. Within the coral tissues are the zooxanthellae which are small chlorophyll-containing protozoa (algae) which live with the coral polyps in a state of symbiosis, although its exact nature is not known. Corals deprived of their zooxanthellae are unable to deposit calcium which is vital to the formation of their protective structures.

Corals are limited in their development by several environmental conditions:

- (i) Warm water temperatures 20 - 28°C
- (ii) Salinity - close to that of the ocean,
- (iii) Shallow water depths - which permit enough light penetration essential for the symbiotic algae living in the coral reef, and
- (iv) Continuous supply of well oxygenated water - which provides their food.

The rate of increase for the large rounded corals is about 10 mm per year, while the branching form may grow 10 - 20 cm per year. Corals are slowgrowing; the building of a reef represents a minimum of 7,000 to 10,000 years of coral growth (Bock 1978). Reefs are the result of a balance between coral growth and destruction - from waves, predators and human activity. The reef detritus may enrich adjacent sand flats, supporting a macrobenthic invertebrate fauna upon which many fish feed. Thus the amount of coral reef and amount of substrate covered by living coral tend to be positively correlated with the diversity and biomass of fish (Nagelkerken 1977, Parrish and Zimmerman 1977). There are almost 26 families of fish which are found in the reef ecosystem (Appendix 6.3).

Although the lagoonal habitats are complex, not all types of marine plants and animals are found at every location along the coast. The generalized diagram (Figure 16) illustrates their main features (Bock 1978). The shoreline shallows consist of sandy extensions of a gradually shelving beach or a more or less flat platform derived from an ancient eroded coral reef containing tidal pools. In most cases sandy shallows are not particularly rich in species, although frequently an incoming tide may bring many fish, including rays, pipefish, sardine, sand-dwelling eels and flatfish.

Beyond the sandy shallows, the shoreline tidal pools have macrophytes which afford ample cover and protection for many species and constitute an important nursery for young fish of such species as gobies, blennies and rockhoppers. Very young damselfish, batfish, grey mullets and even barracuda are often found in great numbers.

The seagrass meadows are dominated by the species Cymodocea. The grasses are the habitat of parrot fish, cardinal fish, and species of sea urchins which often occur in vast multitudes.

The next area, immediately inshore of the reef platform, includes extensive areas of coral rubble and rocky debris. This zone is wealthier in both species of fish and in populations of certain species. These include two species of the damselfish, the surgeon fish, apogons, wrasses and angelfish.

Before the reef platform is a substantial area of deeper water, where coral gardens may occur. This habitat is richest in species and densities.

The reef platform is uncovered at low tides and during spring tides. Tidal pools are evident and abound in animal and plant life. Their walls, thickly encrusted with algae, sponges bryozoans, tunicates and small corals, support dense fish populations of numerous species such as the wrasses, damsels, surgeons, soldiers, rock cods, blennies, scorpions, boxfish and others.

In addition to the coral fish, the echinoderms and crustacea are important parts of the ecosystem. Starfish, molluscs (such as the giant clam, octopus, squid and cuttle fish) feed upon the coral or live in the reef. Lobsters and crabs are valuable resources of the reefs, but are limited in Kilifi District. Shrimp are caught in the Ungwana Bay.

Dugong - sea going, herbivorous marine mammals - are native to the coral ecosystem and were spotted in 1975 during the last census. Green turtles are occasional visitors to the protected beaches where they lay their eggs. The turtles with their eggs and dugong are hunted for food and as trophies. Some turtle beaches have been disturbed and are no longer suitable nesting sites.



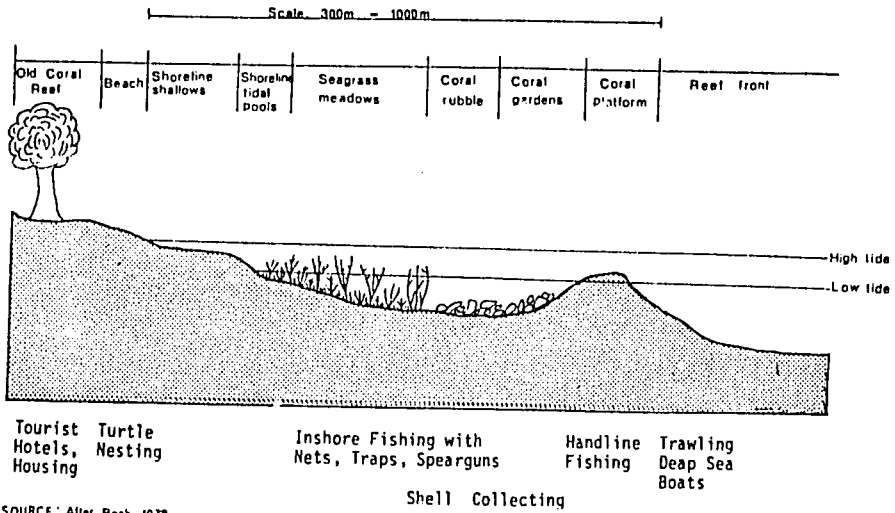


FIGURE 16: CROSS-SECTION OF CORAL LAGOON

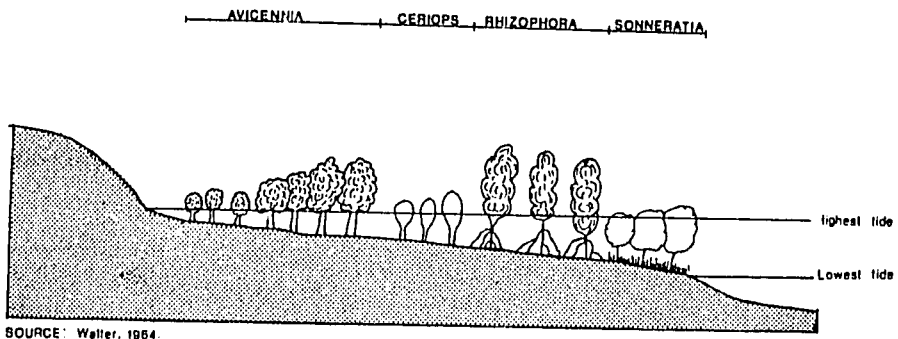


FIGURE 17: CROSS-SECTION OF MANGROVE FOREST.

### 1.6.3 MANGROVE STANDS

The mangrove community is a productive and valuable ecosystem, with an important inter-dependence in the ecology (and food chain) of the near shore waters. Populations of exploitable organisms such as shrimp and crabs are associated with the swamps which are also breeding grounds for larvae of commercially important marine fish and crustacea normally captured away from the shore. The mangrove stands help in extending the alluvial coastal plains and protect the shore from erosion by tides and tropical storms. Material carried down to the sea by runoff and detritus material carried landward from the sea accumulate around the tangled roots of the mangroves. As the force of wind and currents is reduced, this material settles down within the mangrove community and a fine, rich mud accumulates, stabilizing the shoreline.

Mangrove species occur in distinct zones as they have different requirements for shade, turbidity and salinity (Figure 17). Some of the important economic species are the Rhizophora mucronata, Sonneratia alba, Avicennia marina, Ceriops tagal and Bruguiera gymnorhiza. Mangrove forests cover an area of 6,378 hectares in Kilifi District. Human beings use mangroves for many purposes:

(a) Used as building poles for houses and (rails on) boats as they are slim, straight, strong, termite and rot resistant. The species Bruguiera gymnorhiza is used for timber in Kenya. Mangrove poles are exported to the Middle East from Lamu by dhows and steamships. No legal exportation occurs from Kilifi District.

(b) Tannins extracted from mangrove bark are used in the process of tanning leather.

(c) Mangroves have also been used for fuelwood and charcoal.

### 1.6.4 MARINE MACROPHYTES

Marine macrophytes and mangrove trees comprise the major marine botanical resources. Macrophytes encompass the algae and marine angiosperms and are conspicuous in the intertidal zone, especially on a spring low tide. Field observations show that the macrophytes show seasonal abundancies related to the northeast and southeast monsoon due to contrasting changes in the climate, hydrography and tidal patterns. The harvestable Rhodophyta (red algae) which dominate the flora in numbers of species show two peaks in the northeast and southeast monsoons.

Phaeophyta (brown algae) are more abundant towards the end of the southeast monsoon period in September and October whereas Chlorophyta show maximum growth in December/January during the southeast monsoon. In general there is better algae and agiosperms growth during the southeast monsoon (Isaac & Isaac 1968; Moorjani 1978 and 1979; Newell 1957 and 1959; Brakel 1980).

Botanical resources can be economically and ecologically important, although so far only mangroves have been used commercially. Ecologically macrophytes are important as:

- primary producers which are the foundation of the ecosystem,
- shelter to many invertbrates, and
- sediment binders. The roots of various angiosperms, especially Thalassia and Cymodecea, help to hold soil particles together, creating suitable microhabitats for organisms which would easily be swept away by currents.

#### 1.6.5 FISHERIES

The marine fisheries are divided into two groups: the demersals and the pelagic fish. The former include such fish as the rabbit fish, parrotfish, scavengers, snappers and surgeonfish. These fish are normally caught in the inshore waters. The pelagic fish are not normally found inshore of the reef, and are caught in the open sea. They are most abundantly caught between September and March.

#### 1.6.6 IMPLICATIONS FOR ENVIRONMENT AND DEVELOPMENT

The coastal marine resources of Kilifi are important for their aesthetic value (both to local people and tourists), as sources of food and for commercial exploitation. Many of the resources could be more productive with proper management. Seawater itself could be utilized in the extraction of certain minerals. Salt drying at Ungwana bay by Kenya Salt Manufacturers, Fundisha Salt Works and Ngomeni Salts have been profitable.

A less obvious but possibly fruitful line of investigation concerns the exotic compounds which have been extracted from a range of marine organisms, seagrasses and sponges. Coelenterates have been found to contain chemicals of pharmaceutical interest. Imperial Chemical Industries and Roche have experimented with marine invertbrates from the Red Sea and Australia and it is quite likely that our coastal flora and fauna support organisms of interest in this respect. Aquaculture of algae, turtles, fish and dugong is another potential resource.

However, the coastal environment is in many respects fragile and needs to be protected. Export of some shells changes the structure of the local ecosystem and reduces the reefs' scenic value. Overfishing of crustacea and young tropical fish for aquariums has also been noted. Pollution resulting from shipping, potential off-shore oil development, wastes from towns and agricultural run-off threaten the health of the coral reefs. Direct damage to coral reef by visitors includes breakage by walking on the coral reef and damage from anchors. More detail on these issues is given in Sections 2.5 and 2.6

## 1.7

### P O P U L A T I O N

#### 1.7.1 POPULATION DENSITY AND ETHNIC COMPOSITION

The total population in 1979 was 430,986 with a density of 34 persons per sq. km. However, population densities vary greatly from an average of 1 person per sq. km. in Adu Location in the Malindi dry hinterland to about 842 persons per sq. km. in Kilifi Township. Ganze Division is less densely populated than Bahari and Kaloleni Divisions (Figure 18).

Kilifi District is inhabited predominantly by seven of the nine Mijikenda tribes, the other two being found in the neighbouring Kwale District. They include the Agiriama, Adzihana (Jibana), Achonyi, Araphai, Akambe, Akauma and Arike, with the Agiriama forming the majority. During the 1969 Census the Mijikenda accounted for 91.8 per cent of the total district population. This figure dropped to 90.7 per cent in 1979 (Table 1.7). The other major tribes are the Akamba and Bajun.

#### 1.7.2 1 AGE-SEX PYRAMID

The age-sex pyramid distribution is broad-based due to the high proportion of the young population in age-groups 0-9 (34.7%) and 10-19 (21.1%) (Table 1.8 and Figure 19). The dependency ratio is 53:2.

TABLE 1.7 POPULATION BY SEX, TRIBE OR NATIONAL GROUP FOR KILIFI DISTRICT, 1969 AND 1979

TRIBE OR NATIONAL GROUP	1979				1969
	MALE	FEMALE	TOTAL	PERCENTAGE OF TOTAL DISTRICT POPULATION	PERCENTAGE OF TOTAL DISTRICT POPULATION
<u>KENYAN AFRICAN</u>					
Mijikenda	183,957	206,949	390,706	90.70	91.80
Kamba	4,111	3,449	7,560	1.75	1.36
Bajun	2,482	2,378	4,860	1.13	0.96
Luo	2,058	1,842	3,540	0.82	0.56
Kikuyu	1,363	1,144	2,507	0.58	0.35
Luhya	1,340	960	2,300	0.53	0.32
Taita	910	1,049	1,959	0.45	0.22
Boni/Sany	288	275	563	0.13	0.40
Others	2,732	2,213	4,947	1.15	0.81
<b>TOTAL</b>	<b>199,241</b>	<b>219,901</b>	<b>419,142</b>	<b>97.25</b>	<b>96.76</b>
<u>KENYAN NON-AFRICANS</u>					
Asians	125	111	236	0.05	0.35
Europeans	32	39	71	0.02	0.11
Arabs	592	615	1,207	0.28	1.25
Others	564	479	1,043	0.24	0.01
<b>TOTAL</b>	<b>1,313</b>	<b>1,244</b>	<b>2,557</b>	<b>0.59</b>	<b>1.71</b>
<u>NON-KENYANS</u>					
Africans	1,095	824	1,919	0.45	0.66
Asians	355	357	712	0.17	0.13
Europeans	902	893	1,795	0.42	0.57
Arabs	2,362	2,303	4,665	1.08	0.14
Others	92	104	196	0.05	0.02
<b>TOTAL</b>	<b>4,806</b>	<b>4,481</b>	<b>9,287</b>	<b>2.15</b>	<b>1.52</b>
<b>DISTRICT TOTAL</b>	<b>205,360</b>	<b>225,626</b>	<b>430,986</b>		

SOURCE: Central Bureau of Statistics 1969 and 1979

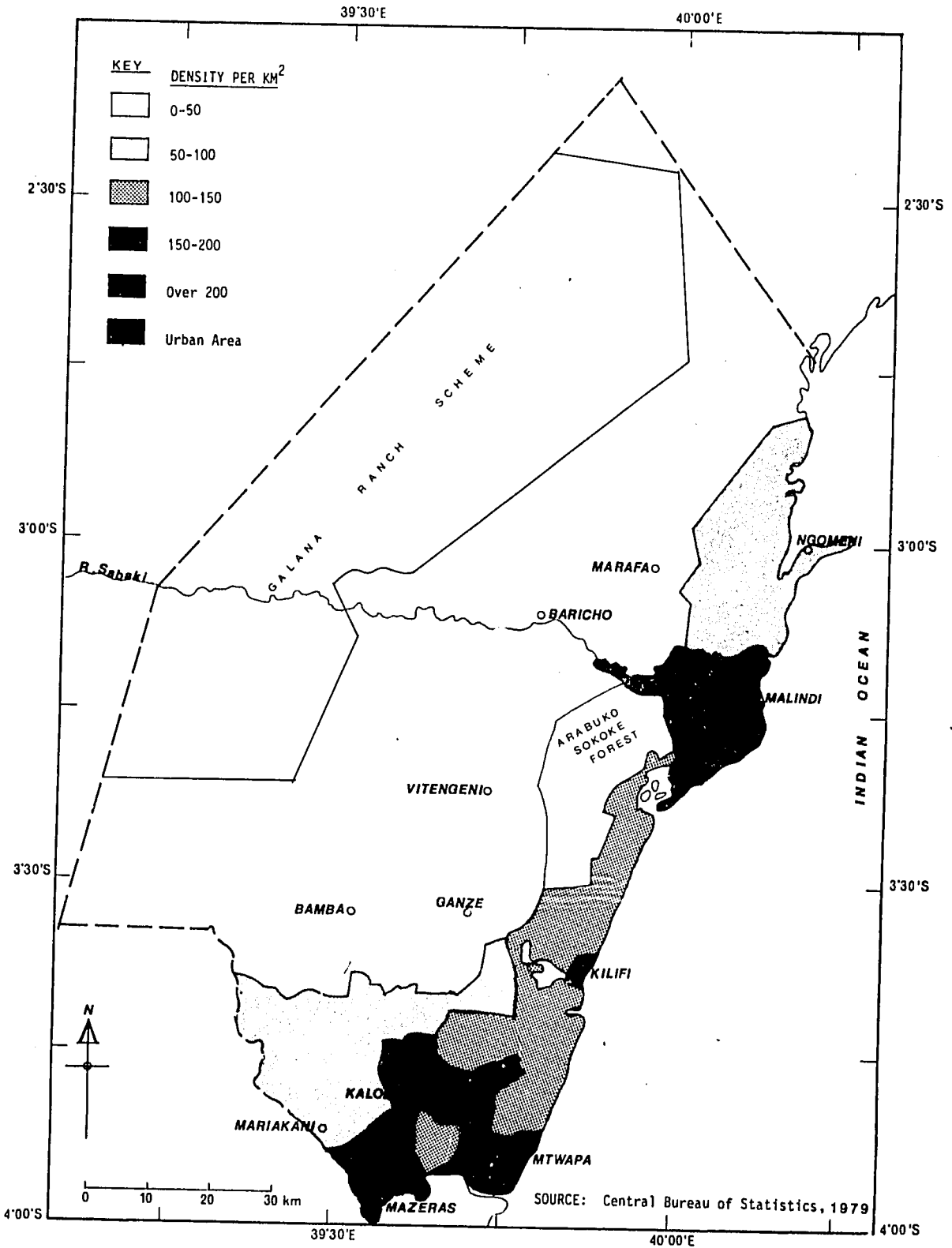


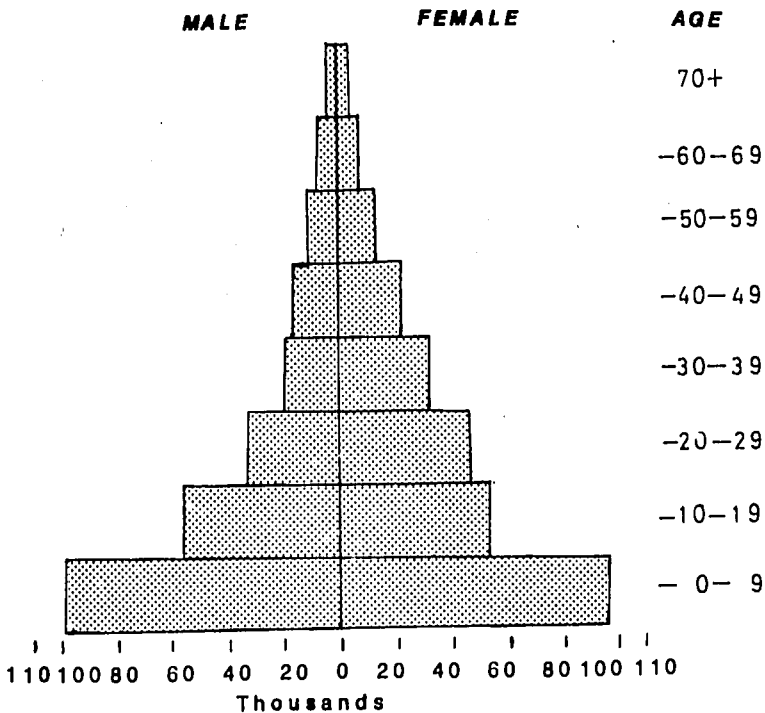
FIGURE 18. POPULATION DENSITY, KILIFI DISTRICT

TABLE 1.8 POPULATION BY SEX AND AGE GROUP, KILIFI DISTRICT, 1983

AGE GROUP	MALE	FEMALE	TOTAL
0 - 4	54,393	54,924	109,317
5 - 9	44,475	42,164	86,639
10 - 14	31,125	28,417	59,542
15 - 19	22,914	24,557	47,471
20 - 24	16,772	26,004	42,726
25 - 29	16,244	20,664	36,908
30 - 34	11,998	17,861	29,859
35 - 39	11,335	14,177	25,512
40 - 44	8,681	11,191	19,872
45 - 49	8,468	9,813	18,281
50 - 54	6,165	6,571	12,736
55 - 59	5,195	5,113	10,308
60 - 64	4,056	3,947	8,003
65 - 69	2,935	3,003	5,939
70 - 74	1,545	1,413	2,958
75+	1,547	1,425	2,972
TOTAL	247,798	271,244	519,042

NOTE: 1983 Population projected from 1979 census assuming constant levels of fertility, mortality and net migration

SOURCE: Central Bureau of Statistics, 1983



SOURCE: Central Bureau of Statistics, 1983.

FIGURE 19. AGE-SEX DISTRIBUTION, KILIFI DISTRICT, 1983

1.7.3

MIGRATION AND POPULATION GROWTH

There has been immigration and internal migration as well as outmigration from the District. The 1979 Census figures indicated that 7.05 percent of the total population of the District have migrated into the District. The settlement schemes have been one cause for internal migration as well as immigration. There is currently a shift towards areas served by water from the Sabaki pipeline. Outmigration to Mombasa is common, especially for young men seeking employment.

Kilifi District, with a total land area of 12,500 sq.km. is the most densely populated among Kenya's coastal districts (excluding Mombasa). The 1979 census indicated a population size of 430,986, while the figure for 1969 was 307,568. This implies a growth of 40 percent since 1969. The growth rate during the 1962 to 1969 inter-census period was 3.5 percent and currently the estimated annual net growth rate is 3.92. The current population in Kilifi District is larger than was anticipated and is growing faster than projected. If the present growth rate of 3.92 percent continues there will be 0.7 million people in the District by the year 1990. (Central Bureau of Statistics 1983).

1.7.4

IMPLICATIONS FOR ENVIRONMENT AND DEVELOPMENT

Current demographic trends indicate that population growth in Kilifi warrants serious concern, since there is an imbalance between population growth and the ability to generate employment, develop key resources and maintain current standards of services. The District is not, strictly speaking, overpopulated, but it will be difficult for development to keep pace with the current growth rates. Section 3.1 explores this problem more fully.

1.8

AGRICULTURE AND LIVESTOCK

The vast majority of the rural population are engaged in agricultural and livestock production. For perhaps 90% of the people, farming is their major source of income (ADEC 1983). Several general types of agricultural and livestock production are recognized (Figure 20):

- small holder mixed agriculture
- large commercial estates
- commercial ranches
- pastoral systems
- group ranches

Much of the district is dry, although there are sizeable areas of moderate agricultural potential particularly in the coastal uplands. Of the District's total land area, 11,964 sq. km., 7,113 sq. km (59%) is available for agriculture. Of the agricultural land 6% is high-medium potential, 29% is medium potential, and 64% is most suitable for ranching (Jaetzold and Schmidt 1983). Appendix 6.4 summarizes recent agricultural farm data. (see figure 21).



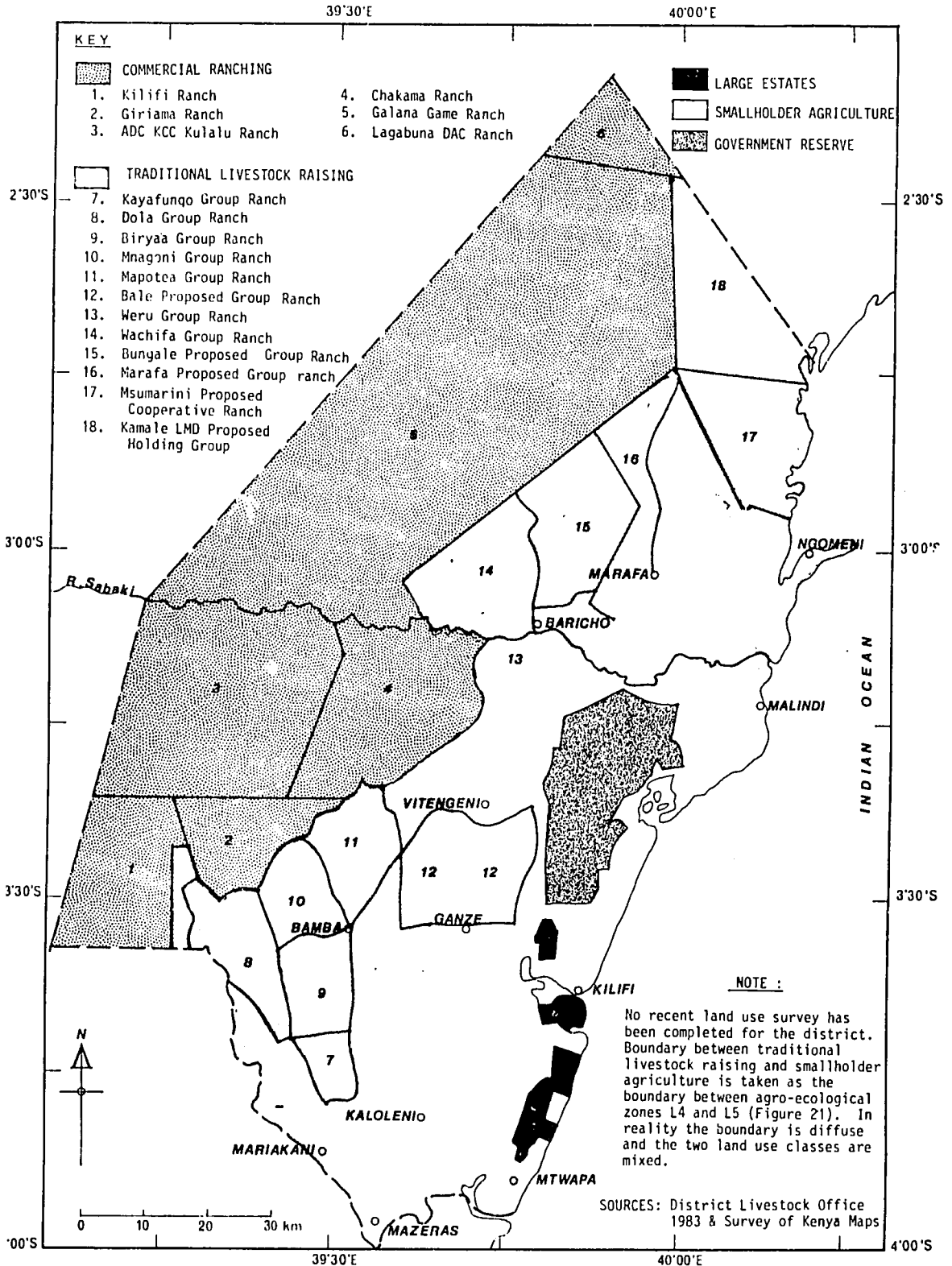


FIGURE 20. AGRICULTURE AND LIVESTOCK SYSTEMS, KILIFI DISTRICT

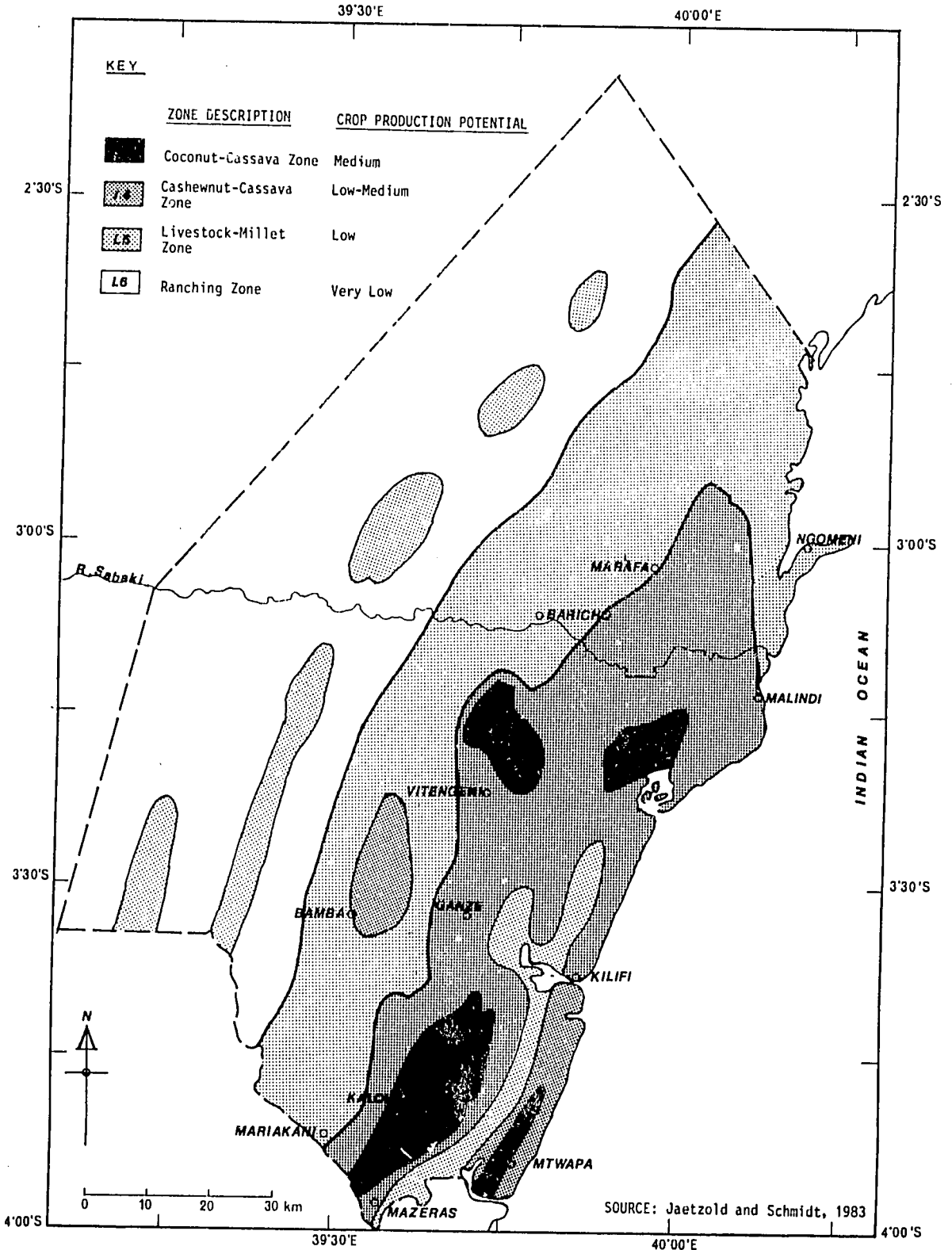


FIGURE 21. AGRO-ECOLOGICAL ZONES, KILIFI DISTRICT

### 1.8.1 FARMING SYSTEMS

The small-holder mixed agriculture regions are along the coast and in the coastal uplands. A number of settlement schemes have been established in these areas (see Section 1.7.2) to provide secure land title to the existing farmers, allow for settlement from overcrowded areas (local and upcountry), and as a means of extending technical assistance and infrastructure. The most intensive small-holder agriculture is in Kaloleni Division and in parts of the District north of the Sabaki River.

The majority of farmers plant food crops such as maize, beans and cassava and some cash crops including cashew nuts, coconut, cotton, sesame and sisal (Table 1.9). The smallholder farming system varies within the district, but generally food and cash crops are grown along with tree crops and many farmers have a few livestock. Recent efforts have been to improve the herd quality, including provision for dairy cows.

Food crops such as maize and rice give low yields most of the time. There is a deficit in foodstuffs in the district, which has to import food from other parts of the country. Most of the farmers purchase a significant portion of their food. At present the district imports about 50,000 tons of maize per year. Efforts are being made to encourage farmers to appreciate new technologies and raise the production of food crops especially rice and maize from the present 10 to 15 tons per hectare.

Although the district quite often suffers from the effects of drought, there are no large scale irrigation schemes. At the moment there are about four (4) minor irrigation schemes. These are, Sabaki Minor Irrigation - which covers 20 hectares with about 64 farmers growing horticultural crops, Chakama Irrigation Scheme, Jilore Minor Irrigation Scheme and Bugangi Rice Pilot Project.

At the moment, credit facilities are available to assist small-holders to improve their agricultural production. The Agricultural Finance Corporation (AFC) provided credit through short medium, and long term loans to benefit farmers and ranchers in the district. However, so far, few farmers have made use of this facility.

Pesticides and fertilizers are not widely used by small-holders. Even rice growers do not apply pesticides. There are only a few cases where pesticides for stalk borers in maize are used.

Commercial agricultural estates, at Vipingo and near Kilifi, produce sisal, along with a few other crops and livestock.

TABLE 1.9 FOOD AND CASH CROPS IN KILIFI DISTRICT, 1976 - 1982

CROPS	UNITS	1976	1977	1978	1981	1982
MAIZE	Ha.	23,678.82	39,303	25,000	41,440	26,450
	Bags	118,394.1	982,575	400,000	285,111	75,555.6
	Bags/ha	5	25	16		
CASSAVA	Ha.	5,270.69	5,170	4,000	5,870	5,090
	Tons	-	-	-	78,300	101,800
	Tons/ha	-	-	-	13.34	20
SORGHUM	Ha.	220.20	100	59.7	96	93
	Tons	-	-	-	57.6	26
	Tons/ha	-	-	-	0.6	0.27
RICE	Ha.	331.35	627	222.3	1,030	1,343
	Kg.	-	-	77,805	1,030	1,343
	Kg/Ha	-	-	-	-	-
SWEET POTATOES	Ha	-	627	-	20	47
	Tons	-	-	-	200	470
	Tons/ha	-	-	-	10	10
CASHEW NUTS	Ha.	16,153.12	16,324	16,477.11	16,690	16,902
	Tons	-	6,121.42	8,719.36	12,520	3,800
	Tons/Ha	-	0.37	0.52	0.75	0.72
COCONUTS	Ha.	16,821.45	17,019.68	17,219.68	18,590	19,006
	Tons	-	-	-	8,364	8,550
	Tons/Ha	-	-	-	0.45	0.45
SESAME	Ha.	3,104	3,548	3,246.32	6,150	2,900
	Tons	-	-	-	2,900	870
	Tons/Ha	-	-	-	0.6	0.3
SISAL	Ha.	270.4	478	-	10,000	10,000
	Tons	-	4,000	-	-	18,400
	Tons/Ha	-	-	-	-	2.3
COTTON	Ha	7,221.25	7,442.2	4,559.26	7,000	3,705
	Tons	-	-	-	-	1,480
	Tons/Ha	-	-	-	-	0.40

SOURCE : Ministry of Agriculture District Annual Reports, 1976 - 82

Cashew trees are mostly planted by out-growers although some are grown on a few poorly managed, small estates. The Kilifi District Co-operative Union delivers the cashew nuts to the Kenya National Cereals and Produce Board (NCPB) on behalf of the out-growers. The NCPB subsequently sells the crop to the Kenya Cashewnut Factory for processing, packing and handling. The Co-operative also handles copra from the out-growers, which it sells to millers within and outside the District. Sesame (simsim) is also handled by the NCPB. Vipingo and Kilifi Sisal Plantations have organized marketing channels, on an individual basis to foreign markets. Due to the relative under-development of agriculture in the District, the co-operative movement has lagged behind, compared to other parts of the country.

#### 1.8.2 LIVESTOCK RAISING

There are over 631,307 livestock in Kilifi District. This includes well over 143,667 cattle, 30,654 sheep, 188,470 goats, 266,080 poultry, 650 rabbits, 370 pigs, 190 donkeys and 38 horses. Of the total number of cattle, less than ten percent are grade. With improved management techniques, the numbers of sheep, goats and poultry are expected to rise.

Towards the hinterland, rainfall is unreliable and the region is dry much of the year. This region is mainly suitable for rangeland development. The ranching potential in the district is quite high provided that the water for both human and livestock consumption is made available. At present, there are about sixteen ranches (Table 1.10). Of these, only the three commercial ranches (Galana, Giriama and Kulalu) are operating. The Galana Game Ranch extends into Tana River District and operates as a company with a letter of allotment. Kulalu ranch is under the auspices of the Agricultural Development Corporation and Kenya Co-operative Creameries. The Giriama Ranch, one of the most successful, started operating in 1975 and was financed by a loan from the Agricultural Finance Corporation.

The Government has established holding grounds at Sabaki and Kurawa near Tana River District to provide marketing facilities to serve the Kilifi stock-traders. There are also two auction rings at Mariakani and Bamba, operated and maintained by the Kilifi County Council.

Much of the dry areas of Kilifi District have been divided into group ranches. At the moment, there are thirteen group ranches, of which five have title deeds and three are only proposed. None of the Group Ranches operate sizeable central herds.

TABLE 1.10 RANCHES IN KILIFI DISTRICT, 1983

GROUP RANCHES	HA	NO. MEMBERS
Weru	12,900	275
Mapotea	23,400	1,272
Biryaa	15,400	460
Dola	21,065	230
Mnangoni	13,560	460
Kaya Fungo	10,720	1,400
Bungale	28,215 (est.)	Proposed
Marafa	14,600	Proposed
<b>TOTAL</b>	<b>119,860</b>	<b>4,097</b>
<b>OTHER RANCHES</b>		
Kulalu ADC	96,000	
Kilifi Ranch Co.	42,000	
Giriama	25,938	
Chakama	51,938	
Galana	300,000	
Lagabuna	18,000	
Wachifa Coop.	27,600	
Musumarini Coop.	26,000	
<b>TOTAL</b>	<b>589,476</b>	
<b>GRAND TOTAL</b>	<b>727,336</b>	

SOURCE: District Livestock Office 1983

### 1.8.3 IMPLICATIONS FOR ENVIRONMENT AND DEVELOPMENT

Although over half of Kilifi is of low agricultural potential or constrained by unreliable rainfall or poor soils the full agricultural potential has not been realised. More intensive agriculture is possible in the wetter areas.

The potential for livestock development is also significant, although constrained by the lack of dry season water, traditional attitudes towards livestock and management problems in the group ranches.

While development must proceed, care should be exercised to preserve a balance with wildlife and to maintain representative natural communities.

## 1.9 TRANSPORT, COMMUNICATIONS AND SERVICE CENTRES

### 1.9.1 TRANSPORTATION

There are four modes of transportation available to the district: road, rail, water and air (Figure 22). The road network in Kilifi District is very poorly developed with only tarmacked roads: Nairobi - Mombasa, Mombasa - Malindi and Mazaras - Kaloleni (Table 1.11). These roads are busy and are located in densely populated areas. The rest of the road network falls under categories C, D, and E and mostly branch from the Mombasa - Malindi and Nairobi - Mombasa roads.

39°30'E

40°00'E

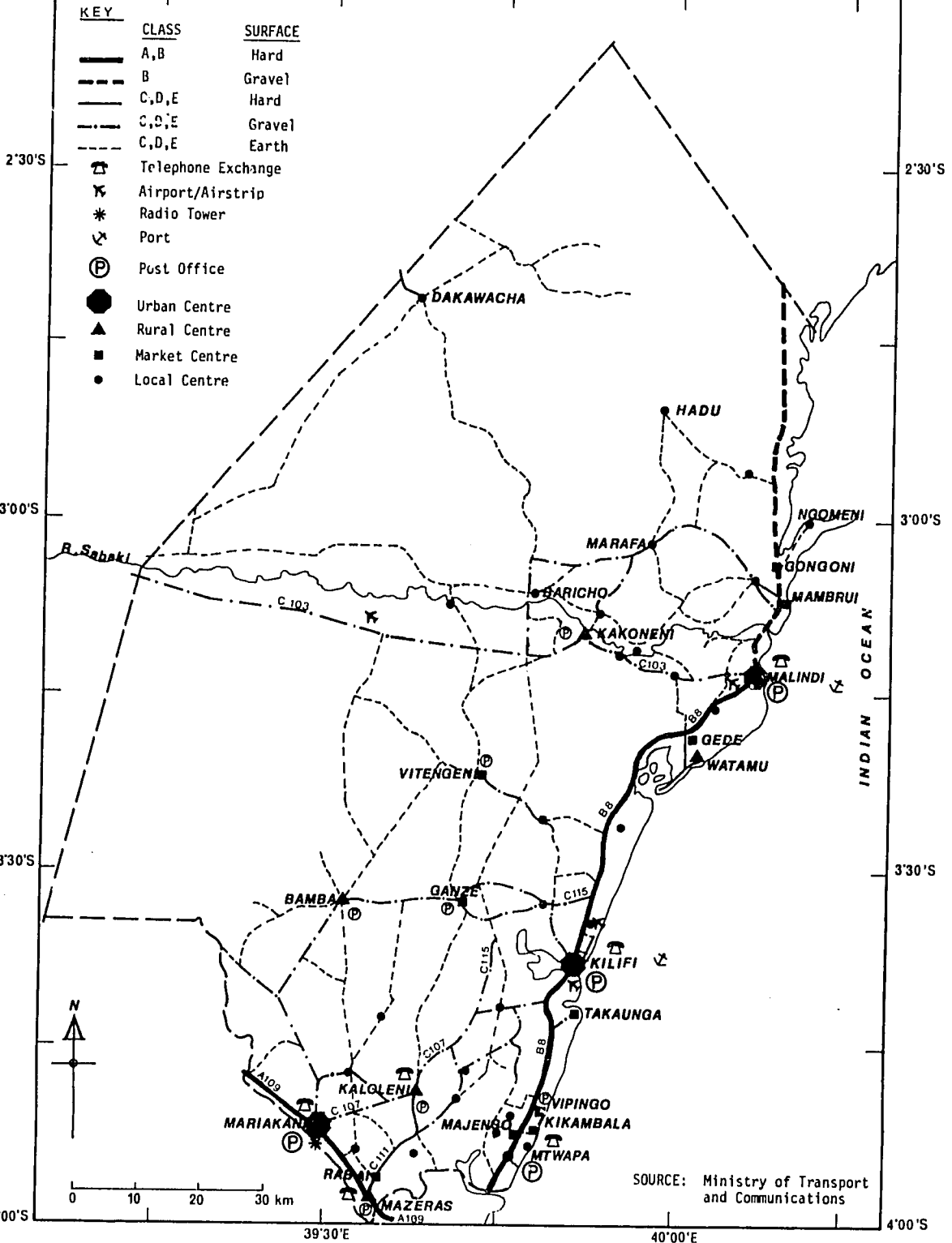


FIGURE 22. TRANSPORTATION ,COMMUNICATION AND SERVICE CENTRES, KILIFI DISTRICT

The road network is more dense in the areas of high agricultural potential - Kaloleni, Bahari and Malindi Divisions - leaving the north-western parts of the interior, which are sparsely populated with very few roads and relatively fewer means of transport for goods and people.

TABLE 1.11 ROAD NETWORK IN KILIFI, 1983

ROAD TYPE	CLASS	DISTANCE IN KM.	ROAD SURFACE
Trunk Road	A	34.4	Bituminized
National	B	168.6	Bituminized
Primary	C	219.3	Bituminized
Secondary	D	414.0	Loose surface
Minor Roads	E	648.0	Loose surface
TOTAL		1484.3	

SOURCE: Ministry of Transport and Communications, Mombasa, 1983

The Ministry of Transport and Communications constructs and maintains all the classified roads while other organizations are responsible for the unclassified roads until they are approved and taken over by the Ministry. These include the Rural Access, Tourist, and Settlement Roads.

The Mombasa - Nairobi railway line has stations at Mazaras and Mariakani. Goods and passengers are transported.

Sea transport is not very significant in Kilifi District but there is considerable use of boats and canoes by local fishermen, and dhows and large boats carry heavy goods from Lamu to various points along the Kilifi coast. The Malindi jetty extension expected to be completed in 1984, is intended to boost sea transport and provide better fish landing facilities. However, the Malindi harbour is rapidly silting up, thus limiting the jetty's usefulness.

There is a second class airport at Malindi and airstrips at the Mnarani Club, Kiswani Farm, Kilifi Township and Galana Game Ranch. The runway at Malindi can accommodate DC9 aircraft. This airport is used mostly by chartered planes used in the tourist industry and to airlift agricultural products such as fruits and seafood to Nairobi and Overseas. (Table 1.12.)



TABLE 1.12 AIRCRAFT LANDING AT MALINDI AIRPORT,  
1981 and 1982

TYPE OF AIRCRAFT	1981	1982
Chartered Planes	6049	5464
Scheduled Planes	1515	1388
Cargo	7036.3 Kg	20592.1 kg
Passenger	25667	26474

### 1.9.2 COMMUNICATION

Communication facilities in Kilifi District consist of post offices and telephone services, a Ministry of Information and Broadcasting Station, radio calls, newspapers and the satellite launching centre (Figure 22).

The demand for postal services has grown in excess of the current capacity, particularly for post boxes, postal orders and savings bank. There is need for additional postal services in the existing post offices or establishment of new ones. Additional services required include telegrams, money orders, and savings banks, particularly in Kaloleni and Vipingo.

The Ministry of Information and Broadcasting has a station in Mariakani (Sauti ya Pwani) and offices in Kilifi and Malindi. They have information officers who collect information for dissemination through radio and television. The locally-distributed newspapers (Nation, Standard, Kenya Times and Coast Week) carry articles about the Coast every week. The Italian Satellite launcher at Ras Ngomeni includes satellite tracking and communication capabilities.

Radio calls are stationed at various points in the District where telephones are not available, such as Mkomani, Fisheries Department and Marafa.

### 1.9.3 SERVICE CENTRES

The service centres in Kilifi District consist of urban, rural, market and local centres arranged in an hierachial order based on infrastructural facilities, including administration, transportation, communication, social services and commerce (Figure 22 and Table 1.13)

TABLE 1.13 SERVICE CENTRES IN KILIFI DISTRICT, 1983

Urban Centres	Rural Centres	Market Centres	Local Centres	
Kilifi	Bamba	Gogoni	Fundisha	Ribe
Malindi	Kaloleni	Takaungu	Kakuyuni	Kidutani
Mariakani	Mazeras	Gede	N gomeni	Kwademu
	Kakoneni	Mambrui	Hadu	Mtonda
	Watamu	Vitengeni	Roka	Msabaha
		Rabai	Marafa	Jaribuni
		Ganze	Dida	Gotani
		Majengo	Baricho	Mitsangoni
		Kikambala	Sokoce	Mbayuivi
		Vipingo	Dagama	Jeuri
			Kibaoni	Maziwani

SOURCE: Kilifi District Development Plan, 1979 - 83

The service centre infrastructure in the District shows a low growth rate, with local and market centres offering the poorest services. The rural and urban centres are so widely distributed that they do not adequately serve the population. Among the needed developments in the local and market centres are water supplies, transport and communication, health facilities and commerce.

#### 1.9.4 IMPLICATIONS FOR ENVIRONMENT AND DEVELOPMENT

The roads, where available, are not properly maintained and since they are constructed with gravel or earth, they become impassable during the wet seasons. Very few public transport vehicles penetrate to the interior leaving the area inaccessible for distribution of agricultural inputs and marketing of produce.

Water, particularly during the dry season, is a major problem for most rural and local centres.

The low level of development of local and rural centres means people must travel long distances to secure basic services - health, banking, manufactured products, even paraffin.

1.10

INDUSTRIAL DEVELOPMENT

During the last few years, the industrial sector has expanded greatly within Kilifi District. There are fifteen large industrial concerns and a large number of cottage industries. The industrial centre is Malindi Town, commanding about 20% of the total industrial establishments in the district, with 55% in the Malindi sub-district. With the exception of 2 firms, all the other large scale industries are located in the coastal strip where the infrastructure is more developed and where there is a high density of population (Table 1.14). The informal sub-sector consists of a comparatively large number of small units (cottage industries) located in most of the population centres, but concentrated in the urban market and rural centres. Almost all these units have little capital investment and low production capacity.

1.10.1 KENYA CASHEWNUTS

Kenya Cashewnuts is one of the largest employers on the north coast. It was established in 1973 with a total investment of Ksh. 66 million, and started operation in 1975. The shareholders are the National Cereals and Produce Board, Industrial and Commercial Development Corporation, Industrial Development Bank and farmers through their cooperatives. Kenya Cashewnuts covers an area of 350 acres, and has 1850 permanent employees and 200 casuals, the number of the latter varying from season to season. Of the permanent employees, there are 1330 women and 520 men.

Raw cashewnuts are bought from the small-scale farmers through 23 co-operatives in Kilifi, Lamu and Kwale Districts. The nuts are harvested from November to March and processed throughout the year except for the month of November when cleaning and maintenance are carried out. The spoilt nuts are used as animal feed. The outer shell of the nuts is bought by Tapioca Ltd and Kenya Colloids for oil extraction.

1.10.2 SMALL SCALE INDUSTRY

Kenya Industrial Estates in collaboration with the Rural Industrial Development Centre (RIDC), carries out development projects in various parts of the district. RIDC was established in 1976 and is based in Malindi Township. Besides the Central Factory facilities, the programme has embarked on an extensive drive to assist local entrepreneurs in establishing small scale industries in areas outside Malindi Township. Such projects include handicrafts making, furniture, wooden carvings and tailoring. (Table 1.15). The loans committee of the RIDC conducts education campaigns to build up an adequate level of local entrepreneurship in the district.

TABLE 1.14 INDUSTRIAL ESTABLISHMENTS IN KILIFI DISTRICT, 1983

INDUSTRY	LOCATION	GENERAL REMARKS
Kenya Cashewnuts	Kilifi Township	Parastatal; one of the major industries in the District. Product: Cashewnuts, animal feed, shells sold for oil extraction. Employment capacity: 3000. Established in 1973
Vitengeni Mines	Vitengeni - Ganze Division	Sponsors: Mineral Mining Corporation. Mining of Baryte and Fluospar. 70 employees
Hafswa Sawmill Ltd.	Mtondia, Bahari	Sponsors - Kenya Industrial Estates. Established in 1977
Winter Industries Fundisha Salt Works	Gongoni; Malindi	Sponsors - Kenya Industrial Estates - Kensalt Ltd. Salt extraction from sea water, grinding and packing
Tapioca	Mazeras; Kaloleni Division	Sponsor: Tapioca Ltd. Products: Starch and Dextrin from Cassava. Annual Turnover: 250 tons 50 employees. Established in 1977
Mariakani Milk Processing Factory	Mariakani, Kaloleni Division	Sponsor: Kenya Cooperative Creameries Processes milk and other products. Status uncertain due to organizational problems.
Malindi Ginnery	Malindi Township	Privately owned, ginning of cotton and cotton seed cake processing
Kenya Colloids Ltd	Kilifi Township oil seeds,	Privately owned, extraction of oils from various oil seeds, e.g. sunflower seeds.
Vipingo Sisal Estate	Vipingo; Bahari Division	Extraction of Sisal fibre. Established in 1977
Kilifi Plantation	Kilifi Township	Manufacture of boats. Total investment 0.8 million. 34 employees; milk plant packs liquid milk
The Malindi Steel Fabrication	Malindi Township	Started operation in 1981
Copra factory	Kilifi Township	Sponsors: Kilifi District Cooperatives Union, extraction of oil from coconuts
Paper factory	Malindi Township	Privately owned

SOURCE: Ministry of Commerce and Industry 1983

TABLE 1.15 RIDC FINANCED PROJECTS, KILIFI DISTRICT, 1983

NAME OF PROJECT	LOANS DISBURSED (Ksh.)
<b>LARGE PROJECTS</b>	
Hafswa Sawmill	181,807
Malindi Motors Ltd	-
Apolo Toy Industries	99,430
Malindi Refrigeration Services	18,478
Watamu Joinery Furniture Mart	114,659
Malindi Electro Services	-
Salt Mill Malindi	-
Manufacture of Concrete Products	-
Carpentry Unit in Lamu	-
Malindi Decorative Furniture Mart	79,373
Kilifi Central Furniture Mart	-
<b>SMALL PROJECTS</b>	
Small Vehicle Repair Unit	10,263
Carpentry Unit, Mtangani	4,153
Carpentry Unit, Kilifi	6,880
Bicycle Repair, Ramada	3,031
Plumbing Unit, Malindi	4,330
Watch Repair Unit, Malindi	8,754
<b>TOTAL</b>	<b>531,158</b>

SOURCE: Ministry of Commerce and Industry, 1983

### 1.10.3 IMPLICATIONS FOR ENVIRONMENT AND DEVELOPMENT

In a few cases industries have caused local pollution by improper waste disposal.

Industrial development in Kilifi has slowed in recent years, and lags behind the increases in the labour force. A vigorous programme for industrial development must include safeguards for the quality of the environment.

## PART II

### ENVIRONMENT AND DEVELOPMENT

#### 2.0 NATURAL RESOURCE MANAGEMENT

##### 2.1 ENERGY

Woodfuel, including charcoal and firewood, paraffin, gas, petrol and diesel, electricity, wind and solar energy are the main energy sources in the District (Figure 23). The demand for energy, both in the rural and urban areas exceeds supply. Apart from woodfuel, the other energy sources are either expensive or not available to the rural public. Figure 24 and Table 2.1 provide comparative data for the Coast Province which probably holds true for Kilifi District as well. Appendix 6.4 includes a summary survey for the Mtwapa area.

##### 2.1.1 SOLAR ENERGY

Solar energy is utilized on a small scale by the tourist hotels along the coast for heating water, while direct sunshine is used for drying fish, copra and fuelwood. The potential for expanding the use of solar energy is enormous. Wind energy is used on a very small scale in wind mills to pump underground water to the surface.

##### 2.1.2 HYDROCARBONS AND ELECTRICITY

Gas (LPG) is used mainly in the urban areas and beach hotels for cooking and hot water heating. Paraffin is used in the rural areas for lighting and in the urban areas, it is utilised in cooking and for lighting where there is no electricity supply.

Electricity for lighting, cooking and heating is used in towns, urban centres, beach hotels and factories. There are no hydro-electric power stations in the District and electricity is transmitted from far away, which makes rural electrification very expensive. The only areas that are supplied with electricity include towns, like Malindi, Kilifi, Kaloleni, and the beach hotels along the coastline. There is an electricity transmission line along the Mombasa-Malindi highway and few settlement along this route have electricity. Kilifi town was supplied with electricity in 1981 by a line from Mombasa.

TABLE 2.1 DISTRIBUTION OF HOUSEHOLDS BY DISTANCE FROM SOURCES OF ENERGY IN THE COAST PROVINCE

DISTANCE (KM)	FIREWOOD %	CHARCOAL %	PARAFFIN %	GAS %
0-0.9	50.5	81.1	75.2	71.8
1.0-1.9	26.4	8.5	14.9	7.4
2.0-2.9	12.4	1.9	4.2	3.9
3.0- 3.9	2.6	7.3	1.1	15.1
4.0-4.9	6.4	0.3	1.8	0.4
5.0-5.9	0.5	-	0.7	-
6.0-6.9	0.7	0.90	0.3	-
7.0 +	0.6	-	2.0	1.4
<b>TOTAL</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

SOURCE\_ Central Bureau of Statistics 1980

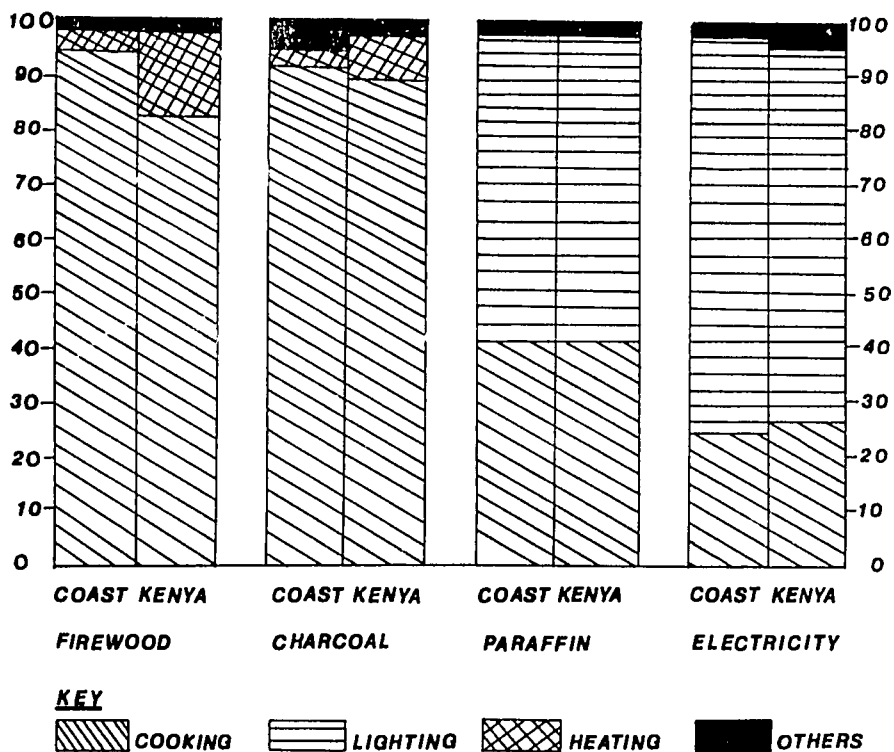
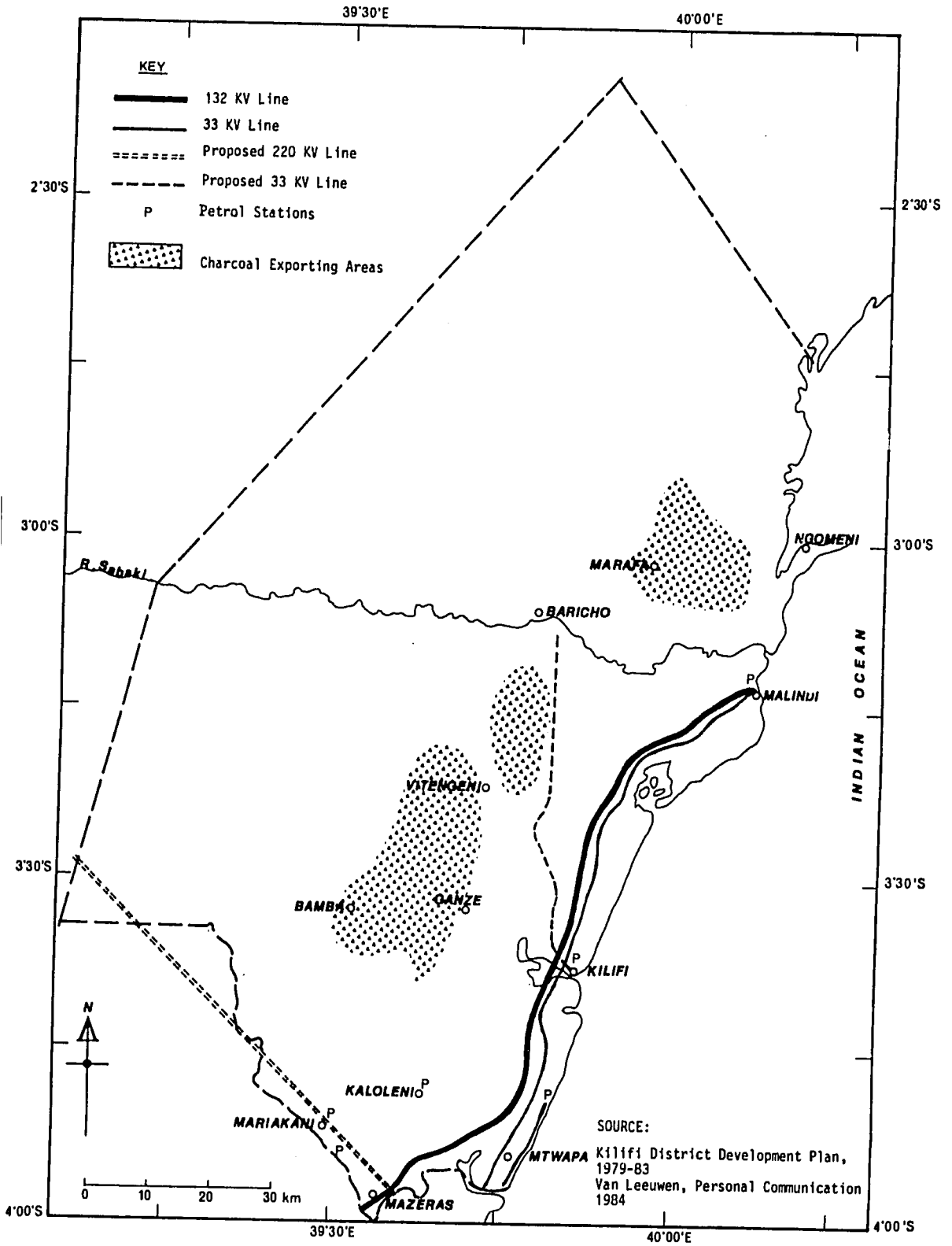


FIGURE 23. THE USAGE OF ENERGY IN KENYA AND THE COAST PROVINCE

SOURCE: CENTRAL BUREAU OF STATISTICS, 1980



**FIGURE 24. ENERGY SUPPLIES, KILIFI DISTRICT**



The rural public especially on an individual basis cannot afford to pay electricity installation costs. Even for where electrical cables pass it is very expensive to buy by, transformers for electricity distribution. Although the potential rural public demand for electricity is high, contributions through harambee are very low, which hinders government assistance. Outside the service centres there are few permanent houses where electricity could be fitted. The limited supply of electricity in the rural areas is one constraint to industrial development. There are plans to supply all Divisional Headquarters in the District, and other towns like Bamba, Vitengeni and Sokoke with electricity as funds become available. The Kilifi-Bura transmission line funded by the Finnish Government will serve areas along the line up to the Kilifi-Tana River irrigation project.

### 2.1.3 WOODFUEL

Firewood is the main source of energy for cooking and lighting in the rural areas. Charcoal is used for cooking on a small scale in the rural areas but the demand as a cooking fuel is very high in towns.

The high demand for woodfuel has led to felling of trees on large scale (Figure 23). The rural people prepare and sell charcoal at about Ksh. 15 per bag. A bag fetches about ksh. 45 in Mombasa and a bit less in other towns. Most rural people sell charcoal as a way of earning a cash income, whereas the middle-men are able to make huge profits. In the Magarini settlement scheme selling of charcoal, to supplement the people's income for basic necessities, is controlled. About 300 bags per month are sold in Malindi. Ganze area supplies most of the charcoal sold in Mombasa. Several large lorries are involved, each lorry making about 3 trips per week. Licensing charcoal burning in Ganze Division is controlled by the District Officer. Due to the dry, sparse vegetation in many areas a large area has to be cleared. Also the people in the District are not traditional charcoal kilners and this leads to improper kilning and wastage.

At Mtwapa Agroforestry Research Station farmers are advised to practice agroforestry and interplant food crops with trees suitable for building materials and woodfuel. There is a large nursery from which seedlings are issued to the farmers free of charge, but the response is poor. Research and development of woodfuel-saving 'jikos' (stoves) is being carried out. The target has been to distribute 110 improved jikos for field testing mainly to women's groups like Maendeleo ya Wanawake, the Bahai and Methodist Church groups.

Sixty improved jikos had been distributed by the end of February 1983. The Centre also plans to undertake extension work. At Magarini Settlement Scheme the tree nursery supplies farmers with seedlings, but the response is also poor.

At Gede there are tree plantations harvested for building, fencing and firewood purposes. The people are allowed to interplant food crops with the trees until they reach maturity. Yields are usually higher in the plantations than the surrounding areas.

In much of the district woodfuel is fairly readily available. In the Mtwapa area women rarely walk over one km to fetch firewood. This may explain why seedlings for woodfuel trees have not been in high demand. In Kaloleni, farmers are interested in growing trees, particularly for building poles. However the continued woodfuel demand will outstrip supplies in the near future, and deprive soils of recycled nutrients and increase soil erosion on cleared land. The need for woodfuel and charcoal has spurred encroachment onto traditionally reserved areas such as the Kaya forests. Much of the indigenous vegetation has been destroyed.

#### 2.1.4 RECOMMENDATIONS

The availability of electricity in urban and rural centres will encourage development of small scale industries and generation of employment. Electricity should be supplied in the rural areas and extra charges added on monthly bills to recover the installation costs.

Development of alternative renewable sources of energy like bio-gas, solar, wind and wave energy should be given priority.

New charcoal-kilning methods which are superior to the traditional methods should be encouraged. Firewood and charcoal saving stoves (jikos) should be encouraged.

Small-scale charcoal production should be organized in cooperatives. Indiscriminate burning should be discouraged as it leads to serious environmental degradation. The possibility of starting tree plantations for charcoal production for export markets should be considered.

The rural people should be encouraged to plant more trees. For example, those who grow the most trees should be given priority for licences to burn charcoal. More nurseries in the rural areas should be established.

## 2.2

### SOIL EROSION AND SEDIMENTATION

Soil degradation due to soil erosion is not as serious in Kilifi District as in many other districts in the republic, although a few areas are susceptible to erosion. Sedimentation and coastal erosion is a more serious problem, especially in the Malindi area.

#### 2.2.1 SOIL EROSION

Soil erosion is the result of several factors - climate, soil type, topography, land use and management practises. The intensity of rainfall at the coast yields a high rainfall erosivity factor. Soil types most susceptible to erosion are the Magarini sands, shales, Mazeras sandstones and Mariakani sandstones. Along the coastal plain the shallow, sandy soils have little humus; even low levels of soil erosion can reduce the water retention capabilities and affect agriculture. Topography- the degree and length of slope - is particularly important in the coastal hills (Gachene and Berber 1982). The conversion of forests or bushland to agriculture results in dramatic increases in soil erosion. In some cases the conversion may destroy the soil, where forests have developed on shallow, sandy soils or coral rag. In a few areas overgrazing, particularly near water points, has led to soil loss. Charcoal burning and tree cutting are locally-important in causing soil erosion. Few areas in the district have been protected by conservation techniques.

Soil erosion losses are in the range of 4 to 15 tonnes/ha in the central and western parts of the District. Excessive rates in the Magarini area, 8 to 16 tonnes/ha, are due to the recent expansion of the cleared area.

#### 2.2.2 SEDIMENTATION AND COASTAL EROSION

One of the consequences of soil erosion is sedimentation. The most affected area is near the mouth of the Sabaki River, where sediments from up country, primarily Kiambu and Machakos, are deposited in the delta or washed into the ocean. The dominant currents take the fine sediments northwards in March to November and southwards in November to February (Brackell 1980 ). Reports by local observers indicate that the problem has worsened since the 1960s, due to increased cultivation upcountry, relaxation of the conservation laws and changes in the river and delta after the 1961 floods. Although the Sabaki River has always been silt laden, the balance between deposition and flushing determines its environmental impacts (see National Committee on Sabaki River Malindi Bay Siltation 1974).

Since the 1960s it appears that sediment has been accumulating at a rapid rate in the Malindi Bay and nearby coral reef lagoons. The Malindi Bay is frequently cloudy, beaches have been accreting, in some places by several hundred meters in twenty years. Every year the sediment moves further south into the Malindi Marine Park. The sediment smothers the coral polyps, reduces light and increases erosion at the base of the coral formations. A healthy coral reef provides a barrier to sea waves, is a breeding ground and habitat for many important fish, and provides sand to the beaches. Destruction of the reef will, therefore result in beach erosion and cause adverse environmental impacts.

The most serious locations of coastal erosion in Kilifi District are the Silver Springs area south of Vasco da Gama Point, the Vasco da Gama point itself and the coastline near Kanamai. At Silver Sands a road, several cottages and a line of trees have been lost to the sea in the last 15 years.

### 2.2.3 CURRENT ACTIVITIES

Soil conservation and afforestation are getting more attention than in the past. The Permanent Presidential Commission on Soil Conservation and Afforestation has been set up and is active. The Rural Afforestation Extension Service has also been active in educating the people, especially in settlement schemes, on soil conservation. However, there is a lack of knowledge on proper land management and, due to economic pressures, the local farmer has not been able to participate fully in soil conservation. Some gabions and sea walls have been built in the Malindi area to control the coastal erosion. However they are very expensive. Preservation of the Vasco da Gama pillar has required concrete pillars in the coral rock.

### 2.2.4 RECOMMENDATIONS

Areas with serious soil erosion problems and those with potential problems should be closely monitored. Incipient gullies should be controlled before they get too large.

Cultivation on steep slopes and river banks should be limited to grasses and trees.

Local leaders should emulate the good examples shown by His Excellency President Moi on mobilising the people on soil conservation. Local self-help groups should be encouraged to build terraces, grass strips, cut-offs and to use sound cultivation methods, (such as mulches and cover crops).

Sedimentation problems originate from other districts where the main tributaries of the Sabaki River originate. Strict soil conservation measures should be applied in these districts.

## 2.3 VEGETATION CLEARING AND CONSERVATION OF NATURAL AREAS

### 2.3.1 EXTENT OF VEGETATION CONVERSION

As felling of trees in the gazetted forest is controlled to some extent, deforestation is usually most severe in the ungazetted forest area. Although there are no figures available, both government officers and local people report widespread cutting down of trees, mainly for burning of charcoal. The most affected areas include the remnants of the tropical monsoon forests and the *Brachystegia* woodlands, although the management of the Arabuko Sokoke Forest has not adequately conserved the indigenous forest.

### 2.3.2 CAUSES AND CONSEQUENCES

The major reasons for vegetation clearing are charcoal burning, the timber industry, high demand for building poles, and clearing of bushland and forests for settlement land and agriculture. In the Magarini area clearcutting of the indigenous forest was carried out at the beginning of the settlement process. At Ngomeni a large portion (60 ha.) of mangrove swamp forest was cleared to give way for the prawn aquaculture project.

The consequences of clearing vegetation are obvious and catastrophic. If uncontrolled felling of trees continues there will be no fuelwood, building poles and timber in the very near future. Some of the indigenous plants may be sources of resin, dyes or drugs, but they may become extinct before they are identified.

Clearing of vegetation without replanting could cause irreversible damage to the area through soil erosion. This is made worse by the geology, terrain, and the type of soils of the district. Due to the sedimentary nature of the underlying rocks erosion can be serious in areas devoid of vegetation and areas which have severe slopes or are susceptible to flooding (see Section 2.2).

The catchment areas of seasonal rivers in the district could be destroyed if vegetation destruction is not controlled. Interference with the ecosystem by clearing mangrove forests could adversely affect the breeding ground for fish and other sea organisms (see Section 1.6.3). Lastly, the only remnants of a formerly enclosed monsoon forest, which are very rich in flora could disappear if the felling of trees in the forest remains uncontrolled.

### 2.3.3 CURRENT PROGRAMMES

The Government must be commended for its efforts to plant trees in the district. There are two main Forest Department nurseries:

- Gede Forest Station with capacity for 1,000,000 seedlings, and
- Jilore Forest Station with capacity for 750,000 seedlings

A Government afforestation programme in the Arabuko-Sokoke-Gede area is going on and people are being encouraged to practice agroforestry. There is an agroforestry research station at Mtwapa under the Ministry of Energy and Regional Development (see Appendix 6.4). The Rural Afforestation Extension Services in the District has tree nurseries at Sabaki, Magarini and Kilifi. Prisons Department and Chiefs also have nurseries.

The goal of the plantation programme is to plant 60.0 ha per year. In some areas the indigenous forest has been replaced by the fast growing trees, especially Casuarina equisetifolia which is harvested after 5 - 6 years. The trees are mainly used for building poles.

The main problems connected with the afforestation programmes are the lack of adequate water and transport, and the lack of enthusiasm by the local people. Hence the number of seedlings exceeds demand, although the seedlings are usually issued free of charge. People in Kaloleni Division are now realizing the need for on-farm tree stands, especially for building poles. Demand there exceeds supply.

### 2.3.4 ARABUKO-SOKOKE FOREST

In Arabuko Sokoke Forest Reserve the management policy has been to clear parts of the forest for plantations and research trials (over 265.7 ha) and to selectively cut larger indigenous trees for timber. Small amounts of firewood and an unknown volume of building poles are collected from the forest. The result has been a gradual depletion of the indigenous forest, reducing the habitat of many animals.

### 2.3.5 RECOMMENDATIONS

Agroforestry should be encouraged and emphasized in future development plans.

The elders who used to protect the Kaya forest have apparently lost the respect they used to enjoy from the people, hence the continued destruction of these forests. The County Council or National Museums of Kenya should bolster the elders' role in protecting the forests.

Administrative centres, schools, factories, hotels and other institutions should be requested to set examples on tree planting and preservation of the indigenous trees and forests.

Cutting down of trees in settlement areas should be done selectively.

Water catchment areas should be protected.

Portable charcoal kilns should be introduced to improve the efficiency of local methods.

Further plantations should not be developed from indigenous forest. County council and private land should be utilized more extensively.

Several areas within the Arabuko-Sokoke Forest should be gazetted as National Parks. These would include reasonable tracts of representative and unique plant communities. The park tracts would then serve as a control section and genetic reserve for better management of the rest of the forest. The tourist potential of the forest is underexploited.

At least one area in the District should be selected as a model of how conservation and development can proceed together (see Figure 25). The model conservation area could begin as an environmental study area which would draw together the resources of the government, private firms and local residents.

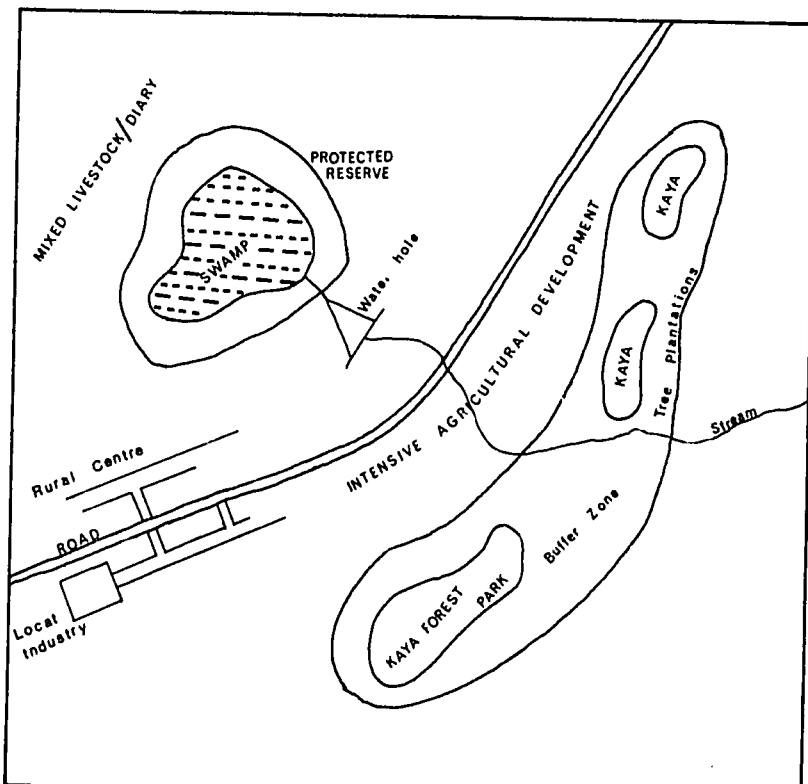


FIGURE 25: MODEL CONSERVATION AREA

2.4

TERRESTRIAL WILDLIFE MANAGEMENT

2.4.1 VALUE OF WILDLIFE

Wildlife is an important resource in the district: it includes many of the big game species, as well as a host of smaller animals. In the most general terms there is an aesthetic appeal, knowing that some of nature's elegant and resplendent creations are yet alive and thriving in their natural habitats. It is a heritage of which many Kenyans are very proud. This attraction and the proximity of natural areas, is one of the main stays of coastal tourism. Although big game hunting is currently banned, wildlife is a potential source of food, hides and trophies. This is a delicate subject, but plans are underway for selective hunting. Bird hunting will be resumed in 1984 in designated areas. Thus wildlife has a direct benefit to the country's and district economy.

2.4.2 CONSERVATION OF WILDLIFE

Poaching continues to be the major threat to elephants and rhinos in the district. Even though many of the sporadic reports of tusks and trophy seizures in the Coast Province reflect activities outside Kenya or trophies from years ago, poaching has not been effectively controlled. The large areas to be covered and lack of staff and funds are constraints to more effective efforts. Light sentences and even corruption among public servants are further problems. It appears that often a petty burglar, who robs one household, receives a stiffer penalty than a poacher who commits a crime against nature. Of concern here is not the man who kills an occasional animal to feed his family, but the modern, armed hunter who kills to sell the trophy to luxury markets abroad.

While poaching threatens a few species, the greater threat to wildlife is from conversion of their natural habitats into agricultural lands, grazing areas, settlement schemes and forest plantations (see Section 2.3).

In several areas of Kilifi land use conflicts between wildlife and livestock or farming have reached significant levels. During the peak of the famine that struck the whole country in 1980, many elephants moved from the drought stricken Galana and Kulalu ranching areas, and from as far as Tsavo East National Park, to Jilore and Sokoke forests. These movements, either in search of food, water, breeding grounds or in response to seasonal cycles, cause damage to crops in adjacent farms, concentrations of wildlife herds beyond the areas's capacity, killing of some livestock, infestations of diseases, and, in some cases, loss of human life. Game Wardens have tried to contain animals to the Sokoke Forest, but it is difficult to control such a large area.



Compensation is available for crop damage, but requests outnumber the available funds and claims take several years to be completed. It takes considerable skill and patience to have a petition honoured by the Ministry.

The competition for grazing land is most prominent in the western parts of the district. Before the ban on hunting, the Galana Ranch had been relatively successful in combining wildlife and livestock management. However, a rational grazing compensation scheme has not been worked out. At present the County Council is compensated for wildlife costs, but the funds are seldom spent on environmental conservation or wildlife management.

Several groups have begun to recommend game cropping for those species which are abundant and well-protected within the existing national parks. After the hunting ban, and with several years of good rains many of the herbivores have increased their numbers. A few of these species in a few areas, may now be seriously competing with livestock for food and water.

#### 2.4.3 RECOMMENDATIONS

A portion of the benefits from tourism should be reinvested into wildlife conservation and management. A levy on tourist class hotels, similar to the training levy, could be instituted with fixed percentages applied to wildlife management, research, environmental education and compensation for wildlife damage.

A limited experiment in game cropping should be initiated on several large ranches. Livestock and wildlife can coexist, but there must be some rewards to the ranchers. Sport hunting should be reinstated if proper controls can be implemented.

The indigenous habitats must be preserved where they protect unique species. In many places this means creating small parks or reserves, integrated into surrounding land uses. Figure 25 depicts one possible conservation plan.

Education programmes, through wildlife clubs and other groups, should be strengthened and extended (see Section 3.13)

Anti-poaching activities must be increased and legal sanctions stiffened.

## 2.5

### CORAL REEF ECOSYSTEMS

Coral reefs are valuable as shelter and breeding grounds for fish, tourist attractions, and barriers which protect beaches from erosion. A variety of processes and activities are threatening the coral reef ecosystems in Kilifi District: siltation, mechanical damage, shell collection, beach erosion, oil pollution, and overfishing. At the same time there is considerable opportunity for more intensive management. Most notable for their abundance are the flats of sea grasses. The potential for algae production and fish farming are reviewed in Section 2.6. A first approximation of the uses of the various elements of the coral ecosystem and their status is presented in Table 2.2. Most notable in any study of Kenya's coastal environment is the lack of thorough baseline studies. While this deficiency is being rectified, some judgements can be made, subject to subsequent testing and verification.

#### 2.5.1 SILTATION

The Sabaki River carries high sedimentary loads during the flood seasons. During the northeast monsoons the sediment tends to disperse into the Malindi area, while during the southeast monsoon it generally travels northward. However, in 1982 for the first time Malindi Bay was muddy during the high tourist season, in spite of the southeast monsoon. By many reports the problem has worsened since the 1961 floods. This is attributed to a change in river's channel through the delta, pushing the discharge further south rather than out to sea, and increases in soil erosion upcountry as agriculture has expanded and soil conservation measures slackened. The beaches in Malindi Bay have accreted some 200 - 300 metres in the last 20 years. Already high sediment loads have reached the northern reefs of Malindi National Park (see DuBois 1984).

Silt damages the coral in two ways. Abrasion and suffocation of the polyps along the base of the coral block reduce the stability of the reef. Eventually blocks may be undermined and topple over - destroying the sheltered environment. If the sediment concentration is high enough for long enough periods, the coral polyps may suffocate from a lack of oxygen reduced light for photosynthesis, and overloading of silt in the polyp itself. Generally silt from flood waters is dissipated fairly quickly by tides and storms, and coral growth is inhibited only in the immediate vicinity of the river's mouth. But it appears that silt in the Athi/Galana/Sabaki River system has increased to the point that a substantial reservoir of silt has been deposited in the Malindi Bay. This has extended the period of risk to the coral reefs.

TABLE 2.2

STATUS OF MARINE RESOURCES IN KILIFI DISTRICT

RESOURCES	HUMAN USAGE			Trophies	ENVIRONMENTAL TREND			Abundant	IMPLICATIONS
	Scenic	Food	Commer- cial		Enda- ngered	Threa- tened	Stable		
<u>CORALS</u>									
e.g. <u>Acropora</u> <u>Tubipora</u>	X		X	X			X		Important tourist attraction, threatened over long term. Diving and boating in coral gardens damages coral esp. <u>Acropora</u> .
<u>SHELLS</u>									
e.g. Tritons Helmet Conches	X	X	X	X	X				Although many shells are still abundant, depletion of shell animals is threat to coral ecosystem.
<u>DEMERSAL FISH</u>									
e.g. coral reef fish	X	X	X	X			X	X	collection of Aquarium fish and unregulated fishing may deplete fisheries.
e.g. Parrot Fish <u>Siganus sp.</u>		X	X					X	Possible fish farming with mullets.
<u>PELAGIC FISH</u>									
e.g. Shoaling fish, sardines		X	X					X	
<u>CRUSTACEANS</u>									
Lobsters <sup>1</sup> and crabs		X	X				X		Lobsters rare in district now.
Prawns		X	X					X	
<u>PLANTS</u>									
Mangroves			X			X			Exportation, banned in district at present.
Macrophytes		X						X	Under-exploited resource
<u>GEOLOGIC sands</u>									
	X		X						Extraction may alter beach dynamics local affects of cutting coral blocks
Coral rock			X						
Oil		X	X						Existence unknown
Salt		X						X	Abundant resource, drying, pans should not replace mangroves
Turtles	X	X	X	X	X				Turtle farming
Dugong	X	X		X	X				No recent sightings in the district

NOTES: 1. Although called lobsters the species are a marine crayfish

### 2.5.2 MECHANICAL DAMAGE TO CORALS

Unintentional damage and breakage by careless fishermen, gogglers, boaters and divers, and intentional damage by shell and coral collectors, has occurred in Kilifi District. Within the marine parks, moorings have been established to prevent damage by anchors. But at low tides or when the coral gardens are crowded some damage occurs. Human damage to the coral may tilt the balance between reef building and reef erosion. Each coral which is removed or dislodged (and later dies in the sandy bottom) represents thousands of years of growth. Fortunately dynamiting of the reef for fishing has not occurred in Kenya. In Tanzania this has resulted in beach erosion and unsuitable swimming areas as sharks have invaded the once protected waters.

### 2.5.3 SHELL COLLECTING

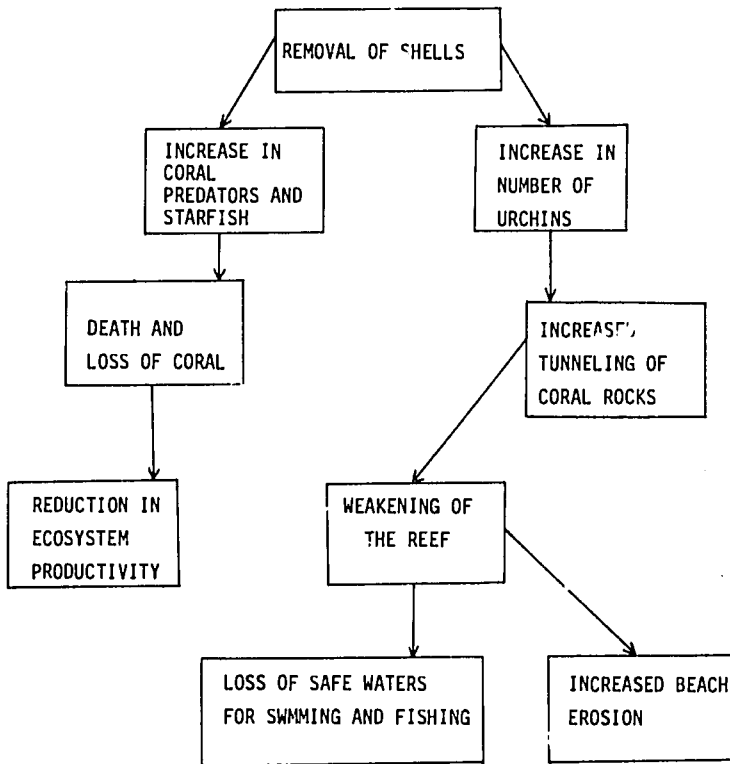
Many large and beautiful shelled molluscs, such as the triton (Charonia tritonis), helmet (Cypraecassis rufa), cowries (Cypraea spp.), spider conches (Lambis sp.), and others occur as a natural part of the reef ecosystem. These are regularly collected by local fishermen and sold to tourists directly or to traders near the hotels and in Mombasa. Several wholesalers are involved in an international shell trade. Table 2.3 compares shell prices from Shariani and Vipingo. The difference between the prices paid to the collectors and the costs to tourists is notable. Shell collecting and retailing is licenced by the Fisheries Department. Tourists are allowed to export up to 5 kilogrammes duty free.

TABLE 2.3 SHELL PRICES AT SHARIANI AND VIPINGO, KILIFI DISTRICT

Name of shell	Latin Name	Price paid to fishermen-KSh.	Cost to tourist KSh.
Triton shell	Charonia tritonis	60-100/-	400-600
Tiger cowry	Cypraea tigris	-/50 each	20/-
Rare cowries	Cypraea sp	12/50 to 5/-	variable
Egg cowry	Ovum	3/50	20/- or more
Helmet shell	Cypraecassis	25/- per kg. gr.I 12/- per kg. gr.II 3/- per kg. gr.III	60-100
Spider conch	Lambis sp	-/40 each -/20 more for a rare form	50/-
Clam		-/50	2/- per pair
Turban shell (small)	Turbo	-/50 each	more than 10/-
Green Turban shell	Turbo marmoratus	20/- per kg.	more than 100/-

SOURCE: B. Kendall, personal communication 1983  
gr. - grade

Large-scale removal of shells causes an ecological imbalance (Figure 26). Gastropod molluscs are predatory, thus when certain species are removed their food organisms tend to increase in numbers. For example, the triton shell, *Charonia tritonis*, is the natural predator for the coral-eating starfish, crown of thorns (*Acanthaster planci*). Population explosion of crown of thorns in the late seventies in various parts of the Pacific has been linked to the continuous collection of triton shells. An explosion of the crown of thorns would result in accelerated destruction of the coral reef. Throughout most of the Kilifi reefs, triton shells are quite rare, and it may be that crown of thorns are increasing. However, there are two theories concerning the crown of thorns/triton shell relationship. Many fear that over-exploitation of the triton shells has resulted in an increase in the crown of thorns starfish. Alternatively, it may be that there is a cyclical increase in the starfish population which occurs at infrequent intervals and is thought necessary for the genetic stability of the species as a whole. The answer may well lie somewhere between the two conflicting theories (Bock 1978). At any rate it seems wise to adopt a cautionary policy.



SOURCE : Kendal1 1983

**FIGURE 26. IMPACT OF SHELL REMOVAL ON CORAL REEF**

#### 2.5.4 BEACH EROSION

Beach erosion has been a problem in a few places in Kilifi. The tourist hotels in Kikambala are using sand bags to keep back the sea. A road, a row of cottages, concrete walls and palm trees have been lost south of Malindi at Silversands. The causes are complex, and largely unknown, but weakening of the protecting reef may be a major factor. It is a subject which needs further investigation, particularly since the costs of coastal erosion control are very high.

#### 2.5.5 OIL POLLUTION

Oil pollution of marine areas comes predominantly from four sources: off-shore oil wells, ship wrecks, daily cleaning and leakage from operating ships, and leakage from loading facilities. Although exploration for oil continues in Kenya, as yet none has been found. By far the largest source of oil pollution is the daily discharge from passing ships. Tar balls have been found on several of the district's beaches, but the level of pollution is not as yet critical (Munga 1981). The problem will increase as shipping into Mombasa rises. This sort of pollution is difficult to control as it involves changing normal shipping practices. The potential for a major oil spill exists and adequate clean-up equipment are lacking. Small spills from the oil terminal in Mombasa are unlikely to significantly affect Kilifi District.

#### 2.5.6 AQUARIUM FISH TRADE

Small coral fish are collected for export to Europe for the aquarium trade. The small, extremely colourful fish are normally abundant and are food for larger fish. They also enhance the scenic value of the reef. This trade has not been well regulated and there is a danger of changing the ecosystem by over-collection of the more attractive species. Many of the species could be raised in fish aquariums if there is a sufficient demand.

#### 2.5.7 RECOMMENDATIONS

Despite the importance of the marine coastal environment to the economy of Kenya, much of the basic data needed to guide policy has yet to be collected. The University of Nairobi, Kenya Marine and Fisheries Research Institute (KMFRI) and Wildlife Planning Unit of the Ministry of Tourism and Wildlife have made notable progress, but more work is needed. Details of a concerted research effort will have to be worked out by the various specialists concerned with marine resources. However, a few general recommendations are suggested.

The KMFRI and the University's Marine Resource Programme should jointly establish a training centre at the University's property on Diani Beach. The Centre would initially train post-graduate students and serve as a south coast sub-station for the KMFRI. In addition medium-term courses for training marine park wardens should be carried out.

Every assistance should be provided to the KMFRI library to make it a first-class resource centre for material on the East African Coast. This would include acquisition of copies of holdings now held in the Seychelles, subscription to marine science journals, and establishment of displays for the identification of marine species.

A long-term monitoring programme should be initiated by the KMFRI, Ministry of Tourism and Wildlife and Fisheries Department, building upon work already underway. Sites in Kilifi District should include Vipingo and Malindi Marine Park. Expatriate expeditions should be required to leave at the Institute full documentation concerning their sites and methods, and one set of the collected data. The monitoring programme should include oil pollution, sedimentation, species diversity, population dynamics and other pollutants.

Public appreciation of marine resources should be increased. A small demonstration centre should be built either at Casuarina Point or near Mida Creek. If funds are available, a second research sub-station should also be constructed. The educational centre should include material on other coastal resources, such as birds, forests and wildlife.

The shell and decorative coral trade should be more strictly regulated. The ecological imbalances caused by shell collection are not fully known, and more research is needed. At the very least the export trade in species known to be important in the coral reef ecology - triton, helmet shells, puffer fish - should be banned.

## 2.6 FISHERIES AND MARINE RESOURCES

Nation-wide, marine fisheries are less developed than fresh water fisheries and currently constitute only 10% of the total fish landed. However, marine fish are an important resource and should be exploited on a sustained yield basis for such basic needs as food and employment, and a source of foreign exchange.

### 2.6.1 PRESENT STATUS OF FISHERIES

The fisheries potential in the district are mainly from the Indian Ocean, and the Sabaki and Rare Rivers. The marine fishing seasons depend on the winds. Fishing is active when the seas are calm during the northeast trades, from October to March. From April to September the seas are extremely rough and dangerous during the southeast trades. Not all of the fish caught in the Kenya's coastal waters is landed in Kenya. Fishermen from Japan, Korea, Taiwan and the Soviet Union, among others, have fished the Indian Ocean for over two decades. Some of the vessels use facilities in Mombasa for transit and cold storage.

The fishing areas for landings recorded in Table 2.4 are along Kenya's 450km coast. Marine fishing in Kilifi District is conducted in the coral lagoon and milango (gaps in the reef), on the barrier reef, within the continental shelf, and in the deep sea. The continental shelf is narrow with an average width bounded by the 100 fathoms contour, of about 10 nautical miles (18.5 kilometers) from the shoreline. The largest share of the Kilifi catch comes from the area north of Malindi, especially Ungwana Bay, which is particularly important for shrimp trawling. Significant fishing is also carried out at Kilifi, Mida Creek, Mtwapa and Takaunga (Figure 15). There has been little fresh water fishing in Kilifi - most of the freshwater fish catch is sold locally.



TABLE 2.4 QUANTITY AND VALUE OF FISH LANDED, 1975 - 1979

	M. Tons '000 Shs.		M. Tons '000 Shs.		M. Tons '000 Shs.		M. Tons '000 Shs.		M. Tons '000 Shs.	
	1975		1976		1977		1978		1979	
<b>MARINE FISH</b>										
LAMU	874	1533	1882	1504	753	1455	954	1869	917	2871
KILIFI	615	1851	978	2874	923	3054	712	2661	627	2883
MOMBASA	054	3285	1216	4079	1119	4051	1317	6874	815	5067
KWALE	495	1166	502	1347	450	1337	546	1937	404	1761
Other S/C Vill	-	-	-	-	-	-	-	-	-	-
Sport fishing	67	373	111	494	155	696	120	541	62	382
Area unac for	883	2099	-	-	252	2012	528	2005	-	-
<b>TOTAL</b>	<b>4220</b>	<b>10758</b>	<b>2889</b>	<b>10822</b>	<b>4046</b>	<b>13574</b>	<b>1177</b>	<b>15911</b>	<b>2958</b>	<b>2493</b>
<b>CRUSTACEA</b>										
LAMU	48	392	62	500	69	815	110	1149	88	1104
KILIFI	26	237	37	377	29	230	34	215	28	418
MOMBASA	24	203	45	382	41	378	112	1787	78	1616
KWALE	14	88	18	83	27	83	62	512	56	490
Other S/C Vill	-	-	-	-	20	146	-	-	-	-
Area unac for	-	-	-	-	22	262	48	564	-	-
<b>TOTAL</b>	<b>124</b>	<b>983</b>	<b>159</b>	<b>1414</b>	<b>208</b>	<b>2064</b>	<b>366</b>	<b>4328</b>	<b>256</b>	<b>3677</b>
<b>Other Marine Products</b>										
LAMU	-	-	-	-	1	3	4	6	70	121
KILIFI	1	19	1	20	-	-	8	11	122	339
MOMBASA	75	75	56	74	17	19	75	914	526	2092
KWALE	-	-	-	-	-	-	4	9	79	228
Other S/C Vill	-	-	-	-	-	-	-	-	-	-
Area unac for	111	1516	50	1704	64	1130	-	-	-	-
<b>TOTAL</b>	<b>187</b>	<b>1610</b>	<b>101</b>	<b>1798</b>	<b>82</b>	<b>1152</b>	<b>91</b>	<b>946</b>	<b>801</b>	<b>2789</b>
<b>GRAND TOTAL</b>	<b>4531</b>	<b>13351</b>	<b>4141</b>	<b>14035</b>	<b>4337</b>	<b>16790</b>	<b>4634</b>	<b>21179</b>	<b>3915</b>	<b>18959</b>

SOURCE: Fisheries Department 1983 and Central Bureau of Statistics 1979  
Report on Fisheries for 1977 and Statistical Bulletin 1979

TABLE 2.5 FISH LANDINGS, KILIFI DISTRICT, 1976

	M. Tons	Ksh.
<u>Fish</u>		
Demersal	350.9	1,178,552
Shark	149.5	266,867
Pelagic Fish	381.9	1,048,557
Mixed Fish	195.2	489,956
Unknown	19.5	59,475
<b>TOTAL</b>	<b>996.9</b>	<b>3,043,407</b>
<u>Crustacea</u>		
Spiny Lobster	13.0	194,917
Prawns	17.2	144,438
Crabs	7.1	36,505
Unknown	3.7	39,505
<b>TOTAL</b>	<b>41.0</b>	<b>415,986</b>
<u>Miscellaneous</u>		
Game Fish	66.9	300,941
Oyster	1.3	20,069
<b>TOTAL</b>	<b>68.2</b>	<b>321,010</b>

NOTE: Landings Statistics do not mean that the fish were caught off the coast of the district in which they were landed. It is not unusual for fishermen to catch large fish quantities from Ungwana Bay and to land their fish at Mombasa.

SOURCE: Fisheries Department 1976

TABLE 2.6 MARINE FISH CATCH BY SPECIES, KILIFI DISTRICT, 1979.

MARINE FISH

<u>DEMERSAL</u>	<u>M. Tons</u>	<u>PELAGIC</u>	<u>M. Tons</u>
Rabbit fish	19	Cavalla jack	13
Scavenger	71	Mulletts	31
Snappers	13	Little mackerel	7
Parrot	7	Barracuda	5
Surgeon fish	5	Milk fish	3
Unicorn fish	6	King fish	100
Grunters	7	Queen fish	9
Pounder	2	Sail fish	17
Goat skin	2	Bonito skip jack	30
Streaker	10	Dolphin	3
Rock-cod	16	Mixed pelagic	34
Cat fish	5		
Mixed demersal	138		
<b>TOTAL</b>	<b>375</b>	<b>TOTAL</b>	<b>252</b>

		<u>CRUSTACEA</u>	
Shark	40	Lobster	8
Sardines	32	Prawns	11
Mixed fish	38	Crabs	9
		Unknown	1
<b>TOTAL</b>	<b>110</b>	<b>TOTAL</b>	<b>28</b>

MISCELLANEOUS

Beche-de-mer	1
Octopus	9
Squid	1
<b>TOTAL</b>	<b>11</b>

A variety of fish are landed in Kilifi District (Table 2.5 and 2.6). The Demersal and Clarias dominate in the marine and freshwater catch, respectively. The fishing methods used depends on the amount of capital the fisherman can afford. Methods used for fishing in shallow water include a hook and line, fish trap basket, speargun, net and the fence trap, (Swahili - uzio). Inshore fishing produces a wide variety of food fishes (Table 2.7).

TABLE 2.7 COMMON MARINE FISH CAUGHT IN KILIFI DISTRICT

Family	English Name	Common Name	Swahili Name
<u>IN-SHORE</u>			
Labridae	Wrasses	Cheilinus	Stefue
Scaridae	Parrot fish	Scarus	Kwangu
Holocentridae	Squirrel fish	Holocentrus	Tembo
Acanthuridae	Surgeon fish	Acantharus	Togo
Siganidae	Rabbit fish	Siganus	Tafi
<u>BARRIER REEF</u>			
Plectorhychidae	Sweet Lips	Plectorhychus	Leya
Serranidae	Rock Cod	Epinehhalus	Tewa
Cardngidae	King fish	Cephalopholus	Kole-Kole/
Spaeridae	Sea Pike	Barracuda	Papa Tazanda

SOURCE: Kendall 1983

The fishing around the reef includes such methods as hook lines from the reef or boats and spearguns. This area produces heavier, stronger swimming fish (Table 2.7).

Artisanal fishermen using traditional methods operate from dugout canoes and large Arab dhows (mashua). Only about 5% of the fishing fleet is motorized. Sail-powered boats restricted by weather and sea conditions, are used within the coral reefs and creeks. The inability of fishermen to work outside the reefs, puts heavy pressure on the inshore stocks and leads to over-fishing as evidenced by a decrease in the sizes of fish landed. Larger fish on the continental shelf are caught using sea-going boats.

Sport fishing by local residents and tourists occurs up to 50 km at sea, though most is done between the reef and 20km from the shore. Sport fish caught in this area are mainly Sea Perch, Wahoo, Tuna, Bonito, Black Marlin and Striped Marlin, Sharks, Barracuda and Sailfish. The fourth method of fishing is deep-sea fishing of shoals of commercially important fish, particularly Tuna (*Neothunnus*). Trawler fishing is important along the shorelines of Ungwana Bay and Malindi Bay. It is characterized by the presence of a wide variety of species depending on depth.

Surveys of the deep fish resources in Kenya find a low biomass of commercially valuable species. The total potential yield of commercial demersal fish and shrimp is estimated to be about 400 tons per year, of which more than 30% consists of deep-sea lobster and small shrimp found only in a limited area near Malindi. Attempts made by large commercial and research vessels indicated that year-round trawling is not possible (FAO/UNDP 1983).

Although some authorities do not consider the deep sea fishing grounds to have been overfished, many fishing areas have experienced over-exploitation or are in danger from over-fishing. A Norad fishing vessel in Kenyan water during 1982 to monitor the potential deep water catch has reported a serious depletion of stocks. Except for 1982 (an unexplained anomaly) fish statistics for Kilifi District show a decrease from 1979 - 81 (Table 2.8). Inshore fish catches appear to have dropped seriously over the last 20 years. (Figure 2.7). Twenty years ago, a fisherman could take 25 - 40 kg of fish in a day but now, in 1983, a fisherman may catch only 2 kg. per day. These estimates are based on interviews with local fishermen in the Vipingo area, but are likely true for large stretches of the coast

Dugong, when spotted, are hunted by the local fishermen at night using spears and nets. They may grow to three metres in length and produce fat for cooking, skin for leather and highly prized meat. However their population has greatly decreased and they must now be considered a seriously endangered species. A relic population probably exists in the Lamu area.

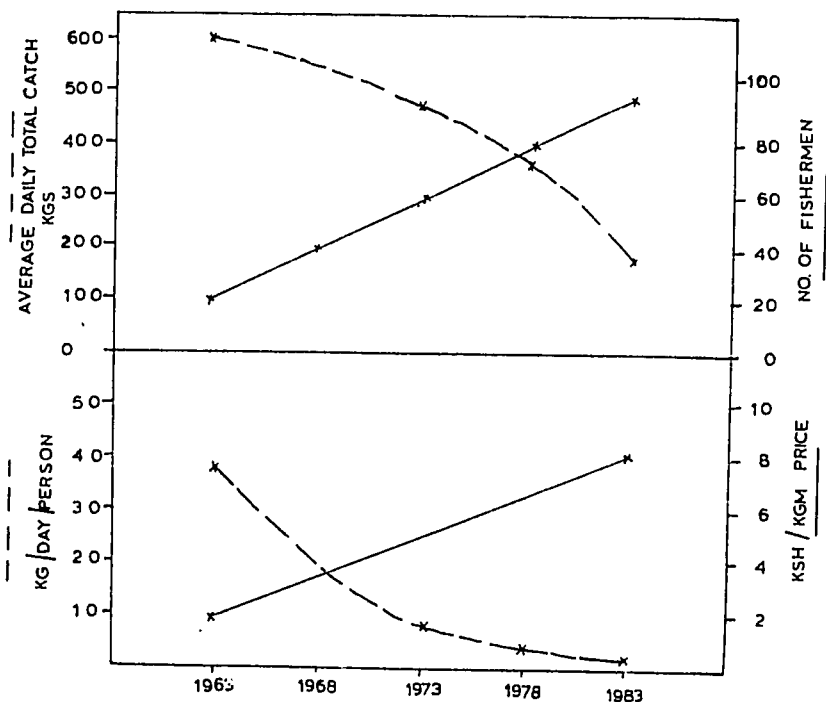
Three species of turtles are believed to nest in Kenya. The most widely distributed are the Green Turtle (*Chelonia mydas*), the Olive Ridley Turtle (*Lepidochelys olivacea*, and the less frequent Hawksbill Turtle, (*Eretmochelys imbricata*). The Green Turtle produces calipee, a cartilage used with turtle meat in the making of soup. The shell of the Hawksbill Turtle is used in ornaments and combs. Removal of shore sand for construction has increased the beach slope and changed the beaches dynamics - thus depriving the turtles of nesting sites. A far greater threat is predation of nesting sites and turtles by human beings.

TABLE 2.8 MARINE FISH LANDINGS, KILIFI DISTRICT 1967 - 82

YEAR	M. Tons	1000 shs.	YEAR	M. Tons	1000 shs.
1967	6	28	1975	250	778
1968	110	149	1976	428	1720
1969	125	190	1977	383	1272
1970	134	242	1978	754	2987
1971	324	527	1979	777	3637
1972	176	373	1980	667	3579
1973	127	325	1981	581	4956
1974	150	482	1982	1334	8301

NOTE: These figures do not include landings brought to Mombasa for transit storage by foreign, long distance fleets

SOURCE: Fisheries Department, Nairobi 1983



NOTE: Lines are interpreted from points (Xs) where estimates were obtained.

SOURCE: Interviews with elders in the Vipingo area (Kendall 1983)

FIGURE 27: FISHING IN VIPINGO AREA

The crustaceans are widely fished and are sold to tourist hotels. Deep sea lobsters (Metanephrops andamanicus and Puerulus angulatus) are caught by trawlers. While working in the Ungwana Bay, Burkett (1979) landed an average of 20 - 60kg/hr in June, July and November. Sometimes the catch exceeded 100kg/hr. The dominant species of crab is Scifila serrata which is common in muddy estuaries and shallow mangrove areas. Quantitative populations studies among crabs have not been undertaken, though it would appear that appreciable stocks of this and other species exist in mangrove swamps. Prawns exist in in-shore areas and bays and muddy river mouths and in deep sea. Nursery grounds of important species are in the sheltered bays and inlets. Families represented include Pandalidae, Aristaeidae, Atyidae, Caridae, Sergestidae and Solenoceridae. Shrimp have been heavily fished. The present Jumbo prawn is about ten times smaller than the Jumbo of the 1960s which indicates an adaptation toward earlier maturity in response to high fishing rates. The Food Agricultural Organization has assisted the Fisheries Department to establish a prawn culture project at Ngomeni. Six gravity-fed ponds are in operation and different treatments are being tested.

#### 2.6.2 DEVELOPMENT OF MARINE RESOURCES

The problems experienced in the fishing industry are varied but may be broadly categorized as technical, socio-economic and cultural in nature. The technical problems include design and building of improved boats, questions of sustainable yields, experiments in aquaculture and design of improved landing facilities. The cultural constraints are also real. Most traditional fishermen regard fishing as a way of raising food and enough income to meet occasional needs, rather than as a capitalist endeavour to promote broader development goals.

The most important constraints are socio-economic. The lack of capital to purchase improved boats and gear prevents many local fishermen from expanding their efforts. Fisheries Department renewed the loan scheme in 1977, after it had been discontinued in 1970. Loans are limited to an upper ceiling of Ksh. 20,000, at an interest rate of 6% per year for a maximum of five years. The loan scheme has serious problems including management problems and failure of the fishermen to utilize all the loans. Co-operatives which could be used to channel funds to fishermen have not been very successful.

TABLE 2.9 RESOURCE POTENTIAL OF ALGAE

Type of Algae	Utilization of Product	Region
A. <u>Chlorophyta</u> (Green Algae)		
1. <u>Caulerpa</u>	Food Salad & Food for animals	Mediterranean countries Asia India
2. <u>Chaetomorpha</u>		
3. <u>Enteromorpha</u>		
B. <u>Rhodophyta</u> (Red Algae)		
1. <u>Eucheuma</u>	Raw materials of agar	Japan
2. <u>Geidium</u>	Raw materials of agar	Worldwide
3. <u>Gracilaria</u>	Raw materials of agar	Worldwide
4. <u>Ceramium</u>	Raw materials of agar	Eastern countries Sub-tropic & Tropical countries
5. <u>Hypnea</u>	Powdered and Used in place of lime in conditioning soil	Asia
6. <u>Lithothamnion</u>		
C. <u>Phaeophyta</u> (Brown Algae)		
1. <u>Cystophyllum</u>	Food	Japan
2. <u>Cystoseira</u>	Alginic acid & Alginates	Worldwide
3. <u>Sargassum</u>	Alginic acid & Alginates	Worldwide
4. <u>Turbinaria</u>	Food	Asia
	Alginic acid and Alginates	Phillipines & India
4. <u>Padina</u>	Fertilizer for coconut plantations	Phillipines
	Fertilizer	

SOURCES: Dawson 1966; Levring et al. 1969; Kumar and Singh 1971



The relationship between the small-scale artisan fisherman and the commercial fishing companies - with larger boats, better gear and more capital - is more important. If the latter intensify their activities, the traditional fishermen may be unable to compete in the market. At times the commercial trawlers have even disrupted the local fishermen's nets and traps. Many of the fishermen sell their fish at the fishing centres to local women who sell dried, smoked or fried fish in local centres. The responsibility for marketing fish in the Malindi area is held by the Malindi Fishermen's Co-operative Society. However, the members have not fully realized the importance of the co-operative movement, because they are discouraged by the 10% commission they have to pay the society. Many prefer to sell their catch to middlemen. More co-operatives will be formed to include all fishermen in the district thus facilitating efficient data collection, both of members fishing transactions and fish production data.

Additional constraints are skilled manpower shortages for expansion of services and projects and lack of training and basic education for fishermen.

In addition to the above problems, there are several environmental issues concerning fisheries development: pollution from oil, domestic and industrial wastes, and siltation (see section 2.5).

Different uses of aquatic macrophytes have been documented from various localities around the world (Table 2.9). There is a great potential in Kenya for exploitation of marine angiosperms and algae resources. There are technical and cultural constraints, but they are not insurmountable.

### 2.6.3 RECOMMENDATIONS

The main objective is to promote the maximum exploitation of the fishery resources on a sustained yield basis in order to guarantee additional employment and income, and to increase the availability of animal protein. In order to achieve this objective, the following are recommended.

Improved fishing technology - motorized boats and improved fishing gear and practices, should be made available, but used together with sail boats. For deep sea fishing there is need for creation of an agency to provide financial assistance to stimulate investment in fishing through acquisition of vessels and training of personnel. Night fishing should be promoted.

Landing and cold storage facilities should be provided at Ngomeni, Kilifi, Malindi and Mtwapa. Facilities should include ice-plants, cold stores, jetties and ramps. The government should move quickly to set aside land for these centres.

Improvement of transportation facilities from the landing points to the markets is needed. Cold storage trucks would be desirable.

Fishermen should organize themselves into co-operative societies to avoid exploitation by private fish dealers. The co-operatives should compete with private dealers' prices instead of taking their commission from the fishermen.

Fish farming should be promoted and commercialized using species with high growth rates. Extension services should be enhanced in order to provide fishermen and fish farmers with information aimed at maximizing returns from fish farming.

Mariculture could produce food that may alleviate local deficiencies and luxury products such as pearls or expensive export food items. Location such as enclosed creeks, shallow lagoons and rich waters by mangrove swamps are available and both invertebrates and fish could be reared.

Research programmes and experimental projects should be set up to investigate the potential of such species as oysters, prawns, catfish, and milkfish.

## 2.7

### NATURAL HAZARDS

Mankind is periodically plagued by natural disasters - infrequent events in the biosphere, lithosphere, and/or atmosphere, which affect human activities. They result from such geological events as earthquakes, landslides and volcanic eruptions, and from atmospheric phenomena such as severe storms and lightning. Floods and droughts for example, are disasters which result from a combination of geological and climatic factors. The balance of natural versus man-made disaster is determined by the magnitude of the natural phenomenon and the vulnerability of the human activities.

In Kilifi District, available data show that natural disasters have occurred in the past and are likely to happen again. The low-lying nature of the land to the north and especially around the Sabaki River, and general climatic conditions marks the district for such disasters as floods and droughts.

#### 2.7.1 FLOODS

A 1961 report on famine and floods in Kenya shows that from 24th September to 31st December, 1961 Kenya experienced the heaviest and most prolonged rainfall since records were kept. Daily falls of 75 to 125 mm (3 to 5 inches) were frequent and monthly totals far exceeded anything previously recorded. In September, 48 hours of extremely intense rainfall caused intensive flooding in the lower Tana and Galana/Sabaki River Basins. Many areas north of Mombasa, particularly Malindi, Garsen and Lamu received between 37 and 50cm (15 and 20 inches) of rain in less than two days. On 30th September, 1961 flooding was reported in the area north of Malindi with widespread damage and possible loss of life. The bridge over the Sabaki River immediately north of Malindi was completely swept away. Communications between Mombasa, Kilifi Malindi and the flooded areas were broken. Supplies of foodstuffs and other basic commodities had to be airlifted to these areas. The flood waters carried an enormous amount of silt and even caused the Sabaki River channel in the delta to change, directing discharges more towards Malindi than was previously the case (Roberts 1961).

Although the 1961 flood on the Sabaki River was largely fed from upcountry rainfall, local flooding was also reported. Rainfall intensities in Kilifi reached 100mm/hr resulting in a high rate of run-off and flooding low lying areas, damaging roads bridges, crops, dwellings and pipelines.

The probability of local floods has not been estimated but the 1961 floods are estimated to have a 1% chance of occurring any year. As such the flooding is an ever present hazard.

## 2.7.2 WINDSTORMS AND SEVERE STORMS

Severe windstorms have been known to tear roofs off buildings, collapse walls of buildings under construction, loose coconuts from their stems and even uproot trees which may fall on animals or human beings leading to loss of life. The storms also lead to severe soil erosion by wind and subsequent heavy rains. It is difficult to document occurrence of these windstorms. Nevertheless there have been various reports of damage from high winds in Kilifi.

## 2.7.3 DROUGHTS

Kilifi District is susceptible to drought conditions (Table 2.10). The largest portion of the district averages between 508 and 762mm of rainfall, adequate for long rotations agriculture. From January to August 1961, most of the inland areas of the Coast Province received less than 75% of the average rainfall. During this period most farming and ranching areas suffered from severe shortages of water, for crops, grasslands, and domestic supply (Roberts 1961).

In 1976, weather conditions in the Coast Province were characterised by high temperatures and low rainfall. The Ministry of Agriculture and Livestock Development reports indicated that drought adversely affected ranches resulting in death of many calves and milking cows.

There were also severe drought conditions in 1978-79 in the District and subsistence had to be sought from outside.

The scanty/<sup>available</sup>information indicates that Kilifi is prone to droughts of various frequencies and magnitudes. Drought is a phenomenon that should be guarded against as it causes havoc for human beings, livestock and crops.

## 2.7.4 RECOMMENDATIONS

Rare extremes of natural forces are difficult to predict, but they can be anticipated. Floods like those of 1961 cannot be discounted. Construction of shelters near river bottoms, especially the Sabaki flood plains and near the ocean's edge should be avoided.

Large dams should be constructed unriver on the Athi to regulate water downstream. The storage of water could be of economic value for hydro-electricity, water supply and irrigation. But these development schemes must include ways and means of controlling mosquitoes and bilharzia.

There is a need to provide varieties of trees for windbreak other than coconut trees. Experiments and planting of both indigenous and exotic drought-resistant trees should be carried out to provide a stronger windbreak in case of windstorms.

TABLE 2.10 DROUGHT AND FAMINES ON THE KENYA COAST

Year	
1850	Famine among Duruma in Kwale, probably exacerbated by Masai raids
1884	Famine in Jibana, called Nzala ya Maembe
1883-5	Famine among Nyika, called famine of Mwakisenge
1889-90	Famine of Wkufu (or 'Magongo'), also rinderpest among Giriama
1898 - 1900	Famine among Nyika. Children sold for grain, migration of Giriama and Pokomo
1901	Famine of "Kodi-Kwandza"
1904	Famine of "Rupia tahu tahu"
1914	Famine of "Muzungu"
1915	Famine of "Faini"
1918	Famine of "Pishi Mwenge"
1921	Severe drought in Lamu
1930	Moderate drought in Malindi
1933	Moderate drought in Lamu
1939	Moderate drought in Lamu
1949	Severe drought recorded in Lamu, Malindi and Mombasa
1952	Severe drought in Lamu and Mombasa
1954	Moderate drought recorded in Lamu, Malindi and Mombasa
1955	Moderate drought in Mombasa
1956	Severe drought in Lamu
1958	Severe drought in Lamu
1963	Moderate drought in Malindi and Mombasa
1965	Moderate drought in Mombasa
1969	Severe drought in Malindi
1970-71	Moderate drought in Mombasa
1974	Severe drought recorded in Lamu, Malindi and Mombasa

SOURCE: Kelley 1960, Downing 1982

The Baobab farm on the Bamburi Cement Factory land provides a good example of trees to plant. Apart from providing a windbreak, trees can provide fuel, food and fodder.

Droughts have been experienced in Kilifi necessitating subsistence to be sought from outside the district. Dependence on maize and cassava as staple foodstuffs should be supplemented with other varieties of drought-resistant or drought-avoiding crops. There should also be a balance between cash crops and foodstuffs to ensure the district is self-sufficient in food. Improved on-farm storage and maintenance of buffer stocks of foodstuffs to cater for shortages when weather conditions curtail a good harvest, are essential.

3.0 HUMAN SETTLEMENTS

3.1 POPULATION GROWTH AND RESOURCES

3.1.1 TRENDS IN POPULATION GROWTH

Fertility

The total fertility rate recorded in Kilifi District during the 1969 Census was 4.67, with the 20 to 24 age group having the highest rates. Figures for age-specific fertility rates during the 1979 Census are not available but the current rate of growth (3.92% per year) clearly indicates that this figure has risen since 1969.

Mortality

The 1969 Census recorded that mortality among children born by mothers within the 20-24 age group was rather low. This set the stage for the increase in population as shown in the 1979 Census. Adult mortality rates for the District are not available, but a fair representative is the national crude mortality rate of 14 per 1000 (1979 Census). Life expectancy in the District is estimated to be approximately 66 years.

Migration

A pattern has been established of people migrating from the densely populated south and the arid hinterland to the coastal and marginal zones. This has been triggered by several factors, among which is the quest for employment at the coastal zone where job opportunities are more plentiful. The availability of water is also another factor resulting in the internal migration from the more arid areas towards the Sabaki Pipeline, in particular where water points occur on the pipeline. Internal migration is also due to the search for more and better land for cultivation, since farming supports about 90% of the District population. The Kaloleni area has recently been the target of a major population in-flow from the high population density zone in the east and the more arid hinterland areas to the west.

The migration from rural to urban areas of the District is evidenced by the rise in population within the various urban centres over the ten years from 1969 to 1979. The population within Kilifi Township as well as the Malindi Municipality more than doubled in this period. The population in Malindi was 5,818 in 1962 while by 1969 it rose to 10,757 indicating an annual growth rate of 9.2% from 1962 to 1969. In 1979 the population in Malindi had increased to 23,275 owing partly to a change in boundaries (see section 3.2).

There has also been considerable migration both into and out of Kilifi District. The 1969 Census indicated that 12.8 percent of the total population of the District was born outside the Province but within the country; while in 1979, the figure was 3.6 percent. 1.16 percent of the population residing in Kilifi District in 1979 were born in Mombasa (Table 3.1). This is followed by Kwale, Lamu, Taita/Taveta, Machakos, Tana River, Kakamega, Nairobi, South Nyanza and Kisumu Districts. Over seven percent of the total population within Kilifi District have migrated into the District. Over 27,500 people born in Kilifi District, resided in Nairobi, Mombasa, Kisumu or Nakuru (Table 3.2). This indicates a total outmigration of 6.4 percent. Males are the dominant migrants.

### 3.1.2 POPULATION SCENARIOS FOR YEAR 2000

Three population scenarios have been developed for the District (Table 3.3).

I	Current trends	constant levels of fertility and mortality
II	Low growth	fertility declines 25% by 2000, constant mortality
III	High growth	fertility increases 20% and mortality decreases 15% by year 2000.

Migration rates have not been included in the scenarios. They are assumed to remain at roughly the current levels. A twenty percent increase in fertility corresponds to an increase in the average number of children born per woman from the current 5 to 6 in the year 2000.

The population scenarios are used to illustrate resource trends in the following section. Clearly, regardless of the assumptions, the population of Kilifi District is growing rapidly. Even with the low growth scenario (II), population will double in 23 years and 43% of the total population will be children under the age of 15.

### 3.1.3 RESOURCE TRENDS

The population growth in Kilifi District is of serious concern, particularly at the current levels of income and resource utilization. The 1979 Census indicated that 46 percent of the population was under 15 and 5 per cent over 65 years old, yielding a dependency ratio of 532 per 1000. The implications of population growth for food, water, wood, housing, education, employment, agriculture and rural infrastructure are discussed below and summarized in Table 3.4. While it is premature to say the District is overpopulated, the rapid rate of growth will severely strain the District's ability to plan and benefit from development.



TABLE 3.1 IN-MIGRATION INDICATED BY DISTRICT OF BIRTH  
KILIFI DISTRICT, 1979

DISTRICT OF BIRTH	MALE	FEMALE	TOTAL	PERCENTAGE OF POPULATION OF KILIFI DISTRICT
MOMBASA	2,457	2,524	4,981	1.16
KWALE	2,146	2,201	4,347	1.01
LAMU	1,215	1,164	2,379	0.55
TAITA/TAVETA	897	1,008	1,905	0.44
MACHAKOS	1,249	568	1,817	0.42
TANA RIVER	762	532	1,817	0.30
KAKAMEGA	811	482	1,293	0.30
NAIROBI	517	578	1,095	0.25
SOUTH NYANZA	625	373	998	0.23
KISUMU	583	411	994	0.23
SUB-TOTAL	11,262	9,841	21,103	4.90
TOTAL BORN IN KILIFI DISTRICT	188,703	211,892	400,595	92.95
TOTAL POPULATION KILIFI DISTRICT	16,657	13,734	30,391	7.05

NOTE: Only the 10 Districts from where there has been the most in-migration are included.

SOURCE: Central Bureau of Statistics 1979

TABLE 3.2 OUT-MIGRATION INDICATED BY POPULATION BORN IN KILIFI DISTRICT AND ENUMERATED IN NAIROBI, MOMBASA, KISUMU OR NAKURU, 1979

DISTRICT OF ENUMERATION	TOTAL POPULATION			POPULATION BORN IN KILIFI DISTRICT			% POP. FROM KILIFI DISTRICT
	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	
NAIROBI	479,448	348,327	827,775	1,290	540	1,830	0.22
MOMBASA	189,942	151,206	341,148	16,051	9,303	25,354	7.43
KISUMU	238,042	244,285	482,327	47	34	81	0.02
NAKURU	268,717	253,992	522,709	190	85	275	0.05
TOTAL	1,176,149	997,810	2,173,959	17,578	9,962	27,540	1.27

SOURCE: Central Bureau of Statistics 1979

TABLE 3.3

POPULATION SCENARIOS FOR YEAR 2000 ('000s)

				SCENARIOS								
1983 (Projected)				I: Status			II: Low Growth			III: High Growth		
AGE	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
0-4	54.5	55.0	109.5	98.8	99.8	198.6	70.0	70.8	140.8	126.9	127.9	254.8
5-9	44.0	43.2	87.2	79.1	80.4	159.5	58.5	59.5	117.9	98.9	100.2	199.1
10-14	33.4	31.5	64.9	65.1	66.1	131.3	50.8	51.6	102.4	78.7	79.6	158.3
15-19	24.2	24.0	48.2	54.6	54.7	109.3	45.5	45.5	91.0	63.2	63.2	126.5
20-24	18.0	22.9	40.9	45.9	45.1	91.0	40.9	40.1	80.9	50.9	50.0	100.9
25-29	14.7	20.5	35.1	36.2	36.2	72.3	33.8	33.8	67.7	38.7	38.6	77.3
30-34	12.1	17.4	29.5	27.6	28.8	56.4	26.7	27.9	54.6	28.8	29.9	58.7
35-39	10.5	14.3	24.9	20.7	23.5	44.1	20.4	23.2	43.5	21.2	24.0	45.3
40-44	8.8	11.4	20.2	15.7	19.5	35.1	15.6	119.4	35.0	16.0	19.8	35.9
45-49	7.7	9.5	17.2	12.2	16.1	28.3	12.1	16.1	28.3	12.4	16.4	28.9
50-54	6.3	7.2	13.5	9.6	13.1	22.8	9.6	13.1	22.8	9.9	13.4	23.3
55-59	5.0	5.2	10.3	7.7	10.4	18.0	7.7	10.4	18.0	7.9	10.7	18.6
60-64	3.9	3.9	7.9	6.0	7.9	13.8	6.0	7.9	13.8	6.2	8.2	14.4
65-69	2.9	2.9	5.9	4.4	5.7	10.1	4.4	5.7	10.1	4.7	6.0	10.7
70-74	1.8	1.8	3.6	3.0	3.7	6.7	3.0	3.7	6.7	3.3	4.0	7.3
75	1.6	1.6	3.2	2.9	3.7	6.6	2.9	3.7	6.6		4.4	8.0
TOTAL	249.4	272.4	521.8	489.4	514.6	1004.0	407.9	432.3	840.1	571.5	596.3	1167.9
Average annual growth rate-%			4.08				3.95				3.03	4.74
Doubling time-years			17				17				23	14
No. children under 15 for every person 15 or over			1.00				.95				.75	1.10

SOURCE: Central Bureau of Statistics 1983 and NEHSS Population/Resource Model.

The District at present does not produce enough food to adequately feed its residents. The short fall is expected to increase unless agricultural productivity is greatly improved (TARDA 1983). This is internally related to poverty, as malnutrition is characterized by unequal distribution and lack of financial resources, rather than absolute scarcity.

Domestic and other water demand will increase due to population growth as well as increased consumption with improvements in water supplies. Based on the current trends scenario, demand will triple by the year 2000.

Although the District is not currently experiencing a wood scarcity crisis, continued population growth requires an accelerated tree planting programme to keep pace with the growing demand. Building poles will continue to be a critical requirement.

Regardless of the scenarios, school facilities will need to be more than doubled, just to maintain the current student/facility ratio. This assumes only a modest percentage increase in students.

Employment is already scarce in the District, and the future is not optimistic, even with a rather high employment expansion rate.

Agriculture must continue to support most of the rural population. Decreasing size of holdings has already led to migration to coastal and marginal areas. It may stimulate more intensive management, if adequate inputs and services are available.

The urban and rural infrastructure - health facilities, roads, post offices and telephones- will also need to be expanded. In the cases of health facilities and roads even the current levels are inadequate. Further development should improve existing facilities before constructing new, costly buildings.

#### 3.1.4 RECOMMENDATIONS

There is need for concerted use of the various methods to control fertility. The high fertility rate within the District can be partly attributed to the low status of women and their role in society. A vigorous broad-based population policy is necessary in order to lower the fertility rate.

The Maternal and Child Health-Family Planning (MCH-FP) Programme should be promoted. Currently, the Programme is constrained by:

TABLE 3.4 POPULATION AND RESOURCE TRENDS, KILIFI DISTRICT

RESOURCE	RELATIONSHIP	UNIT	TOTAL NEEDS FOR DISTRICT			
			1983	CURRENT TRENDS	LOW GROWTH	HIGH GROWTH
POPULATION	Total	1000s	522	1004	840	1168
FOOD <sup>1</sup>	Standard kcal requirements by age and sex	10 <sup>6</sup> kcal/day	1052	2230	1897	2563
DOMESTIC WATER SUPPLY <sup>2</sup>	Urban centres 140lt./person/day	m <sup>3</sup> /year	14,589	44,773	37,464	52,093
	Rural connections 70lt./person/day					
	Rural communal posts 25lt./person/day					
	Natural sources 15lt./person/day					
WOOD <sup>3</sup>	Per capita consumption for firewood and timber	m <sup>3</sup> /year	395,467	732,518	612,864	957,293
HOUSING	New houses needed next year based on additional households	Houses/year	3,800	7,078	5,421	8,517
EDUCATION	% of school attenders for given age group	No. of Schools				
		Primary	357	614	465	755
		Secondary	18	67	56	78
		Adult	347	901	862	954
EMPLOYMENT	Labour force=85% of adults 15 to 64 & employed with 5% annual growth in wage employment	1000s	210.4	417.5	387.3	450.2
AGRICULTURE	Agricultural land/rural households	Ha/HH	7.8	9.9	10.7	9.2
HEALTH FACILITIES	Service population of 200,000 per hospital, 80,000 per health centre, 15,000 per dispensary	Hospitals	4.06	2.4	2.4	2.4
		Health centres	3	5	4	6
		Dispensaries	6	13	11	15
ROADS	Kms need at current ratio to total population	kms	30	67	56	78
POST OFFICES	Post offices needed at current ratio to total adults	Nos.	2680	5151	4309	5992
TELEPHONES	Telephone lines needed at current ratio telephones/household	Nos.	8	12	12	13
			870	2033	2026	2037

- NOTES: 1. Food requirement calculations are elaborated in Appendix 6  
 2. Domestic water demand is projected using the following conversions:

Demand	% of Population with Connections	
	1983	2000
Urban connection 140lt./per/day	8	18
Rural individual connections 70lt./per/day	1	2
Rural Communal posts 25lt./per/day	24	60
Natural sources 15lt./per/day	67	20

3. Wood needs<sub>3</sub> for firewood and timber, are calculated at rural=0.7m<sup>3</sup>/person/yr, urban=0.50m<sup>3</sup>/person/yr, using the same urban/rural projection as for water.  
 4. Average household size in 1979 was 5.6. This is decreased to 4.9 for scenario II, and increased to 6.5 for scenario III, in year 2000.  
 5. Education facilities needs are based on the following conversions

age class	% of age class attending school		ratio of students/school	
	1983 (actual)	2000	1983 (actual)	2000
Primary schools 5 - 14	60	75	355	355
Secondary schools 15 - 19	9	15	243	243
Adult education centres 20++	7	10	45	45

6. Total agricultural land comprises the medium and high potential areas, totaling 351,000ha., divided by rural households:

	% population rural	Rural household size
1983 projection	92	5.7
Scenario I	82	5.7
Scenario II	82	4.8
Scenario III	82	6.6

SOURCE: NEHSS Population/Resource model, Data from other report sections, TARDA 1983 for water, wood, health facilities, roads and telephones.

- i) The cultural belief in large families as a means of social security and status, the attitude towards children as a source of labour, the traditional beliefs about family composition, and religious opposition to artificial methods of birth control.
- ii) Low coverage in terms of accessibility i.e. a concentration of clinics in certain areas with some areas of the district not being well covered.
- iii) Lack of transport facilities as well as a shortage of trained personnel.
- iv) Inadequacy of stationery and equipment in some clinics.
- v) High level of illiteracy coupled with general poverty.

Family planning is not a sickness. Thus there is need to separate family planning centres from health centres or hospitals. This helps in dispelling the "sickness-hospital feeling", thus making the exercise more appealing.

The support of voluntary women's organizations will also aid in the campaign for stemming population growth. The Maendeleo ya Wanawake Organization could play an important role in organizing informational seminars and workshops. Other fora for this kind of campaign include adult education classes, religious gatherings, chief's barazas, schools and community development groups.

### 3.2

### URBANIZATION

#### 3.2.1 URBAN GROWTH

The designated urban centres in Kilifi District are Malindi, Kilifi and Mariakani. Each of these centres has a residential population of not less than 5,000 people, and has at least treated piped water supply and sewage disposal systems. In all three, the disposal plant is not fully developed. Malindi and Kilifi are growing rapidly and the available services are falling far below demand.

Rural to urban migration is caused by several factors: unfavourable conditions in agriculture and ranching (in particular the unpredictable climate), search for employment and attraction to services, including water and health. People who migrate to the urban centres are from both within and outside the district. Most of them are Government employees, people working in factories and hotels, and businessmen. Tourism has also contributed towards migration. Malindi was traditionally a fishing and agricultural service town but developed a large tourist industry, which has contributed to its being one of the fastest growing towns in Kenya (about 11.5% per year currently).

Kilifi, and Mariakani are also growing, although compared to some coastal towns, they have the lowest levels of the labour force employed in the modern sector. Over the last 20 years employment in Kilifi and Malindi has increased by 7.6 and 6.5% respectively.

Low and high projections of urban growth are displayed in Table 3.5. Even in the lower growth projection total population in urban areas will increase threefold in the next two decades. This is a faster growth rate than the general population, and will have clear environmental impacts.

TABLE 3.5 PROJECTIONS OF URBAN GROWTH IN KILIFI DISTRICT

URBAN CENTRE	LOW PROJECTION ( '000s)		HIGH PROJECTION ( '000s)		ANNUAL AVERAGE GROWTH RATE (1980-2000)
	1980	2000	1980	2000	
Malindi	21.3	73.6	22.6	87.6	7.0%
Kilifi	4.6	12.1	5.1	16.2	6.0
Mariakani	2.0	5.1	2.0	6.4	6.0
TOTAL	27.9	90.8	29.7	110.2	

SOURCE: Physical Planning Department 1978.

### 3.2.2 ENVIRONMENTAL IMPACTS

The development of both rural and urban areas is seen as an interdependent and complementary process, and it is within this perspective that urbanisation and its impact on the environment in Kilifi can be analysed. The urban areas play an important role in the development of the district:

- They offer commercial, educational, administrative, health and recreational services to both urban and rural people.
- They provide infrastructure which further supports rural development such as industries, transport centres, and banking insitutions.
- They are consumers of agricultural produce from the rural areas.

The population increase within the various urban centres has put a heavy burden on the available facilities and services. The existing water supplies are unable to expand consistently with growth in urban population and industrial expansion in Kilifi and Malindi. The housing stock in all the urban centres falls far short of the demand, while services like health, sewage, fire and recreation are inadequate.

This imbalance between urban population and facilities/services has had a telling effect on the environment. Slums have grown as a result of a shortage of low-cost houses. Sewage facilities are inadequate thus posing a health hazard. Cultural changes have resulted in traditional morals and values no longer being the norm. Shortage of proper educational institutions is contributing to the high level of illiteracy prevailing in the district. Employment opportunities are generally fewer than the job-seekers, thus leading to high unemployment which has in turn generated an increase in robberies, muggings, prostitution and other related vices like drug trafficking.

The position of the main towns along the coast has led to pollution of the marine and estuarine environments. A proposed marine sewage outfall in the Malindi Marine Park has been temporarily shelved, but might be reintroduced.

### 3.2.3 PROGRAMMES UNDERWAY

Plans are already underway to tap water from the Sabaki River to supply the major urban centres and other local centres. The Housing Finance Company of Kenya, through the Ministry of Housing, has been approached to provide loans so that more houses can be constructed. Also planned is provision of other amenities such as sports facilities, road construction and maintenance, sewerage, cemetery, and a tractor to be used in the disposal of solid waste. At the moment regulations on zoning of land-use are not in strict operation.

### 3.2.4 RECOMMENDATIONS:

Based on the development potential, Malindi is one of the centres in Kenya that seems to be viable for concentration and stimulating growth centre activities. Kilifi and Mariakani need substantial government and private development initiative to achieve a level of self-sustaining growth. It is recommended that Malindi be promoted to growth centre status, and the growth centre policy be put into effect (see Physical Planning Department 1978).

In preparing development plans, there is need to improve the productivity of the land in order to absorb the anticipated population increase. It is also necessary to exploit the industrial potential which will increase employment opportunities (see Section 3.11).

The local authorities, in their efforts to provide housing and infrastructure, should use more local materials and labour. In this way they would be able to provide low-cost housing which is within the reach of the majority of the people.

Efforts should also be made to create a more appropriate balance between rural and urban economic opportunities. The main thrust of this activity should be in the integrated development of the rural sector, and the spread of small-scale industries, such as fruit canning or drying, in the rural areas.

## 3.3

HOUSING3.3.1 URBAN HOUSING

The inadequacy of housing in Kilifi District is well illustrated within the urban and service centres. Population growth and urbanization are contributing to greater pressures. Kilifi Township currently has a population of over 10,000, most of whom are civil servants, traders and hotel staff--of whom about 50% reside outside the town. To date, there are only 24 government houses. Within the last nine years only five government houses have been constructed. These are quite inadequate for the present number of civil servants and even these have been neglected due to lack of funds. Due to this neglect, some of these houses pose an environmental hazard in that the flat roofed houses harbour stagnant water providing ideal mosquito breeding conditions. The Kilifi County Council also provides housing within the town, but they are inadequate to cope with the housing shortage. The County Council charges relatively fair rents--KShs.800/- per month for a 4 roomed house, KShs.600/- per month for a 3 roomed house and KShs.400/- for a 2 roomed house.

Housing in Malindi Town is also seriously underprovided. The town currently has a population of 23,275, mainly located within three major residential areas--the Government and Council owned areas, the old urban centre, and unapproved development on private land on the outskirts of the town.

The Government quarters and Ngala Estate are both rental schemes on Government land in the south-west section. The Government quarters are administered by the District Officer while Ngala Estate (32 Units) is administered by the Town Council. Bomani, Barani, Shella and Sophia form the centre of the old town. All land and buildings are owned by many individuals. Both landowners, house owners and tenants live here together. Shops, workshops and residential houses are intermixed, making a lively atmosphere. Building standards vary greatly from mud and wattle houses reinforced with coral stone with a makuti roof to concrete block buildings with corrugated iron roofs. Almost all houses have internal courtyards, usually with firmly closed doors. Apart from the main roads, the central residential areas have no paved roads, no surface drainage and no sewers (though some houses have septic tanks). Water is taken from individual connections against payments or from public wells. An Italian community has built residential houses in the southern parts and far north of Malindi Beach. The houses are rent or sold to foreign nationals who occupy them seasonally.

Kaloleni (also known as Kisumu Ndogo) is a 20 acre area lying south-west of the town. This land is owned by one person, who rents out building plots for KShs.10 per month. It is well laid out (straight lines and open spaces) and the Provincial Administration through the District Officer provides both public stand pipes and individual water connections. Its expansion as a residential area started in 1972 and at present about 400 houses have been built. Most owners live in their houses and rent out a few rooms. However absentee landlords are on the increase. The expansion of Kaloleni is evidence of the shortage of accommodation in Malindi Town.



Some Tenant Purchase Houses built through the USAID/NHC Scheme are unoccupied because the people contend they are too expensive-- the deposit is too high and the monthly payments are too high over too long a period. Despite the high demand for housing a number of rooms are not rented out. The inhabitants of certain streets maintain a closed Moslem community and are not willing to rent out rooms to tenants who do not belong to the same sect. The Municipal authorities maintain that rents charged in Malindi are fair, for they range from KSh.400 per month for a 2-room self-contained house (79 units) to KSh.500 for a 3-room self-contained house (4 units). However, people interviewed complained about the sharp increase in rent over the last few years. They suggested that more rental accommodation be built for reasonable rents i.e. upto KSh.250 or 350 per month.

To alleviate the housing problem within the urban and service centres, both the Kilifi County Council and Malindi Municipal Council have proposed housing requirements, pending availability of funds (Table 3.6).

TABLE 3.6 PROJECTED HOUSING NEEDS

AREA	HOUSES	AREA	HOUSES
<u>Bahari Division</u>		<u>Ganze Division</u>	
Kilifi Township	120 rental 20 tenant purchase 36 site and service	HQ (Ganze) Bamba Trading Centre Vitengeni Trading Centre	6 rental 15 rental 4 rental
Vipingo Trading Centre	6 rental		
Mtwapa	6 rental		
Mkwanjuni	5 rental		
<u>Kaloleni Division</u>		<u>Malindi Rural</u>	
HQs (Kizurini)	20 rental	Marafa Trading Centre	
Mariakani	20 rental	Centre	15 rental
Rabai Trading Centre	20 rental	Jilole Kakone	6 rental
Dzizoni	4 rental	Ngongoni Trading Centre	6 rental

SOURCE: Kilifi County Council 1983

The Malindi Municipal Council has approached (among other donors), the Kenya National Assurance for a loan of 5 million Kenya Shillings for the construction of middle and high income houses. Rents for these will range from KSh.1,000 to 1,200 per month. For the lower income group, a site and service scheme was launched in 1980 but few houses have been completed because of escalating costs of building materials. A squatter allocation scheme has also been initiated whereby the people in slum areas are slowly being shifted to a properly demarcated area. The aim is to provide leasehold rights to the squatters in the future.

The housing situation in the urban areas of Kilifi District is typified by such environmental hazards as fire, especially in

Swahili areas where roofs touch one another. The inadequacy of infrastructure and cleaning personnel and the lack of proper sewage disposal systems are other problems.

### 3.3.2 RURAL HOUSING

The provision of housing within Kenya's rural areas is left largely to the initiative of individuals. This trend is noticeable in Kilifi District where 92.1 percent of the population lives in rural areas. Traditionally, the houses are constructed of palmfronds (makuti) for roofing and mud-plastered walls of mangrove poles, and are characterised by a verandah at the frontage. This house design is suitable in this district where the climate is rather hot and humid. Other house types found within the rural areas are those built around service institutions like health centres, schools and churches. These are conventional permanent structures constructed of stone blocks, iron and asbestos sheet roofing and glass windows.

The rural areas of the District have sub-standard houses and many are environmentally hazardous. Such houses are disaster-prone in that they are usually exposed to floods, fires and infiltration by such pests as mosquito and snakes. The number of people per house depends on the family size, but over-crowding is not uncommon.

Rural housing is also hampered by the unavailability of building materials. The traditional roofing material (makuti) has become expensive for the rural folk. Some five years ago, a two-foot long section of makuti cost only 40cts. Currently, the same size costs KSh.1. A four-roomed house requires about 2000 makuti pieces--KSh.2,000 for the roof alone if the makuti must be purchased. At the same time, makuti has to be replaced after every three years. This indicates the need for research into alternative roofing material which is both inexpensive and durable.

The low level of innovation existing among the people also hinders the development of rural housing. New ideas are shunned at times out of fear of witchcraft and also due to the strong cultural bonds which still dictate daily life. Innovation is curtailed by widespread poverty. There is also lack of housing education. Even the few well to-do people are not aware of the existence of loan facilities e.g. from the Housing Finance Company of Kenya (HFCK) for housing improvement or purchase. There are at least two women's groups trying to develop housing, but they have faced a number of constraints.

The demand for housing within the rural areas is expected to increase in accordance with the increase in population. Thus by the year 2000, more than 100,000 additional houses will be required.

### 3.3.3 RECOMMENDATIONS

A district level organization dealing with housing development should be established. The local authorities should take greater initiative in the provision of housing as well as in deciding on the criteria for hour allocation.

Voluntary participation in housing development should be encouraged.

Research information on the improvement of such building materials as makuti should be disseminated to the people. At the same time more research should be carried out on such materials, as well as assessing the value of work carried out by other countries, and its application to Kenya. The National Environment and Human Settlements Secretariat, Housing Research and Development Unit of the University of Nairobi should take leading roles.

### 3.4

#### RURAL INFRASTRUCTURE

##### 3.4.1 PROBLEMS

The rural infrastructure of Kilifi District strongly reflects the distribution of population and emphasis on the coastal plain. The road network tends to follow the terrain, with the major roads running north-south along the coast and coastal hills, and east-west near the Sabaki River. Roads which cross the coastal hills are subject to erosion.

Many of the roads in the interior are earthen, and become impassable during the rainy seasons as small streams swell and black cotton surfaces become mud holes. Most of the second class roads are rough even in the dry season. As a result public transportation in the interior is slow and irregular.

While the postal service is adequate, only Malindi has reliable telephone service. Communication services to the interior are lacking.

##### 3.4.2 RECOMMENDATIONS

The road network is probably adequate in size (with the exception of small rural access roads) but the major roads to the interior should be improved to all weather standards. First priority are the Malindi-Tsavo East and Kilifi-Ganze-Bamba-Mariakani roads. As the Magarini Settlement Project becomes more productive the coastal roads should be tarmacked as far as Mambui.

A booster should be constructed to step up television and radio transmission from Nairobi.

Automatic telephone exchanges should be installed in Kilifi Town and reliable service made available in Ganze, Bamba, and Kaloleni in the interior.

### 3.5

#### WATER SUPPLY

##### 3.5.1 WATER POINTS AND SOURCES

Much of Kilifi District is semi-arid or dominated by porous soils and basement complexes. Thus there are few reliable sources of surface water. Even within similar geologic units, ground water is not uniformly distributed, and is often highly mineralized.

Thus it is not surprising that only 8% of the population has access to government-aided water supply schemes, while almost two thirds draw water from traditional sources (TARDA 1983). (Table 3.7).

Treated and piped water supplies are limited mainly to the urban areas and towns such as Kilifi, Malindi, Kaloleni, Mariakani, Watamu and a few others along the coastal strip. Kisauni water supply caters for the coastal area south of Kilifi Town. A few rural areas have been supplied with water by the Government (Table 3.8).

The Baricho-Sabaki piped water supply comes from the Sabaki River at Baricho, where it is fully treated. The present output capacity is 28,800m<sup>3</sup>/day with a maximum anticipated output of 53,000m<sup>3</sup>/day. Further development is to add 19,000m<sup>3</sup>/day. The water is supplied to Mombasa via the Sabaki pipeline including Kilifi Town, Takaungu, Wagutatu, Bomani, Kibe and Muharani where reservoirs have been constructed. The Kilifi town reservoir has a capacity of 3,546m<sup>3</sup>.

The Sabaki-Malindi water supply is fully treated from the Sabaki River at Kwaniyani. The output capacity is 110m<sup>3</sup>/hr and it supplies Malindi Town.

The Mzima Springs-Mombasa pipeline passes through Mazeras and has two storage tanks at Jaribuni and three in Kilifi Town. The water is supplied to Jaribuni, Kilifi Town, Kaloleni and surrounding areas.

TABLE 3.7 POPULATION SERVED BY WATER SOURCES  
IN KILIFI DISTRICT 1983

DIVISION	BAHARI	GANZE	KALOLENI	MALINDI	TOTAL
<b>RURAL WATER SUPPLY</b>					
INDIVIDUAL CONNECTION	946	745	1706	1281	4678
COMMUNAL POINTS	25080	19746	45199	33952	123977
TRADITIONAL MEANS	68614	54021	123659	92886	339180
URBAN WATER SUPPLY	7981			31665	39646
	(Kilifi)			(Malindi)	
<b>TOTAL</b>					<b>507,481</b>

SOURCE: TARDA 1983

TABLE 3.8 MAJOR WATER SUPPLIES IN KILIFI DISTRICT

SCHEME	OUTPUT CAPACITY- m <sup>3</sup> /day	POPULATION SERVED
1. Mazeras - Jaribuni Rural Water Supply	1296	14,250
2. Tezo Roka Water Supply	50	900
3. Kilifi Rural Water Supply	540	3,000
4. Ganda Watamu Rural Water Supply	500	4,400
5. Malindi Urban Water Supply, including Ganda	3430	10,000
6. Sabaki Pipeline	28800	N.A.
7. Magarini Boreholes	1500	N.A.

NOTE: Data for 1,2,3, and 4 are for 1977; 5,6, and 7 are for 1983

SOURCES: Ministry of Water Development; TARDA 1983; Ministry of Lands and Settlements.

There are numerous boreholes in the district, most of which are in the coastal plain (Table 3.9). Depths, yields and water quality vary considerably. There are seventeen boreholes in the district maintained by the Kilifi County Council, but most of these are not in operation due to mechanical breakdowns or lack of running funds. Bamba, Vitengeni, Hadu, Marafa and Kayafungo townships get water from these boreholes. Magarini Settlement Scheme gets water from three boreholes whose output capacity is 1,500m<sup>3</sup>/day. There are also 3 boreholes at Ganda whose output capacity is 33m<sup>3</sup>/hr. The water is chlorinated and supplied to Ganda, Gede, Watamu, Kakuyani, Sabatia and sometimes to Malindi when there is a shortage.

The district had 167 dams constructed up to the mid 1960s but most of these are not in operation due to heavy siltation and lack of maintenance. In Ganze untreated water is pumped from Benesi dam constructed on a dry valley and recharged by rain water. Animals and people around this area depend on this dam for their water needs. The dams supply water to people living within a radius of about 15kms, although the Migimiri and Mnagoni dams serve a greater radius. The dams in areas where piped water has been supplied are often neglected.

On the coastal plain there are numerous wells, water holes, swamps and marshes where people draw water. In the dry areas underground water is not fully exploited because the water table may be too deep, or the water quality may be poor.

Harvesting of rain water is limited to public centres like shops, stores, dispensaries, health centres and schools. At Bamba Health Centre there are roof and surface water catchments

and an underground concrete storage tank. In the rural homes there are few corrugated iron sheet roofs for rain water catchments and the costs are usually prohibitive. In some areas loans or equipment for roof water catchment are given, but on a very small scale.

Self-help water projects in Kaloleni Division include Makobeni and Kigundigundini (assisted by CARE and the District Development Committee), Makombani-Kinani (assisted by CARE and Ministry of Health). Jilore in Malindi Division is assisted by the District Development Committee and the European Economic Commission. When these water projects are commissioned an additional 5% (24,450) of the population and approximately 2,100 livestock units will have improved water supply.

TABLE 3.9 BOREHOLE RECORDS FOR KILIFI DISTRICT, 1983

PHYSIOGRAPHIC UNIT	NO. BOREHOLES	YIELD RANGE m <sup>3</sup> /day	DEPTH RANGE-m	NUMBER OF BOREHOLES		
				DRY	UNSUITABLE	POTABLE
Coastal Plain	112	1-920	0-231	3	34	75
Foot Plateau	26	1-327	236	7	1	18
Coastal Range	16	40-500	152	-	6	10
Nyika Plains	24	0-720	461	2	10	12
Sabaki Flood Plain	6	40-230	8-63	-	2	3
<b>TOTAL</b>	<b>184</b>			<b>12</b>	<b>53</b>	<b>118</b>

SOURCE: TARDA 1983

### 3.5.2 PROBLEMS AND CONSEQUENCES

The District is lacking both surface and underground water resources. The Sabaki River is the only permanent river in the District, but during the dry period the flow of water is very low. Most of the piped water comes from this river which is situated in the northern part of the district. This makes the supply of piped water very expensive.

The Sabaki-Malindi water supply is threatened with siltation which causes the Sabaki river to change course at the intake point, especially during the low flows. In 1982 a prison's crew had to dig a channel in the sand and silt deposits to bring water back to intake point. The salty Baishe stream empties into the Sabaki River above the intake point and is a problem during low flows. At low flow the main river diverts away from the intake point and the relative contribution from Baishe is greater. This sometimes makes the water supply salty, but a new intake point has been recommended. The river is heavily silted during the floods and requires special sedimentation tanks and flocculants to clear the water. The erratic supply of water to Malindi Town adversely affects the tourist industry. The problems with high silt loads also affect the Baricho-Sabaki pipeline.

The lack of surface water supplies is most notable in Bamba, Ganze, Vitengeni, Sokoke, Marafa and Magarini, where the rural people have to travel long distances, sometimes more than 20kms, together with their livestock, in search of water. During the dry

periods, water may be trucked in from as far as Kilifi and Mariakani. In some dry areas homes are abandoned until rains come, and in the remote dry areas including Guzuuguru, Nzomni and Gotani people sometimes obtain water from leaves.

Data for underground water resources is limited. The water is usually hard, saline and well mineralised. The pH of the water usually ranges from acidic 6.1 to the alkaline range of 7.4. In the Magarini Settlement Scheme two boreholes had a pH of 6.7, one contained a high manganese concentration of 1.5ppm, and two were organically polluted. Of 35 cells recorded in Kilifi District, 9 wells yielded water of unacceptable quality while 26 yielded good water. The poor quality of underground water in some areas and deep water table have limited the exploitation of the water. The water supply from boreholes in the drier areas like Bamba and Marafa during the dry period is inadequate and deteriorates in quality.

The lack of both surface and adequate usable underground water supply has hindered the development of the District especially in the dry areas. There is a tendency for people and their livestock to shift southwards from the dry hinterland during the dry periods in search of water. This hinders the development of livestock and farming and creates semi-permanent settlements which constrain the establishment of schools, health facilities and other social and economic amenities. Along the Sabaki pipeline, where communal water drawing points have been constructed, people and their livestock have been attracted to settle. The majority of the people draw water from any source regardless of its quality since they have no alternatives. As a result there are high incidences of diarrhoeal, intestinal and other water-borne diseases.

### 3.5.3 RECOMMENDATIONS

The dry division (Ganze and Malindi) had the largest number of dams to retain surface water. These dams were very helpful and should be rehabilitated and maintained. More dams could be constructed at convenient sites.

Over the long term, expansion of the Sabaki and other pipelines should give first priority to the dry rural areas. Feasibility studies should be conducted in the near future to determine the demand and costs. Emphasis should be placed on communal water drawing points along the pipeline, rather than insisting on piped water which will be too expensive to provide in the near future. In some areas piped water may be supplied to rural homes under a loan scheme. Extra charges in the monthly bills would recover the loans, although the repayment period may be long and people may not be able to afford the higher charges. More storage tanks or reservoirs should be constructed to have enough water for distribution.

The use of wind mills to run boreholes, instead of diesel which is expensive, should be looked into, especially in the higher areas where wind speeds may be fast enough for economic use. Solar pumps might also be used.

With the development of rural housing, rainwater harvesting should be encouraged through provision of loans to purchase materials. Cheap local materials for construction of water storage tanks would lower the costs. Self-help groups can be organized to build these systems.

### 3.6 WASTE DISPOSAL AND WATER POLLUTION

#### 3.6.1 SANITATION AND PUBLIC HEALTH

Inadequate facilities for waste disposal give rise to potential health hazards. Wastes which find their way into water sources may contribute to water-related diseases such as amoebosis, shigellosis, cholera, diarrhoea, schistosomiasis and skin diseases (Table 3.10). Increasing population densities, without improvements in waste disposal facilities, will lead to increases in diseases. Other environmental impacts from water pollution are also likely - eutrophication of ponds, increased nutrient loading of aquatic systems, and bioaccumulation of toxic chemicals.

There are no sewage collection and treatment facilities in Kilifi District. Urban domestic wastes are collected in septic tanks and pit latrines; in rural areas pit latrines and open defecation are used. In Kilifi Town only about 57% of the people have sanitary facilities. Thus even in urban areas open defecation is common. The extensive use of open defecation is of obvious concern; not only is it highly unsanitary and offensive but pathogenic bacteria which are present in significant amounts are a threat, as evidenced by the high incidence of water-borne diseases and skin diseases.

Pit latrines are likely to contaminate the ground water if the water table is high. The effluent from septic tanks is as dangerous as raw sewage, if the holding time is not adequate. The situation is made worse by the fact that most of the septic tanks are not efficient and are not inspected and emptied periodically. Further, when hotels expand, the septic tanks may not be expanded accordingly and are therefore overloaded. The wastes discharged into the ocean constitute a potential threat to public health, tourist attractions such as the coral reefs, and a direct threat to swimmers and beach users. Some viruses (e.g. hepatitis) can survive for sufficiently long periods in sewage and subsequently in the sea and seafood to allow effective transmission of the disease through the marine environment.

Solid waste disposal is a problem due to poor waste management practices. Wastes that are collected are not usually separated according to the potential for disposal by incineration, composting or recycling. Open incineration is common in towns as well as the rural areas and leaves tin and other non-combustible refuse uncollected. These provide breeding sites for mosquitoes, flies and other disease carriers. Insufficient attention has been given to looking into satisfactory methods for solid waste disposal. As a result significant amounts of waste are disposed of informally by inappropriate means.

#### 3.6.2 PLANNED IMPROVEMENTS

There are plans by the local government to provide a sewage treatment plant for Malindi. One option was for a marine outfall, although a land-based system was also proposed.



TABLE 3.10 DISEASES RELATED TO UNCONTROLLED DISPOSAL OF SEWAGE

DISEASE	CAUSATIVE ORGANISM	USUAL METHOD OF TRANSMISSION	PREVENTIVE STRATEGY
<u>DIRECT RELATIONSHIP</u>			
Infant Diarrhoea	Virus	Contaminated water and food	Improve hygiene Improve sewage disposal
Typhoid and Paratyphoid	Salmonella	Contaminated water and food; also spread by flies and direct contact with urine and faeces	Improve hygiene Improve sewage disposal
Infantile gastro-enteritis	Certain E. Coli (Bacteria)	Direct contact with faeces	Improve hygiene Improve sewage disposal
Cholera	Bacteria	Contaminated water and foods- also spread by flies and direct contact with faeces	Improve water supply Improve hygiene Improve sewage disposal facilities
Hookworm	Hookworm	Through skin of new victim whilst touching soil contaminated by excreta	Improve sewage disposal Wear protective foot gear
<u>INDIRECT RELATIONSHIP</u>			
Schistosomiasis	Helminth	Percutaneous	Improve sewage disposal facilities Provision of safe and adequate water supplies Control snail population

SOURCE: GOK/UNEP/NEHSS 1981

The Ministry of Health has proposed construction of 25 demonstration pit latrines per division. Public toilets will be provided in selected trading centres and all urban centres will be provided with proper refuse collection facilities and disposal systems.

Monitoring of water pollution will continue on an ad hoc basis, as sources of pollution are identified.

### 3.6.3 RECOMMENDATIONS

The level of industrial activity is very low in the District and so far no cases of pollution have been reported. Since none of the industries treats its wastes before discharging into the environment, there is need to undertake an appropriate study to assess present sources and levels of pollution from all the existing factories, so that suitable guidelines for waste treatment and standards for discharge and periodic monitoring can be established by Interministerial Committee on Industrial Activities.

In order to integrate environmental considerations into all future industrial projects an environmental impact assessment (EIA) should be carried out early in the planning and feasibility stages. The assessment need not be exhaustive, but depending upon the type and scale of industrial project and its site, the EIA should focus on the factors that would have the most pronounced impacts. The appropriate recommendations arising from the assessment and implemented by the developer would be monitored by the Interministerial Committee on Industrial Activities, so that the benefits accrued from the EIA will not be neglected.

The government through the Ministry of Local Government should strengthen its efforts to provide proper sanitary facilities in the urban areas and to build sewage treatment works. The demonstration pit latrines should be located in market centres and schools throughout the District, where rural people may see and use them before endeavouring to construct them in their homesteads. The social and ethical beliefs of the inhabitants must be taken into account. Special effort will be needed to ensure the demonstration facilities are well maintained.

Refuse from urban centres should be collected and disposed of in quarries where it can be buried or composted.

A regular water pollution monitoring programme should be instituted. School children, through wildlife or science clubs, should be trained in simple field tests of nearby waters. The Ministry of Water Development should regularly test for pesticides and industrial pollutants from Nairobi in the Sabaki River, while the KMFRI should monitor marine pollution. The annual results from the various Ministries should be collected and published.

Existing, or if needed, additional legislation should be enforced to require all urban dwellings, industries and hotels to have satisfactory waste disposal facilities, to prohibit open defecation and to protect the coastal marine waters from pollution.

### 3.7

#### ENVIRONMENTAL HEALTH

Health problems are increasingly seen to be related to the environment. Diseases are borne in the water, air and land, or transmitted by various vectors such as mosquitoes. First priority has been to control the widespread diseases, although environment is an important contributor to cancers and heart diseases. Nutritional status is another important aspect of environmental health, related to rural productivity, food preferences and customs.

##### 3.7.1 MORTALITY AND MORBIDITY

Infant and under five mortality rates in the District are 212 and 66 per 1000 respectively. Life expectancy is approximately 66 years based on the infant mortality rate. No records are available for maternal mortality or crude mortality for the district, but national data show a crude mortality rate of 14 per 1000 (CBS 1979). Table 3.11 shows the causes of mortality and morbidity from recorded cases. The information is confined almost exclusively to deaths occurring in health establishments and does not accurately reflect the general mortality rate. Nevertheless, it clearly reviews the essential importance of communicable disease, nutritional deficiencies and the complications of pregnancy and child birth. The leading causes of mortality vary over the years, but the common ones are measles, malaria, tetanus, anaemia, malnutrition, diarrhoea and skin diseases. Malnutrition deficiencies are quite pronounced and are certainly involved in a large number of deaths attributed to communicable diseases. The younger age groups and women account for a large portion of the deaths which can be termed 'avoidable', although data on this are not available. In 1981 many cases of anaemia and malnutrition were recorded. Diarrhoeal diseases constitute one of the greatest social evils; not only do they kill young children, but they also retard the growth and impair the quality of life of those who survive.

Morbidity is also dominated by the communicable diseases which, although not fatal, cause temporary or permanent disability that places a heavy strain on economic resources. As with mortality, they vary over the years, but malaria, diarrhoea, malnutrition, anaemia, skin diseases and tetanus are common. Other diseases of environmental concern that are fairly common include schistosomiasis, typhoid and paratyphoid fevers, shigellosis and amoebosis. Measles is rife in the district among children aged between 6-36 months with moderately high case fatality rates. Immunity by vaccination has not eradicated the disease because of low vaccination coverage. Bacterial diseases remain endemic owing to inadequate sanitation, while parasitic diseases are the principle cause of sickness in the district. Malaria is characterized by very high endemity and a high level of transmission.

TABLE 3.11 REPORTED CASES OF LEADING CAUSES OF MORTALITY AND MORBIDITY, KILIFI DISTRICT

DISEASE	1982		1979		1978	
	MORT.	MORB.	MORT.	MORB.	MORT.	MORB.
Tetanus	33	234	133	204	133	204
Anaemia	32	23,577	44	488	44	488
Measles	27	19,029	169	1,125		
Malnutrition	24	5,262	18	-		
Malaria	7	262,133	39	637	39	637
Diarrhoeal Diseases	6	56,897	47	765	48	460
Intestinal Worms	-	55,755	-	-	-	-
Skin Diseases	-	7,934	-	-	-	-
Whooping Cough	-	1,570	-	-	-	-
Pneumonia	-	-	77	737		
Schistosomiasis	-	-	-	197	1	197
Acute Respiratory Infection	-	-	-	-	5	75
Disease of Pregnancy and Child Birth	-	-	-	-	0	828

SOURCE: Ministry of Health Annual Reports

### 3.7.2 NUTRITIONAL STATUS

Judging by the number of anaemic women and children, and from the recorded cases of malnutrition in institutions, the nutritional status among the people is very low (Table 3.12). Kilifi District ranks in the top ten in the country (indicating high rates) for stunting, wasting, child mortality, % sick and incidences of malaria (Central Bureau of Statistics 1983). Severe protein energy malnutrition (PEM) is encountered as a paediatric problem in all the health institutions and the Family Life Training Centre. Although the populations served by these institutions are not necessarily representative of the whole district, the data do indicate that nutritional problems are an important reason for admission of children.

The Kilifi Family Life Training Centre, situated near Kilifi Township, aims to eradicate childhood malnutrition caused by contributory factors. Malnutrition is found to have a high incidence within the population depending on cash crops for their livelihood. One contributory cause is the lack of knowledge about food. This group mostly originates from low income groups, such as labourers from sisal estates, the cashewnut factory and the cement factory. Poverty, single parents and bad drinking habits all lead to children not being fed on a balanced diet. It is interesting to note that even within families with high income, malnutrition still occurs because of ignorance about balanced diets.

TABLE 3.12 MALNUTRITION CASES AT THE KILIFI FAMILY LIFE TRAINING CENTRE

TYPE OF MALNUTRITION	1978	1979	1980	1981	1982
Kwashiokor	2	159	177	783	NA
Marasmus	4	110	203	507	NA
Kwashiokor/Marasmic	6	137	86	NA	NA
Anaemias	-	3	56	NA	NA
Polio/Marasmic	-	25	2	NA	NA
Mentally Retarded/Marasmic	-	1	5	NA	NA
Under Weight Children	NA	NA	NA	542	NA
Nutritional Deficiencies	NA	NA	NA	NA	5,262
TOTAL	17	551	629	1,197	5,262

SOURCE: Kilifi Family Life Training Centre, 1983

Kwashiokor, resulting from a protein and energy deficiency, seems to be more prevalent than marasmus. Children suffering from measles, malaria, severe cases of malnutrition, pneumonia, gastroenteritis and anaemia are admitted to Kilifi Hospital. Nutrition field workers and family health educators refer mothers whose children are malnourished to the Kwashiokor Centre. There, mothers are taught the importance of proteins, energy and vitamins in overcoming kwashiokor. In 1980, 417 mothers and 629 children were 'trained' at the Centre. The Maternal Child Health/Family Planning (MCH/DP) clinics also treat children suffering from malnutrition and immunise against polio, BCG and measles.

TABLE 3.13 PATIENTS TREATED BY MATERNAL CHILD HEALTH/FAMILY PLANNING CLINICS

CAUSE	PERMANENT				MOBILE			
	1979		1980		1979		1980	
	OLD CASES	NEW CASES	OLD CASES	NEW CASES	OLD CASES	NEW CASES	OLD CASES	NEW CASES
Kwashiokor	1,950	695	1,147	1,215	1,013	219	108	114
Marasmus	966	478	781	536	328	85	71	82
Underweight children	83	301	70	298	3	7	Nil	14

SOURCE: Ministry of Health 1983

### 3.7.3 ENVIRONMENTAL FACTORS IN PUBLIC HEALTH

In general the major health problems are caused by the lack of adequate potable water supply, the absence of proper sewerage and sanitation facilities and by the high incidence of parasitic and communicable diseases. The low level of health can also be directly linked to poverty. The low productivity and weak purchasing power of most families tend to be aggravated or perpetuated by such problems as inequitable land ownership, limited availability of water, lack of economic incentives and to some extent population growth. The agricultural practices have trapped many people in a vicious circle of inadequate productivity, low income and low standard of living. A shortage of funds prevents building of roof catchments and underground storage tanks for conservation and storage of water. In the rural areas where the raising of crops and livestock forms the basis of the economy, there is little diversity of skills and few community services are organized; houses are scattered or distributed in small groups which makes it difficult to organize services such as water supply, excreta disposal and others. Many families are forced to travel long distances in search of water since less than 25% of the District's population has piped water supplies. Uncontrolled dumping of domestic wastes causes transmission of diseases either directly through bodily contact with pathogenic organisms in sea water or on beaches, or indirectly through consumption of polluted seafood.

The three forms of Protein Energy Malnutrition are common due to:-

- i) Dietary restrictions especially in respect of animal proteins (e.g. chicken, eggs). The restrictions result from a combination of beliefs about food, food availability and food prices.
- ii) Famine and seasonal food shortage and poverty especially in the dry parts of the district (Ganze and Bamba).
- iii) Lack of awareness of the need of a balanced diet and the need for the semi-solid feeding of infants.
- iv) Recurrent infections are sometimes contributory causes of kwashiorkor.

Some of the diseases, particularly diarrhoea, are associated with poor personal hygiene, insanitary arrangements for water supply and wastes disposal, poor food hygiene and lack of disease vector control. Although these problems are not new, the health services even in the urban areas are inadequately equipped to deal with them and are short of trained personnel.

The number of people suffering from diseases related to pollution caused by domestic liquid waste and solid waste is uncertain. A large number of cases, some fatal, are reported as unspecified diarrhoeal diseases. But in most cases the causes can be directly related to contaminated drinking water. Bathing in sewage polluted water can result in infections of the throat, ear, eye and nose.

Where bacterial infection is also present, it can lead to other diseases especially when ingested due to biomagnification. There are areas, where due to a shortage of water, there are common supplies for man and domestic animals which certainly increases the risk of infections.

#### 3.7.4 HEALTH FACILITIES AND PROGRAMMES

Health care for the rural and urban population is provided by three hospitals, thirty seven dispensaries and five health centres, most of them run by the government (Figure 28). The bed/population and hospital/population ratios clearly show that the district is insufficiently provided with medical care and other health benefits (Table 3.14).

The scattered nature of the population, the communication difficulties, the shortage of qualified staff and supplies and inadequate motivation mean that very often a large proportion of the rural population have no access to health services, while such services as exist may be over-utilized. The urban facilities absorb the majority of the financial, material and human resources.

There are 16 field educators in the district, supervised by the public health education officer. Covering a 3 km. radius around the village, they motivate the population towards family planning and give lectures on proper health at primary schools in the district. Visits are made to homes advising mothers about child and maternal care. There are a total of 6 public health officers and 25 public health technicians in the district covering 4 divisions and 30 locations. The number of health personnel has generally increased over the last two years (see appendix 6.6).

The programmes underway are geared towards the three most important and inter-related factors causing high morbidity and mortality in young children and their mothers: malnutrition, infection, and the consequences of repeated and closely-spaced pregnancies. Particular attention has been directed in the following areas.

The inadequacy of water supplies both in quantity and quality is an important contributor to poor health. The government intends to provide the greatest possible number of people with safe water in sufficient quantities. This will help in the control of diarrhoea, bilhazia and skin diseases. In addition it is proposed that:-

- all places along the main Sabaki Water Pipeline with a population of 100 people within three km radius be supplied with piped water,
- rainwater catchments in the form of roof collection, surface collection fitted with a hand pump and construction of water tanks at individual houses be initiated, and
- clearing of banks of streams and filling in depressions with stones be emphasised so as to control bilhazia.

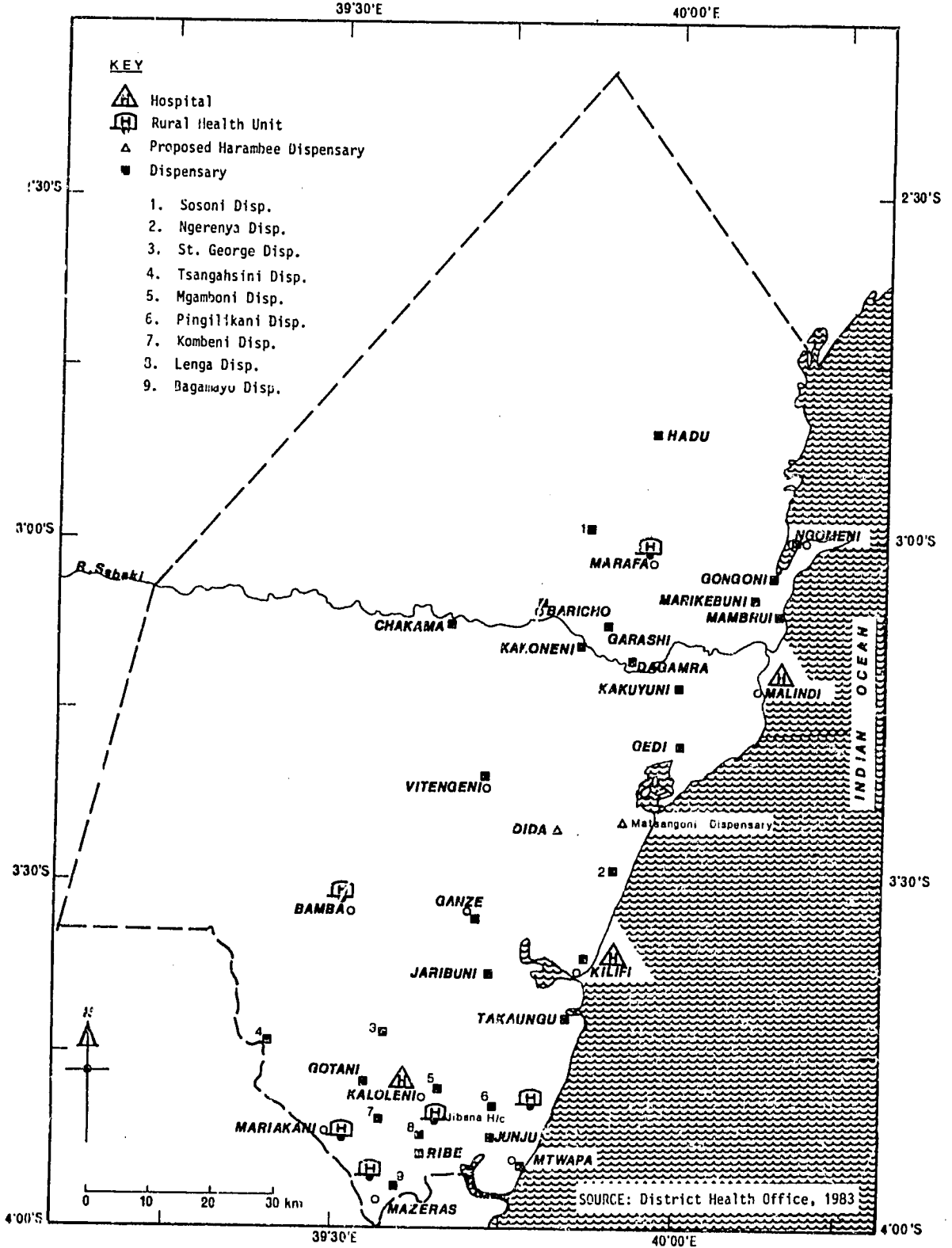


FIGURE 28. HEALTH FACILITIES, KILIFI DISTRICT



TABLE 3.14 DISTRIBUTION OF HEALTH FACILITIES, KILIFI DISTRICT, 1983

DIVISION	NAME	FIELD EDUCATORS	BEDS	POP./BED RATIO	POP./HOSPITAL RATIO
<u>HOSPITALS AND HEALTH CENTRES</u>					
Bahari	Kilifi Hospital	2	184		
		2	12		
			196	433	42,462
Kaloleni	St. Luke's Hospital	-	140		
		2	12		
		2	12		
		2	8		
			172	881	37,886
Ganze	Bamba HC	2	12	5,453	65,437
Malindi	Malindi Hospital	2	115		
		2	NA		
			115	1,122	64,541
<u>DISPENSARIES</u>					
Kaloleni	Kombeni				Chonyi
	Bwagamogo				Pingilikani
	Ribe				Tsangatsini
	Lenge				Gotani
	Mugamboni				
Bahari	Ngerenya				Junju
	Takaunga				Mtwapa
Ganze	Vitengeni				Ganze
	Mryachakwe				Jaribuni
Malindi	Gede				Ngomeni
	Kakuyuni				Ada
	Kakoneni				Marafa
	Chakama				Garashi
	Marikebuni				Dagamra
	Mambrui				Baricho
	Gongoni				Sosoni

SOURCE: District Medical Officer of Health 1983

A second factor is the absence of proper systems for the disposal of wastes including human excreta. - The aim is to remove the solid and liquid wastes to a safe distance from the dwellings. It is proposed that at least 25 demonstration latrines per division be constructed each year of the planning period. Public toilets will be provided in the selected trading centres - Mtwapa, Vipingo, Mazeras, Mariakani, Kaloleni, Ganze, Bamba, Watamu, Gede, Msabaha and Marafa. All urban centres will be served with water-borne sanitation and provided with proper refuse collection and disposal system. The following urban centres have been identified in order of priority - Kilifi, Mariakani, Watamu, Kaloleni, Takaungu, Mazeras, Mtwapa and Vipingo.

The danger of the spread of diseases owing to the presence of mosquitoes, rodents and other vectors of communicable diseases must be controlled. In order to control malaria, it is proposed that an additional anti-malaria station at Mariakani be constructed. Also to be constructed will be anti-malaria drains at Kanamai/Kikambala, Matsangoni, Kilifi Town, Tezo, Malindi Airport and Njanaheri. The government intends to raise the immunization coverage by 23% through intensive efforts to control communicable diseases. A programme will be launched to take immunization services to the under fives at home.

Community participation, resulting from effective health education, is another aspect of the programme. Health education is meant to conform to local patterns and practises. To combat malnutrition in the district, intensive nutrition education programmes are to be conducted, including more demonstrations, for the purpose of changing eating habits and introducing more nutritious foods. Demonstration kitchen gardens will be established at each of the hospitals and health centres. Family planning education will be intensified with the aim of improving the health of mothers and children, and to motivate families to adopt a small family norm. Plans are underway to help communities to build healthy and comfortable houses, properly lit and ventilated, and affording adequate protection from external hazards (see Section 3.3).

### 3.7.5 RECOMMENDATIONS

Efforts to combat poverty, increase agricultural productivity, and provide treated water supplies, adequate waste disposal and better housing will have a beneficial effect on health. Therefore the recommendations in other sections of this report are relevant here as well.

Specifically regarding the distribution of health facilities and services, the emphasis should be on strengthening the rural health programmes and utilizing para-professional health workers. Many of the improvements in public health require fairly simple changes, which a cadre of trained residents could accomplish on a self-help basis. In some cases the traditional medicine men could be integrated into the modern health services.

### 3.8

#### LAND TENURE

##### 3.8.1 HISTORY AND NATURE OF LAND TENURE PROBLEMS

The history of land tenure problems in Kilifi District dates far back to pre-independence days when the ten-mile coastal strip was under the Sultanate's rule. During this time the land was registered under the old Registration Act. The owners were Arabs and Indians, many of whom are no longer traceable. This registration did not grant land to the indigenous Africans hence they became squatters.

The British honoured the Sultanate's title deeds in their colonial administration and the Kenya Government agreed to uphold all the Colonial title deeds. Whereas in the highlands much of the colonial lands were bought up and distributed to Africans, this has not been the case at the Coast. In some areas the residents may not know they are landless until they attempt to register their farms.

The land tenure problem in some areas of Kilifi District hinders development. Tenants are unable to acquire loans even though they have improved their land with dwellings and tree crops. The mushrooming slum areas in the urban centres, fed by the landless are environmental health hazards and slums around Malindi impede expansion of the town. Difficulties in getting title deeds issued have even delayed government projects. In one case a new fish landing facility was removed because the land proved to be privately owned.

In 1970 the Land Adjudication Programme was launched to curb the land tenure problem (Table 3.15). This programme is fairly well implemented despite such hinderances as lack of aerial photographs and maps, budget constraints, and disputes in the densely populated areas.

Settlement schemes such as at Magarini, have been introduced in Kilifi to settle the landless. The current adjudication programme will enable wananchi to acquire loans for land development from financial institutions using the title deeds as security.

##### 3.8.2 RECOMMENDATIONS

The Kenya Government should seek external assistance to buy land owned by absentee landlords or where the owners are no longer traceable, and distribute the land to the current residents. The Government/Oman might be interested in such a programme, as the/of original Arab settlers were largely from Oman. In any case, the process of identifying the landless and resettling them should be accelerated to enhance other rural development programmes. The Government should buy unused land from willing sellers.

A detailed map of land ownership in Kilifi should be prepared and made available. Based on the map, plots can be set aside for public facilities. The map should have a legal status to prevent indiscriminate issuing of title deeds.

TABLE 3.15 LAND ADJUDICATION BY DIVISION, KILIFI DISTRICT, 1983

DIVISION	REGISTERED SECTION	SIZE IN HA.	NO. OF PARCELS
BAHARI	Mandeteni	1,114	625
	Matsangoni	1,309	71
MALINDI	Jimba	1,450	439
	Dabaso	1,388	332
	Mijiamboni	4,300	805
	Chembe/Kibabamshe	1,850	440
	Kakuyuni/Maduguni	1,400	415
	Baraka Chembe	4,100	308
KALOLENI	Vishakani	2,355	810
	Chalani	2,690	750
	Chasimba	1,500	418
	Galenema	2,930	480
	Bandarasalama	2,469	878
	Nyalani	2,206	1,489
	Chiluru	1,120	515
	Mwarakaya	1,125	523
	Kanani*	3,300	804
	Mbwaka Maereni*	984	634
	TOTAL		37,590

\*Completed, land certificates not issued yet

SOURCE: District Registrar of Lands 1983

### 3.9 AGRICULTURAL PRODUCTIVITY

#### 3.9.1 AGRICULTURAL POLICY

Agriculture, including livestock, is the nation's major source of food, foreign exchange and employment. The government's policy is to ensure that the agricultural sector supplies the food required by a growing population, produces more for export, provides productive work for the expanding labour force, maintains rural livelihoods, and, above all, sustains environmental health. The rapid growth of agricultural production is the nation's highest development priority.

Agricultural productivity can be increased through the expansion of hectares under crops and increases in yields per hectare. It is the government's intention to achieve increases in output largely through the achievement of higher yields (Ministry of Finance and Planning 1983). About 60 per cent of Kilifi's land area is semi-arid or rangeland. Therefore agricultural development will involve heavy investments to establish irrigation schemes, make fuller utilization of idle land, establish ranches, use of improved varieties of seeds, extend use of fertilizers, insecticides and pesticides, better

farm management and improved infrastructure. However some expansion of the cultivated area is possible in the medium potential areas of Kilifi.

### 3.9.2 CONSTRAINTS TO INCREASING AGRICULTURAL PRODUCTIVITY

The majority of farmers in Kilifi District are small-holders and most of them are constrained by limited resources. Lack of resources has made many farmers unable to acquire farm inputs such as fertilizer, insecticides and labour for weeding and harvesting crops. (see Appendix 6.4)

One important limiting factor is the unreliability of rain - there are significant risks, especially in Ganze Division, of failure from inadequate or poorly distributed rainfall. (Figure 29). For example, while the average annual rainfall in Kaloleni is 1,090mm, in 6 out of 10 years only 772mm can be expected - and that is divided in two seasons.

The lack of interest among some people to work on the farms apparently retards agricultural production. One of the reasons attributed to this is that most of these people live as squatters on land owned by absentee landlords and therefore do not have the incentive to develop land that does not belong to them. Climatic conditions, a satisficing attitude and poor health status are also reasons for low levels of labour inputs into farm development.

In addition there are problems of credit availability and farming technology. Many small farmers are not aware of the Agricultural Finance Corporation's branch that was opened at Kilifi recently, and even if they may be aware, few of them would be willing to go for a loan. Farming methods in most cases are traditional with women doing much of the work on farms. Few families have oxen for ploughing or donkeys for hauling produce.

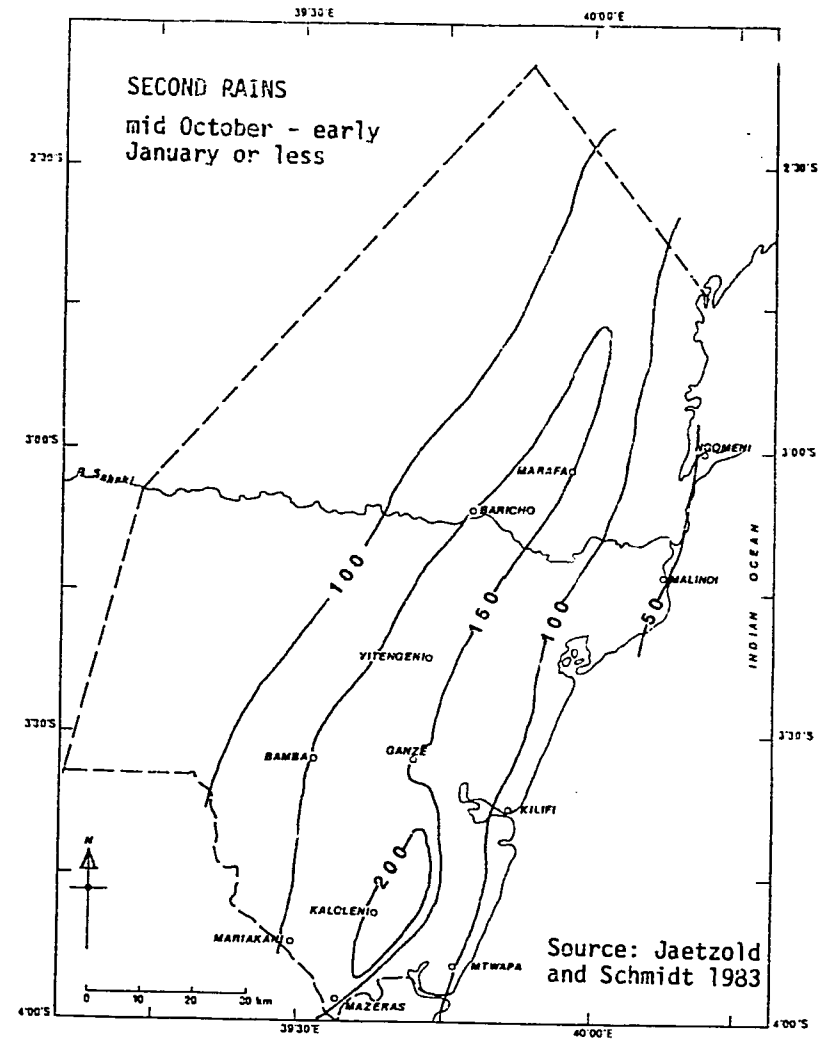
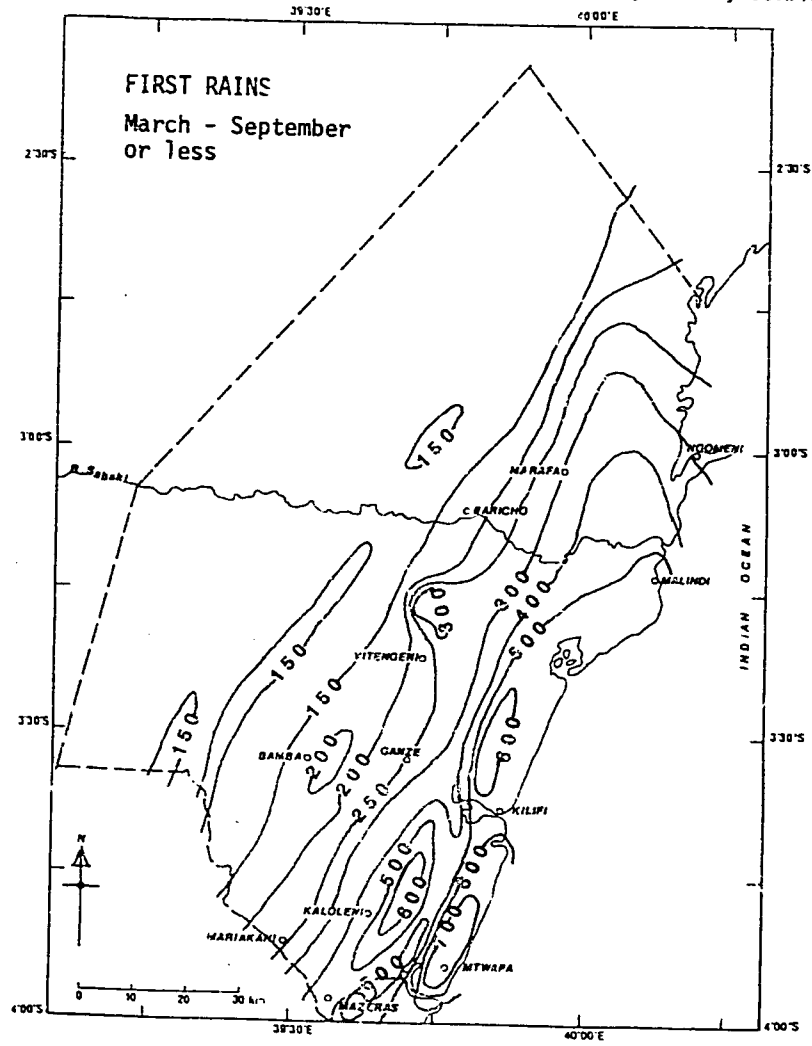
Even in those areas where agricultural activity is more progressive, there is the problem of poor development of rural access roads and shortage of storage facilities. This makes the marketing of agricultural produce and the distribution of inputs very difficult.

The hot climate coupled with inadequate water supply, affects livestock development in the district because it reduces the availability of grazing land, especially during the dry seasons.

### 3.9.3 PROGRAMMES UNDERWAY

The extension services play an important role in the achievement of agricultural objectives within the district. A farmers' training centre at Mtwapa provides training to farmers who attend courses on a periodical basis. This helps to provide for an improvement in the quality and expansion of agricultural education programmes and facilities. The centre also provides training in agroforestry and energy conservation.

AMOUNTS, IN MM, SURPASSED IN 6 OUT OF 10 YEARS



Source: Jaetzold and Schmidt 1983

FIGURE 29. 60% RELIABILITY OF SEASONAL RAINFALL, KILIFI DISTRICT

Although facilities for artificial insemination are available, not many farmers make use of them. There are also demonstrations of zero grazing being carried out at farmers training centres. Demonstration plots for fodder crops have been established in some areas. Research on disease control, through the tsetse survey and control programme, is addressing the control of trypanosomiasis.

#### 3.9.4 RECOMMENDATIONS

The Ministry of Agriculture and Livestock Development should increase the number of extension workers in the District so that many small-scale farmers can be taught about proper land preparation, planting, use of improved seed and application of fertilizers, insecticides and pesticides. The extension service should be operated on a training and visitation basis. Small demonstration plots on farms should be established in each location to show the suggested practices.

Rainfall in most parts of the district is unreliable. In such areas, emphasis should be put on crops which are drought-resistant, such as cassava, soghum, and grams. Better integration of livestock should be practiced. Farmers should be encouraged to grow vegetables to supply the urban and tourist markets.

The Department of Lands should try to solve the problem of land ownership in the District by giving new title deeds to those people who are willing to make productive use of the land and also by looking for alternative areas to resettle the landless.

Through education, people should be encouraged to adopt new methods of farming and try to modify some of their traditional values where they are constraints to development.

Most of the rural access roads are in very poor condition. The ministry concerned should try to improve these roads so that transportation of agricultural produce and distribution of inputs can be facilitated. Stores should be built throughout the District to supply inputs and tools on a timely basis.

Agroforestry is already being practised, but can be considerably extended. For instance grazing below coconut trees reduces the evapotranspiration of bushland and adds fertilizer to the soils. Many cashew, coconut and mango trees are beyond their most productive years and should be cut down and replaced. Trees for building poles should be planted along farm boundaries or in woodlots.

### 3.10 DRYLAND DEVELOPMENT

#### 3.10.1 SPECIAL PROBLEMS AND OPPORTUNITIES OF DRYLANDS

Almost two-thirds of the total land area of Kilifi District can be classified as rangeland. Rain and water supplies are the most significant constraints affecting livestock development because the hot climate coupled with inadequate water supply reduces the extent of accessible grazing land, especially during the dry seasons.

Dryland development is also faced with the problem of limited technology. Dry farming systems, development of plant varieties that can best survive in these areas, grazing and feeding techniques have not been adequately developed to meet the growing demand for food.

Lack of adequate basic infrastructure also affects the development of dryland areas in the District. The distribution of goods and services is very difficult. Lack of infrastructure also limits the possibility of providing better extension services to these areas and other basic services like health and schools.

Although the total population on the rangelands is small, at the present rate of increase it may soon exceed the ability of the land to sustain the increasing population at the present level of technology.

For these reasons, the bulk of land in the district remains sparsely settled and in most cases underutilized. Unexploited potential for irrigation exists along the coastal belt and the Sabaki flood plain. These areas could offer great scope for the development of livestock, tree crop production (coconut and cashewnuts) and horticulture. Drought resistant food crops (cassava, soghum, millet) can be planted in some of the dry areas where some irrigation (seasonal flooding perhaps) is available.

### 3.10.2 RANCH DEVELOPMENT PROGRAMMES

As in many areas of Kenya the most successful ranches in Kilifi are private or company ranches, including the Galana Game Ranch, Giriama Ranch, Kilifi Co. Ranch and Kulalu ADC Ranch (see Table 1.10). These ranches keep large numbers of cattle, sheep and goats. There are 12 group ranches, but only a few have title deeds and central herds established. Thus in the group ranching area, traditional pastoralism is practised. The Ministry of Agriculture and Livestock Development provides extension and veterinary services and assists in developing the group ranches. Although the group ranches have been under development for over a decade, they have failed to reach a self-sustaining basis. Provision of dips and water supplies are still needed. If nothing else the group title restricts alienation of land from the indigenous inhabitants.

### 3.10.3 RECOMMENDATIONS

For the rangelands to be brought under extensive livestock production, the following integral elements should be included in the development programme: provision of extension services to ranchers within the district, development of water supplies, dip construction and provision of credit facilities to ranches approved by the Agricultural Finance Corporation. It is recommended that the relevant Government agencies concerned with development of dry lands take urgent measures to develop the basic infrastructure in these areas.

It is important to determine the land carrying capacity in order to avoid overstocking.

Development of local human resources in the rangeland should be encouraged. This will ensure the implementation of development projects in these areas.



In addition to livestock development, drought-resistant food and cash crops should be promoted.

Water from the Sabaki River should be utilized for irrigation and domestic purposes.

### 3.11 POVERTY AND EMPLOYMENT

#### 3.11.1 NATURE OF POVERTY

In absolute terms, poverty is defined as the number of people below a specified minimum level of subsistence income which is necessary to secure the bare essentials of food, clothing and shelter. (Todaro 1977). Poverty in Kilifi District can be attributed to unemployment, illiteracy (especially among women), poor weather conditions in most parts, reluctance on the part of most people to accept and adapt to changes, inadequate infrastructure, and in some areas landlessness.

The average disposable income in Kilifi is estimated to be approximately KShs.4,000 per year per rural household. Much of this income is derived from small scale agriculture and trade. The main sources of family incomes in urban areas include wholesale and retail trade, social services and manufacturing. Income levels and distribution are largely determined by the pattern of employment and the agricultural potential.

A cross-section of people living in the rural areas, particularly in Ganze Division, shows that many people suffer from poor health, live in poorly constructed houses in which living conditions are substandard, lack clean water and have inadequate food resulting in a high rate of malnutrition. There are many landless families who have no incentive (and often little capability) to improve their farming methods.

Another factor that may contribute to the increasing number of poor people in the District, is the rapid growth of population (see 3.1). When it out paces development, poverty increases.

Poverty in developing countries such as Kenya is a major cause of environmental destruction. A poor person's (whether farmer or pastoralist) main concern is short-term food production for his family--he may not be able to avoid long-term environmental destruction. Since the poor have limited income, they will do everything possible to the environment in order to survive. Further, those who are aware of the need for conservation, they may lack capital for making improvements to their farms. It is indeed with these considerations in mind, that the Government has now focused attention and efforts towards the alleviation of poverty among the majority of people both in rural and urban areas.

#### 3.11.2 EMPLOYMENT TRENDS

Between 15 and 20 percent of the estimated potential labour force of Kilifi District is engaged in wage employment. The residual labour is estimated to be about 180,000 in 1983, while the rate of employment creation in the District has been between 8 and 10 percent per year (KDDP 1979-1983).

The share of wage employment provided by agriculture is estimated to be only 4.0 percent of the potential labour force. This is due to the fact that throughout most parts of the district, agriculture is still under-developed. Table 3.16 illustrates the trends in wage employment and earnings in Kilifi District from 1972 to 1980. The number of people engaged in wage employment as well as total earnings have not been increasing as would be expected due to the slow rate of economic development in the District.

One of the Government's objectives has been the promotion and establishment of small-scale industries in the rural areas to absorb the increasing number of school-leavers. Through a comprehensive programme which includes the Kenya Industrial Estates, oriented towards modern small industries, a number of measures including the establishment of a fund to assist informal, small-scale industries are being taken.

### 3.11.3 RECOMMENDATIONS

The Kenya Industrial Estates should establish a facility in the District to provide loans, training and workshop facilities for small-scale rural enterprises. Potential exists for entrepreneurs to make use of the facility. Priority must be given to those small industries which use agricultural raw materials. The manufactured products should have an easy access to the market.

Provision of rural infrastructure will contribute a great deal towards the success of the whole programme, through forward and backward linkages. Reduction in poverty may therefore have beneficial effects on the environment.

TABLE 3.16 WAGE EMPLOYMENT AND EARNINGS IN KILIFI DISTRICT, 1972-1980

YEAR	NUMBER	EARNINGS - K&#39;000
1972	7,753	1,721.5
1973	7,939	1,976.6
1974	10,802	2,384.1
1975	11,773	2,998.2
1976	12,830	3,734.2
1977	12,286	3,818.7
1978	13,264	4,517.3
1979	14,167	4,823.1
1980	15,619	5,296.9

SOURCE: Central Bureau of Statistics 1978 and 1981

### 3.12 TOURISM AND NATIONAL HERITAGE SITES

#### 3.12.1 GOALS AND NATURE OF TOURISM

The fundamental national goal for the tourist industry is to maximise net economic benefits from the scenic environmental resources of the country. In addition it is intended for the industry to generate foreign exchange, increase employment and promote Kenyan ownership and management. At the same time tourism is to proceed without compromising cultural values or destroying the environment. Local tourism is also being promoted and will provide an increasing opportunity for the local population to benefit from the natural environment, which should ensure increasing public support for environmental protection.

Most of the tourist facilities are concentrated in the Malindi-Watamu area, although there are scattered hotels and cottages elsewhere along the coast (Figure 15). In addition Crocodile Camp on the Sabaki River is just outside Tsavo East National Park. Most of the foreign visitors are Europeans, dominated by the West Germans, but including large numbers of Italians, French, Swiss and British tourists as well. As a long-haul destination Kenya competes with Thailand, Sri Lanka, the Indian Ocean Island countries, and several other African holiday centres. The average length of stay has risen since independence to about 15 days (in 1981). Each tourist spends, on the average KSH.5,110 (Table 3.17).

Beach holidays in Kilifi District had more than doubled from 1968 to 1978 (Table 3.18). Some estimates envisioned that growth would continue at 9% per year through 1994. However the last few years have seen a decline in the number of tourists to Kenya in general, and to Kilifi in particular. This recent trend is probably due to the economic recessions, competition from other holiday centres and restrictions on air charters. The south coast development has drawn tourists from Kilifi District, and many hotels have had to lower their rates to stay in business. The heyday of the mid-1970s is probably over, although hotel owners in the Malindi area believe there will always be a market for tourists due to the attractions of the marine parks and Malindi Town. However, many of the hotels in the Malindi-Watamu area are urgently in need of renovations to tourist-class standards.

The hotels are a major source of wage employment in Kilifi District, although over 90% of the population are still dependent on the agricultural sector. The tourist industry is largely dominated by expatriates, who represent their international companies, and up-country Kenyans. However, at three hotels in Kilifi surveyed in 1981, 60% of all the employees were from Kilifi District, 74% were from the Coast Province (including Kilifi) and 46% of those in professional jobs were from Kilifi District. Compared to figures for the south coast, the people from Kilifi District have received more benefits from the tourist industry (Migot-Adholla et al 1982). In general the younger men with some education are more eager for the tourist industry to expand than older men and women who see tourism as a force in cultural change, or do not anticipate any personal benefits from tourism. Very few women are employed in the tourist industry at the Coast - due to cultural and educational reasons.

TABLE 3.17 KENYA TOURIST VISIT, STAY AND EXPENDITURE, 1963 - 1981

YEAR	NO. VISITS '000	AVE. LENGTH OF STAY Days	AVE. EXPENDITURE PER PERSON KE
1963	110.2	9.4	81.7
1964	120.8	8.9	77.8
1965	147.4	9.3	73.3
1966	188.7	11.0	75.8
1967	225.5	10.3	65.2
1968	257.1	9.5	67.3
1969	276.0	8.5	60.5
1970	338.8	8.8	54.6
1971	399.7	9.3	59.8
1972	428.4	11.1	63.8
1973	388.1	11.4	62.6
1974	379.6	11.6	69.8
1975	386.1	12.9	86.5
1976	424.2	12.5	96.9
1977	344.4	14.8	140.2
1978	333.3	14.2	180.0
1979	347.2	15.5	178.6
1980	362.6	15.7	227.5
1981	352.2	15.2	255.5

SOURCE: Migot-Adholla et al 1982

TABLE 3.18 AVAILABLE HOTEL BEDS AND OCCUPANCY RATE, KILIFI DISTRICT, 1969 - 1983

YEAR	KILIFI-WATAMU			WATAMU-MALINDI			KILIFI DISTRICT		
	AV. BEDS	OCC.	OCC. RATE	AV. BEDS	OCC.	OCC. RATE	AV. BEDS	OCC.	OCC. RATE
			%			%			%
1969	162	88	54	216	99	46	378	187	49
1970	204	116	57	213	115	54	417	231	55
1971	234	131	56	236	141	60	470	271	58
1972	307	161	52	368	171	46	675	332	49
1973	257	122	47	381	147	39	638	269	42
1974	316	148	47	398	157	39	714	305	43
1975	305	147	48	393	174	44	698	321	46
1976	310	149	48	394	184	47	704	333	47
1977	300	168	56	385	195	51	685	363	53
1978	347	179	52	435	225	52	785	404	51
1979	350	160	45	415	200	48	780	500	64
1980	352	167	47	400	215	53	775	410	52
1981	300	156	52	420	202	48	800	370	46
1982	303	150	49	410	270	65	804	410	51
1983	309	175	56	435	259	59	808	420	52

SOURCE: Kenya Tourist Development Corporation 1984

Central Bureau of Statistics, 1969 - 1978

The beaches and coral reefs are the primary attractions for visitors to Kilifi District. The traditional pattern of holiday-making was based upon these environmental resources. Many visitors have appreciated visiting the marine parks, which are quite different from the land-based parks. Facilities for swimming, goggling, photography and birdwatching are provided at the parks, while water sports are offered by many of the hotels in the area. Revenues from visitors to the marine parks are significant in the national and local economies (Table 3.20). Tourists also visit the Arabuko-Sokoke Forest and various national heritage sites (see below). The forest contains two very rare animals - the Zanzibar or Aders Duiker and the Yellow-rumped elephant shrew although they are rarely seen. Much more could be done to attract tourists to forests in the District (see Section 2.3).

### 3.12.2 NATIONAL HERITAGE SITES

Most of Kenya's national heritage sites (Figure 15 and Table 3.19) are found along the Coast; many of them on private land. They consist of ruins of buildings, palaces, houses, walls with gates and tombs, and remnants of household utensils and articles. National monuments are preserved in order to maintain various aspects of Kenya's history. In addition to their historical value, the sites are also preserved for architectural and archaeological reasons and as tourist attractions. Sites such as Gede offer visitors the serenity of a mature forest and opportunities for watching birds, animals and butterflies (Table 3.20). There are a number of sites of historical interest which are protected under Antiquity and Monument Act, 1983. But apart from Gede, Mnarani and Jumba la Mtwana, which are administered by the Museum Trustees of Kenya, there is no financial provision made for their maintenance and the sites have not been developed for tourists (local or foreign). The work of identifying additional sites continues.

Preservation of these monuments faces several problems. Owing to the isolation of the sites, they are vulnerable to vandalism. For instance, Chinese porcelain bowls embedded in walls are stolen or broken into pieces. Overgrown vegetation around some sites checks accessibility. The monuments face erosional problems from wind and rain, and cracking of walls due to heat and roots. Lack of trained manpower and funds prevents rehabilitation of more historic sites.

TABLE 3.19 NATIONAL HERITAGE SITES, KILIFI DISTRICT

LOCATION	MOSQUES	HOUSES	TOMBS	NOTES
Mtwapa		Several		Large but size reduced by construction of houses over-looking creek and the sea. Potential for study or archaeology, settlement pattern, survey and mapping.
Jumba la Mtwana	4	Several		A national monument since 1927
Kitoka	2	Several		On 6 acres of private land. There is cultivation around the entrance. Needs protection from the owner.
Mnarani	2		1	A national monument.
Kiburugeni	1		2	
Watamu	1			
Uyombo	1			
Kilepwa	1	Several	Several	Ruined mosque and conduit.
Mgangani	1	Several		Destroyed settlements.
Mida Creek	1			
Gede		Many		A national monument
Malindi	1		Several	Portuguese chapel, Vasco da Gama Pillar, Jemadari mosque, pillar tombs.
Mambrui	1		Several	
Kibirikani	1			
Ngomeni	?			

SOURCE: National Museums of Kenya, Mombasa, 1983

TABLE 3.20 VISITORS TO GEDE NATIONAL MONUMENT AND MALINDI/WATAMU MARINE PARKS

YEAR	GEDE VISITORS	MALINDI/WATAMU VISITORS
1976	23,396	NA
1977	25,801	37,257
1978	29,747	42,232
1979	36,838	48,830
1980	34,088	55,106
1981	NA	47,135
1982	NA	46,608

SOURCE: Central Bureau of Statistics 1975-1981,  
District Game Warden 1983

### 3.12.3 ENVIRONMENT AND TOURISM

Tourism and the environment are related in several ways. The attractiveness of the environment was mentioned above. This section looks at the environmental impacts of tourism and problems related to cultural conflict and change.

Tourists contribute to the exploitation of marine resources. They create a needed market for fish and crustacea, but also damage the coral reefs during swimming and boating or possibly by collecting certain types of shells (see Section 2.5). At present tourists may take upto 5kg. of shells out of the country duty-free. Siltation of the Malindi area is now an established threat to the tourist industry. The beaches could be regularly cleared of debris, but the seasonally muddy water is unsuitable for swimming.

The tourist industry as a whole does not have serious impacts on the surrounding natural areas. Gas and electricity are the main energy sources, although some charcoal is used. Coral building blocks are readily available. Construction of new facilities will continue the present linear development. While this limits access to beaches by the local peoples, the beach front plots are not generally good agricultural lands. Planning for labour lines, staff houses and sewage treatment facilities should be coordinated to avoid the disruptive growth witnessed in Watamu and development of substandard settlements in the second tier of beach plots.

The cultural background of the peoples of Kilifi District have always been diverse--it is an area where 'local people' and 'outsiders' have mixed at least since the 9th Century. The tourists, and the tourist industry, are often seen as the dominating agents in changing the traditional Afro-Arab culture. At one scale tourism is viewed as a microcosm of colonialism, with a well established hierarchy of European-up-country Kenyan-local African Kenyan. At a more personal level there are continued conflicts over nudism, prostitution, muggings, robberies, and the increasing number of young 'beach boys'.

The results of a survey of local attitudes towards tourists yielded some interesting findings (Migot-Adholla et al, 1982). About 550 people were interviewed in the Malindi-Watamu and South Coast areas, drawing from a cross-section of the local coastal residents. The responses included:

- 84% would like to see more tourists come to Kenya.
- 46% felt more tourism would bring more employment, progress and development.
- Of those who did not want tourism to increase only 7% cited an increase in sexual promiscuity as their reason.
- Only about one-fourth reported having a direct interaction with the tourists--through selling crafts, dancing or working in the hotels--over half of the respondents in Kilifi District had never visited a tourist hotel.
- 85% of the Kilifi District respondents had not heard of any conflicts between tourists and local people.
- 45% of the Kilifi District respondents said they disliked the tourists' sexual promiscuity. Almost 50% reported there was nothing disliked.
- 44% of the Kilifi respondents desired work in the tourist hotels (mostly younger respondents with primary education).
- Benefits from tourism were agreed to include: more jobs (87%), pays well (65%), earns foreign exchange (79%), local market for goods (81%), friendship between Kenyans and foreigners (87%) and develops beaches and land for Kenyans (81%).
- Adverse consequences from tourism were agreed to include: best land alienated (68%), increased cost of living (69%), perpetuates colonial dependence (28%), lowers people's morals (50%), increases drug use (33%).

The overall picture, then, is one where a lot of the coastal people have little direct contact with tourists, but in general support the industry. The pace of cultural change is recognized and worrisome, particularly among the elders.

#### 3.12.4 RECOMMENDATIONS

The soundness of the tourism industry in Kilifi District is a major concern. The Malindi airstrip should be upgraded to handle direct international flights. Charter arrangements must be developed, as the Kenyan holiday relies on tour packages. The facilities must be upgraded: this should include upgrading the tourist hotels; improving access and town roads; control of curio stalls; establishment of a museum in Malindi; development of facilities at other historic sites; development of nature trails; daily cleaning of the beaches; development of a marine interpretive centre. These improvements should be undertaken with cooperation between the hotels, traders and government. An extension of the Utalii College should be established at the coast to train more guides and local staff.

The problem of off-season vacancies can be addressed through advertising and development of local tourism, as is currently being promoted by the Ministry of Tourism and Wildlife. Schools, wildlife and science clubs, and other groups should form tours.



It is important that the local peoples of Kilifi District benefit from the tourism industry. More coastal peoples should be trained for top management positions. Access to the beaches and fish landing facilities should be guaranteed and traditional rights of way recognized.

Cultural changes and conflicts will continue, but may be minimized by educational programmes, greater policing of public areas, and perhaps by creating more private, tourist areas. A series of talks on the history, cultures and environment of the coast should be developed and given in the hotels.

Training of personnel in archaeology and conservation should be promoted. Areas of particular scenic or historical value should be identified, preserved and publicized. Research on preservation of monuments should continue.

### 3.13 ENVIRONMENTAL EDUCATION

#### 3.13.1 THE ROLE OF EDUCATION IN ENVIRONMENTAL MANAGEMENT

There is need for people to approach economic development with full awareness and understanding of its environmental implications. This calls for a broad public understanding of alternative courses of action which will enable them to move from the crisis-oriented, remedial efforts to a positive approach which will support the environment and quality of life. Environmental education for the whole public is the most powerful existing force for bringing about this improvement and change. With the growing awareness of environmental problems, efforts have been made in considering the type of educational programmes needed to meet our requirements. Although the content and methodology will vary according to the target groups, the interdisciplinary approach is appropriate because it examines the total environment.

#### 3.13.2 PRIMARY EDUCATION

In primary schools, the science syllabus exposes the learners to an integrated approach to environmental education. It aims to develop the problem solving abilities of children through investigations. However, the introduction of environmental education in social sciences and languages is essential. Whereas there is an adequate environmental component in the primary school curriculum, the following are some of the problems and constraints, which make the delivery of educational services difficult.

The Primary Teachers College curriculum has not focussed on environmental education sufficiently to create the right attitude among teachers toward environmental education. Almost half of the teachers in Primary Schools are untrained (Table 3.21). Untrained teachers are usually C.P.E., K.J.S.E. and Division 4 graduates. Since the requirements for entry into Primary Teachers' Colleges have been raised, these teachers will most likely remain untrained. The large number of untrained teachers may be attributed to the fact that trained teachers posted to Kilifi District find life difficult and transfer to other Districts. Reasons cited include poor transport, which increases

the cost of procurement of essential requirements, lack of teachers' houses and lack of social facilities. On the whole, the number of untrained teachers is decreasing as more teachers graduate and untrained ones are admitted to teachers' colleges.

There is a shortage of office accommodation, personnel and equipment at some divisional headquarters. Lack of transport is a major constraint in the supervision of primary education. Most Parents' Associations in Kilifi are unable or unwilling to put up buildings, buy desks and make other improvements. As a result some children in many schools learn under trees and remain at home during the wet season. This situation is partly responsible for poor C.P.E. results and will adversely affect the preparation for Standard 8 and the expansion necessitated by the rapidly increasing population.

Although there are many schools in the district, they are not evenly distributed (Table 3.22). In areas like Ganze, Bamba, Marafa and Mariakani, children walk long distances to school.

Many parents in remote areas like Ganze do not seem to appreciate the value of education due to lack of job opportunities in the area. In dry areas, enrolment is affected by seasonal migrations, while enrolment for girls tends to be low as a result of early, arranged marriages. The administration is trying to curb this trend.

The water problem is widespread in Kilifi District and it partly affects the turnover of teachers, especially those from outside the district. The inability to harvest rain water, because many houses are grass or makuti thatched contributes to shortages.

Malnutrition is common among children and it certainly affects the effectiveness of learning.

### 3.13.3 SECONDARY EDUCATION

The approach adopted in teaching environmental education in secondary schools in Kenya involves the inclusion of suitable curriculum units within the existing framework of the Kenya Certificate of Education. The main objectives are to promote awareness and understanding of environmental problems and also develop a concern for environmental quality. Among the strategies of incorporating environmental education in the education process which are considered feasible is the re-orientation of subject matter within the normal curricula which is currently undertaken. The following are constraints facing higher and environmental education in secondary schools in Kilifi District.

Except for the Source Book on Environmental Education, there is lack of general guidelines on incorporating environmental education into the education system. With the present examination-oriented system, students tend to narrow their areas of specialisation to a few subjects and do not undertake a comprehensive environmental component. To change this trend their teachers need re-orientation through inservice and pre-service courses.

TABLE 3.21 CATEGORIES OF TEACHERS, KILIFI DISTRICT 1983

PRIMARY SCHOOLS	JANUARY		TOTAL	MAY 'TOTAL
	MALE	FEMALE		
Trained	1003	222	1225	1327
Untrained	831	192	1025	929
<b>TOTAL</b>	<b>1834</b>	<b>414</b>	<b>2248</b>	<b>2256</b>

SECONDARY SCHOOLS	MAINTAINED	ASSISTED*	HARAMBEE/ PRIVATE	TOTAL
Dip.Ed., Graduates	42	1	8	51
Approved	3	-	1	4
S 1	27	2	1	30
'A' Level	-	2	57	59
P.1 'O' Level,				
Others	-	-	7	7

ADULT EDUCATION	FULL TIME	PART TIME
'A' Level, Div. 3	X	
Div. 4	X	X
Failures		X
KJSE, CPE		X

\*At least one teacher supplied by the Teachers' Service Commission

SOURCES: Ministry of Basic Education 1983, District Basic Education Officers 1983, Ministry of Higher Education 1982 (Provisional Figures), District Adult Education Officer 1983

TABLE 3.22 SCHOOLS IN KILIFI DISTRICT 1983

PRIMARY	DIVISION				TOTAL
	KALOLENI	BAHARI	MALINDI	GANZE	
Government	79	54	73	50	256
Private	-	-	1	-	1
<b>TOTAL</b>	<b>79</b>	<b>54</b>	<b>74</b>	<b>50</b>	<b>257</b>

SECONDARY	DIVISION				TOTAL
	KALOLENI	BAHARI	MALINDI	GANZE	
Maintained	7	4	5	2	18
Assisted					8
<b>TOTAL</b>					<b>26</b>

ADULT	DIVISION				TOTAL
	KALOLENI	BAHARI	MALINDI	GANZE	
Full time	27	23	24	14	88
Part time	55	26	42	17	140
Self-help	46	21	61	NA	119*
<b>TOTAL</b>	<b>128</b>	<b>61</b>	<b>127</b>	<b>31*</b>	<b>347*</b>

\*At least this many

SOURCES: Ministry of Basic Education 1983, Ministry of Higher Education 1982 (Provisional figures), District Adult Education Officer 1983, Area Adult Education Officers 1983

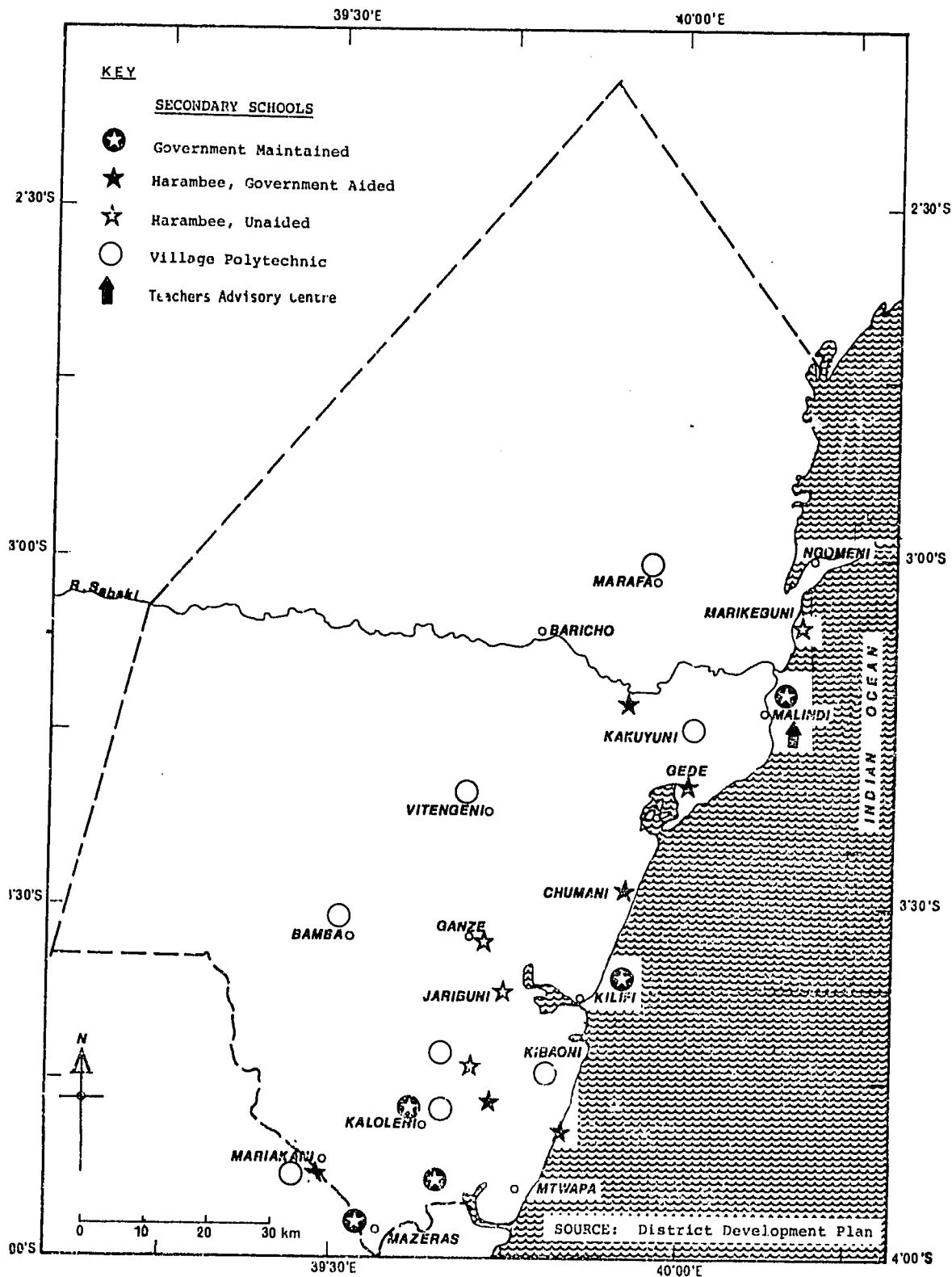


FIGURE 30. EDUCATION FACILITIES, KILIFI DISTRICT

Forty percent of the teachers are either untrained or not qualified to teach in secondary schools. The Harambee and private schools tend to have less qualified teachers than maintained schools (Table 3.21).

The secondary schools are too few to cope with the graduates from 257 primary schools and the rapidly increasing population (Table 3.23). Many of these schools are located in Kaloleni Division. Generally students face the problem of walking long distances to school (Figure 30).

Most schools do not have the major physical facilities due to lack of funds for expansion, maintenance and purchase of equipment. There is also lack of support from parents through parents associations.

There are fewer girls than boys in secondary schools, due to early marriages (Table 3.23). A large number of women may not benefit from the environmental education offered to schools.

#### 3.13.4 ADULT EDUCATION

Many of the problems to which environmental education addresses itself today are traceable to adults. These problems include: soil erosion, poaching of wildlife, charcoal burning, over exploitation of marine resources and deforestation. Environmental Adult Education should, therefore, be seen as a continuous life-long process and a tool to enable adults to understand the complex nature of the environment gain skills and which will help them solve their day to day problems.

According to the First Quarterly Report of 1983, the enrolment in Adult Education Centres was 15,452 (Table 3.23). Although the enrolment is large, attendance is irregular and low. This situation is a result of an interplay of factors outlined below.

The most important drawback is the fact that most people have not accepted illiteracy as a problem because there seems to be no immediate use to them of literacy, i.e. jobs on completing their courses.

There is a shortage of essential materials such as books. This problem arises partly from the hurried planning prior to the onset of the programme, especially in relation to supply of equipment and partly from shortage of funds. Learners, on the other hand, are unwilling or in some cases, owing to the low economic level of the area, unable to buy books or pens to supplement available material.

The number and distribution of adult education centres is determined by the distribution of population and the availability of teachers. According to the number of literacy centres, the divisions rank as follows: Kaloleni, Malindi, Bahari and Northern (Table 3.23). The drier, poorer areas are not well-served. There are three types of centres:

- Full-time centres, whose teachers are on government payroll,
- Part-time centres, whose teachers are paid honoraria of KSh 150 per month, and
- Self-help centres, which are assisted with material only.

The teachers work on voluntary basis. The total number varies according to availability of teachers.

The part-time and self-help teachers have no background in the methodology of teaching (Table 3.21). These teachers are interested in their work as long as there is a hope of being appointed on permanent terms. Otherwise they leave, causing a high turnover rate characteristic of these centres. This is a serious problem affecting adult education because some 70% of the centres are either part-time or self-help.

There is a generation gap between the learners and teachers which calls for tact on the part of the teachers. This is usually lacking, since most of the teachers are untrained and operate on near-voluntary basis. On the other hand supervision of such teachers is difficult, partly because teachers are not paid and partly because supervisors do not have facilities to enable them to carry out effective supervision.

In order to increase the level of attendance and effectiveness of learning, several steps have been taken. Classes are held between 1 p.m. and 6 p.m. This flexibility enables teachers and learners to choose suitable times. A project has been started for the production of low-cost teaching materials at Matuga District Development Centre. Writing of relevant local materials, e.g. Tegemeo la Pwani, is being promoted. Full-time teachers received a 2 week Induction Course in 1979. This course is supplemented by the Radio Correspondence Courses produced by the Department of Adult Studies, University of Nairobi.

### 3.13.5 RECOMMENDATIONS

#### General

The Ministry of Education, Science and Technology should formulate a clear policy on the integration of environmental education at all levels of the education system.

The Inspectorate should work out a system of supervision and evaluation to ensure environmental education is taught through an interdisciplinary approach in all schools.

All examinations should emphasize environmental education.

The Kenya Institute of Education should revive and strengthen the environmental education panel.

Kenyan professionals and authors should be encouraged to write books and other reading materials on current environmental issues for use both in the formal and non-formal systems of education.

TABLE 3.23 SCHOOL ENROLMENT IN KILIFI DISTRICT, 1983

	MALE	FEMALE	TOTAL
PRIMARY	56,978	34,371	91,349
SECONDARY SCHOOL			
Form I - IV	3,066	1,146	4,212
Form V - VI	158	-	158
TOTAL	3,224	1,146	4,370
ADULT EDUCATION	3,672	11,780	15,452

SOURCES: District Basic Education Officer 1983, Ministry of Higher Education 1982 (Provisional Figures), District Adult Education Officers 1983

Existing institutions like the University and Teacher Training Colleges should be encouraged to get involved in the production of low cost teaching aids and materials.

Environmental education should be included in pre-service and inservice teachers courses.

Where possible curriculum developers and school inspectors should be encouraged to keep track of trends in environmental education by attending short courses, international seminars and workshops.

An environmental education seminar kit should be developed.

There should be more programmes on radio and television and feature articles in newspapers to increase awareness of environmental issues among the public. Short segments and slogan should be included between regular radio and television shows.

#### Primary Education

The Teacher Advisory Centre (TAC) in Kilifi District, together with the National Environment and Human Settlements Secretariat should develop an environmental education programme for the TAC's services.

The role of Education Officers is important, and they should be encouraged to participate in environmental education programmes.

#### Higher Education

Students should be encouraged to have an Environmental Study Area near their schools, using guidelines to be prepared by the National Environment and Human Settlements Secretariat.

Because environmental awareness is promoted through extra-curricular activities such as wildlife clubs, scouting, 4-K clubs and girl guides, schools should be encouraged to organize and run more clubs. Club activities should be competitive for more recognition.

## Administrators

Formal in-servicing at the Kenya Institute of Administration, Farming Training Centres and other training institutions is recommended for policy and decision-makers including politicians, K.A.N.U. officials, senior public servants, and members of the D.D.C.

Informal education programmes and seminars should be organized locally for top planners, civil servants, members of the D.D.C. and top personnel in the private sector to discuss major issues in the district, such as the effect of settlements schemes on forests. National Environment and Human Settlements can assist in organizing such seminars once its regional offices are established.

## The Public

Administrators should create environmental awareness and concern among the public (through barazas), more so in the rural areas where divisional and locational teams influence the environment in their daily duties.

Programmes should be developed to introduce and strengthen the environmental component in the activities of organizations such as the National Council of Women, women's religious organizations, co-operative societies, trade unions, the Agricultural Society of Kenya and Government extension programmes.

Support should be given to the development of environmental exhibitions and shows.

Research findings on environmental issues should be made available to the public through libraries, village polytechnics and district data centres. Pamphlets in Kiswahili, on selected themes can be used to reach a wider audience.

There should be more slogans in Kiswahili on radio, and feature articles on environmental issues in Sauti ya Pwani. NEJSS should coordinate with the Ministry of Information and Broadcasting to utilize the mobile film units.

### 3.14 DEVELOPMENT ADMINISTRATION

Development is the interaction of two sets of activities: private initiatives to promote individual and group welfare, and government programmes and resources applied in various sectors. Critical to both activities is development administration - how initiatives are organized, promoted and implemented. The recurrent problems of misallocation of funds, poor co-ordination, lack of manpower, and lack of incentive must be taken seriously if development is to succeed.

#### 3.14.1 SELF-HELP MOVEMENT

Thirty percent of the national development can be attributed to self-help spirit (Mbithi 1974), and especially so in the rural areas. People make contributions of funds, labour and in kind to identified projects. When a project has been initiated the Community Development Officer approaches the District Development



Committee which decides which projects should be assisted. The Government, through the annual allocation of funds, sometimes in collaboration with national and international organizations, provides both technical and financial support.

The self-help movement takes a low profile in Kilifi District. Illiteracy, coupled with low incomes and lack of income-generating activities, contributes to the low level of participation, even in the existing groups. However, the movement is becoming popular among women and Rural Youth Clubs based at primary and secondary schools. By the end of 1982, there were 74 active women groups and 75 youth clubs which were used for expansion and extension of agricultural technology in the District (see Appendix 6.7). Though agriculture is the main activity among these groups, they operate in several areas:

- Agricultural/Economic Projects - keeping goats, cattle and poultry; growing vegetables; and operating bakeries.
- Water Projects - operating water kiosks.
- Educational Projects - construction of Harambee secondary schools, village polytechnics, nursery schools and adult education centres.
- Environmental projects - tree planting and soil and water conservation.
- Housing and Home Improvement Projects - some women groups put up rental houses in the major centres while others try to improve the standards of member's homes either by roofing with iron-sheets or erecting permanent buildings depending on availability of funds.

All these activities have made some measure of success amidst a host of problems and constraints.

Membership in women's groups is low and coupled with low incomes in the District, it is difficult to accumulate funds for projects. The few donors, like C.A.R.E. and the E.E.C. have enhanced the movement, but more funds are needed for greater success.

Women groups concerned with rental houses have problems in acquiring plots. The local authorities either refuse their applications or give stringent conditions difficult to meet. In a community where a woman's place is in the kitchen, women have to get permission from their husbands to join such social groups. Permission is seldom granted, especially among the Muslim community.

Low level of education in any society is a stumbling block to development. The more educated a society, the easier it becomes to introduce policies and projects or any type of change.

Lack of transport facilities for the Government extension workers makes it difficult to follow-up on-going projects and to meet the various groups to provide advice and supervision.

3.14.2 CO-OPERATIVES

The Co-operative Movement in Kilifi District started in 1958 when three multi-produce primary societies were established. Rapid development of the movement occurred during the period 1958-70 when most of the existing societies were formed. To-date, co-operative development has lagged behind other parts of the country due to the less well-developed agriculture and the inadequacy of the Ministry of Co-operative Development promotional and support activities.

Most of the primary societies are agricultural, formed by farmers to counter exploitation by middlemen. Through their societies, the farmers are able to bargain for better prices and at the same time stabilize the price mechanism. Loans from the Government and other bodies are channelled to the farmers through the societies.

At present, there are 40 Co-operative (Primary) Societies and one Union, the Kilifi District Co-operative Union (Table 3.24). Appendix 6.7 shows the distribution and membership of the societies.

TABLE 3.24 CO-OPERATIVE SOCIETIES, KILIFI DISTRICT, 1983

<u>SOCIETIES</u>	<u>NUMBER</u>
Farm Produce Societies	15
Savings and Credit Societies	13
Fruits (Mangoes and Pineapples)	2
Dairy Societies	3
Artisan Societies	3
Fishermen Societies	2
Consumer's Societies	1
Ranching	1

SOURCE: District Co-operative Officer 1983

The membership in the societies ranges from 20 to 1865 members, giving a total of approximately 15,000 members for all the societies in the District. Of the 40 societies, only 33 are fully active. Msumarini Ranching Farmers' Co-operative is only provisionally registered. The Consumer's (Mtwapa) Co-operative Society was liquidated in 1982. The Society had no assets and members took goods on credit and never paid for them. Posland Savings and Credit Society is dormant, while the Churches Savings and Credit Society is in liquidation. The three dairy co-operatives have been dormant for the past ten years or so. They were affiliated to the Kwale/Kilifi Dairy Co-operative Union which operated mainly in Kwale and has yet to pay the societies over KSh.400,000. This debt owed to the societies was the major reason why they stopped delivering their milk to the Union. There is no other Dairy Union in Kilifi to cater for them. Revival attempts by the D.D.C.U., Ministry of Agriculture and Livestock Development and Kenya Co-operative Creameries have been futile as the farmers insist on being paid first.

Most of the societies have homogeneous activities. The farm produce societies handle cashew nuts, copra and sesame. Only two societies out of 15 have secondary activities. There are two bodies to which the societies are affiliated. Primary societies handling farm produce are affiliated to the Kilifi District Co-operative Union (KDCU) while the Savings and Credit Societies are affiliated to the Kenya Union of Savings and Credit Co-operative Organizations (KUSCCO). The Artisan Societies operate under the auspices of the K.D.C.U. though they are not affiliated to it.

Co-operatives in Kilifi District have an array of problems most of which are inherent in the size of the co-operative. Most of the societies, and especially in Kaloleni Division are too small with a minority of members having paid-up shares. As a result there is a lack of working capital for the societies and even for the K.D.C.U. The societies are weak and unable to provide transport and storage facilities for themselves. Although the movement has a monopoly over marketing scheduled crops, most of the copra is smuggled to private millers in Mombasa. The co-operatives pay copra farmers twice per week, while the private millers pay cash on delivery.

Illiteracy and lack of knowledge about co-operatives coupled with lack of properly selected and trained Ministry of Co-operative Development (MCD) staff has led to mismanagement of the societies, including poor accounting and auditing.

Disloyalty of members to their society and loan-giving agencies is a major problem affecting the development of the movement. Members are known to sell produce, especially copra and fish, to private buyers instead of their societies, thus affecting the performance of the movement. Dodging and delay of loan repayment is a common practice among members with the result that granting of more loans becomes impossible.

Weather conditions, especially in the dry areas, adversely affect produce of the societies and the ability to repay loans. The homogeneous nature of activities also becomes a problem, especially when there is not enough or too much rain and the societies are unable to generate any income. Lastly, the M.C.D. is unable to supervise and monitor the societies effectively due to lack of transport facilities.

The Ministry of Co-operative Development, has embarked on certain programmes aimed at solving the problems and enhancing the movement. It is trying to get loans and grants from the Co-operative Bank and the Government to facilitate construction of stores and provide transport facilities. Godowns have been put up at Rabai and Chonyi and others are planned.

Amalgamating smaller societies into large ones has not been very successful as every society wants to exist independently. At present Kayafungo and Kaloleni societies are in the process of being amalgamated. The move has to be initiated by members, not in M.C.D. and the process is quite slow.

Intensifying education to members and the Ministry staff is done through barazas, seminars for committee members and ministry staff, and members' day when all members are supposed to attend.

Trying to broaden the activities of the societies has been achieved with Kaloleni F.C.S. which now keeps poultry. Plans also exist for Kaloleni and Kilifi F.C.S. to sell makuti as a subsidiary activity. The M.C.D. also encourages investments in commercial fields. The K.D.C.U. has bought the Sindbad Hotel for KSh.3.8 million and owns KSh.8.3 million of shares in Kenya Cashewnuts. The profits from these investment should be ploughed back into the societies to reinforce their operating funds.

On disloyalty of members, the K.D.C.U. is enlisting the help of the Provincial and Local Administration to curb smuggling of copra and illegal sale of farm produce. These efforts have not had much success, especially for the fishermen societies. Both are situated in urban areas (Kilifi and Malindi) and the Kilifi County Council and Malindi Municipality have no guards to enforce the by-laws.

### 3.14.3 DISTRICT ADMINISTRATION

Development administration is the responsibility of the Government. Although initiatives also come from the local people, it is through the District Development Committee that proposed programmes are planned, coordinated and implemented, and necessary research authorised. The D.D.C., chaired by the District Commissioner, is composed of heads of the various ministries and departments within the district, representatives from parastatal bodies and political and local leaders. Representatives from provincial offices and development authorities are also included.

Government funds are channelled through development grants and rural development funds. Projects in Kilifi that have benefited from these funds include cattle dips, water dams, rural access roads, women's groups, soil conservation and crop demonstrations. The 1984-88 Kilifi District Development Plan has given priorities to health, education, water, electrification and fisheries.

Several provincial organizations assist the district staff. The Kenya Marine and Fisheries Research Institute, situated in Mombasa, has the task of researching the ways and means of increasing and preserving Kenya's marine resources. At the Coast, they have a new facility at Nyali and two dozen professional officers although more trained senior researchers are needed. Many recent projects were reported in their workshop in July 1981 on aquatic resources of Kenya.

The Coast Agricultural Research Institute at Mtwapa, Mariakani and Msabaha (Gede) serves the whole of Coast Province. Their main research projects are aimed at coming up with breeds of crops that are favourable to climatic conditions of the region as well as increasing yields. The Coast composite maize, pigeon peas, cow-peas, sunflower, castor oil, velvet beans and mangoes are some of the crops under study. Unfortunately, the Mtwapa site is rather unique in its soils and climate, thus the results cannot be easily extended to other parts of Kilifi. The new Coast Agricultural

College will also assist in promoting agricultural development.

The Tana and Athi River Development authority has begun plans to develop the Athi River system. Their recent review of Kilifi District is a good step in providing assistance to the District. Although centred in Nairobi, they are members of the D.D.C.

#### 3.14.4 EXTERNAL ASSISTANCE

The Kilifi economy, particularly in the rural areas, has not been geared towards income generation and there is a lack of funds for self-help projects. Therefore the activities of the private sector, non-governmental organizations (NGO), private voluntary organizations (PVO) and international donors are important in developing the district. Many of these activities are local projects on a small scale, although larger programmes operating through central government departments have also been implemented.

NGO groups working in the district include Maendeleo ya Wanawake (social welfare projects aimed at uplifting the standards of living of their member groups), and East African Women's League (nursery schools, family life education, school for the deaf and financial aid to disabled members).

International donors have provided assistance in several large projects. The Food Agricultural Organization/United Nations Development Programme has an experimental project on prawn culture at Ngomeni. C.A.R.E. and E.E.C. (women's groups and social welfare projects), Peace Corps (water projects). The Australians have assisted the Magarini Settlement Project. Several settlement areas south of Malindi have received technical assistance from the GTZ. The European Economic Community has assisted women's groups and the livestock sector. Other donors on smaller projects include USAID, World Bank and the Netherlands (through their Training Project in Pedology).

The tourist industry is the largest private investor in the district. Hotel-keepers and tour operators have recently been responsible for improving the roads in Malindi. The private sector also plays a leading role in marketing, transportation and provision of goods and agricultural inputs.

#### 3.14.5 RECOMMENDATIONS

##### Self-Help Movements

Emphasis should be placed on Adult Education Programmes. Women who excell in this programme should be employed as social workers after attaining a certain grade. This will make it easy for them to work and command influence among women in their villages and neighbourhood and also serve as an incentive to others to enroll in the programme.

Local administration (chiefs, sub-chiefs and elders) should be used extensively. Since they are members of the same community they command a larger audience than extension workers who are most often than not, "outsiders".

The education division in the Department of Social Services ought to work out a comprehensive training programme to encompass the various social groups, local leaders and even schools where future leaders and parents are being trained. Political leaders should attend seminars to be persuaded to shoulder and try to eliminate the problems of their electorates.

The Ministry of Culture and Social Services should use motorcycles in their extension work. Due to poor transport facilities in the District, the majority of the people are not easily accessible.

### Co-operative Movements

The existing programmes of the M.C.D., if implemented, would achieve greater success for the Co-operative Movement in the District. However, certain measures and recommendations need to be emphasized.

Most of the societies, being too small, cannot operate economically. Whatever the case against amalgamation of smaller societies into larger units, secondary organizations are needed to solve the problems facing individual societies. After all, most of the primary produce societies deal in the same commodities, viz. cashewnuts, copra, and sesame. The Ministry of Co-operative Development should use the K.D.C.U. to make members appreciate the need to create strong organizations. The merging of Kayafungo and Kaloleni F.C.S. should set an example to other societies, as such its success is important. It is easier to supervise a few large units than many small units which are far apart.

The necessity of having proper accounting and recording system developed and implemented is strongly emphasized as the existence of such systems are fundamental for the other activities to be successful.

Co-operative education is necessary in strengthening the loyalty of members to their societies and to make them realize the advantages offered by membership in co-operatives. The education division of the M.C.D. should establish an education activity within the Union. A comprehensive training programme to suit the needs of societies in Kilifi District should be worked out. Local courses on standardized accounting, recording, management systems and improved methods and equipment of production should be intensified for recorders, secretary managers and Union staff.

The K.D.C.U. must find an efficient marketing system and subsequent payment to farmers so as to discourage members from selling their produce outside their societies, thereby making it difficult for recovery of loans and credit extended to them.

The Artisan Societies working with wood should be made to plant and maintain tree plantations. The economic gains should not override the environmental implications of continued use of wood without replenishment.

P A R T I I I

SUMMARY AND RECOMMENDATIONS

4.0 STATE OF THE ENVIRONMENT IN KILIFI DISTRICT

4.1 THE ENVIRONMENTAL PERSPECTIVE

This report describes Kilifi District from the perspective of Environment. Environment is a term which is frequently defined as "the totality of life support systems; the world around us". It is indeed a large word, for there is little in the universe that could not be subsumed under its umbrella. However, the word environment, as it is commonly used, connotes a perspective on development that is more limited. Environment, in this sense includes four elements:

- The notion that there exists a way of life, that "everything is connected to everything else". The concept of an ecosystem of organism and materials connected by various processes is important in analyzing the effects of development.

- The goal of balancing preservation, conservation and utilization. Some resources are so scarce and so valuable that they must be preserved in such a manner that resources are conserved for their long-term utilization.

- The caution that environmentally-sound planning should anticipate the negative effects of development and strive to reduce them or mitigate their consequences. Prevention is safer and less expensive than subsequent repairs.

- The realization that environment is ultimately the responsibility of the people. Therefore development must proceed with the full participation of the peoples involved, and in such a manner that its benefits and costs are distributed equitably.

Kilifi District like many in Kenya, is one of great variety. The rich environmental patterns present a challenge to the District's inhabitants, and the planners who will attempt to guide the District's development over the next decade.

Overlain on the natural resources - stretching from the coastal plain and marine resources to the arable uplands and the dry hinterland - is a diverse set of economic activities developed over many centuries of human occupancy. The details of the Kilifi environment are presented in the first three chapters of this report. Below is a summary of the main features of each division an analysis of the dominant trends in natural resources and the human environment. While specific recommendations are suggested in chapters two and three, the final section proposes several policies that deal with the holistic environment - the foundations and surroundings of human activity upon which life depends.

#### 4.2 ENVIRONMENTAL TRENDS

##### 4.2.1 KALO LENI DIVISION

The southern division of Kilifi District is the most densely populated, with most of the land under cultivation. The area has a medium to high potential for agriculture and livestock. Tree crops dominate the landscape. Several dairy projects have been initiated over the years.

Population growth has led to visible pressures on resources in the Division. The proximity of neighbouring farms has led to a ban on burning fields in preparation for planting. In this area people are already eager to plant trees, as they can see the natural supply fo building poles dwindle.

The natural forests in Kaloleni have virtually disappeared except for a few remaining Kayas. Even these are being cleared for cultivation, firewood and charcoal and building poles. The loss of forest cover may affect soil erosion, water supplies, as well as reducing the diversity of species available for medicinal and other uses.

Problems of human settlements are pronounced - inadequate housing, poor sanitation, lack of improved roads, unimproved water supplies, poor educational standards and facilities. However the people are relatively better off than in other rural areas in the district and improvements are being made. Piped water from the Mzima and Sabaki pipelines will be available in many areas in the next few years.

Agricultural development has been slow due to conservatism of the people. With adequate extension services (inputs & expertise) and improved markets and transport much improvement can be expected.



#### 4.2.2 GANZE DIVISION

The northern division of Kilifi District is very sparsely populated, with much of the area occupied by ranching activities in the dry hinterland. The group ranches have protected the inhabitants' land tenure, but have not converted the area to productive rangeland. A few of the private and commercial ranches are doing reasonably well. The chief constraints are management, water supplies and disease control. Rotational grazing is needed to allow regeneration of grasslands and control erosion.

In the coastal hills agriculture could be considerably expanded, although shortening the fallow period will require intensive soil management. Expansion of the agricultural land will reduce the natural forests. In addition to Arabuko Sokoke Forest, Division is a major source of charcoal sold in Mombasa, the further deforesting the area. It is not too early to adopt more stringent controls and to require replanting of the charcoal source areas.

The Division is rather poor. Only one of the District's 16 large-scale industries is located in the Division. Lack of roads and markets hamper rural development. Most of the Division is inaccessible during the rains.

Piped water from the Sabaki Pipeline is encouraging migration to the communal drawing points. This shift in the rural population may have important environmental impacts.

While many improvements have been made, much more is required to provide adequate infrastructure of water, housing, education, urban centres and markets and health facilities.

#### 4.2.3 MALINDI DIVISION

Aside from Malindi Town, the Malindi sub-District remains predominantly a traditional ranching area. Aside from the coastal strip the Division has few roads, and most of them are not serviceable in the wet season. Group ranches have been proposed in three places, but are not near to being registered. The Magarini settlement project has provided assistance to small-holders in the area. With improvements in roads and infrastructure, markets in Malindi and Mombasa could be established. Poor housing conditions, few schools and lack of water are other problems in the rural areas.

The coastal strip of Malindi Division is relatively well off. Adequate services are available for transportation, water and communication. Urban pressures in Malindi Town are increasingly severe. Squatter settlements, waste disposal, health facilities and the urban roads all need attention.

The marine resources of the Division are notable, but currently endangered by siltation from the Sabaki River. The marine parks and reserves are slowly being degraded from siltation, shell collecting and mechanical damage to the corals. The prawn culture experiment has demonstrated the potential for mariculture - but at a significant cost to the district's dwindling mangrove forests.

Coastal tourism is a major land use and economic activity. However it has also meant conflicts over local values and traditions.

#### 4.2.4 BAHARI DIVISION

Much of Kilifi's development has been concentrated in the coastal Central Division. The land is divided between large estates, growing sisal and cashewnuts and raising cattle, and small-holder areas, including several settlement schemes. The proximity to markets, good infrastructure and reasonably productive land contribute to a favourable development potential. Poor soils, erratic rainfall, and wildlife damage near the Arabuko Sokoke Forest are constraints.

Land tenure is complicated by title deeds held by absentee, and in many cases unknown, Arabs and Indians. The resident squatters are unable to secure loans for development of their plots.

#### 4.3 PROPOSALS FOR ENVIRONMENTAL MANAGEMENT

Environmental management is an attitude towards development which takes into account the negative impacts of certain changes, seeks to preserve environmental resources and balances the costs, and benefits of development. Several broad policies are suggested below which would meet these objectives.

##### 4.3.1 PRESERVATION, CONSERVATION AND DEVELOPMENT

Distributed throughout the District are many small areas with special environments - Kaya forests, patches of swamps or grasslands, and coral gardens. The traditional approach toward conservation has been to establish large reserves or parks. Yet often these parks are developed in a way which changes their natural environment. The Kayas demonstrate that even very small areas can be preserved in their natural state. Ways and means must be found of extending throughout the district this model (Figure 25). One of the requirements may be to secure title deeds as county council reserves or national monuments. But management and preservation of the localized areas must ultimately rest with the local residents. Benefits from tourism should go toward projects in the area. Schools can use natural areas as study sites. Special development projects might be initiated to demonstrate how conservation and development are partners. For instance rather than cutting a natural forest for charcoal, a cooperative could be established to plant fast-growing trees and make charcoal with improved kilns.

#### 4.3.2 MARINE RESOURCES

The balance of conservation and development appears to be dangerously tilted in the management of the District's marine resources. The importance of the coral reef to the coast is beyond doubt. Three policies seem necessary at present.

- (1) The export trade in shells should be strictly regulated, particularly for the shells most important to the reef ecology.
- (2) The existing marine reserves, in particular the coral gardens, must be more stringently protected.
- (3) To balance the severe pressures on the inshore fisheries a system of closed areas and seasons should be coupled with a concerted effort to improve local fish farming methods.

#### 4.3.3 DRYLANDS

In the dry areas of the District, enhancement of water supplies must be coupled with improvements in range management. Thoughtless provision of boreholes will lead to another Sahelian drought experience, where animals died of hunger, not thirst, because they had trampled all the grass within a hundred kilometres of water points. Some sort of rotational (nomadic) grazing and seasonal or drought-year destocking is necessary to increase the overall productivity of the drylands. Experiments in game ranching and controlled hunting should be encouraged.

#### 4.3.4 AGRICULTURE

In areas with notable agricultural potential, the chief aim of development should be the provision of improved transport, local sources of inputs, a reliable marketing network and timely extension advice. Given the variability of soils and climate in the District, the agricultural research centres should develop an extensive approach - to demonstrate modest improvements, on farms, in many areas, over several years. The participation of the farmers is of prime importance.

#### 4.3.5 WATER AND HEALTH

The programme of rural water supply should be accelerated and expanded. Since water is crucial to the environmental health problems in the District, cooperative teams should be organized. When water supply point is planned, opened or inspected a health educator, water quality inspector and water technician should be involved to demonstrate how to protect the water and improve sanitation and health.

In general, the widespread diseases cannot be cured in hospitals or health centres - a vigorous rural educational programme is needed. Pollution of rivers and water points should be more rigorously monitored.

#### 4.3.6 ENVIRONMENTAL EDUCATION

Environmental education is indeed the foundation of creating an environmental ethic in the District. The target populations are many, including the District officers and politicians as well as wananchi. Training courses and curricula are important, but equally necessary are sites where people can see demonstrated sound management techniques or the consequences of development without considering the environment implications. A system of environmental study areas should be initiated through the secondary schools.

#### 4.4 SUMMARY AND PRIORITIES

It is difficult to reach consensus on which actions to improve the environment should have first priority. The Kilifi District Development Plan for 1984 - 88 recommends that development emphasize agriculture, including food production and agro-industries for local and export markets, and conservation of forests. To these two priorities should be added resolution of land tenure problems and conservation of coastal marine resources. Other sectors which should be included are health, tourism, industry, transport and energy.

5.0

KILIFI WORKSHOP SUMMARY AND RECOMMENDATIONS

5.1

WORKSHOP SUMMARY AND PLAN OF ACTION

This section is a summary of the Kilifi Workshop held in Malindi from 13th to 16th March, 1984 to discuss the major environmental problems facing the district. Proper management of the environment results from planning which aims at striking a balance among preservation and utilization and the realisation that the environment is ultimately the responsibility of all the people.

The two distinct aims of the Workshop were:-

- (i) To increase awareness among participants of the environment - what it means, why it is important and how to include it in the development. This was achieved through general tasks and discussions, slide and film shows.
- (ii) To formulate a concrete plan of action in a limited number of areas and make proposals for their implementation.

The five main areas of discussions were: environmental education, marine resource conservation, terrestrial resource management, environmental problems of urban areas and environmental health.

## I ENVIRONMENTAL EDUCATION

The major environmental problem in the district is the prevailing general lack of awareness among the local population and where this awareness exists, there is lack of commitment.

At the moment the Ministry of Education Science and Technology is making efforts to incorporate environmental components in most subjects, especially science subjects at secondary school level and social studies at Primary school level. In spite of these efforts, it was noted that the schools Inspectorate alone cannot possibly run a system of supervision and evaluation that would ensure that environmental education is taught in schools due to manpower constraints.

It was also recognised that some action had already been initiated in reviving the Environmental Education Panel and that the Kenya Institute of Education should take immediate steps towards reviving and strengthening the panel.

### Recommendations on a general level

- (1) The National Environment and Human Settlements Secretariat in co-operation with the Ministry of Education Science and Technology, should play an active role in ensuring the infusion of environmental education at both primary and secondary school levels. It was also resolved that NEHSS should invite education officers and Inspectors of Schools to future seminars on environment and development.
- (2) A concerted effort in the reinforcement of the process of attitudinal change was advocated. This would be effectively started with the motivation of teachers at all levels as well as the parents who would in turn impart it to the children. This should be an immediate and continuous process.
- (3) Questions emphasizing environmental aspects should be prominently included in national examinations.
- (4) Bearing in mind that locally written books and other literature on current environmental issues are necessary, it was recommended that potential authors be encouraged. Inspectors of Schools can effectively achieve this by actively involving themselves in recommending such authors. Payment of honoraria would encourage writing of literature.
- (5) Environmental topics could be incorporated into calendars such as the ones produced by the Ministry of Tourism and Wildlife. NEHSS should look into the possibility of producing a NEHSS calendar.
- (6) NEHSS in conjunction with the Kenya Institute of Education (KIE) and School Equipment Production Unit (SEPU) should produce an environmental kit. NEHSS will compile an environmental slide kit based on Kilifi District.
- (7) Policy makers should appreciate the importance of participation in environmental courses and seminars. On the same token, education Officers from NEHSS should attend all seminars organised on environmental aspects at district and local levels. Short seminars, of preferably one day duration, were considered ideal.

NEHSS should endeavour to maintain itself in the mailing list of International Environmental Organisations.

Specific Recommendations on Kilifi District

- (8) On primary education the group requested the local Teachers Advisory Centre (TAC) to incorporate environmental components in their activities. TAC will provide the necessary input e.g. posters and booklets. TAC will liaise with the Office of the District Education Officer (DEO) over this and in future they will organise seminars involving relevant organisations, local authorities, and teachers. NEHSS agreed to organise a seminar at local and district level.
- (9) For secondary education level, NEHSS was encouraged to produce guidelines on the setting up of an Environmental Study Area. It was then agreed that recognition ceremonies be organised for prize-giving. The TAC could organise competition among schools while special certificates preferably endorsed by Director of NEHSS, could act as an incentive. Such activities could effectively be carried out during the World Environment Day i.e. every 5th June at District and Divisional level. It was agreed that budgeting aspect of this exercise be channelled through NEHSS.
- (10) The adult education section should be provided with services and facilities to assist in environmental education and training. Such services should include visual aids of land degradation in educating adults, local councilors, and organised excursions for elders to environmentally degraded examples. Total mobilisation of individuals or groups who can contribute to environmental education is absolutely essential. It was considered that the dissemination of proper environmental education and administrators was vital and that formal inservice training should be encouraged in all Government Training Institutes.
- (11) Taking note of the vital role the public plays in environmental degradation, it was recognised that there is dire need to create awareness among the public through mass media radio, T.V., pamphlets, films, barazas, shows etc. The members also endorsed the idea of mobilising traditional healers who enjoy a high credibility among the people of Kilifi. Such healers would be persuaded to desist from using mystique language and use environmental language. It was suggested that paying such traditional personalities e.g. the famous Kajiwe could be considered.
- (12) Kiswahili pamphlets on the environment which are being prepared by NEHSS will be sent to the district. Kiswahili should also be used in disseminating research findings especially for materials destined for local libraries.
- (13) NEHSS was asked to approach religious organisations, the National Council of Churches of Kenya (NCCCK), mass organisations such as Kenya National Union of Teachers etc. to persuade them to preach the 'gospel' of environmental watchfulness and management.
- (14) Use of appropriate environmental slogans in local dialects over the radio was recommended. Such slogans can also be printed on the wrappers of popular or essential commodities e.g. match boxes, salt, milk etc.
- (15) Public Officers in charge of information were asked to help increase environmental awareness through one or two minutes environmental slogans over radio before for example school broadcasts and radio news, and by the District Information Office reporting speeches of the Minister and the Director of NEHSS in the Sauti ya Pwani Newspaper (Participants were encouraged to present articles to the Newspaper)

- (16) The planned wildlife clubs of Kenya education centre at Casuarina Point in Malindi will be useful in the promotion of environmental education.
- (17) Extension workers should follow-up public activities e.g. seedlings planted to ensure they attain their ends.

Additional Suggestions:

It was suggested:

- (1) That a set of slides prepared by NFHSS on Kilifi to disseminate information on environmental education be given to the local Advisory Centre, and that the number of TAC's in the District be increased. Currently there is only one.
- (2) Home visits by field visitors should be encouraged and be made to inject environmental aspects in their work e.g. in family planning.
- (3) Environmental awareness should be provided for managers and industrialists.

II MARINE RESOURCE CONSERVATION

Shell Trade

Shell collection poses a serious problem because killing of shell animals leads to an imbalance in the reef ecosystems. The Fisheries Department tries to resolve the problem by restricting the issuing of licences to shell collectors. However, the shortage of personnel to patrol the coastline is a major constraint.

Recommendations

1. The collection of the Triton shell (*Charonia tritonis*) the Red helmet shell (*Cyraecassis rufa*) and the Porcupine fish should be banned as these are natural predators of the crown of thorns star fish.
2. The shell export trade should be banned, since most of the shell traders and collectors have other means of livelihood.
3. Expatriate researchers should be required to leave full documentation of their research findings in Kenya for future reference.
4. A monitoring programme initiated by Kenya Marine and Fisheries Research Institute (KMFRI) and the Fisheries Department should step up work already underway on species diversity and population to marine fish shells.



## Oil Pollution

It was noted that although oil pollution is not yet a major problem, oil spills within a distance of 370 km (200 nautical miles) of the coastline are likely to affect the entire coastline. However, in major oil spills, the Kenya Ports Authority (KPA) have facilities such as the crafts to skim the oil and oil "booms" to contain the oil for cleaning using dispersants. However, caution should be taken in the use of dispersants, which are chemicals that may be deleterious to marine life if used in large quantities.

## Recommendations

1. In the case of major oil spills, there is need for co-operation between the local authorities in Kilifi District and the KPA.
2. Tarry lumps if sighted by local people or hotel staff, should be collected and burnt in perforated drums.
3. Support is required for the KPA oil spill contingency plan and assistance be solicited when required from E.A. Regional Seas, Protocols and Convention, TOVALAP and Law of the Sea convention.
4. Local materials such as coconut husks, palm fronds and seagrass can be spread on lower ends of beaches to prevent oil spill reaching the beach before anti-pollution team arrive to carry out oil cleaning exercise.

## Siltation

Siltation is a problem which can have devastating effects on marine life in the long run. It has its genesis in the hinterland, mainly caused by poor agricultural practices.

## Recommendations

1. The mouth of River Sabaki should be dredged so that the silty water is taken further out into the sea.
2. Soil conservation practices upcountry should be encouraged and the planting of crops on the Athi/Galana/Sabaki river bank should be stopped.
3. Tana/Athi River Development Authority (TARDA) /should plan development projects along rivers e.g. dams, to reduce rivers speeds.

## Fisheries

The fishing in Kilifi District is dominated by small scale fishermen who do not have modern facilities e.g. large mechanized boats to enable them to venture into deep sea). This therefore results in overfishing of the inshore areas.

### Recommendations

1. The Commissioner of Lands be asked to reallocate land for purposes of landing and installation of cold storage facilities in the important fishing centres along Kilifi Coastline such as Mtwapa, Watamu and Takaungu. The refrigeration facilities at the Malindi wholesale fish market should be repaired.
2. Modern facilities are required by local fishermen for deep sea fishing to reduce the problem of overfishing of inshore areas.
3. The Fisheries Department should set fish farming projects on trial basis to encourage the people in the hinterland in areas where fresh-water is readily available to have their own fish ponds.
4. Co-operative education should be provided to the fishermen in order to encourage them to join Co-operative Societies, so that they can gain from the various benefits offered by Co-operatives.

### Coral Reefs

Coral reef is being threatened by siltation, breakage through walking, goggling, anchoring of boats and by collection of coral rocks by tourists. When silt settles on the coral reefs, the corals suffocate. It was noted that at the moment there is no coral reef from Malindi to Mambrui.

### Recommendations

1. The proposed marine education centre in Malindi should be supported and would educate the local people and visitors on the importance of coral reefs.
2. Coral gardens should be identified so that they can be preserved.

## III TERRESTRIAL RESOURCE MANAGEMENT-VEGETATION

### A. Fuelwood demand/Supply and Conservation

The fuelwood supply is decreasing due to shortage of vegetation and an assumed sense of sufficiency arising out of lack of knowledge. In addition, this shortage of fuel is attributed to:-

- a. shifting cultivation,
- b. destruction of natural forest (indigenous tree species) that take a long time to regenerate.
- c. increasing population

It was observed that the major threat to fuelwood supply comes from charcoal burning rather than wood fuel. However, since this activity is carried out by the rural population this observed fuelwood supply threat will increase. There is an added threat stemming from the fact that charcoal burning tends to be species dependent activity. For example Acacia species is preferred for charcoal burning. As more big trees disappear, a larger area will have to be cleared to get the same amount of charcoal.

Other competing factors that influence fuelwood supply/demand are related to the following activities:-

1. Timber Industry
2. Wood carving
3. Saltworks
4. Prawn breeding
5. Building
6. Agriculture and Livestock development
7. Human settlements

### 1. Timber Industry

Timber industry is part and parcel of the economy and hence the need to provide for it. Where virgin forest is opened, trees are selected for timber. The remains of timber industry are left for charcoal burners. Therefore, the timber industry is not only a competitor but accentuates the problem of demand/supply of fuelwood. In the effort to balance supply and demand in gazetted forests a number of constraints arise.

- (a) Lack of upto date inventory data specifically on stock and annual increment rate leading to over exploitation and a false sense of sufficiency.
- (b) Politization of and corruption in issuing licences/quotas
- (c) Inadequacy of legal deterrence.
- (d) Inadequacy of supervisory and technical staff.
- (e) Lack of awareness among local people
- (f) Difficulties in selecting species suitable for specific ecological areas
- (g) Overstocking
- (h) Inadequacy of advisory services

The bulk of fuelwood in the district is either in the private lands or in trust lands which are administered by local councils. At present there exists in every district a forest licencing committee chaired by the District Commissioner. Despite the presence of this committee, it is apparent that not much is done in the way of forest conservation in both private and trust lands.

### Recommendations

1. Reinforce the rules laid up in the forestry Act in licencing and quota system.
2. Increase the planting of both fast growing species and also indigenous species.
3. Trustland forests which form the bulk of fuel wood supply should be treated like gazetted forest by the District Licencing Committee.

4. Exploiters of the wood resources should be required to contribute to replanting as a condition of obtaining a licence.
5. Involve schools in tree planting activities e.g. by establishing of tree nurseries in schools.
6. Experience has shown that National Tree Planting Day does not coincide with the time when soil moisture content is enough in all parts of the country. Therefore only Ceremonial trees should be planted during this time. Others should be planted when soil moisture content is enough to increase their chances of survival.
7. As regards forests located in private lands, consultation should be made with technical services Ministries before trees are cut to determine what trees are to be felled and what should be done thereafter.
8. The requirement that every chief should have a tree nursery should be enforced so that seedlings are near the people.

2. Wood Carving

This involves highly selective cutting of specific tree species viz. Muhuhu and Mringa. Some of these trees are already depleted in some areas.

3. Debarking for Rope Making

This is another competitive and selective activity which involves mainly two species of Brachystegia speciforms and Sterculia rynchocarpa. It is noted that action has not been taken in the way of conserving these species as a source of fuelwood.

Recommendations

1. Encourage the use of sisal rope (fibre) in building to reduce demand for Brachystegia fibre.
2. Meanwhile explore the possibility of other building materials and technology.
3. The possibility of a total ban of rope making from these species or introducing a system of licencing should also be explored.
4. District Forest Licencing Review Committee should take the appropriate action.

4. Salt Works, Prawn Breeding and Building

Presently three activities viz. salt works, prawn breeding and building construction have had profound impact on mangrove forests. It is now considered that there is need to take action to conserve them.

### Recommendations

1. In future, alternative sites e.g. flat areas adjacent to the sea and where mangroves do not exist should be considered before any project undertakers decide to clear mangrove stands.
2. The DDC should be made aware of the present prawn breeding experiment and its effects on mangrove forests.
3. The DDC should determine potential of mangrove forests as a source of fuelwood and building materials on sustained yield basis.

### 5. Agricultural and Livestock Related Activities

Shifting cultivation, over-grazing and uncontrolled bush burning destroy the soil cover. Regeneration of some species is impossible due to animal browsing on them. The remaining stumps are usually swept by fire when the pastoralists burn grazing blocks in an attempt to improve the rangeland. It is also clear that traditional values attached to livestock plays a major role in overstocking and eventual overgrazing.

### Recommendations

1. Promote livestock marketing and local banking facilities.
2. Expand company and group ranching in more areas so that a proper habitat management can be reached.

### 6. Human Settlements

In this category there are two groups of settlements which have been considered regarding their influence on fuelwood supply. The groups consist of organised and legal settlement schemes under which a laid down procedure for land clearing exists, e.g. Magharini. The second group is made up of settlements which arise as a result of existing facilities which tend to attract people to settle in these areas. The first type has tried to follow the laid down land clearing procedure with some success. However, this does not guarantee a viable supply of fuel wood.

### Recommendations

1. Requirement of a woodlot should be enforced in every settlement scheme.
2. The service Ministries should work in an integrated manner to avoid the danger of having migratory squatters in some areas where forest as a fuelwood source is threatened. Any proposed action by each Ministry should discourage spontaneous settlements.
3. Increase extension services to promote energy saving jikos. For example, the DDC's could provide a few of these jikos to selected women groups.

## B. Forest Conservation and Protection

Most of the problems, measures and issues discussed with regard to fuelwood production (supply/demand) also apply to forest conservation and protection. However, it is found that some types of forests contain unique biological (genetic resource) and cultural attributes which demand special consideration e.g. Mijikenda hollowed grooves (Kayas) and Brachystegian woodlands which are under threat due to human encroachment. In the case of Arabuko Sokoke forest, special attributes are not restricted to the vegetation but also the wildlife therein.

### Recommendations

1. Some of the Kayas have been destroyed to a point where they could not contribute much as special sites of scientific interest or as the hollowed places they culturally were. Therefore, a careful selection of Kayas could be gazetted and declared nature reserves under the Forest Department. The more destroyed Kayas could still be protected as forest reserves.
2. Brachystegia woodlands are most threatened and therefore local administration should withhold any further activity affecting them e.g. settlements. This problem should be specifically defined and supported with empirical data and be communicated to the Director NEHSS, and copied to the Permanent Presidential Commission on Soil Conservation and Afforestation before 22nd March, 1984.
3. There should be no land adjudication on hill tops and swamps. These areas should be left as government land.
4. Increased enforcement of Agriculture and Water Acts is required for the preservation of riverine vegetation.

## C. Wildlife in Forest Areas

At present the wild animals are usually scared by wildlife officers as a protective measure. This mode of operation is usually inadequate because officers are not around all the time. Shortage of staff, lack of empirical data and/or effective co-ordination to justify application of more effective measures are major constraints.

### Recommendations

1. Improvement on co-ordination, gathering and use of reliable data.
2. Station a game ranger at every forest post
3. Provision of arms and training in their use to the foresters.

D. Research and Extension

Recommendations

1. Research findings should be disseminated in an appropriate language understood by extension officers and at the same time the extension officer should give a feed back.
2. The DDC should establish a depository in the district for research activities.
3. The Chairman of the DDC should co-ordinate other research activities in the district, in liaison with National Council for Science and Technology (NCST)
4. 'Training and visit' programme involving extension officers and wananchi should be intensified.
5. Intensify and integrate adult education programme through direct contact and mass media.

IV TERRESTRIAL RESOURCE MANAGEMENT - AGRICULTURE

4. (A) Agro-Forestry

The following problems were discussed:-

- Land scarcity especially in Kaloleni division and some parts of Bahari division caused mainly by the growing population.
- Negative attitudes on the part of the farmers towards planting of trees other than the ones which produce food.
- Lack of enough trees for building purposes and for firewood.
- The small number of nurseries.
- Difficulties in the distribution of seedlings to farmers.

Recommendations

1. In order to increase the survival rate of trees and increase the benefit of trees to farmers, species must be selected on the basis of their suitability to specific ecological zones.

Under the guidance of a Research Personnel M.E.R.D. the agro-forestry nursery at Mtwapa and the Rural Afforestation Officer, the following tree species have been recommended for planting in various Agro-Ecological zones:

Ecozone III Casuarina equisetifolia, coconut and mango

Ecozone IV Cassia Siamea, Cacia Spectabilis, Casuarina equisetifolia, cashewnut, and eucalyptus species on top of hills.

Ecozone V - Azadirachta indica (Mkilifi) Acacia albida  
VI - VII Leucana, Cassia Siamea, Prosopsis  
Alfzelia (Bambakofi) Cassia tortolis and  
Cassia Spectabilis

2. On the interplanting of crops with trees, more information is needed on the spacing of trees and crops to avoid the destruction of crops by the tree canopy.
3. Swampy areas should be reclaimed by planting casuarina, eucalyptus and mangroves.
4. The farmers should be encouraged if possible by local chiefs to take care of the seedlings after planting.
5. In places such as Ganze and Bamba where major deforestation is taking place, seedlings should be made available from the chiefs' nurseries for replanting. In this connection, local nurseries raising local species should be encouraged.
6. The District Development Committee should take up the responsibility of transporting the seedlings from nurseries to where they should be planted.
7. The planting of more fruit trees must be encouraged because there is high demand for the fruits.

B. Crop-Selection

A number of problems with respect to different crops were pointed out.

The transportation of crops to factories, especially cassava to Tapioka factory is a big problem, due to lack of organised marketing system. There is also lack of information of proper planting methods and this explains why yields for food crops are very low.

The potential for increased agricultural productivity has not been fully exploited due to inefficiency in land utilization. In view of the above problems, the following programmes are underway to improve the agricultural productivity, particularly as it relates to production of food crops in the district.



The growing of cassava in ecozone III, IV and V will be intensified in the next five years. Cassava can be sold for cash and/or be consumed by the farmers. The growing of cow-peas and green grams will be promoted in ecozones IV and V. The growing of legumes will help in balancing of diet, thus reducing the problem of malnutrition and infant mortality which is prevalent in the district.

Other crops that have been found to do well in the district, include sorghum, sesame and cotton, provided proper farm management methods are followed.

The following recommendations were made with respect to crop selection:-

- (1) The idea of commodity exchange should be encouraged in future so that farmers will concentrate on production of those crops whose returns justify the cost of production.
- (2) Seed selection must be based on locally available material.
- (3) In ecozone II, coconut, cassava, maize, sesame, cow peas, green grams and cotton were recommended. In ecozone IV and V, the appropriate crops are cassava, sorghum, green grams and cow peas.
- (4) In view of the past experiences, in future the Agricultural Finance Corporation should first of all consult with the Ministry of Agriculture and Livestock Development and Co-operative Development, before giving loans to farmers, especially those who want to plant maize, to ensure that crops are planted in appropriate zones.
- (5) More bulking plots for materials should be established and more research carried out to find varieties that are resistant to pests.
- (6) Chemicals that have been found to be dangerous to fauna and flora should be discouraged.

#### C. Extension Services

The major problem of extension services is the shortage of staff. At present the district is experiencing a shortage of 68 technical staff. The objective is to have 400 farmers or families, served by one technical officer in order to make the technical assistance more effective. Even when extension officers are available, it is very difficult for them to travel into the interior and serve farmers due to transportation problems. In the case of establishing group ranches, it takes a long time to establish a successful group ranch, while farmers expect immediate returns. There are also problems in obtaining loans to start operating ranches and the Artificial Insemination Programme is viewed with contempt due to local beliefs.

### Recommendations

1. Soft loans should be made available for extension officers to buy motor cycles or bicycles so that the National Extension Programme being implemented in 1984 can be a success.
2. There is a need to intensify efforts to change the traditional behaviour as far as farming methods are concerned. e.g. bush clearing and burning.
3. Farmers should be encouraged to carry out soil conservation measures in their own farms and the soil conservation committee at the District level should become an arm of the District Development Committee.
4. The chiefs should intensify efforts to control bush fires through the use of the Chief's Act.
5. The existing dams which have silted should be rehabilitated and methods of controlling siltation intensified.
6. Through demonstration units, farmers, should be encouraged to use improved tools, such as the ox-plough. The local administration should approach interested farmers who can make use of the traditional ox-drawn ploughs as the one being implemented at the Magarini demonstration plot.

### D. Marketing

The problems of marketing were discussed with respect to the following:-

- |            |   |
|------------|---|
| Pineapples | Most pineapples rot before reaching the market. The large pineapples are unacceptable to Kenya Cannery Company and farmers have therefore to rely on buyers in Malindi who buy them at a very low price.                            |
| Mangoes    | About a quarter of all the mangoes do not get to the market.  |
| Cashewnut  | The production level has been decreasing over the past few years. This is mainly due to unfavourable weather conditions and also due to poor crop husbandry.  |
| Coconut    | 75 per cent of the copra produced in the district is taken to oil millers in Mombasa. There does not exist a large oil mill in Kilifi district to process all the nuts produced.  |
| Cassava    | The production potential exists but the main problem is that the product is perishable. There is a factory at Mazaras which processes cassava but the crushing capacity of 15 tons a day is too low to cope with the total produce. |

**Livestock**      Milk produced in the district is inadequate. There is also a shortage of broilers and eggs in the district, due to the closure of poultry hatcheries at Kikambala. The price of poultry is very high.

### Recommendations

1.      The DDC should get in touch with the Industrial Promotion Department to carry out feasibility studies on possibilities of putting up processing plants for pineapples, copra and cassava in the district.
2.      The Kenya Cannery should be asked to relax some of the restrictions of marketing of pineapples, and research should be done to find out ways of controlling the size and sweetness of the fruits.
3.      With respect to cashewnuts, there is a need for constant reviewing of prices to avoid fluctuations in prices and to give farmers an incentive to increase production. No new cashewnut factory should be built, at least in the near future, because the present one is operating below capacity.
4.      There is need to construct another oil mill in Kilifi to process the copra produced to benefit farmers.
5.      A big factory is required to process cassava chips for human food and cassava pellets, for animals. Potential investors in the industry should be encouraged.
6.      In the operating ranches existing boreholes should be rehabilitated by the Kilifi County Council or the Ministry of Water Development to provide water for the animals and people.
7.      Due to the increasing demand for poultry meat and eggs, there is need to utilise local resources for example cassava products, copra cake etc. as feeds for poultry.
8.      In the future there will be need to have one or two milk cooling plants in the district, and in addition, the Mariakani milk scheme should be reviewed.

V. ENVIRONMENTAL PROBLEMS OF URBAN AREAS

A. Urban Crowding

The main areas of urban crowding were identified as Kilifi township, Malindi and Mariakani. The main causes of urban crowding are:-

1. Employment opportunities: The rural population often come to these areas in search of employment. Some of these people are usually employed as casual workers.
2. Tourism: The sudden influx of tourists into these places and especially Malindi, has resulted in influx of indigenous people into towns in search of market for their products e.g. food, curios, etc. This influx has by far out-stretched the existing infrastructural and physical facilities in the towns.
3. Social Satisfaction: The lack of social amenities such as schools, hospitals, theatres, dancing halls, and other services in the rural setting contributes to the over-crowding of urban areas, where these facilities exist.
4. Natural growth: The natural population growth of population which has been resident of urban areas for a long time.

The consequences of urban crowding in the towns have been inadequate housing, education, health water and recreational facilities. The problems arising from crowding plus lack of job opportunities have contributed to the growth of crime.

In an effort to reduce crowding, the Municipal Council of Malindi as well as the County Council have approached different agencies like the Kenya National Assurance, Housing Finance Company of Kenya, the National Housing Corporation etc in attempt to solicit funds for the construction of more houses. Plans have been prepared for residential areas and are awaiting implementation.

Donations towards water projects have been received from some well wishers. Harambee meetings have also been organised for the construction of schools. The Ministry of Health has stepped up the surveillance and improvement of the health facilities in terms of transport and adequate staff.

Recommendations

1. The local authorities in the district should request the Commissioner of Lands to expedite action on the issue of land e.g. title deeds.
2. A reasonable amount of the money collected from tourism in Kilifi District should be re-channelled to the district from the Treasury to help solve the problem of over-crowding. The Government should reinstate the grant to the Council as a matter of urgency to enable them cope with influx.

3. The financing institutions e.g. National Housing Corporation should speed up the requests made to them by the Kilifi local authorities.

B. Sanitation and Waste Disposal:

The problem is a lack of proper disposal of human waste and refuse. Malindi residents usually constructed latrines outside their houses. The pit latrines are usually shallow due to rock structure and the high water-table in the area. Hence, these fill up fast and new ones have to be constructed every 5 - 7 years resulting in a lot of wasted land.

The closely spaced Swahili houses in Kilifi and Malindi do not allow access for waste disposal vehicles. These problems greatly interfere with the planning of towns. The refuse collection services have not kept up with the rapid increase in population. The major consequences that have arisen from the above problems have been increasing incidents of diseases, fly breeding, smell nuisance, flooding of Malindi town and pollution of underground water. So far there has been no action taken to ease the problem largely due to lack of funds.

Recommendations

1. There should be a review and follow-up of the study done in 1978 on the problem and see the possibility of implementation of the study.
2. The concerned authorities should take necessary steps as soon as possible to improve the sanitation and waste disposal in urban areas.
3. The County/Municipal Councils should act immediately on the problem as a matter of urgency.

C. Recreational Facilities

The facilities for recreational activities are missing and the consequence has been idleness, lack of physical fitness, etc. The action being taken now includes the construction of such facilities and the recruitment of personnel. The constraints that have arisen are lack of finance, expertise and low priority given to the provision of such facilities.

Recommendations

1. The local authorities should appreciate the need to develop a positive attitude towards the problem of recreational facilities, and solicit funds from the relevant Ministries.
2. The Ministry of Local Government should speed up decision-making in approving requested posts of community development assistants.
3. The residents should be made aware of the need to use these facilities.

#### D. Town Planning

Town planning is the rational utilization and management of land in towns or the organisation of space in land use. It is a problem in the district and is largely caused by population increase, the delay in approval of plans by the Commissioner of Lands, and the lack of implementation of the plans by the people in general and the implementing government departments. The lack of plans and none implementation of plans have resulted in haphazard growth of towns.

#### Recommendations

1. The land administrative machinery should be streamlined.
2. The different government departments and the general public be required to follow the approved plans. The Ministries of Water, Health, Transport and Communications, the Department of Survey, Lands, Physical Planning, the Kenya Posts and Telecommunications and the Local Authorities all do have an important role to play.

#### E. Land Tenure

The problem of land tenure is largely due to lack of title deeds for some parcels of land. This gives rise to the slow process of land acquisition which in turn delays development of land. In some cases land is owned by absentee landlords and it cannot be acquired quickly or be used for development.

#### Recommendations

1. Land should be bought from the absentee landlords by the government as a matter of urgency.
2. The Commissioner of Lands should speed up the advertisement of plots in urban areas so that rights to the plots can be established.

#### F. Water Supply

The problem of water supply is in regard to the lack of portable water supply in Malindi and Mariakani. The major cause has been lack of funds. Malindi is to be provided with portable water under the second phase of the Sabaki Water Project which is now being carried out.

#### Recommendations

1. The County Council should put up their own treatment plant in Mariakani for the water supplied to the area.

## G. Industrial Waste

One of the major case of industrial waste in Kilifi is connected with the Kenya Cashewnuts Factory in Kilifi. The major industrial waste are the shells which are disposed of by uncontrolled burning causing air pollution. At present the only effort to reduce air pollution has been the selling of the shells to other factories which need the shells. But the demand for the shells is limited. No major effort has been made to find alternative means of getting rid of these shells instead of burning them.

### Recommendations

Further utilization of the shells by other factories should be explored either in the extraction of the remaining oil from the shells or development of other products e.g. charcoal, pressed boards which could be used for ceiling etc.. The Factories Inspectorate, the cashewnut factory, the Ministries of Health, Energy, Education, Science and Technology, the National Environment and Human Settlements Secretariat, the University of Nairobi, the Kenya Industrial Research and Development Institute are all establishments which can help solve the problem.

## VI RURAL ENVIRONMENTAL HEALTH

### A. Malnutrition

Malnutrition is lack of balanced diet  
In Kilifi District this is caused by:-

1. Lack of knowledge - Food is available in most cases but mothers do not understand the importance of a balanced diet.
2. Poverty: Poverty plays a great role in determining the life style of the people. Women would rather sell the eggs, chicken, goats, fruits and vegetables to earn an income than use these to feed their children. Most of the district is dry (except the coastal strip) with very little productivity.

Identified consequences of malnutrition include:-

- (i) Susceptability to communicable diseases such as T.B., Malaria and diarrheal diseases.
- (ii) Mental and body growth retardation.
- (iii) General apathy.

### Action Being Taken

The Ministry of Agriculture and Livestock Development extension workers are providing home economics education. The Family Life Centre at Kilifi admits malnourished children and their mothers. The mothers are educated on the importance of a balanced diet.

ICA situated in Kaloleni Division is helping to educate the community on various activities including nutrition.

## B. Population Growth

The available resources cannot keep pace with the increasing population. Families are having more children than they can feed and educate. This problem is more serious among polygamous families. Unavailability of improved technology on use of the available materials cause low productivity of the land.

Organisations such as the Family Planning Association of Kenya, Women Groups, NGOs and the DDC are helping to educate the community to adjust their traditional values and have children they can feed and educate.

### Recommendations

1. Intensify family planning programmes.
2. Intensify community based health care.
3. Strengthen nutrition education in schools.
4. Parents with malnourished children should be encouraged to visit more developed areas to understand the need for change of food practices.
5. Increase the training and number of social workers and provide them with more transport and housing or accommodation allowances.



### C. Rural Water Supply

There is a serious problem of scarcity of portable water for human consumption and for livestock. The majority of people in the district use water from the wells, springs, rivers, dams and boreholes. These water sources in most cases are unprotected from contamination, leading to high incidence of water-borne and water-related diseases. Many hours are wasted by women walking long distances to fetch water and little time is spent preparing food for the family. Lack of water in some areas of the district affects the population distribution, and agricultural development. A small population in parts of Jibana, Kaloleni and Kakuyuni locations have treated piped water.

#### Action being taken:

1. Dams in dry areas like Ganze are being constructed.
2. Surface rain water catchment basins are being constructed.
3. Roof catchment in institutions and homes is being developed.
4. Wells are being dug.

#### Recommendations

1. DDC, self-help groups, and Catholic Relief Funds should work hand in hand and implement programmes to train maintenance technicians to maintain and improve the already available water sources e.g. boreholes and dams.
2. These organizations should encourage rain water catchment in public institutions and in private homes.
3. Dams should be built at appropriate intervals on Sabaki river to regulate the flow of water at all times by the Tana/Athi River Development Authority.
4. Standardized appropriate technology is important in maintaining the water supply.
5. People should be encouraged to use the hand pumps since they require minimum maintenance and are durable.

### D. Sanitation:

Sanitation in rural areas of Kilifi is poor due to:-

1. Lack of standard housing
2. Improper human waste disposal.
3. The quantity and quality of water supplies.
4. Unsatisfactory rural refuse collection in market centres.

5. Lack of vector control resulting from heaps of coconuts shells and stagnant water
6. Lack of proper education to the community.
7. Poverty.
8. The geographical location because in some areas it is difficult to construct pit latrines since the soil may be rocky, water logged, and collapse easily.
9. Some cultural and social habits play a role in promoting poor conditions. For example, a mother cannot share the same toilet with the son-in-law. As a result there is a prevalence of infectious diseases and irritating smells from human waste and heaps of coconut shells.

#### Action being taken

1. DDC and the general community programme educates the public on the construction of ventilated pit latrines and twin latrines of 5 feet deep.
2. Pilot demonstration schemes and health education are being carried out.
3. Inspection of the problem areas by public health staff is also encouraged.
4. ICA is involved in the cultural aspects of the community.
5. The village health committees involve the participation of the local community.
6. Women groups are also involved in community development.

However, the local leaders and the local government have not worked hand in hand to stimulate and motivate the extension workers. Poverty and lack of funds also cause constraints to the output of these workers.

#### Recommendations

1. There is need to build demonstration houses and improved ventilated pit latrines as demonstration each location.
2. Increase protection<sup>/of</sup> water supply sources.
3. Strengthen village health committees.

5.2

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PART IV  
APPENDICES AND REFERENCES  
CLIMATIC DATA

TABLE 6.1 MONTHLY RAINFALL AVERAGES FOR SELECTED STATIONS, KILIFI DISTRICT

STATION (Elevation, length of record)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
BAMBA (24m, 14 yrs)	10	15	53	104	137	29	27	30	46	74	78	74	677
GANZE (10m, 25 yrs)	25	14	48	97	187	56	42	44	54	84	103	78	832
MARIAKANI (195m, 30 yrs)	35	18	72	118	166	58	44	53	59	89	108	76	896
KILIFI 3m, 9 yrs)	18	15	38	122	268	117	78	56	56	71	73	43	955
KALOLENI (220m, 11 yrs)	31	25	43	121	175	102	77	81	96	141	134	62	1088
MAZERAS (160m, 9 yrs)	25	22	57	150	194	100	59	81	62	130	145	69	1094
MTWAPA (21m, 13 yrs)	21	26	56	235	246	159	106	80	70	104	123	41	1267
Wettest spot:	3	7	3	7	4	7	7	5/6	5	5	6	2	
Average days in a year	(35)	(26)	(72)	(235)	(268)	(159)	(106)	(81)	(96)	(141)	(145)	(78)	
Driest Spot	1	2	4	2	1	1	1	1	1	4	4	7	
Average days in a year	(10)	(14)	(38)	(97)	(137)	(29)	(27)	(30)	(46)	(71)	(73)	(41)	

SOURCE: Floor, 1980

TABLE 6.2 ANNUAL RAINFALL FOR SELECTED STATIONS, KILIFI DISTRICT, 1968 - 1982 (in mm)

STATION	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	Average	Average Rainy Days
Malindi	1531.0	365.1	933.1	926.3	1100.2	920.6	617.8	801.6	951.0	1355.5	1222.4	614.7	892.2	993.4	1711.3	996.1	69.6
Kilifi	1566.7	770.4	712.2	691.2	1099.7	977.1	543.3	819.1	639.1	1110.7	1563.6	1334.4	912.0	1018.9	1605.9	1037.6	71.4
Vitengeni	1330.7	1160.9	770.3	490.5	967.2	1005.9	490.2	495.5	648.3	920.9	1011.8	912.7	527.5	518.4	830.6	805.	56.2
Malindi	1278.3	1097.8	712.4	656.0	639.2	588.8	448.7	208.0	318.5	799.5	929.5	874.9	601.4	593.9	1046.1	719.8	61.7
Mazeras	1762.9	874.5	776.8	579.7	1518.9	982.0	804.1	900.9	961.3	1415.0	1095.9	1256.3	618.4	975.6	N/A	1037.3	81.0
Genze	1142.2	603.1	517.7	445.6	776.6	713.2	411.5	677.7	1217.5	1357.6	863.1	534.6	745.4	745.4	882.2	751.4	55.6
Mwaspa	2105.2	1098.9	722.0	1060.9	1407.2	1260.6	683.2	1129.0	936.5	1292.7	1478.2	1598.0	976.9	1086.4	1025.0	1190.9	105.2

SOURCE: Meteorological Department 1983



APPENDIX 6.2

VEGETATION

Typical species in each vegetation zone (see Section 1.4) are presented below. The natural vegetation in three zones has been substantially altered in some cases. The source for this list is Moonmaw (1950), with updated nomenclature.

I. Acacia Thorn Bushland

1. *Dobera glabra*
2. *Acacia zanzibarica*
3. *A. seyal*
4. *A. senegal*
5. *Euphorbia tirucalli*
6. *E. spp.*
7. *Grewia sp.*
8. *Commiphora spp.*
9. *Boscia spp.*
10. *Sansevieria kirkii*
11. *Adenia globosa*

II. Lowland Dry Forest

1. *Gyrocarpus jacquini* (=americanus)
2. *Combretum schumanii*
3. *Ficus bussei*
4. *F. spp.*
5. *Cassipourea euryioides*
6. *Adansonia digitata*

III. Lowland Cultivated Savanna

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| 1. <i>Acacia mellifera</i>        | 8. <i>Terminalia prunioides</i>   |
| 2. <i>A. zanzibarica</i>          | 9. <i>Commiphora campestris</i>   |
| 3. <i>A. stuhlmannii</i>          | 10. <i>Piliostigma thonningii</i> |
| 4. <i>A. spp.</i>                 | 11. <i>Grewia villosa</i>         |
| 5. <i>Manilkara sansibarensis</i> | 12. <i>G. plagiophylla</i>        |
| 6. <i>Diospyros cornii</i>        | 13. <i>Vanilla roscheri</i>       |
| 7. <i>Sterculia rhynocharpa</i>   | 14. <i>Euphorbia tirucalli</i>    |
|                                   | 15. <i>Adenia globosa</i>         |

IV. Lowland Woodland

Overstory

1. *Brachystegia spiciformis*
2. *Trachylobium verrucosum*
3. *Paramacrolobium coeruleum*
4. *Julbernardia magnistipulata*
5. *Azelia quanzensis*
6. *Lanea Stuhlmannii*

**Understory**

1. Combretum spp.
2. Vitex mombassae
3. Tinnea aethiopica
4. Heinsia crinita
5. Hugonia castaneifolia
6. Manilkara sulcata
7. Acridocarpus zanzibaricus
8. Uvaria acuminata
9. U. leptocladon
10. Ozoroa obavata (= Heeria mucronata)

**V. Lowland Dry Forest on Coral Rag**

1. Gyrocarpus jacquinii (=americanus)
2. Combretum schumannii
3. Ficus bussei
4. F. spp.
5. Cassipourea euryioides
6. Adansonia digitata

**VI. Lowland Rain Forest**

(a) High trees

1. Chlorophora excelsa
2. Sterculia appendiculata
3. Antiaris toxicaria
4. Gyrocarpus jacquinii (=americanus)
5. Newtonia paucijuga

(b) Smaller trees

1. Macrolobium coeruleum
2. Cynometra suaheliensis

(c) Shrubs

1. Memecylon sp.
2. Ximenia caffra
3. Securidaca longipedunculata
4. Dracaena usambarensis
5. Monodora grandieri

**VII. Lowland Moist Savanna**

Shrubs and trees:

1. Albizia anthelmintica
2. Hyphaene compressa
3. Acacia zanzibarica
4. A. spp.
5. Commiphora

Grasses:

1. Themeda triandra
2. Sporobolus pyramidalis
3. Cymbopogon caesius

VIII. Mangrove Swamps

- |                          |                          |
|--------------------------|--------------------------|
| 1. Rhizophora mucronata  | 7. Xylocarpus granatum   |
| 2. Avicennia marina      | (= benadirensis)         |
| 3. Sonneratia alba       | 8. Sporobolus virginicus |
| 4. Ceriops tagal         | 9. S. kentrophyllus      |
| 5. Bruguiera gymnorrhiza | 10. Hibiscus tiliaceus   |
| 6. Lumnitzera racemosa   | 11. Suaeda monoica       |

IX. Bare Coral Rock

1. Sideroxylon inerme ssp. diospyroides
2. Salvadora persica
3. Cynachum tetrapterum
4. Cissus rotundifolia
5. Sphenosylis briartii
6. Indigofera cliffordiana
7. Cordia somalensis
8. Pemphis acidula
9. Azima tetracantha
10. Barleria sp.
11. Capparis cartilaginea
12. Portulaca oleracea
13. Sesuvium portulacastrum

X. Sand Dunes and Beach Littoral

1. Impomoea pes-caprae
2. Halopyrum mucronatum
3. Cyperus maritimus
4. Sporobolus virginicus
5. Lapturus repens
6. Zaleya pentandra
7. Scaevola plumieri
8. S. taccada
9. Tephrosia noctiflora
10. Cordia subcordata
11. Tephrosia noctiflora
12. S. taccada
13. Tephrosia noctiflora
14. Cordia subcordata
15. Dodonaea viscosa
16. Atriplex farinosa
17. Cistanche tubulosa
18. Wedelia sp.
19. Hyphaene parvula
20. Casuarina equisetifolia
21. Flacourtia indica
22. Ehretia petiolaris
23. Maytenus senegalensis
24. Crotalaris sp.

APPENDIX 6.3

FISH OF KILIFI DISTRICT

FAMILY	ENGLISH NAME	COMMON EXAMPLE	SWAHILI NAME
<u>IN-SHORE</u>			
Pomacentridae	Coral fish		
Labridae	Wrasses/Rainbow fish	Cheilinus	Stefue
Scaridae	Parrot fish	Scarus	Kwangu
Holocentridae	Squirrel fish	Holocentrus	Tembo
Acanthuridae	Surgeon fish	Acanthurus	Togo
Chaetodontidae	Butterfly fish		
Siganidae	Rabbit fish	Siganus	Tafi
Apogonidae	Cardinal fish		
<u>REEF AREA</u>			
Plectorhynchidae	Sweet Lips	Plectorynchus	Leya
Serranidae	Rock Cod Groupers	Epinephalus	Tewa
		Cephalopholus	
Carangidae	King fish	Ulua Caranx	Kole-Kole
Sphaeridae	Sea Pike	Barracuda	Tazanda
	Half beaks		
	Gar fish		

SOURCE: B. Kendall 1983

APPENDIX 6.4

SUMMARY OF FARMING SYSTEMS DATA FOR KILIFI DISTRICT

This appendix presents summary data on farming systems from various sources. Section A with references cited as ADEC 1983 is from a survey by African Development and Economic Consultants Ltd., for the Ministry of Energy, Kenya Renewable Energy Project. The 70 respondents were drawn from a 70km radius wide around the Mtwapa FTC. Section B, references cited as Schreurs 1982 and Waaijenberg 1981, is from the Training Project in Pedology, working in the Bamba-Ganze-Kilifi-Kaloleni area. Section C, references cited as MOA 1983, is from data presented in Jaezold and Schmidts's Farm Management Handbook for East Kenya.

SECTION A:

MTWAPA FTC SURVEY

TABLE 6.3

SOCIO-ECONOMIC DATA

		MARITAL STATUS		CHILDREN WITH AGES		EDUCATION		NO. OF HH MEMBERS RESIDING ELSEWHERE	
		%		%		%		%	
20 yrs		Married	96	5	52	None	52	0	41
20-29	13	Single	1	5-9	33	Std 1-7	33	1-2	27
30-39	19	Divorced	3	10+	15	FM 1-2	2	3-4	16
40-49	21	Widowed	-	None	0	FM 3-4	5	5-6	10
50+	41					Higher	0	6+	6
						Adult	0		
N=	70		69		52		64	N=	70

Annual Income		Expenditure by Income Class			Sources of Income	
KSh.	%	Food	School Fees	Hired Labour		
1000	22	11	67	40	Farm	56
1-2000	25	16	9	20	Wage	11
2-4000	14	12	12	30	Self	21
4000+	40	71	12	10	Other	9
NA		N=	66	42		70

SOURCE: ADEC 1983

TABLE 6.4

FARM MANAGEMENT

Land Holdings	Mean Size	% HH
Cultivated	1.45 ha.	40
Fallow	.38	10
Pasture	.36	10
Waste land	.48	13
Trees/shrubs (fruits, etc.)	.40	11
Other trees/shrubs	.39	11
Water	.01	Negl.
Housing area	.16	4
Roads	.01	Negl.
TOTAL	3.64	
N=	70	70

Most demanding activity %	Intercropping: maize and: %	Source of Extension advice %	Contacts by Extension staff last year %
Farmwork 88	Beans 65	Government 34	1 13
Drawing water 4	Potatoes 2	Friends -	2 10
Collecting wood 3	Millet 2	School -	3+ 16
Other 4	Bananas 16	Children -	Other -
		Others 2	None 61
		None 64	
N=	70	N=	56 31

Crops planted in 1982 and their survival rates

Type	Average area	Best Season	Average Survival %
Perennial crop			
Single	Cassava .70 ha.	Long rains	73
	Sugar-cane .20 "	"	53
Mixed	Banana 7 plants	"	100
	Pineapple .10 ha.	"	100
With trees	Coconut 79 plants	During rains	76
	Cashew 29 "	"	66
Grasses	None NA	NA	NA
Fruit trees	Mango 70 plants	Long rains	86
	Orange 12 "	"	70
	Paw Paw 15 "	During rains	80
	Lemon 3 "	Long rains	10
Non-fruit	Casuarina 7 "	"	57
	Cassia 13 "	"	67

Bush or Forest cleared for Agriculture in 1982 %	of yes	Vegetation on farm %	Cover Change general area %
yes 30	average 1.04 ha	increasing 39	47
	maximum 8.10 ha	decreasing 56	45
no 71	minimum .10 ha	not sure 6	8
	mode .80 ha		
N=	61	17	70 70

12% reported access to common grazingland, some of which was reported as owned by the Government  
 Original settlement schemes in the area allocated 4.8ha/HH, which has now dininished due to sub-divisions.  
 Landless (squatters) planted fewer perennial crops.

TABLE 6.5

WATER RESOURCES

Water Source	Season		Distance to Water		
	Dry	Wet	Dry	Wet	
Dam	-	-			
River	9	10%	2 km	71%	90%
Pond	3	13	2-3	21	8
Tap	59	51	3+	8	2
Spring	1	-			
Stream/Wells	28	26			
N=	70	70		63	54

SOURCE: ADEC 1983

TABLE 6.6

SOIL EROSION AND CONSERVATION

Soil types found on farmer's land	Slopes		Erosion problems		On farm average area	Causes	Conservation Measures adopted
Clay	24%	0-5%	62%	slight	29%	.28 ha	over-cropping 5%
Loam	18	5-10	24	medium	12	.30	trec removal 5
Black Cotton	0	10-15	14	severe	9	.31	wind,rain, soils,etc. 90
Laterite	3	15-25	5	Total	50	.89	
Volcanic	0	25+	2				Drains,terraces, trenches 2%
Murram	0						Mulches 14
Sandy	82						Fallow 0
Stony	6						None 83
N=	70	70	70		53		21
							70

SOURCE: ADEC 1983

TABLE 6.7

TREE PLANTING

Year first planted trees on farm	Purpose	Type	Non-fruit trees planted				
			HH's	Average No. trees/HH	Min. No. trees/HH	Max. No. trees/HH	
1960	29%	fuel 2%	Wood-Cassia	17	7	1	13
1960-65	24	sale 31	Casuarina	5	2	1	14
1966-70	9	food 25	Honey-sisal	6	9	5	16
1971-75	22	other 42					
1976-80	11						
1981+	5						
N=	55	55					

40% planted trees last year

Location of non-fruit trees

Types

Along road/paths	Very few trees
Around compound	Very few trees
Scattered in field	Doum palms, Scattered bushes, Acacia
Riverine	Doum palms
Hedges	Acacia, Sisal and Mishomoro
Plantation woodlot	Very few
Natural woodlot	Doum palms, Bushes + thickets, Mishomoro

SOURCE: ADEC 1983

TABLE 6.8 WOOD PRODUCTS

Access to wood from other's land	Of yes: --when	%	--where	%	Distance	Time	Change in distance to collect wood in the last 5 years		
Yes	43	All year	100	County	Mean:2.6km	114 min.	Shorter	3	
No	57	Dry season Wet season	-	Neighbours	5	Mode:1.0km	120 min.	Longer	6
				Only	83				
				Communal	5				
				Government forest	7				
				Other	0				
N=	102		16	41	24	25		70	

Wood products (Non-fruit trees) per HH

End Use	Qty sold	Qty own use	Qty - Total
Wood-			
Fuelwood	stacks/yr		
Charcoal	13	56	69
beamposts	bags/yr		
building poles	5	20	23
posts	posts/yr	0	0
lumber	poles/yr	0	0
Non-wood-	posts/yr	12	12
honey	logs/yr	0	0
fodder	700 ml/yr	5	6
manure	heaps/yr	0	0
human food	kg/yr	0	0

Fruit tree prunnings used for fuelwood.

Source of seedlings in 1982	%	Care of seedlings	%	Comments	%
Own	32	Watered	15	Cheaper to raise own seedlings	92
FTC	16	Fenced	2		92
Chief's Nursery	2	Mulched	9	Government seedlings need too much care	8
Agro-forestry Centre	2	Insecticides	2		
Other	48	Nothing	72		
N=	50		47		

KSh 1/- per seedling is average reported price.

Prune own trees	Reason	%	Pollard own trees	Reason	%
Yes	Fuelwood	89	Yes	Let them branch	40
No	Faster and stronger growth	25	No	Prevent growing too high	20
	Keep trees trim			8	
	Rid of insects	4		No reason	40
	Sunlights to crops	8			
	No reason	3			
	N=			55	

SOURCE: ADEC 1983



SECTION B: TRAINING PROJECT IN PEDOLOGY  
 TABLE 6.9 LAND USE IN GANZE DIVISION

STUDY AREA	TOTAL LAND OWNED	CULTIVATED LAND		IN 1983 TOTAL.
		VULI	MWAKA	
Bamba	13.0 ha	1.9 ha	2.3 ha	4.3 ha
Katofeni	7.7	1.4	2.4	3.8
Konjora	4.1	1.3	1.5	2.7

SOURCE: Schreurs 1982

TABLE 6.10 LABOUR USE IN GANZE DIVISION

LABOUR CATEGORY	STUDY AREA		
	BAMBA	KATOFENI	KONJORA
Women doing farmwork and/or piecework	100%	100%	100%
Men doing farmwork and/or piecework	44	33	52
Men doing piecework and/or temporary jobs most of their time	15	33	0
Men having permanent jobs but not living at the homestead	31	24	34
Men having permanent jobs near homestead	7	7	0
Number of Farms surveyed	9	8	8

SOURCE: Schreurs 1982

TABLE 6.11 SEASONAL LABOUR REQUIREMENTS IN GANZE DIVISION- PERSONS - DAYS/MONTHS

	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN
<b>BAMBA STUDY AREA</b>												
Livestock	30	30	30	30	30	30	30	30	30	30	30	30
Clearing	188	188					155	155				
Planting		31	31	31					26	26	26	
Weeding			78	78					65	65		
Harvesting						21						17
<b>TOTAL</b>	<b>218</b>	<b>249</b>	<b>139</b>	<b>139</b>	<b>30</b>	<b>51</b>	<b>185</b>	<b>185</b>	<b>121</b>	<b>121</b>	<b>56</b>	<b>47</b>
<b>KATOFENI STUDY AREA</b>												
Livestock	20	20	20	20	20	20	20	20	20	20	20	20
Clearing	118	71					69	69				47
Planting		25	25	25					15	15	15	
Weeding			57	57					34	34		
Harvesting						17						10
Cashew Harvesting	12	12									12	12
Cashew Weeding				5	5	5						
<b>TOTAL</b>	<b>150</b>	<b>128</b>	<b>102</b>	<b>107</b>	<b>25</b>	<b>42</b>	<b>89</b>	<b>89</b>	<b>69</b>	<b>69</b>	<b>47</b>	<b>89</b>
<b>KONJORA STUDY AREA</b>												
Livestock	10	10	10	10	10	10	10	10	10	10	10	10
Clearing	90	90					78	78				
Planting		21	21	21					19	19	19	
Weeding			54	54					47	47		
Harvesting						14						12
<b>TOTAL</b>	<b>100</b>	<b>121</b>	<b>85</b>	<b>85</b>	<b>10</b>	<b>24</b>	<b>88</b>	<b>88</b>	<b>76</b>	<b>76</b>	<b>29</b>	<b>22</b>
			Labour force		Area Used				Max. labour			
Bamba			9 persons		Vuli	Mwaka			available person-days/month			
Katofeni			5 "		1.9 ha	2.3 ha			270			
Konjora			6 "		1.4	2.4			150			
					1.3	1.5			180			

NOTE: Labour figures are as reported by farmers, using their average work day. Peak season labour shortage limits cultivation of larger areas, especially since all labour available is not used in farmwork.

SOURCE: Schreurs 1982

TABLE 6.12 SUMMARY DATA FOR GANZE DIVISION STUDY AREA

	BAMBA	KATOFENI	KONJORA
Household composition:			
Men	7.1	3.9	4.3
Women	7.4	4.0	3.9
Children	12.4	6.3	5.9
Family total	26.9	13.6	14.1
Soil types	Saline by semiments	Deep sandy soils	Heavy clay soils
Vegetation	Euphorbia-Acacia bushed woodland	Brachystegia bush woodland	Manilkara-Thespesia bushed woodland
Land use	Grazing/browsing	Subsistence crops/tree-crops/ grazing	Subsistence crops/ grazing
Livestock units/farm	24.7	7.1	3.6
No. of trees/farm	0.5	93.0	23.4
Main source of income	Off-farm work	Off-farm work	Off-farm work
Farm net income KSh/yr	4900-9000	1200-9000	0-6000
Total on and off farm net income KSh/adult/yr	1000-1700	900-1800	1000-1200
Population density-pop/km <sup>2</sup>	67.2	46.5	45.0

NOTE: 1 sheep and goats = 0.2 L.U.; 1 cattle = 1.0 L.U.

SOURCE: Schreurs 1982

TABLE 6.13 SUMMARY DATA FOR KALOLENI DIVISION STUDY AREA

	PINGILIKANI	MBUYUNI	CHILULU	KINARANI
No. of farms surveyed	121	91	99	91
Household composition:				
Men	2.6	3.4	3.0	3.2
Women	3.4	4.0	3.5	3.5
Children	6.2	7.2	6.1	5.6
Total family size	12.2	14.6	12.6	12.5
No. with shale land available	90	86	17	-
No. growing rice	59	44	58	42
Tree crops:				
1-10 coconut palms	18	14	5	40
10 coconut palms	53	66	68	25
1-10 cashew-nut trees	4	56	31	45
10 cashew-nut trees	97	11	26	26
Livestock:				
Own cattle	7	7	5	25
Herd size	12.2	7.2	5.6	24.4
Own 1-10 sheep and goats	27	47	31	36
Own 10 sheep and goats	4	7	7	25
Head of households with off-farm work	30	7	28	18

SOURCE: Waaijenberg 1981

SECTION C:

MINISTRY OF AGRICULTURE FARM MANAGEMENT HANDBOOK

TABLE 6.14

AGRICULTURAL LAND BY DIVISION

AGRO-ECOLOGICAL ZONE

	COCONUT-CASSAVA	COCONUT-CASSAVA-CASHEWUT	CASHEWUT CASSAVA	LIVESTOCK MILLET	FARMING	AGRICULTURAL LAND PER PERSON
KALOLENI	160 km <sup>2</sup>	-	429 km <sup>2</sup>	288 km <sup>2</sup>	38 km <sup>2</sup>	3.22 km <sup>2</sup>
GANZE	30	8	512	915	-	71.42
BAHARI	192	53	243	74	1059	3.10
MALINDI	61	-	855	1431	817	16.48
TOTAL RURAL AREAS	443	53	2045	2658	1914	10.43

SOURCE: MOA 1983

NOTE: The following are based on a small farm survey conducted in CBS Survey Area 54. One cluster is near Kaloleni, the other is between Marikabuni and Sheuri Noyo.

TABLE 6.15

ASSETS, LAND USE, FARMING INTENSITY AND INPUTS

ASSETS	Avg. 0	Avg. 1	FARMING INTENSITY	Avg. 0	Avg. 1
Land ha	6.5	6.5	Crops/yr	1.3	-
Livestock ha	26.8	28.7	Stocking rate		
Equipment	0.3	2.5	farm land LU/ha	0.7	-
			pasture + forage LU/ha	3.0	2.7
			Improved cattle - % of herd	0.6	6.7
PEOPLE ON FARM			INPUTS APPLIED TO ANNUAL CROPS		
Family adults	3.6	3.7	Improved seed - % of area	31.0	53.7
Permanent hired labourers	0.1	1.0	Fertilizer applied - kg/ha of		
Children 14 yrs.	2.0	3.4	pure nutrients	0.1	0.5
			N	0.1	0.5
			P <sub>2</sub> O <sub>5</sub>	0.1	0.5
			Manure applied - t/ha	-	0.1
			Insecticide - kg/ha	0.5	-
LAND USE					
Annual crops - ha	1.8	1.8			
- %	34	27			
Permanent crops - ha	1.7	2.0			
- %	32	30			
Pasture - ha	1.5	1.5			
- %	27	29			
Forage - ha	-	0.1			
- %	-	2			
Fallow - ha	0.3	0.7			
- %	5	11			
Other uses - ha	0.1	0.1			
- %	2	2			
Total - ha	5.4	6.6			
- %	100	101			

NOTES: Avg. 0 = Average of all sampled farms, Avg. 1 = Average of sampled farms excluding zero entries. No inputs were reported applied to perennial crops.

SOURCE: MOA 1983

TABLE 6.16

CROPPING PATTERN AND YIELDS  
AVERAGE PER HOUSEHOLD - ha

CROP	FIRST RAINS		SECOND RAINS		FIRST RAINS	SECOND RAINS	
	Avg.0	Avg.1	Avg.0	Avg.1			kg/ha
Maize	0.7	1.4	0.3	1.2	}	1,408	
Maize-IPC	0.1	1.1	NA	NA		1,887	NA
Cowpeas	0.1	0.7	0.2	1.4		893	NA
Cotton	0.1	0.7	NA	NA		851	NA
Tobacco	0.0	0.0	NA	NA		NA	NA
Cassava	0.2	0.7	0.2	0.7		1,283	NA
Others	0.4	0.9	0.3	0.9		NA	625
Maize + Cowpeas	0.2	1.3	NA	NA		m:2,604	NA
Maize + others	0.4	1.5	0.1	2.9		cp: 339	NA
Tomatoes	NA	NA	0.0	0.4		NA	NA
Citrus	0.0	0.2	0.0	0.2			
Cashewnuts	0.6	1.1	0.6	1.1		NA	
Coconuts	0.6	1.7	0.6	1.7		582	
TOTAL SAMPLE AREA	65.4		34.1			2,068	

SOURCE: MOA 1983

TABLE 6.17

HOME CONSUMPTION OF FARM PRODUCE

CROP	HOUSEHOLD-kg/yr	PERSON-calories/day
Maize	1365	1895
Beans	13	18
Cassava	69	34
Cowpeas	189	265

SOURCE: MOA 1983

APPENDIX 6.5

FOOD ENERGY REQUIREMENTS

Food energy requirements are based on methods devised by FAO/WHO as explained by Baldwin (1975) and Haji (1980).

TABLE 6.18

UNIVERSAL DAILY PER CAPITA KCAL REQUIREMENTS

AGE	M	F
0-4	1374	1374
5-9	2046	2046
10-19	2877	2357
20-39	3000	3000
40-59	2775	2035
60+	2250	1650

TABLE 6.19 PROJECTED DAILY KCAL (X10<sup>3</sup>) REQUIREMENTS OF KILIFI DISTRICT POPULATION SCENARIOS

AGE-SEX	1983	2000:I	2000:II	2000:III
0-4 Total	150453	272876	193459	350095
5-9 Total	178411	326337	241223	407356
10-19 Male	16572	344377	277055	408246
20-39 Male	165900	391200	365400	418800
40-59 Male	77145	125430	124875	128205
60+ Male	22950	36675	36675	40050
10-19 Female	130814	284726	228865	336580
20-39 Female	225300	293920	275000	313500
40-59 Female	67766	120269	120065	111711
60+ Female	16830	34650	34650	37290
TOTAL	1052141	2230460	1897267	2562833
AVERAGE PER CAPITA	2016	2222	2258	2194

APPENDIX 6.6. HEALTH PERSONNEL

TABLE 6.20 HEALTH PERSONNEL IN KILIFI DISTRICT

PERSONNEL	1975	1976	1977	1978	1979	1980	1982/ 83	1984	SHORT FALL
Doctors and Dentists	3	3	3	3	4	6	11	10	10
Pharmacists	Nil	Nil	Nil	Nil	Nil	Nil	1	2	1
Clinical Officers	17	17	19	18	19	19	24	24	22
Kenya Registered Nurses	10	10	9	9	9	10	21	29	23
Kenya Enrolled Nurses	59	59	60	65	65	118	110	124	116
Laboratory Technologists	1	2	1	1	1	1	4	1	4
Laboratory Technicians	3	3	3	3	3	3	13	17	11
Pharmaceutical Technologists	4	4	4	4	4	4	4	6	5

SOURCE: Medical Officer of Health, Kilifi District, 1983

APPENDIX 6.7 COOPERATIVE AND SELF-HELP

TABLE 6.21 DISTRIBUTION OF WOMEN'S GROUPS AND RURAL YOUTH CLUBS

DIVISION	WOMEN'S GROUPS	RURAL YOUTH CLUBS
Malindi	13	33
Kaloleni	35	24
Bahari	7	6
Ganze	19	12
TOTAL	74	75

Data are from the District Cooperatives Office 1983

TABLE 6.22 POLYTECHNICS IN KILIFI DISTRICT

POLYTECHNICS	DIVISION	ENROLMENT
Mariakani	Kaloleni	90
Ngamboni	"	48
Chitsoeni	"	163
Mwamba ya Nyundo	"	90
Kaloleni	"	-
Vitengeni	Ganze	93
Mkwanjuni	Bahari	-
Kakuyuni	Malindi	116
Mapimo	"	93
Marafa	"	31
ENROLMENT - BOYS		466
GIRLS		350
TOTAL		816

PROJECTS COMPLETED UNDER SELF-HELP SPIRIT

1. SOCIAL WELFARE PROJECTS PROVIDING WATER
  - (a) Makobeni-Kigundigundini in Southern Division - assisted by C.A.R.E. and D.D.C.
  - (b) Jilore in Malindi provides water with assistance of D.D.C. and E.E.C.
2. EDUCATION PROJECTS
  - (a) "Harambee" Secondary Schools
    - (i) Gede Harambee Secondary School in Malindi Division was started in 1974.
    - (ii) Chumani Harambee Secondary School in Central Division was started in 1975.
    - (iii) Msumarini Harambee Secondary School in Malindi Division was started in 1976.
    - (iv) Jaribuni Harambee Secondary School in Northern Division was started in 1976.
  - (b) Nursery Schools
    - (i) Bomani Women Group started a nursery school and got financial aid from Tototo Home Industries, Mombasa.
    - (ii) Bidii and Mijomboni Women Groups have had running and well managed nursery schools.
  - (c) Adult Education

Among the Women Groups there are teachers who have volunteered themselves in teaching others through the Adult Education Programme.



(d) Polytechnics

About 10 village polytechnics have been completed and offer a wide range of subjects including Home Economics, Carpentry, Masonary, Agriculture, Tailoring, Leather work, Business Studies and Electrical work.

Members of Women Groups contribute in funds and manpower and construct classrooms and teachers' houses then apply for teachers and teaching equipment from the Ministry of Education through the D.D.C.

3. BUSINESS PROJECTS

(a) Chasimba Chitsoeni Women Group in Southern Division keep dairy cattle and grow vegetables and tomatoes

(b) Gandini Mwarakaya have started a bakery.

4. CONSERVATION PROJECT

Magarini Green Belt movement near Bomani plant trees and have soil and water conservation programmes.

5. HOUSING PROJECTS

Carried out by a Women's Group in Kaloleni and another at Bamba.

TABLE: 6.23 CO-OPERATIVE SOCIETIES IN KILIFI DISTRICT, 22ND JULY, 1983

NAME/DIVISION	NO. OF MEMBERS	NAME/DIVISION	NO. OF MEMBERS
<u>KALOLENI</u>		<u>MALINDI</u>	
Kaloleni F.C.S.	901	Malindi Savings and Credit	145
Jibana "	453	Malindi Teachers Savings and Credit	1100
Kambe/Ribe "	407	Lengo Teachers Savings and Credit	155
Ruruma "	425	Eden Roc Savings and Credit	140
Rabai "	233	Turtle Bay Savings and Credit	50
Kayafungo "	320	Sinbad Savings and Credit	96
Chonyi "	757	Lawfords Savings and Credit	340
Kaloleni Artisans C.S.	20	Malindi F.C.S.	75
Kokoto Savings and Credit	Newly formed	Bungare "	434
Churches Savings and Credit	In liquidation	Magarini "	915
Madzimbani Dairy	Dormant	Msumarini Ranching C.S.	210
Tsangatsini Dairy	Dormant	Maraga Ranching C.S.	634
		Kakuyuni Artisans C.S.	Newly formed
		Galana F.C.S.	1865
		Malindi Fishermen C.S.	316
<b>TOTAL</b>	<b>3524</b>	<b>TOTAL</b>	<b>6475</b>
<u>BAHARI</u>		<u>GANZE</u>	
Tezo/Roka F.C.S.	1346	Godoma	385
Kilifi S.E.F.C.S.	1059	Godoma Artisans	Newly formed
Korosho Savings and Credit	1611	Bamba Dairy	Dormant
Lenga Juu Savings and Credit	172		
Kidilu Savings and Credit	78		
Whispering Palms Savings and Credit	49		
Posland Savings and Credit	Dormant		
Kilifi C.D. Fishermen	No figures available		
Kilifi D.C. Union	15		
Kwamaya F.C.S.	Dormant		
<b>Total</b>	<b>4355</b>	<b>TOTAL</b>	<b>385</b>
<u>SUMMARY</u>			
Total No. of Societies in the District		- 40	
Total Membership (Approximately)		- 15,000	

TABLE 6.24 AFFILIATIONS OF SOME OF THE PRIMARY SOCIETIES,  
KILIFI DISTRICT

NAME		AFFILIATION
1. Texo/Roka	F.C.S.	Kilifi District Co-operative Union
2. Chonyi	"	"
3. Rabai	"	"
4. Kaloleni	"	"
5. Kwamaya	"	"
6. Ruruma	"	"
7. Kambe/Ribe	"	"
8. Jibana	"	"
9. Kayafungo	"	"
10. Magarini	"	"
11. Kilifi S.E.F.C.S.	"	"
12. Godoma	"	"
13. Galana	"	"
14. Malindi	"	"
15. Maraga	"	"
16. Posland Savings and Credit		Kenya Union of Savings and Credit Co-operative Organisation (KUSCCO)
17. Lenga Juu Savings and Credit		"
18. Turtle Bay Savings and Credit		"
19. Lengo Savings and Credit		"
20. Kidicu Savings and Credit		"
21. Korosho Savings and Credit		"
22. Kokoto Savings and Credit		"
23. Whispering Palms Savings and Credit		"
24. Sidbad Savings and Credit		"
25. Malindi Teachers Savings and Credit		"
26. Watamu Savings and Credit		"
27. Eden Roc		"

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