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K I T U I

DISTRICT ENVIRONMENTAL ASSESSMENT REPORT

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in cooperation with Clark University
and the United States Agency
for International Development

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FOREWORD

This is the fourth in a series of District Environmental Assessment Reports, following the already published reports for Kajiado, Nyeri, and Kisii districts. It will be followed by similar reports for Murang'a and Nakuru districts, which are expected to be published in the first quarter of 1982. Subsequent reports to be issued in 1982 will cover Kilifi, Kisumu, and Bungoma districts.

This District Environmental Assessment Report for Kitui District is the result of a collaborative effort between the Ministry of Environment and Natural Resources of the Government of Kenya, and the Program for International Development of Clark University (USA). The NES/Clark University 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 Kenyan 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) The consideration that it is a facet of Government policy to bring environmental factors into the mainstream of Government policy-making in order to optimise the use of scarce resources for the overall national good.
- (ii) The consideration 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 to administer policy of decentralisation of decision-making and policy administration.

- (iii) The realisation that the 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 Kitui District. Its aim is that the development of the district take place without destruction of the resource base upon which it depends so as to ensure a sustained and enhanced quality of life for the people of Kitui. To this end, the report is complementary not only to others in the series but also to other parallel exercises being undertaken by the NES at the provincial and national levels.

The basic framework of the project itself derives directly from the Guidelines for Environmental Management (GEM) developed by the NES and tailored to meet the specific requirements of the district exercise. It is hoped therefore that the recommendations contained in this report, and as they will be refined by a seminar to be organised soon, will form a truly useful basis for the management of the environment of Kitui District in the dynamic context of the development of the district.

I would like sincerely to thank all those persons who made contributions to the success of this exercise including the following: The District political leadership whose enthusiasm boosted the morale of our researchers; the District Heads of Departments and Ministries who accorded unqualified cooperation and assistance to the researchers; the people of Kitui District who provided insights which helped to attune the report to the realities of the district; and finally, the multi-disciplinary NES research team whose contributions helped make this report possible. The NES team who carried

out the research and preparation of this report include:

Mr. G. Ondenge (soil specialist and agriculturalist)
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Miss F. Mulii (social scientist)
Mr. M. Wanga (agriculturalist/Project Secretary)

In addition, Suzanne Kilner and Abe Goldman offered valuable editorial assistance and advice.

It is my sincere hope that the work and the cooperative 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.

M. J. NJENGA

PROJECT MANAGER

DIRECTOR/ENVIRONMENT PROTECTION

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I. INTRODUCTION

1.1 Purpose of Environmental Profile

This Kitui District Environmental Assessment Report constitutes the fourth in a series of district pilot studies. The objectives of this report are twofold:

- (a) to identify environmental pressure points related to development opportunity; and
- (b) to anticipate possible environmental consequences of development.

The pilot studies at the district level fulfil the Government's goal of environmental management as outlined in the present National Development Plan. The Government has recognised the need to develop an information base on the state of the environment and to establish a monitoring system so that changes in environmental conditions can be recognised.

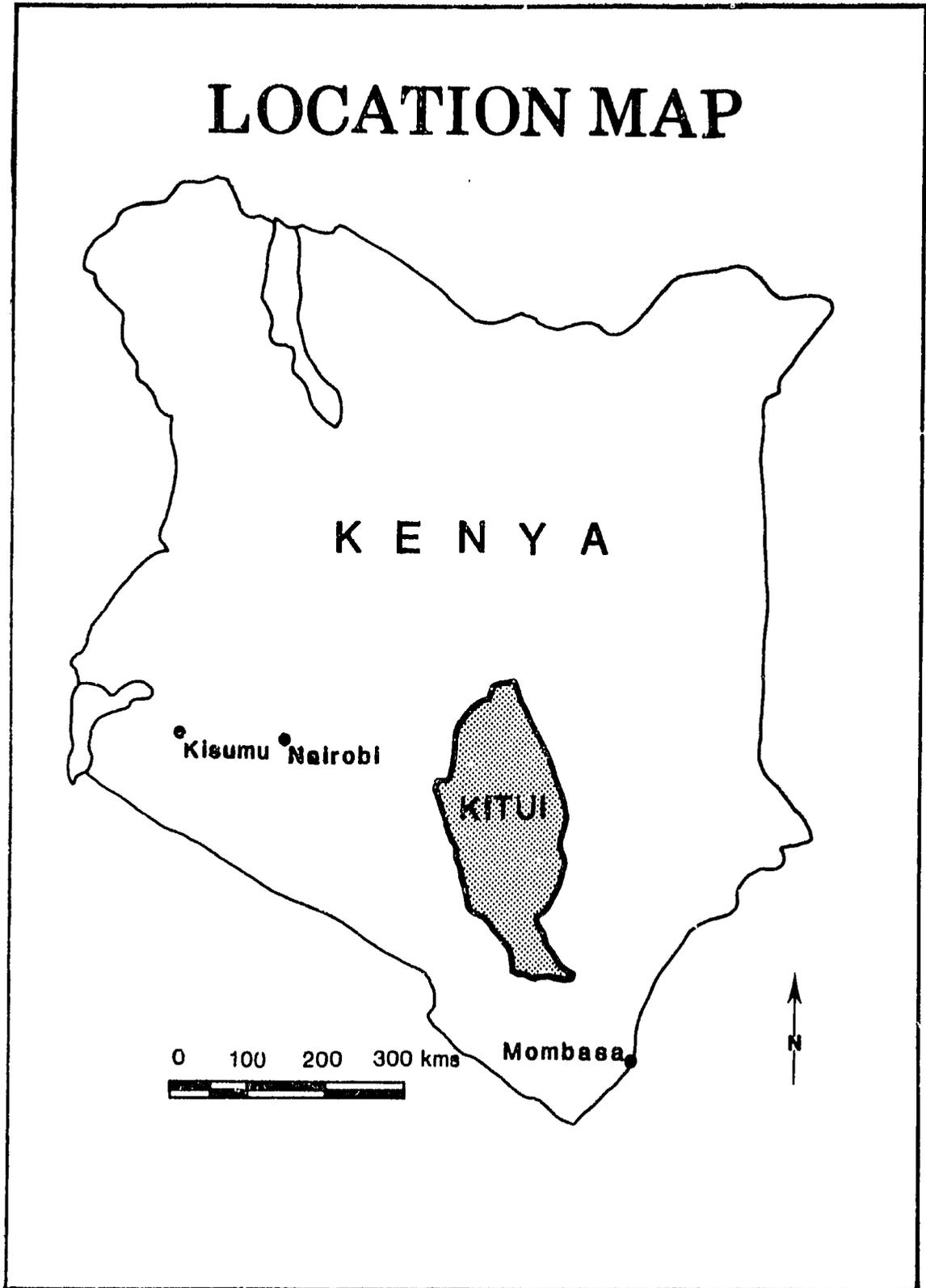
This information system will work towards identifying environmental needs and situations of mismanagement. It will supply basic information required for the identification of corrective measures to conserve the environment for future generations.

1.2 Kitui District

Kitui District is located in the Eastern Province and borders Machakos District to the west, Embu and Meru Districts to the north, Tana River District to the east and Taita Taveta District to the south (see Figure 1).

The district is divided into five administrative divisions: Southern, Eastern, Central, Mwingi (Northern) and Kyuso (Far Northern). The district headquarters are in Kitui Town.

FIGURE 1.



II. NATURAL ENVIRONMENT

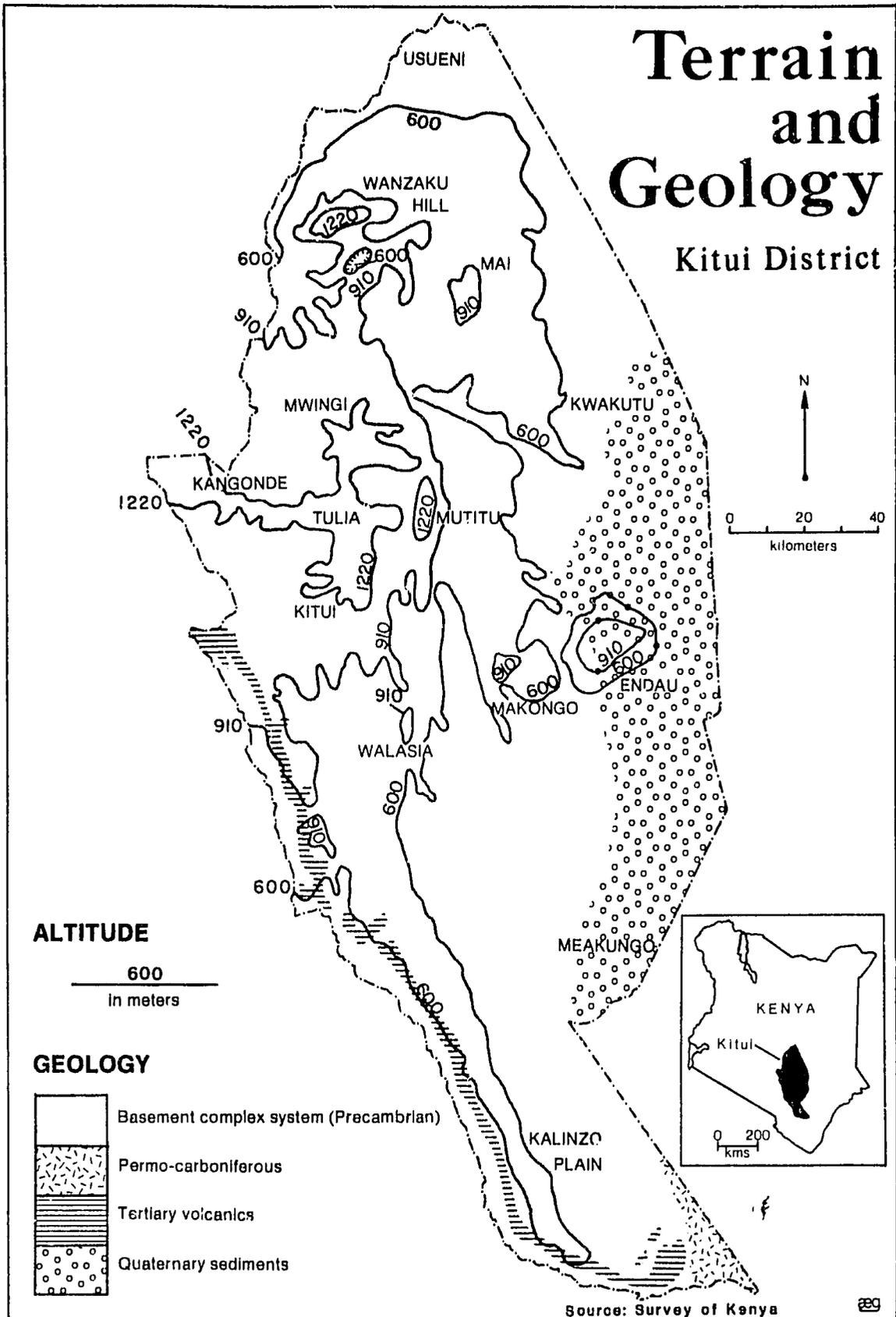
2.1 PHYSIOGRAPHY

Kitui District lies between 400 and 1830 meters elevation and generally slopes from west to east. The western side of the district is an area of scattered hills and ridges with altitudes generally over 910 meters (3000 feet). The highest elevations in the district are at Wanzuku Hill at 1830 meters (6000 feet), the Kitui-Mutito area and the Yatta Plateau (refer to Figure 2). Due to the higher elevations, this area receives greater rainfall than other areas in the district and thus has been able to support a higher population.

The central portion of the district has a slightly lower elevation between 600 and 910 meters (2000 and 3000 feet). A few knobs and inselbergs including Walasia (1220 m) and Mai (1220 m) are found in this area. The eastern side of the district is an almost featureless plain with shallow, widely spaced valleys. The altitude is below 600 meters (2000 feet) except in areas where inselbergs jut out from this plain. Only a few rivers in the periphery of the district carry perennial flows. The Tana River to the north separates Kitui from Embu and Meru Districts; the Athi River to the west and southwest separates Kitui and Machakos districts (Figure 3). The Tana River has several tributaries draining the northern portion of the district. These include Tyaa, Masaa, Kalenga, Nzetu and Kahumbu.

The Tiva, Ilangi, Thua, Kalikuyu, Kansorokana and the Thungutha rivers are ephemeral streams on the eastern side of the district. There are a few swampy areas in the vicinity of these and other rivers. During the rainy

FIGURE 2.



season, the rivers flood and become impassable, while during the dry season they turn into dry sand courses. Some contain moisture in their sand beds and are useful sources of water during the dry season. The incidence of major floods in the district is low.

2.2 GEOLOGY

Geologically, a greater part of Kitui District consists of the Basement Complex system rocks of the Precambrian or Archean era. The eastern portion of the district consists of Quarternary sediment (Figure 2). The southeastern side of the district consists of Carboniferous-Permian deposits while a strip running in the southwestern side of the district is of Tertiary volcanic rocks.

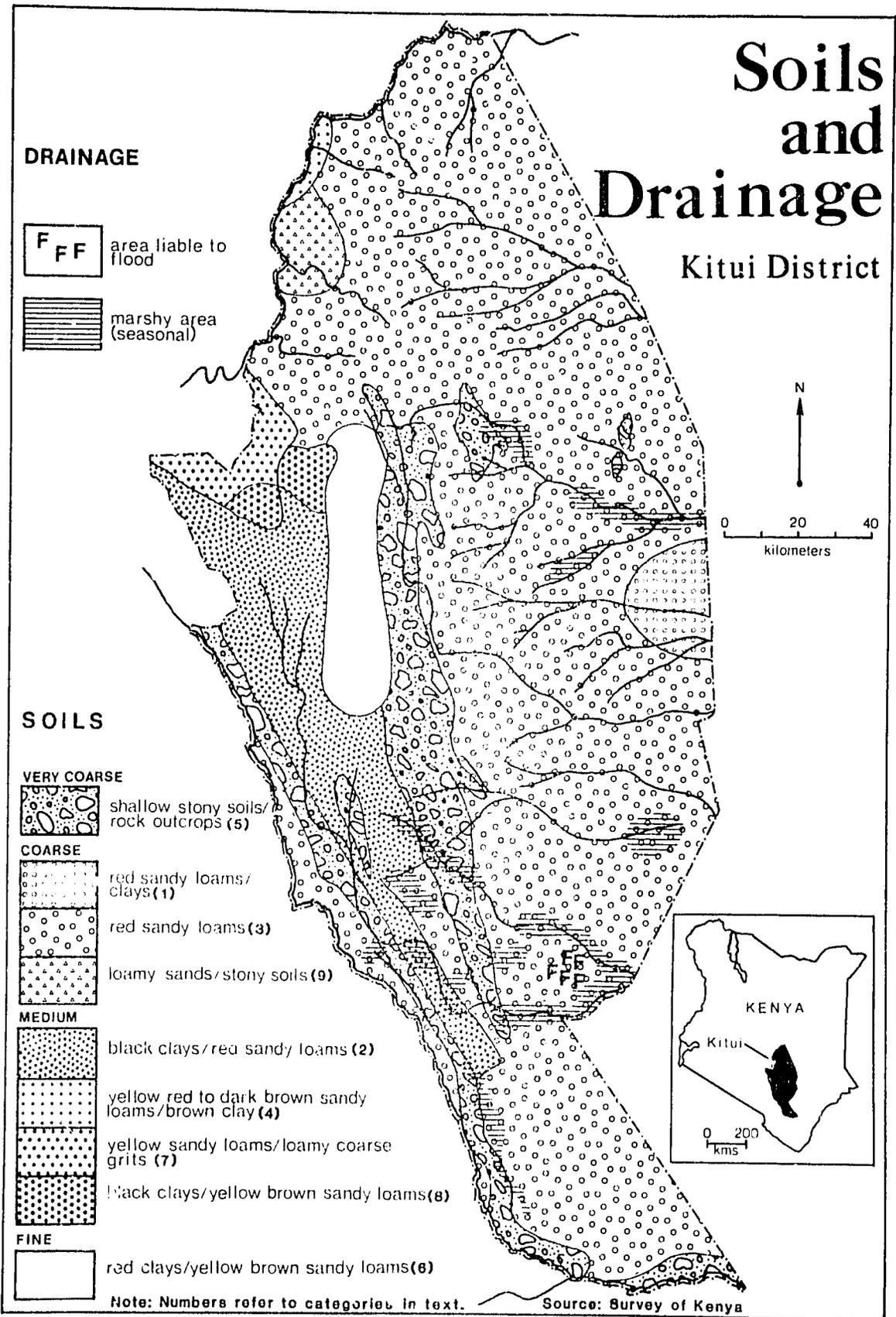
The metamorphic and igneous rocks of the Basement Complex characterise much of the district. Neither inherently permeable nor containing extensive and productive aquifers, these rocks hold extractable water only in relatively small cells where the mantle of weathered rock may be up to 100 meters thick. The cells generally occur only in low areas near stream channels.

2.3 SOILS

On the basis of chemical, physical, and topographical properties as well as drainage, climate, and genesis, the soils of the district are categorised as follows (see Figure 3):

Area 1 - Consists of dark red sandy loams mixed with saline and alkaline clays (solanchak). The low humic (0.5-1%C) soil overlying a sub-angular blocky sandy loam is mixed with saline or alkaline soils

FIGURE 3.



derived from colluvium. Infiltration rates may vary from 0.2 to 1 inch/hour and the available moisture may vary from 1.4 to 2.7 inches per foot of soil. This area would not be suitable for crop production unless water is available for crops and for leaching out the salts.

- Area 2 - Consists of black clays (grumosolic) associated with dark red sandy loams. Here soils may swell when wet and crack when dry although they are not as erodible as the soils in most areas. The "Black Cotton" soils here may include calcareous and non-calcareous variants developed from colluvium. The soils are associated with plains and/or peneplains. The infiltration and moisture retention characteristics are the same as for Area 1.
- Area 3 - Consists of dark red sandy loams which form a greater part of the district. The soils are low in humus (0.5-1.1% C). The horizon is well developed and is underlain by weak sub-angular blocky loam. Infiltration capacity is likely to be about 1 inch/hour while the available moisture is about 1.4 inches by foot of soil.
- Area 4 - Consists of yellow-red to dark brown sandy loams (podsollic) associated with brown clay. This is a small portion on the northwestern side of the district. The organic matter content varies from 0.5 to 2% carbon. In this area, the A horizon overlies sub-angular blocky sandy loam and structureless loamy sand. The infiltration and moisture retention characteristics are more or less the same as for Area 1.
- Area 5 - Consists of shallow stony soils with rock outcrops. The soils are variously developed on steep slopes and escarpments. They have been subjected to geological and recent accelerated erosion and have lost their original characteristics. They are of limited use for arable agriculture both because of surface impediments and shallowness and because they are susceptible to erosion by water.
- Area 6 - Covered with red friable clays (latosolic) associated with light yellow-brown sandy loams. The humic content varies from 0.5 to 3% carbon. The A horizon overlies weak sub-angular blocky friable clays in some places but in others it is underlain by a sandy loam with iron concretions. The soils are associated with peneplains and gently rolling land. Characteristics resemble those of the soils of Area 1. More suitable for arable agriculture than the soils of most areas of the district.
- Area 7 - Occupied by light yellow-brown sandy loams associated with yellow loamy coarse grits. Characteristics more or less the same as for the soils of 3 but differs a bit from 3 because the soils of these areas have residual grits and coarse sand associated with inselbergs on peneplains.
- Area 8 - More or less the same as the soils in Area 2.

Area 9 - Occupied by yellow-red loamy sands (podsollic) mixed with shallow stony soils with rock outcrops. The soils have been subjected to soil erosion and are low in humus (0.5-1.5% C). The A horizon overlies a structureless loamy sand. The soils occur as a catenary component of the upper slopes.

In general, the soils of the district do not have undesirable physical properties except for rockiness and shallowness in soil categories 5 and 9 (Figure 2), the rather low infiltration rates of soils in overgrazed areas, and the sealing of the soil in most areas which reduces the permeability and rainfall acceptance. However, the soils in the district are generally of low fertility compared to the soils of the more humid areas of Kenya. The addition of phosphatic fertilizers has improved productivity in rainfed or irrigated areas since the soils are deficient in phosphorous.

Soil and land degradation in the form of sheet, rill, and gully erosion is being reported from most areas of the district. Natural erosion is caused both by wind in the dry season and running water in the wet season. Accelerated by poor land management practices such as overgrazing, burning, cutting down of trees, and poor cultivation, soil erosion has reached disastrous proportions in Kitui District. The amount of soil loss ranges from complete loss of the top soil to minor soil erosion. The rate of soil loss of about 50 ton/ha/year reported from the district by Dunne (1974) exceeds the maximum acceptable rate of 10 ton/ha/year in shallow soils (12 ton/ha/year for deep soils). This rate of soil loss in the district is equivalent to 500/tons/km²/year of suspended sediment yield.

Overgrazing is an important contributor to soil erosion in the district. Devegetation caused by livestock coupled with compaction of the soil has accelerated soil erosion in a district of relatively thin perennial vegetation cover. Appropriate management practices such as resting

overgrazed areas, reducing stocking rates, and good planning can be used to combat the problem of overgrazing.

Figure 8 in the agricultural section of this report shows that vast areas of the district are under shifting cultivation. The advantages are that it gives the land time to rest and rejuvenate itself. However, the practice of burning for bush clearing reduces vegetative cover and thus can accelerate erosion. Poor cultivation practices such as cropping on steep slopes and up to the edge of river banks without conservation measures also cause soil erosion. Trees are cut in the district for building, charcoal production, firewood, and to provide wood used for curing tobacco. The cutting down of trees, apart from its hydrological implications, accelerates soil erosion, disrupts nutrient recycling, and may cause land desiccation.

Soil degradation in cultivated areas could be greatly reduced by terracing, grass stripping, trash lining, vegetative edges, contour cultivation, strip cropping, the proper use of fertilizers, the incorporation of organic matter (including resting of overcropped areas), and by minimising clearing by fire. Studies have proved that practices that reduce soil degradation also increase crop yields. In uncultivated areas, erosion could be minimised by maintaining vegetative cover.

Several areas in Central and Mwingi divisions have been badly affected by soil erosion (see Table 2.1). The Ministry of Agriculture has embarked on soil and water conservation through Harambee groups--the Miethya and Misewani groups. At the end of 1977, there were 23,655 Miethya groups in the district. The Misewani soil conservation group dug 32,798.7 metres of cut-off drains covering about 602.5 ha. of land. Table 2.2 lists the soil conservation measures completed between 1976 and 1978 (the various afforestation/soil conservation programmes are discussed in the section on

forestry). During 1973-77, a total of 4,884 kilometres of bench terraces were dug in the district.

TABLE 2.1 AREAS MOST AFFECTED BY SOIL EROSION, KITUI DISTRICT

DIVISION	LOCATION/AREA AFFECTED
Central	Many areas badly eroded and exposed. Overpopulation has caused excessive cultivation and overgrazing. Tobacco curers also cut down trees in these areas.
Mwingi	Soil erosion is serious in Mutonguni, Migwani, Tulia and Mwingi areas.
Southern	Mutomo, Ikutha, Ikanga
Eastern	Most areas are affected but not very badly hit, in particular Mutito and Zombe.

SOURCE: Ministry of Agriculture.

TABLE 2.2 SOIL CONSERVATION MEASURES - KITUI DISTRICT, 1976-78

SOIL CONSERVATION METHOD	UNIT	1976	1977	1978
Cut off drains	Km	560	612	414
Terraces	Km	N/A	N/A	389
Sisal edges	Km	108	302	236
Grass strips	Km	9	20	88
Trees planted		42,000	162,000	N/A
Banana holes on steepland		2,137	3,928	N/A
Repaired terraces	Km	98	176	38

SOURCE: Ministry of Agriculture.

2.4 CLIMATE

Most of Kitui is classified as semi-arid (Woodhead, 1968, 1970). Figure 4 shows that the central and western parts of the district, i.e., around Kitui and Mutito Hills and extending north of Mumoni Hills, receive 510 - 760 mm of rain per annum. Within the area, Mulango, Nzambani, Kisasi, Miambanii, Changiwithya, Matinyani, Mutonguni and Migwani Locations get 760 - 1015 mm of rain in a year. The rest of the district (except Endau Hills, which receives 510 - 1015 mm) receives 255 - 510 mm of rain in a year.

Rainfall figures for the various recording stations are given in Tables 2.3 and 2.4. Rainfall varies from a low of 273.56 mm at Tseikuru in the northern part of the district to a high of 1057.89 mm a year at Kitui Boma in the Central Division, with most of the district receiving less than 762 mm/year of rainfall. Rainfall also varies considerably from year to year, from a mean of 333.02 mm/year in 1976 to 650.22 mm/year in 1978. Because of the unreliability of rainfall, crop failures are a common occurrence in the district.

The months of April and November have the highest rainfall (about 156 mm and 258 mm, respectively), half of the total annual rainfall occurring during those months. There are dry spells between the wet periods. July is the driest of all the months, and during June - September most stations receive no rain in 75 out of 100 years. This pattern makes crop production difficult and risky since during most months the rain does not supply the minimum requirement for growth of crops. Also, much of the rain that falls

FIGURE 4.

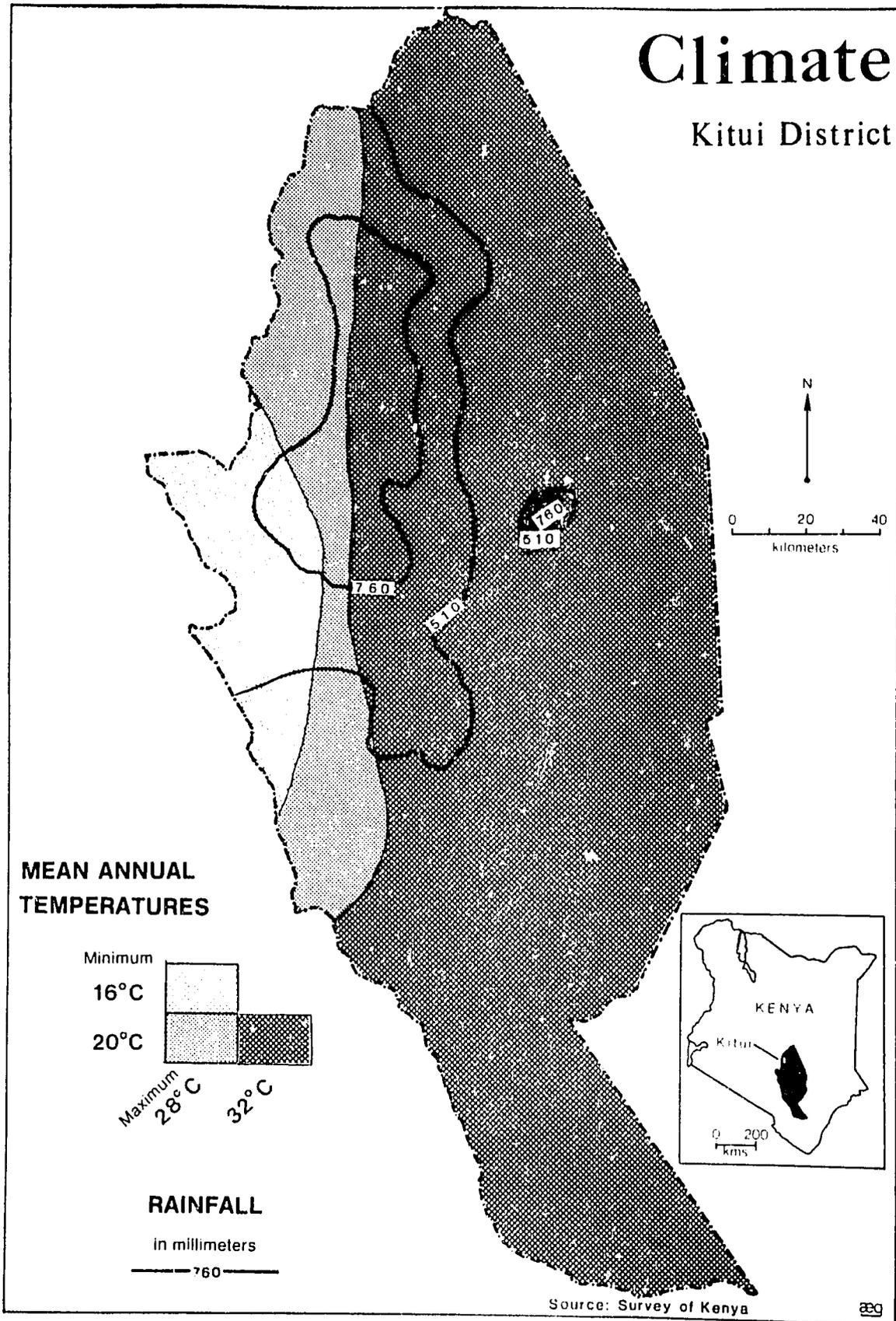


TABLE 2.3 ANNUAL RAINFALL FIGURES FOR THE VARIOUS RECORDING STATIONSKITUI DISTRICT (mm)

Recording Station	1974	1975	1976	1977	1978	Mean Amount
Kitui Boma	1145.15	629.6	658.5	1356.5	1499.7	1057.89
Tiva	602.9	400.7	475.9	N/A	874.1	588.4
Kyusiani	959.2	364.6	612.2	192.1	806.0	586.82
Mutonguni	620.3	515.9	204.5	N/A	474.8	363.1
Kyuso	368.6	490.4	215.1	235.1	239.7	309.78
Mwingi	418.9	362.1	405.7	794.3	670.9	530.38
Mwukoni	277.3	392.8	188.6	547.8	412.5	363.8
Migwani	277.3	942.9	312.4	344.8	626.9	500.86
Tharaka	315.6	326.5	324.8	247.4	290.4	300.94
Katse	484.3	212.5	441.4	498.9	183.3	364.08
Tseikuru	455.8	172.4	190.6	207.9	341.1	273.56
Ngomenii	1100.9	247.8	203.4	400	362.9	463
Voo	206.77	268.7	93.7	635.2	842.3	409.334
Ikanga	198.7	286.7	216.6	782.2	365	369.84
Mutomo	450.9	289.3	448.1	577.0	978.1	548.68
Kanziku	227.5	219.9	483.6	526.4	859.6	463.4
Mutha	726.4	97.6	150.9	328.7	636.5	388.02
Mutito	N/A	265	351	1265	735.85	523.37
Nau	-do-	234.7	357.7	900.3	898.1	478.16
Mui	-do-	311.3	325.6	986.2	908.7	506.36
Means	519.80	351.57	333.02	572.58	650.22	464.14

SOURCE: District information.

TABLE 2.4 MEAN MONTHLY AND ANNUAL PRECIPITATION (mm), KITUI DISTRICT STATIONS

Station	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Kitui Ag. Off.	30	42	170	229	37	25	1	7	13	96	346	114	1116
Mutumo	34	32	75	176	47	5	3	2	11	64	342	172	961
Kitui Sec. Sch.	32	40	132	167	54	6	0	6	13	86	311	126	974
Zombe Ag. Sta.	25	20	94	118	17	2	0	1	7	48	249	92	673
Migwani	7	32	81	201	25	3	1	3	9	74	252	99	776
Kanziku	18	29	88	106	19	2	0	2	8	32	214	108	624
Voo Dispensary	14	12	76	125	15	2	0	3	4	47	163	91	552
Mucha Ch. Camp	26	21	66	126	14	1	1	4	10	34	206	89	598
Mutito Ch. Camp	25	25	84	131	25	2	2	3	5	64	275	105	745
Kitui Dam	35	41	133	225	50	6	1	4	14	60	298	101	968
Tiva Mkt.	17	38	85	112	44	3	0	2	4	32	183	77	597
MEANS	23.91	30.18	98.55	156	31.55	5.18	0.82	3.36	8.91	57.91	258.09	106.73	780.36

Adapted from Drains, Njoroge and Njui (1978).

in the district is of high intensity and short duration, causing much runoff, particularly in sloping areas, and exacerbating the problem of soil erosion.

Air temperatures in the district are quite high. The minimum air temperature varies from 14° - 18° C in the western part of the district to 18° - 22° C in the eastern part of the district. The maximum annual temperature varies from 26° - 30° C in the western part of the district to 30° - 34° C in the eastern part of the district (see Figure 4). At Kitui dam, the mean monthly temperature varies from 18.1° C in July to 20° C in March while at Makindu station, which is just outside the district, it varies from 20.1° C in July to 24.6° C in March. The maximum mean monthly temperature recorded in the district was 27.8° C at both Zombe and Voo locations.

The only available data on potential evapotranspiration is given in Table 2.5. The availability of water is due to a combination of factors such as the efficiency of storage, duration of rainfall, and water loss to transpiration and evaporation. The high evaporative demand, especially in October and March, makes water conservation in the district's dams, ponds, rock catchments, and the soil difficult.

2.5 SURFACE AND GROUNDWATER QUANTITY AND QUALITY

2.5.1 Surface Water

The Tana River, on the northern side, and the Athi River, forming the southern and southwestern boundaries, are the two main sources of water for the western half of Kitui District.

TABLE 2.5 POTENTIAL EVAPOTRANSPIRATION (E_o) OF THREE STATIONS IN AND OUTSIDE KITUI DISTRICT (mm)

Station	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Kitui Dam	170	176	185	160	148	128	123	154	173	189	157	153	1916
Kitui Ag. Off.	189	191	200	169	168	152	149	162	183	203	163	167	2096
Makindu	175	179	182	160	151	139	139	153	179	191	154	149	1951
MEANS	178	182	189	163	155.7	139.7	137	156.3	178.3	194.3	158	156.3	1987.7

SOURCE: Woodhead (1968).

Lack of water is the main obstacle to development of the district as most of the rivers dry up for most of each year, although they flood during the rainy season. Only about 5% of the rural population are within reach of piped water in the district. During the dry periods, most people have to walk distances of up to 15 miles in search of water. Water for both livestock and domestic consumption is supplied by earthen dams, subsurface dams, weirs, rock catchments, springs, and boreholes.

Low flow runoff in the district (95% flow duration)* is as follows:

Tana River area (7 km strip) - 4.0-8.0 L/S/km²

Athi River area (in the district) - 0.5 cumecs (dry months)

Remainder of the district - 0.15 L/S/km²

The mean annual runoff for the Tiva, Tana and Athi rivers in the district are as follows:

Basin (number)	Basin area	Mean annual rainfall	Mean annual runoff	Runoff/ Rainfall Ratio
Tiva River (44)	20,103 km ²	482 mm	24 mm	0.05
Tana River (4ED)	3,088 km ²	698 mm	75 mm	0.11
Athi River (3DA)	821 km ²	810 mm	90 mm	0.11

High intensity rainfall causes massive runoff and flooding, which results in increased soil loss and degradation. Sediment loads of the order of 600 tonnes/km²/year have been reported from Kitui District by Dunne

* Sources include the WHO/Kenya 3202 Map 4 based on discharge records available in 1972 and approximately 200 gauging stations during 10-15 years period, and the mean annual rainfall map of Kenya (1971 edition).

(1974). Estimates of total sediment load or the rates of erosion are not available for the district.

One of the major problems with water development in Kitui District is siltation caused by dams. The Kilundu Dam, built in 1958 as a reservoir for Kitui township, was completely silted up by 1974. The average sediment yield is about 733 tonnes/km²/annum. In general, the average sediment yield in the Kitui area is greater than 500 tonnes/km²/year, which, if translated to soil erosion rate, considerably exceeds the permissible rate of 10 tonnes/hectare/annum for shallow soils (Dunne, 1974; Daines, Njoroge, Njui 1978).

Table 2.6 presents the number of permanent rivers, springs, wells, dams/weirs, rock catchments, and boreholes in the district by division in the year 1979. The data show that siltation is a major problem with dams throughout the district.

Table 2.7 gives the proposed water schemes and sources by 1979. More dams and weirs are planned than any other water projects, followed by rock catchments, particularly in the drier area of the district.

Data on radiation and evaporation are scarce. However, available data suggest that radiation values can be as low as 383 langley's per day at Kitui dam in July, although most of the year the values should be relatively high. The mean annual open pan evaporation for Kitui dam (1963-70) is 1935 mm, with a low of 133 mm for June and a high of 198 mm for October (Daines, Njoroge, Njui, 1978). The high radiation and evaporation make surface water conservation difficult in most of the district.

TABLE 2.6 EXISTING WATER SCHEMES/SOURCES, 1979

Division/ Location	Bore- holes	Permanent Rivers	Springs/ Wells	Dams/ Weirs	Rock Catchments	Comments
<u>Kyuso</u>						
Katse	1	1	1	13	1	10 dams silted up or broken down. 10 dams silted up or broken down. All dams silted up. 7 dams silted up or broken down. 3 boreholes not equipped. 7 earth dams silted up.
Mirukoni	4	-	-	20	3	
Tharaka Tseikuru			2 1	8 11	2	
Ngomeni	4		7	13	7	
<u>Mwingi</u>						
Mutonguni	1			29		20 dams silted up or broken down. 13 dams silted up or broken down. 8 dams silted up or broken down. 13 dams silted up or broken down.
Migwani	1			21	8	
Mwingi	1	1		13	5	
Endui			1	13	1	
<u>Central</u>						
Changwithya	2		1		15	12 dams silted up or broken down. 3 dams silted up or broken down. 3 dams silted up or broken down. 11 dams silted up or broken down.
Migwani	1				3	
Mulango	1		3	5		
Kisasi			16	16		
Yatta		1		6		
Nzambani			2	9		
Matinyani			6	15		
Yatta B2	4	1	1	8	1	2 dams broken down.
<u>Eastern</u>						
Mutito	1		12	12	1	6 dams silted up or broken down. 4 dams silted up or broken down.
Mui			8	17	1	

TABLE 2.6 EXISTING WATER SCHEMES/SOURCES, 1979 (continued)

Division/ Location	Bore- holes	Permanent Rivers	Springs/ Wells	Dams/ Weirs	Rock Catchments	Comments
Nuu			14	11	2	9 dams silted up or broken down.
Endau	1		15	8		6 dams silted up or broken down.
Zombi		1	2	5	1	4 dams silted up or broken down.
<u>Southern</u>						
Mutomo/ Ikanga	4		1	22	2	2 boreholes not equipped, 11 dams silted up or broken down.
Ikutha	2			14	2	1 borehole not equip- ped, 1 dam broken down.
Kanziko	2		2	15	11	8 dams silted up or broken down.
Voo				1	3	2 boreholes not equipped, one dam broken down.

SOURCE: Ministry of Water Development.

2.5.2 Ground Water

Groundwater is tapped through boreholes, wells and springs, and rivers. Most rivers flowing to the eastern side of the district originate from the higher, better watered area around Kitui township. Appendix A presents the number of existing and proposed boreholes by division and location, with depths and yields. The yield of boreholes varies from 0.045 m³/hour at water treatment works at Kigui to 27.273 m³/hour at Ithokwe. The average yield of boreholes in the district is about 5 m³/hour (900 gals/hour).

TABLE 2.7 PROPOSED WATER SCHEMES/SOURCES, 1979

<u>Division/ Location</u>	<u>Bore- holes</u>	<u>Springs/ Wells</u>	<u>Dams Weirs</u>	<u>Rock Catchment</u>
<u>Kyuso</u>				
Katse			1	1
Mirukoni	7	2	5	4
Tharaka				3
Tseikuru			7	
Ngomeni	1	5	11	18
<u>Mwingi</u>				
Mutonguni			18	
Migwani	3		9	3
Mwingi			3	6
Endui	1		9	6
<u>Central</u>				
Changwithya		4	4	
Miambani		2	2	1
Mulango			5	
Kisasi			5	
Yatta			11	
Nzambani			10	
Matinyani			13	
Yatta B?				1
<u>Eastern</u>				
Mutitu	9	2	4	1
Mui	5	2	4	7
Nuu	4	4	4	7
Endau	4	7	5	1
Zombe	1	3	2	2
<u>Southern</u>				
Mutomo/Ikanga			10	7
Ikutha			5	2
Kanziko		1	22	5
Voo		1	3	2
Mutha		1	7	2
TOTAL	35	58	174	76

SOURCE: Ministry of Water Development.

2.5.3 Water Quality

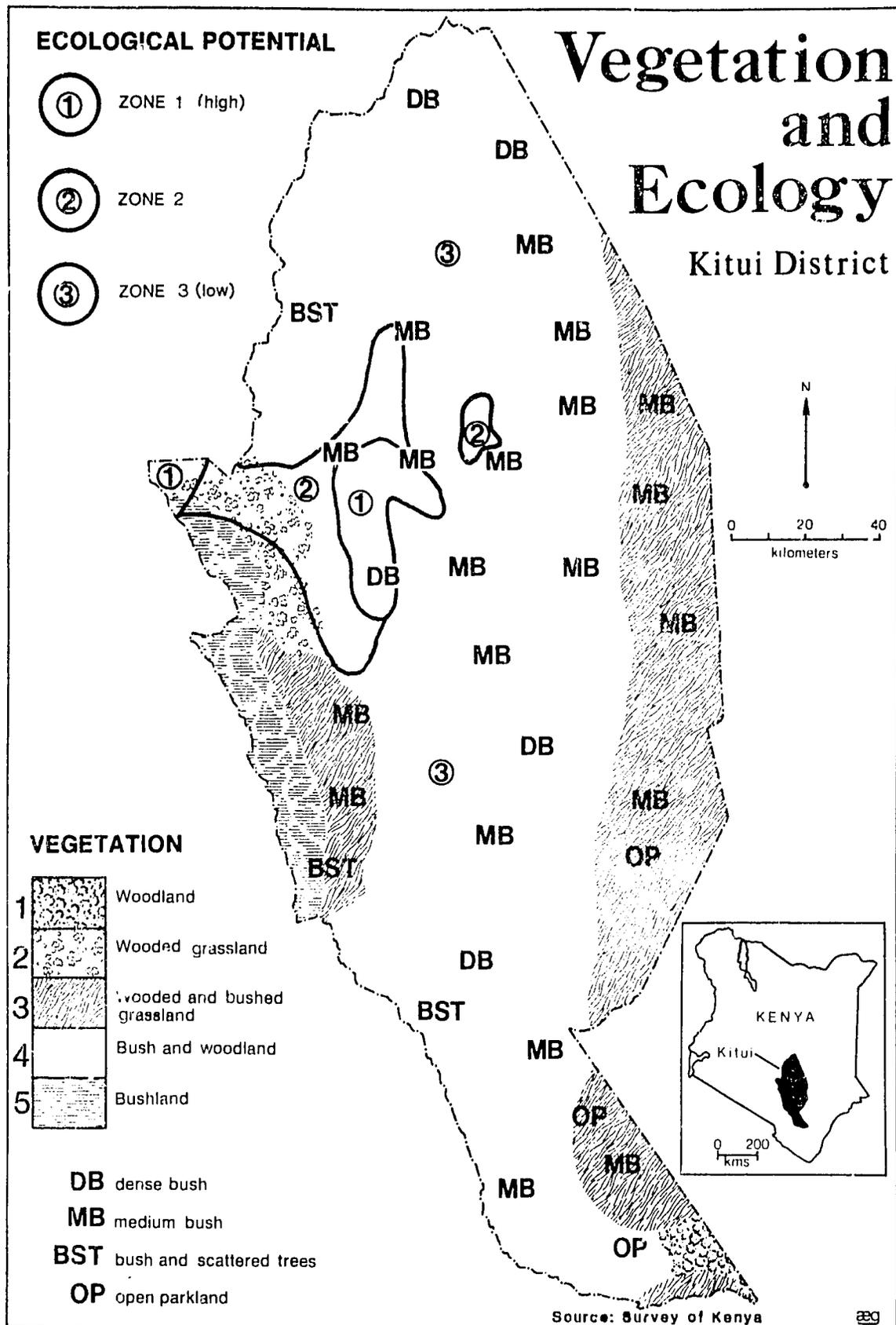
Although data on surface water quality is not available, it is generally observed that there is no serious pollution of surface water in the district since there are no industries discharging wastes into rivers, no towns discharging their refuse into rivers, and use of agro-chemicals is not extensive. However, soil erosion contributes considerably to the silt loads of the rivers passing through the district or originating from it.

Information on groundwater quality comes from tests of 59 boreholes. Of these, 37 have good quality water, eleven have rather saline and hard water, ten have water of unknown quality, seven do not have enough water (some abandoned), while eighteen have about average yield. Salinity and hardness are caused by the presence of salts of magnesium and calcium. For boreholes with hard and saline water the pH is often above 7 and in some cases rises to about 8.4. Borehole water is free from organic impurities and in most cases is safe for domestic purposes, although it is mostly used for watering animals. Water at few places (e.g. Kalinga - 4223) has been classified as being suitable for irrigation purposes. Very saline and hard water may cause gastric problems in human beings.

2.6 VEGETATION AND ECOLOGY

Kitui District, classified as being a semi-arid and arid ecological zone, consists mostly of bush and woodland. Figure 5 divides the district into five vegetation zones according to dominant tree species, genera, and the development of vegetation (Survey of Kenya, 1969). Zone 1 on the map consists mainly of open bush or continuous, but not thickly interlaced, canopy. The canopy cover is over 20%. Tree stands reach a height of 18

FIGURE 5.



metres. Grasses and herbs dominate the ground cover while epiphytic ferns are rare. Zone 2 consists of grassland with scattered or grouped trees with a canopy cover of less than 20%. Zone 3 consists of medium and open bush mixed with scattered and grouped trees. Grass and scattered or grouped shrubs are also common. The canopy cover is less than 20%. Zone 4 consists of dense, medium bush and scattered trees. Canopy height varies from less than 6m to up to 18m in the zone and the canopy cover is over 20%. Here grasses are mixed with herbs and assemblages of woody plants, mostly of shrubby habit, with occasional emergents. Zone 5 is an assemblage of woody plants (shrubs) with a canopy less than 6m in height and coverage of more than 20%.

Ecologically, the district can be divided into three zones (Figure 5). The first, which comprises most of the district, consists of land only locally suited to agriculture, with a moisture index between -42 and -51. The vegetation is woody, being dominated by Commiphora, Acacia and allied genera. Perennial grasses such as Cenchrus ciliaris and Chloris roxburghiana can dominate but are not hardy. The stock-carrying capacity is more than 4 hectares per stock unit. Burning requires great caution but can be highly effective in bush control.

The second zone is marginally suited to agriculture, with a moisture index of -30 to -42. It consists of dry forms of woodland and "savanna" (often Acacia Themeda association) or derived semi-evergreen or deciduous bushland. It has potential for rangeland development and has a stock-carrying capacity of less than 4 hectares per stock unit.

The third zone has a high agricultural potential, soil and topography permitting, and a moisture index of -10 to -20. Emphasis is on ley farming (raising of fodder crops for feeding livestock). The vegetation is varied,

consisting of moist woodland, bushland, or "savanna." The trees are broad leaved (e.g., Combretum), and the larger shrubs, mostly evergreen. Under close management, the stock-carrying capacity is less than 2 hectares per stock unit.

2.7 WILDLIFE AND TOURISM

One fifth of Kitui district is covered by Tsavo East National Park. Although the Park's wildlife is a main tourist attraction in Kenya, wildlife has had little impact on the Kitui economy as the northern border area, adjacent to the populated portion of the district, is closed to the public. Apart from Tsavo East National Park, the only other concentration of wildlife is at B₂ Yatta Ranching Scheme in the Central Division. The wildlife population is sparse elsewhere in the district due to drought, poaching, and human settlements.

In March 1978, the following species of wildlife were recorded in the district:

Elephants	23	Oryx	249
Giraffe	113	Lesser Kudu	1020
Zebra (Burc)	159	Bushbuck	23
Kongoni	23	Gerenuk	68
Impala	91		

SOURCE: Kenya Rangeland and Ecological Monitoring Unit

There is a plant sanctuary at Mutomo, but it is not being exploited at present.

During the current Plan period (1979-83) the Department of Wildlife and Conservation Management has allocated K Shs. 9,040,000 to the South Eastern Game Division for wildlife conservation. The headquarters of this division

is at Ngong and covers Nairobi, Kajiado, Kitui and Machakos Districts. The breakdown by years is provided below.

<u>1979-83 FUND ALLOCATION</u>					
<u>SOUTH EASTERN GAME DIVISION</u>					
<u>K Shs. '000s</u>					
<u>Districts</u>	<u>78/79</u>	<u>79/80</u>	<u>80/81</u>	<u>81/82</u>	<u>82/83</u>
Kitui)					
Nairobi)	740	1,340	2,140	1,860	1,960
Machakos)					
Kajiado)					

Major problems that affect local farmers and the district Game Warden are:

- (a) The wildlife destroy crops and livestock especially in areas bordering the park. The small-scale farmers in these areas cannot afford to erect fences.
- (b) Some wildlife are carriers of rabies, which can easily be transmitted to the livestock.
- (c) Inadequate services in the park such as:
 - (i) lack of enough game personnel to cover the district;
 - (ii) lack of transportation;
 - (iii) lack of communication equipment: at present only Mutomo and Mwingi operate on radio;
 - (iv) lack of housing for game staff;
 - (v) lack of educational equipment (e.g. visual aids) for educating the public on the importance of wildlife.

In addition to assisting the district in alleviating the above problems, it is recommended that:

- more funds be allocated to the Mutomo Plant Sanctuary so that it could be utilised and exploited to the fullest;
- airstrips be constructed in the district to ease communication and spotting of poachers;
- Tsavo National Park be opened from the north and a link be made between Tsavo East National Park and Meru National Park;
- more game reserves be opened to exploit wildlife in the district and to develop the tourist industry. This would both provide revenue to the Kitui County Council and create employment.

III. HUMAN ENVIRONMENT

3.1 POPULATION

The Akamba are the predominant ethnic group of Kitui District, comprising 97% of the total population. Table 3.1 shows the ethnic structure of the district's population, including people of non-Kenyan origin.

TABLE 3.1 ETHNIC STRUCTURE OF KITUI POPULATION

	Male	Female	Total
District Total	215,336	248,947	464,283
Kenyan African	214,572	248,224	462,796
Kamba	207,962	242,336	450,298
Tharaka	3,133	3,324	6,457
Kikuyu	841	502	1,343
Mbere	821	841	1,662
Meru	365	256	621
Luhya	302	177	479
Luo	274	151	425
Others	974	737	1,711
Kenyan Non-African	186	149	335
Non-Kenyan	478	474	952

SOURCE: 1979 Census.

The 1969 census recorded 342,953 persons in Kitui District, with an annual growth rate of 2.8% and an overall density of 11 persons per square kilometre. According to the 1979 census, Kitui had 464,283 persons, with an overall density of 20 persons per square kilometre. Table 3.2 and Figure 6 present population distribution and density. Population density varies considerably, from over 100 persons per square kilometre in Changwithya and Matinyani Locations in Central Division to under five persons per square kilometre in parts of Kyuso, Eastern and Southern Divisions. In general, the agricultural potential of the land has determined the variation in population density, which is fairly high in the well-water areas of Central and Mwingi Divisions and relatively sparse in most of the rest of the district.

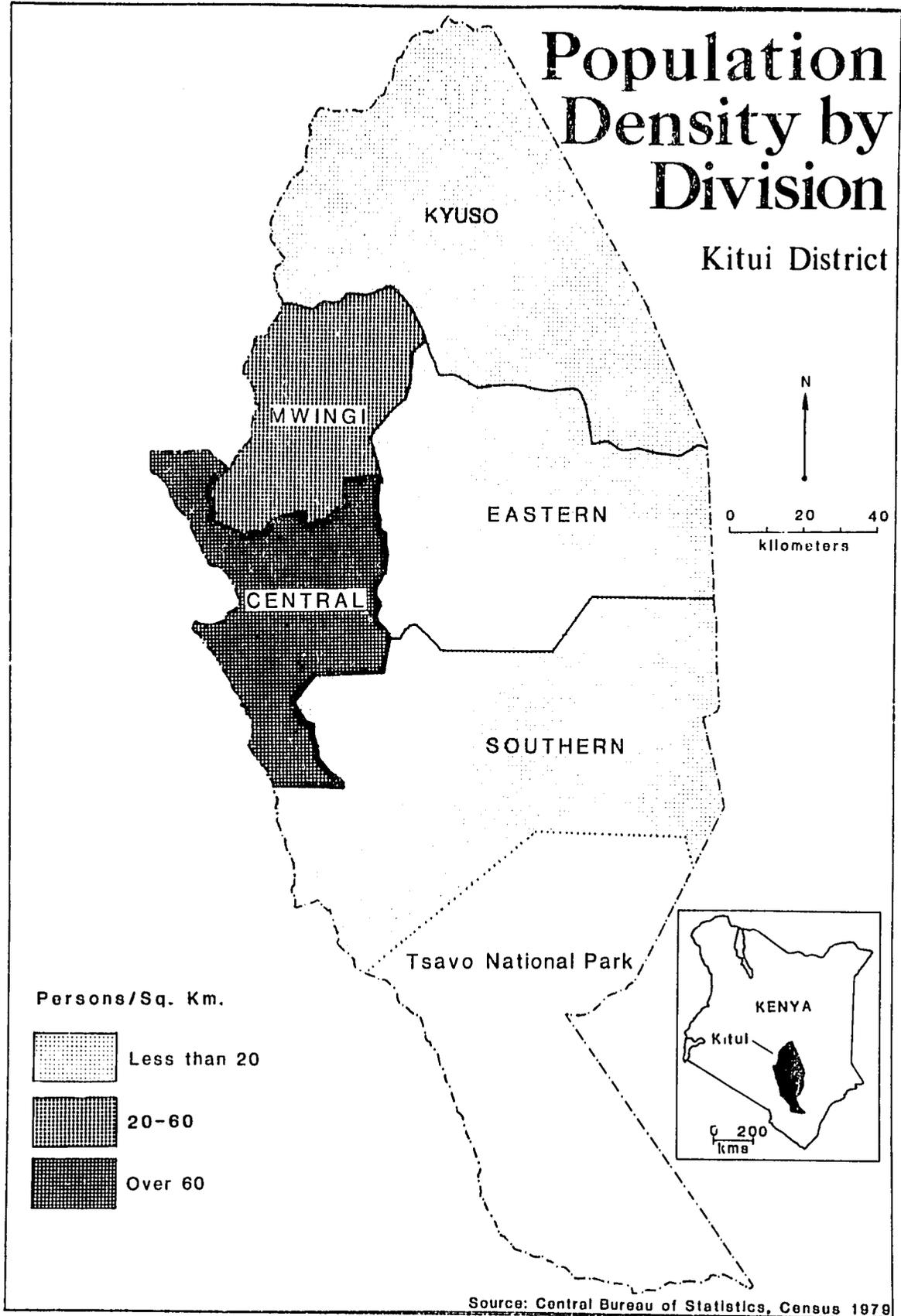
TABLE 3.2 POPULATION DISTRIBUTION BY DIVISION, 1969 and 1979

Division	Sq. km	1969	1979	1979 Density	Population % Increase
Central	2535	111,853	158,667	62	41.9
Eastern	4776	36,062	49,665	10	37.7
Southern	6590	56,182	73,857	11	31.5
Northern (Mwingi)	2245	80,854	109,880	48	35.9
Far Northern (Kyuso)	6668	54,848	72,214	10	31.6
TOTAL	22,814*	342,953	464,283	20	35.4

SOURCE: 1969 and 1979 Census.

* Total land area does not include the area of Tsavo National Park in Kitui, 6309 sq. km.

FIGURE 6.



District population increased by 35.4%, for an annual average growth rate of 3.1% over the 1969 to 1979 decade. This rate of growth, which is somewhat below the national rate of 3.5% over the period, also varied significantly among the different divisions. Central Division grew at an average annual rate of about 3.6% while the growth rate in Southern and Kyuso Divisions was about 2.8%. Migration patterns, as well as fertility and mortality rates, were primarily responsible for the variations. Moreover, because of the harshness of the environment in many parts of the district, even a 3.1% rate of growth is difficult to absorb.

Table 3.3 and Figure 7 present the age-sex proportions and age-sex pyramid for Kitui District. The early age groups have almost the same number of males as females. From ages 15 to 59, the number of males drops sharply, particularly from ages 20-54. This reflects a typical pattern in the rural areas of Kenya where young males migrate to the urban areas in search of employment, leaving females as the main source of agricultural labour in the district.

Data on migration from the 1979 Census was not yet compiled at the time this report was written. However, some indicative data is available. Table 3.4 gives the number of people born in Kitui District who resided in Nairobi and Mombasa during the 1979 Census. These are the two main urban areas to which people of Kitui District have migrated for employment. The preponderance of males is clear, and the majority of these migrants are probably in the productive age groups of 20-50. The total of almost 44,000 people, equivalent to almost 10% of the population of Kitui District, gives a rough idea of the scale of migration out of the district.

The age-sex pyramid also illustrates the extremely high dependency ratio in the district: almost 57% of the population is under 15 or over 60.

TABLE 3.3 AGE-SEX RATIOS, KITUI DISTRICT, 1979

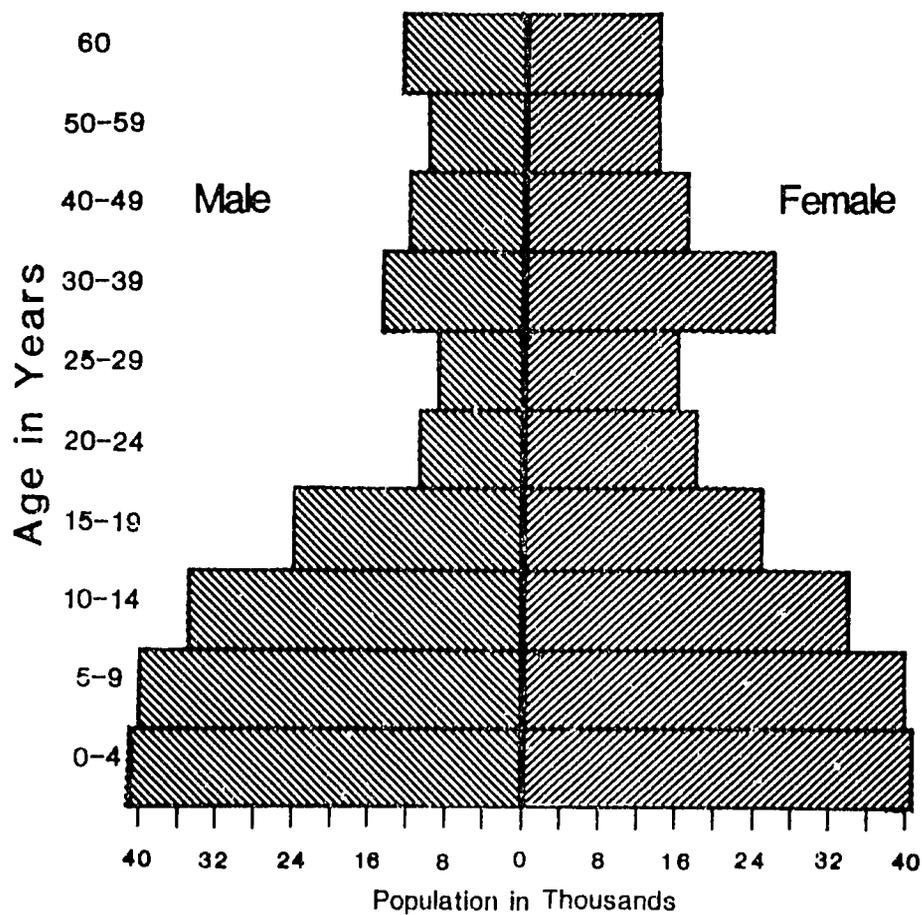
<u>Age</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Sex Ratio</u>	<u>Age Group as % of Total Popula- tion</u>
0 - 4	41, 562	41,918	83,480	99	18.0
5 - 9	40,912	40,742	81,654	100	17.6
10 - 14	35,261	34,363	69,624	103	15.0
15 - 19	24,377	25,854	50,231	94	10.8
20 - 24	11,466	17,956	29,422	64	6.3
25 - 29	9,446	15,904	25,350	59	5.
30 - 34	8,785	15,206	23,991	58	
35 - 39	6,709	10,773	17,482	62	8
40 - 44	6,697	10,094	16,791	66	3.6
45 - 49	5,354	6,842	12,196	78	2.6
50 - 54	6,517	9,541	16,058	68	3.5
55 - 59	4,153	4,763	8,916	87	1.9
60 - 64	3,863	4,535	8,398	85	1.8
65 - 69	3,168	3,011	6,179	105	1.3
70+	6,685	7,073	13,758	95	2.9
Not Stated	381	372	753		
TOTAL	215,336	248,947	464,283	86	100.0

SOURCE: 1979 Census.

FIGURE 7.

AGE/SEX PYRAMID

Kitui 1979



Source: 1979 Census

TABLE 3.4 PEOPLE BORN IN KITUI DISTRICT
RESIDING IN NAIROBI AND MOMBASA, 1979

	Male	Female	Total
Nairobi	17,073	6,829	23,902
Mombasa	13,052	6,870	19,922
TOTALS	30,125	12,699	43,824

SOURCE: Central Bureau of Statistics, 1979 Census

This reflects both the outmigration from the district and the high fertility rates. Fertility data from the 1979 Census was not yet available as this report was written, but in the 1969 Demographic Survey, the fertility rate in Kitui was over eight, which was the highest in Eastern Province and was comparable with the high rates in parts of Western and Central Provinces. Table 3.5 shows rates by age group -- i.e., the average number of children women in each age group were expected to bear over their lifetimes. This ranges from a high of 11.97 for the 30-39 age group to a low of 7.96 for the 25-29 group.

TABLE 3.5 FERTILITY RATES, KITUI DISTRICT, 1969

<u>Age Group</u>	<u>Female Population</u>	<u>Fertility Rate</u>
15 - 19	16,076	9.37
20 - 24	14,838	8.65
25 - 29	13,659	7.96
30 - 39	20,534	11.97
40 - 49	14,383	8.38

SOURCE: Central Bureau of Statistics, 1969 Census.

Because the population growth rate in the district is dependent on both the fertility rate and migration patterns, accurate projections of future population are extremely difficult to make. The net rate of growth over the 1969-1979 decade was 3.1% despite the high fertility rate in the district. If this rate continues, the population of the district will reach 630,000 by 1989 and over 880,000 by the year 2000. Population pressure on the slender resource base of Kitui District will, thus, be a severe problem in the coming years.

3.2 ENVIRONMENTAL PERCEPTION

It is important to examine the cultural background of any group of people before analyzing their environmental problems and making recommendations relating to their systems of livelihood. Not only have their cultural values been influenced by the conditions of their environment, but these values also affect the society's perception of the environment, and they may have important implications for any social activities undertaken to affect environmental conditions. This section will examine some of the main aspects of the culture of the people of Kitui that relate to their environmental perceptions and actions.

3.2.1 Significant Historical Events

The Akamba people are one of the most north-easterly Bantu peoples in Africa and one of the largest tribes in East Africa. They inhabit the eastern slopes of the East African highlands between the upper course of the River Tana and Kenya-Uganda Railway. There are a number of scattered areas in other parts of Kenya and Tanzania settled by Akamba who left their

villages due to famine or during the slave-trading era. Thus, Kamba villages can be found near the government station of Murang'a in Kikuyuland and in Swahili areas. However, most of the Kamba live in either Kitui or Machakos Districts.

The history of settlement in Kitui District has largely been determined by its marginal ability to support animal and human populations. The difficulties of the day-to-day struggle with the physical harshness of the environment are considerable. For example, many of the rivers in Kitui frequently dry up. Since they are quite unreliable as sources of water, the population in these areas is quite low. Although Kitui is three times the size of its sister district Machakos, it can only support half of the Machakos population. Only in the central area of Kitui is the rain reliable. Thus both the current pattern of settlement and the social organisation of Kitui's people have been shaped by the arid climate.

There is little written cultural information which describes recent changes and the effects of modernisation. Natural events have made a great impression in the history of Kitui and are passed along verbally to younger generations. Among these are the great famines, each of which has been given a name. The worst occurred in the 1890's when there was no rain and hence no harvest for five successive rainy seasons. The people had to forage for food -- e.g., the roots and wild fruits of the Baobab, which is common in the eastern part of the country. There was also a great epidemic, suspected to be smallpox, and the majority of the sick had unexplained mental problems. A chart of other major historical events follows.

TABLE 3.6 HISTORICAL EVENTS

1878	- A prolonged famine in Kitui District; many people migrated from Kitui to the neighbouring districts in search of food.
1894	- Rinderpest; many cattle died.
1908	- Another famine.
1917	- Cerebral-spinal meningitis invaded the district.
1924	- A great famine.
1929	- Famine.
1930	- Famine. This year people were busy digging dams.
1942	- There was a great famine which extended up to Kikuyuland. The only crop available was cassava, and this helped people not only in Ukambani but even in Central Province.
1944	- Locusts invaded the district, and a prolonged famine followed.
1946	- Another famine.
1950	- Famine.
1952	- Mau Mau oath taking and declaration of emergency in Kenya.
1961	- Transportation of famine relief by air; heavy rains and much flooding in the district.
1965	- Famine.
1966	- Kitui people were buying food from Masinga in Machakos.

All these events illustrate the harshness of the environment. Famine has become a common occurrence, and the Kitui people have learnt to tolerate the harsh environment.

3.2.2 Food Habits

The common diet in Kitui consists of maize, cowpeas, and millet. In places bordering Machakos District with more rainfall, maize is most prevalent, while in the dryer areas millet and cowpeas predominate.

Meat was obtained from both domestic and wild animals until the ban on hunting. Among the wildlife, predators, buffalo, and usually monkeys were not eaten (except in the very southern areas of Kitui). Domestic animals were reserved for prominent ceremonies such as marriage and circumcision or important visitors.

The morning dish, Muvyuvyo, consisted of porridge and blood from domesticated animals. Women and girls would eat inside the main house while men would eat outside. This food had to be prepared quite early, and after eating people would disperse for the day's work. The very young and very old would remain in the homestead, and the mother or one of the older daughters was responsible for cooking and attending the young children. The women would come back at midday for lunch, but the men would eat wild fruits in the field. The evening meal was served once the cows had been brought in from the field. The women would try to change the diet from what they had for lunch, often mixing maize, cowpeas, and vegetables together as one dish. Again the women would eat inside and the men outside.

Aside from the famines, the people say that kwashiakor and marismus were unknown diseases. Food distribution was ensured by exchange so that the diet was balanced and people had enough in times of shortage. Thus the

extended family network and customs of visitation, both within Kitui and in neighboring districts, helped to overcome climatic limitations in food production and the difficulties of local droughts.

3.2.3 Inheritance

Only men own property, and its distribution is arranged before death. The sons inherit the land through their mother. Each of the deceased's wives knows her "Mbee" - the land she cultivates - which her sons inherit, the eldest son receiving a slightly larger share. If a man dies leaving his wife with daughters only, their half brothers inherit the property.

A barren woman, however, can marry a girl herself. This girl is given a man to give her children and any children she bears are treated as if they were born to the woman who married her. In this way, an old and barren woman may bear sons after her husband's death to inherit her portion of his property. Such customary practices are even today recognised by the law. If the sons of a deceased father fail to agree, the clan is called to settle the dispute.

3.2.4 Religion

The Wakamba had prayer grounds in each village, usually near "Mumbu" or "Mugumo" trees. A few years ago, these trees were regarded as sacred, but now they are being cut for firewood and to clear land for cultivation.

In these prayer grounds they would offer prayers to 'Muhungu' for rain in times of great famine, death, etc. They would also sacrifice a goat before the harvest as a thanksgiving to God. These places were undisturbed by man and were to be kept as virgin as possible.

3.2.5 Recommendations

The survey showed that there are no cultural references in the district. The only sites or monuments were established by the Government, the main one being the monument in commemoration of those who died in the first and second World Wars near the District Commissioner's office. Thus it is recommended that the Ministry of Culture and Social Services identify traditional sites for preservation. The Ministry should also encourage preservation of traditional knowledge and culture so that they are not lost in the process of modernisation.

3.3 SELF-HELP GROUPS AND COOPERATIVES

There are 773 registered self-help projects in Kitui engaged in various types of self-help work (see Table 3.7). During 1979, the Government of Kenya through the former Ministry of Housing and Social Services gave grants of about K.Shs. 55,000/- to assist 38 self-help projects. Most of this money was used for purchasing material in the form of corrugated iron sheets and bags of cement.

In the district men are not very active in the self-help projects. There are 423 very active women's groups (see Table 3.8) who have a total membership of 12,690 and contributed K.Shs. 19,400 in the last year. Aid received by these groups was about K.Shs. 74,540. Their major activities include goat-keeping, poultry keeping, bee-keeping and handicrafts.

Self-help groups are often supported by foreign donors. U.S. AID will be implementing an arid and semi-arid lands pilot project in the Central Division (Yatta, Nzambani, Matuyani and Chamwithya) and in the Mwingi Division (Mutonguai, Migwana and Mwingi). They will spend about \$18,645,000

TABLE 3.7 SELF-HELP PROJECTS, KITUI DISTRICT, 1979

Type of Project	No. of Projects Cont. into 1980	Units Completed	Central Government and Foreign Aid	Total Contribution by People*
Primary Schools	356	124	33,708.00	3,036,934.30
Secondary Schools	27	51		1,237,173.70
Health Centres	10	2		177,371.30
Dispensaries	8	-		12,626.00
Community Halls	1	-		-
Youth Centres	6	-		3,270.50
Nursery Centres	118	2	8,292.00	278,463.95
Teachers' Houses	34	32		441,120.70
Other Buildings	15	-		22,021.50
Separate Kitchen Buildings	8	1		225.50
Latrines	25	34		54,055.40
Mosques/Churches	42	2		202,371.60
Roads	30	3		16,561.50
Drifts and Culverts	12	-		234.00
Dams and Water Catchments	82	-		40,338.50
Wells	12	-		8,400.00
Cattle Dip and Crushes	26	-		9,018.20
Sports Grounds	1	-		-
Land Consolidation	1	-		-
Other Projects	9	2		69,337.75
T O T A L	823	253	42,000.00	5,609,524.40

* The total contribution by people comprises labour, material and cash.

SOURCE: DCDO Annual Report.

TABLE 3.8 WOMEN'S GROUPS, KITUI DISTRICT

Name of Groups	Type of Activity
Mula Kitele	Poultry, Cotton, Maize and Beans.
Kavalula	Cotton, Maize and Beans.
Kivulu.	Goat-keeping.
Tulia	Poultry.
Kwakalole	Water Project.
Kwakalondo	Water Project.
Kyandula	General Farming.
Kiatine	General Farming.
Kangii	General Farming.
Nzimia Mukilye	General Farming.
Kitole	General Farming.
Kea	Bench Terraces, Poultry.
Migwani	Handicraft.
Kyone	Handicraft.
Kavoloi	Handicraft.
Musukini	Handicraft and Traditional Ngomas (dances).
Ithumbi	General Cultivation and Bench Terraces.
Yambyu	General Cultivation and Members Welfare.
Kavuti	Goat-keeping.
Mitamisyi	Goat-keeping.
Ngiluni	Goat-keeping.
Mbuvu	Goat-keeping.
Ivusy	Goat-keeping.
Kakunike	Goat-keeping.
Kalanga	Goat-keeping.
Kavuko	Bench Terraces.
Kiteta	Soil Conservation.
Kilalinda	Farming.
Musonoke	Handicrafts; Goat-keeping; Bee-keeping.
Kakeani	Poultry-keeping; Handicraft; Bee-keeping.
Syomuku	Handicraft; Bee-keeping.
Syongila	Poultry-keeping.

SOURCE: Department of Social Services, Eastern Province Annual and DCDO Annual Report.

and the Government of Kenya will contribute about \$5,645,000 for demonstration projects such as soil and water conservation, improved tillage, preventing and correcting overgrazing, and crop improvement.

Projects assisted by CARE have included pumping sets and pipes at the Kiku, Katheka, Thitani, Katuthya and Katiethoka water projects.

The Dioceses of Kitui run hospitals and a few water projects. Other voluntary organizations operating in the district include the Family Planning Association of Kenya, Scouts and Girl Guides, Child Welfare Society of Kenya, Kitui Catholic Women, and Mother Union Kitui.

The major problems encountered by self-help groups include finance, training, departmental problems in supervising the projects (e.g., transportation), and marketing.

IV. L A N D U S E S4.1 LAND TENURE AND LAND USE PATTERN

There are three broad categories of land in Kitui District: government land, trust land, and private land.

Table 4.1 shows the area of land in each major category in Kitui.

TABLE 4.1 LAND TENURE

Land Category	Amount (sq. km)
1. <u>Government Land</u>	
a. Forest reserve	--
b. Other government reserve	--
c. Townships	--
d. Unalienated land	7,115
e. National Park	6,369
f. Open water	--
TOTAL	13,484
2. <u>Trust Land</u> (not available for freehold)	
a. Forest	204
b. Government reserve	--
c. Townships	5
d. Alienated Land	440
e. Game reserves	--
f. National Parks	--
TOTAL	649
3. <u>Available for small holder registration</u>	
a. Already registered	104
b. Not yet registered	15,152
Total Trust Land	15,905
Total Area of Water	--
Total Area of Land and Water	29,389
% of total land area in Kenya	5.05%

SOURCE: Statistical Abstract 1978.

Government land is the land that was designated as crown land during the colonial period and considered unoccupied by the indigenous people. Also included in this class are National parks and forest land. Trust land forms the former native reserves, which were under effective occupation by the local people. Most of the land in the district, with the exception of Tsavo National Park, is privately owned. Land alienated both from government land and trust land has been adjudicated to private ownership. However, only 104 square kilometres of land in Kitui District was registered by 1977. Small scale farmers occupy most of the private land and, due to subdivision on inheritance, it is becoming very fragmented. People are beginning to encroach upon Tsavo National Park as well as along the river Athi because they are among the few remaining suitable areas for agricultural activities.

Only 16% of the district's total land area is arable; the remainder consists of marginal lands (where possibilities exist for rangeland use) and semi-desert and desert areas. The overall population density figures do not reflect the ecological limitations. In the arable Central and Mwingi Divisions and along the river Athi population densities are high. With a population growth rate of 3.1% or more per annum and a heavy reliance on short-term crops like Kathumani maize, which cannot sustain the population for a long period in terms of famine, the next century may see more severe population pressure in Kitui than is now found in the fertile areas elsewhere in the country.

4.2 AGRICULTURE

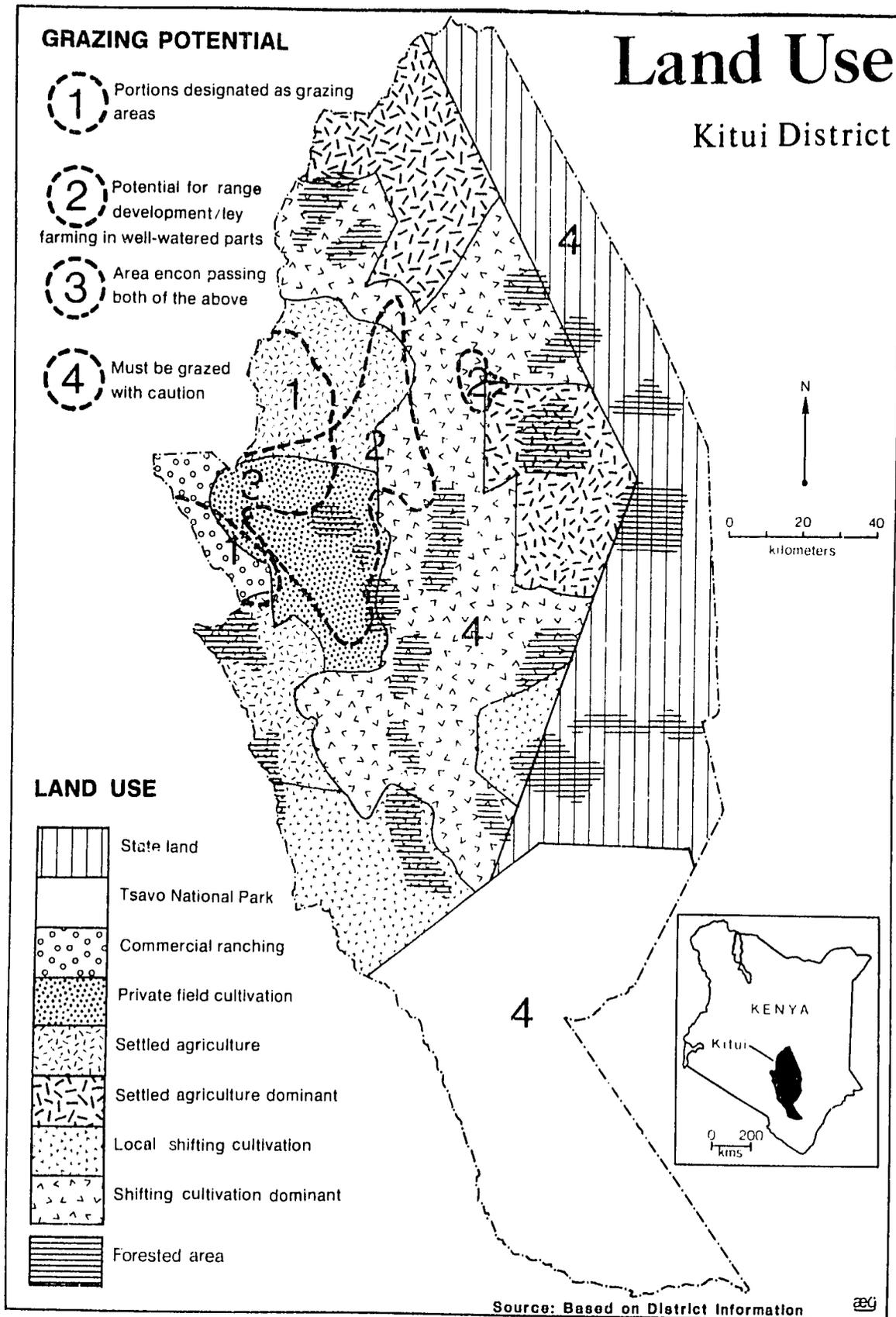
4.2.1 Crop Production

Of the total district land area of 3,100,000 hectares, about 2,479,000 are available for agricultural or rangeland use, the remainder being part of Tsavo National Park. Approximately 800,000 hectares, or one-third of this, can be considered medium potential land, receiving 508 - 762 mm of rain per year. This is the area of settled cultivation; however, crop failures are common due to lack of moisture. (Four out of eight seasons get less than 300 mm of rain in a year.) Drought-evading or resistant crops such as sorghum, beans, sunflower, pigeon peas, cotton, and grams can still produce substantial yields even with inadequate rains as long as good soil conservation measures are used and improved varieties grown.

Approximately 1,670,000 hectares, or two-thirds of the available district land area, are semi-arid and arid. In these zones five to six out of eight years may receive less than 254 mm of rainfall in a year. Drought-resistant crops such as pigeon peas, cow peas, sorghum and sunflowers can be produced if moisture and soil conservation practices are used. Shifting cultivation is widely practised in these areas, and some animals are kept. The drier parts are wholly rangeland.

Figure 8 shows major land uses in Kitui District. The figure indicates that shifting cultivation (which involves resting of land for a period) is widely practised in the district. This generally involves clearing by fire, which can have some deleterious effects on the environment (refer to section on soils). Other farming systems include settled agriculture (cultivation) and livestock production (mainly ranching). Except for ranches, most of the farms in the district are small, with an average size of 2-6 hectares in the

FIGURE 8.



marginal areas but somewhat larger in the drier zones. Traditional tillage methods (i.e., use of the Jembe and the hoe) are widely used. Only a few people can afford oxen for ploughing, whereas tractors are used only on large farms and are usually hired rather than owned. There is a revolving fund for ploughing operated by Kyuso Catholic Mission, which has helped farmers purchase 600 ploughs while another 600 were expected by 1979. A tractor-hire service is operated by the same organisation.

The range of crops in Kitui District is limited by climatic conditions, and only crops adapted to the dry conditions are grown. Table 4.2 presents the types of crops grown in the district, their hectarage, pests and diseases, and the various agricultural chemicals used in 1979. The main cash crops are tobacco, sunflowers, castor, cotton, coffee, and cashewnuts, whereas the main food crops are Njai, cowpeas, pigeon peas, cassava, millet, sorghum, maize, beans, and sweet potatoes. Because of the unreliable rainfall, emphasis is now placed on the use of drought-resistant crops and varieties, dry-farming methods, and irrigation. Efforts are being made to expand the production of Katumani maize, millet, beans, peas, as well as other drought-adapted crops. Cash crops such as tobacco and sisal are important income earners and have substantial possibilities for expansion. An inter-seed church project run by the Catholic Diocese of Kitui in collaboration with the National Christian Council of Kenya (NCCCK) assists farmers in trials with drought-adapted varieties. The Ministry of Agriculture has acted as advisor, and ten successful varieties have been found (Ministry of Agriculture District Annual Report, 1979). As a result, over 100 demonstration plots have been established in the district.

TABLE 4.2 CROP YIELDS, HECTARAGE, PESTS AND DISEASES, AND AGRO-CHEMICALS USED IN KITUI DISTRICT, 1979

Crop	Hectarage and Yield*			Average Yield Per Hectare (tons/ha)	Pests and Diseases	Control Measures and Chemicals Used
	1976	1977	1978			
Sunflower (Issanka and Grey Stripes var.)	(S.R.) 1,500 750	3,000 1,500	4,000 2,000	0.5	Birds, Ballworms	5% DDT
	(L.R.) 2,000 1,000	2,500 1,250	3,000 1,500	0.5		
Castor	2,000 2,000	5,000 5,000	6,000 6,000	1.0	Birds	-
Coffee	30 3	30 3	30 3	0.1	Leaf miner, leaf rust	Malathion
Cashewnuts	10 2	15 3	50 3	0.153	Helopeltis	-
Cotton (UK-59)	3,000 600	6,000 1,200	6,500 1,300	0.2	Ballworms, stainers, and bugs	DD Suphane
Tobacco	200 80	404 120	500 150	0.33	Caterpillars	DD Suphane
Sisal	25,000 150	35,000 210	40,000 240	0.006	-	-
Bananas	300 1,600	250 2,000	300 2,400	7.11	Banana weevil	Dieldrin

* Upper figures - hectarage (ha)
Lower figures - yield in tonnes

S.R. - Short rains
L.R. - Long rains

TABLE 4.2 CROP YIELDS, HECTARAGE, PESTS AND DISEASES, AND AGRO-CHEMICALS USED IN KITUI DISTRICT, 1979
(continued)

Crop	Hectarage and Yield*			Average Yield Per Hectare (tons/ha)	Pests and Diseases	Control Measures and Chemicals Used
	1976	1977	1978			
Mangoes	600 1,200	630 1,260	680 1,360	2.0	Aphids, weevils, scales	
Citrus	200 800	250 800	300 800	3.28	Scales and aphids	Malathion, Kilpest, and Rogor E.
Guavas	N/A	140 ha.	400 ha.	N/A	Scales and aphids	-
Pawpaw	N/A	65 ha.	80 ha.	N/A	-	-
Beans (Rosecoco, Mwezi Moja, Mexican 142)	(S.R.) 4,000 2,000	5,000 2,500	5,500 2,750	0.5	Ballworms, beetles, and caterpillars	Kilpest, 5% DDT and Malathion
	(L.R.) 3,000 1,500	3,500 1,750	4,000 2,000	0.5		
Green gram	(S.R.) 5,000 2,500	5,500 2,700	6,500 3,000	0.48	-	-
	(L.R.) 3,000 1,500	3,500 1,750	4,000 2,000	0.5		
Dolicos Lab-Lab	N/A	450	640	-	-	-
Maize (Katumani and local)	(S.R.) 14,000 7,000	14,500 7,250	15,000 7,500	0.5	Stalk borers	5% DDT
	(L.R.) 10,000 5,000	11,000 5,500	11,500 5,750	0.5		

TABLE 4.2 CROP YIELDS, HECTARAGE, PESTS AND DISEASES, AND AGRO-CHEMICALS USED IN KITUI DISTRICT, 1979
(continued)

Crop	Hectarage and Yield*			Average Yield Per Hectare (tons/ha)	Pests and Diseases	Control Measures and Chemicals Used
	1976	1977	1978			
Sorghum	(S.R.) 15,000 3,000	16,000 3,250	16,500 3,500	0.144	-	-
	(L.R.) 6,000 7,500	6,500 8,000	7,000 8,250	1.21		
Millets	(S.R.) 1,500 7,500	1,600 8,000	1,700 8,250	5	-	-
	(L.R.) 8,000 4,000	8,500 4,250	9,000 4,500	5		
Cassava	(L.R.) 500 2,500	700 3,500	900 4,500	5	Mosaic	Phytosanitation
Sweet potatoes	(S.R.) 350 1,750	360 1,800	370 1,850	5	-	-
	(L.R.) 800 4,000	825 4,125	850 4,250	5		
Onions	150 600	250 1,000	300 1,200	4	-	-
Tomatoes	(S.R.) 60 420	70 490	80 560	7	-	-
	(L.R.) 50 350	60 420	70 490	7		

TABLE 4.2 CROP YIELDS, HECTARAGE, PESTS AND DISEASES, AND AGRO-CHEMICALS USED IN KITUI DISTRICT, 1979
(continued)

Crop	Hectarage and Yield*			Average Yield Per Hectare (tons/ha)	Pests and Diseases	Control Measures and Chemicals Used
	1976	1977	1978			
Njahi	(S.R.)	200	225	250	0.5	N/A
		100	112	125		
	(L.R.)	150	175	200	0.5	N/A
		75	87	100		

* Upper figures - hectarage (ha)
Lower figures - yield in tonnes

S.R. - Short rains
L.R. - Long rains

SOURCE: Ministry of Agriculture reports and District Development Plan (1979-83).

Table 4.2 shows that the total hectarage for most crops and food production increased between 1976 and 1978. Further expansion of arable agriculture in the district may be possible through irrigation or intensification of agriculture.

Yield levels in the district (yield per unit area) are low, due mainly to relatively poor agronomic practices and lack of adequate rainfall. There is increasing evidence suggesting that land productivity is declining due to mismanagement through overgrazing, destruction of trees, and poor cultivation practices coupled with burning, as evidenced by the declining crop yields (Ministry of Agriculture, 1979).

Irrigation potential in Kitui District is also limited by rainfall shortage. Although study of the feasibility of irrigation in Kitui is still ongoing, available knowledge shows that there are no serious problems related to the soil. Borehole water can be used in certain places, but some have salinity problems. (Out of 59 boreholes, about 11 are classified as having saline and hard water, while 10 have water of unknown quality.) Small scale irrigation using borehole water, whenever it is sufficient, has been successful in a few places such as Zombe, Ikutha and Kalinga. The use of dam water for irrigation is also limited since the dams do not supply enough water for domestic use and for watering livestock. They also dry up during the dry season, and they are faced with a large problem of siltation due to soil erosion.

However, there are possibilities of irrigation using the waters of the rivers Tana and Athi. Minor irrigation is already underway along the river Tana, and 700 ha. in the northern portion of the district will be irrigated using the water from the Masing Dam, currently being constructed on the Tana River. Minor irrigation is also operational in the Kaningu area along the

Tana River in Tseikuru Location and in the Kyamatu and Ilika areas along the Athi River. Small scale irrigation projects have also been started by the Catholic Diocese of Kitui and Athi Primary School along the Athi and Mwitasyano Rivers in Yatta Locaion, Central Division. Irrigation projects proposed by the D.D.C. include:

- a. Along Athi River - Central and Southern Division
- b. Along Tana River - Kyuso (Far Northern) Division
- c. Along Mwitasyano River - Central Division
- d. Along Tiva River - Central Division
- e. Along Thua River - Eastern Division
- f. Along Ensiu River - Kyuso Division
- g. Along Tyaa River - Northern (Mwingi) Division
- h. Along Thunguthu River - Kyuso (Far Northern) Division
- i. Along Kithioko River - Northern (Mwingi) Division
- j. Damming of Ikoo and Mui rivers in Eastern Division for irrigation of land lying between Mutito, Zome, and Mwitika.

Increased food production due to irrigation would require improvement of the marketing and storage systems to ensure sound food distribution during the critical periods. Cash received from marketed produce could also be used to purchase additional foodstuffs from other areas. The current food distribution system is rather poor because of the distances and remoteness of many areas. The lack of storage facilities compels farmers to sell produce at harvest time and re-purchase it later at higher prices. It is also worth noting that unreliable input supply is a problem in the district since there is no Kenya Farmers' Association (K.F.A.) branch in the district.

The names of crop pests and diseases in the district are given in Table 4.2. Tomatoes, onions, sweet potatoes, millets, sorghum, lab-lab, grams, pawpaw, and sisal were not attacked by pests and disease during these three years. Attacks by birds, ballworms, leaf miners, leaf rust, helopeltis bug, stainers, caterpillars, banana weevils, scales, aphids, beetles, and stalk borers, however, attained pest status (economy injury

levels) during this period while mosaic virus was prevalent in cassava. Through diversification of cropping, the number of pests and diseases may increase in the future.

Only a few pesticides are used in the district, and fertilizers are not widely used both because soil moisture is limiting and because of the expense. Many farmers, however, use cattle manure because it is cheap and readily available. Insecticides and fungicides are used only by a few farmers and include mainly organochlorines and organophosphates such as 5% DDT, Malathion, DD Suphane, and Dieldrin. Rogor E (dimethoate) and Dithane M-45 are also used. In addition, acaricides such as Delnav D.F.F. and Coopertox and anthihelmintics such as Nilzan are used in the district for the control of tick and internal parasites. These chemicals are used in such small amounts that they do not cause any environmental concern yet. However, in the future, their use will increase with the increase in rainfed and irrigated crop production and thus should be regulated.

Problems associated with crop production in the district include:

- a. Aridity - the sparse rainfall makes crop production risky and uncertain. Efforts should be made to develop further irrigation.
- b. Soil degradation - perhaps the most important problem; soil conservation efforts should be stepped up.
- c. Lack of funds - more funds should be made available for crop development purposes.
- d. Distance - some areas of the district are difficult to reach, which makes input provision and marketing difficult (KFA does not have a branch in the district).
- e. Low level of literacy - the adoption of recommended agricultural practices is limited by the low level of literacy.

4.2.2 Livestock Production

Half of Kitui District is rangeland suitable for livestock production, and thus it is one of the districts with the largest number of livestock. However, the resources for livestock production are not utilised to full capacity. Only a small portion of the district on the western side, covering parts of Central and Mwingi Divisions, can be referred to as grazing areas. The better watered high ground in Kitui and Mutito could be used for fodder crops while the rest of the district must be grazed with caution.

Table 4.3 presents livestock populations and sales of livestock and livestock products during the period 1977-80. It also gives the production of milk, hides, eggs, ghee, honey, and bee wax.

Livestock production in the district is mainly through ranching schemes (see Appendix B). Most are cooperative ranches although some are group and directed agricultural ranches. Either borehole water or dams are used as a source of water. Land conflict is a common feature of ranching in the district since adjudication is not complete.

Kitui District has organised livestock marketing centres where cattle, goats, and sheep are sold locally. Auctions are of little significance except in the B2 Yatta Ranching Co-operative Society.

The majority of cattle in the district are the local zebus, raised mainly for meat production. Up-grading of the local cattle has been started in some ranches by crossing the pure exotic breeds with the local stock and artificial insemination. It is felt that artificial insemination should be extended to Changwithya, Mulango, Kisasi, Miambani, Nzambani, Mutonguni and Migwani locations. Although increasing, the number of dairy animals in the district is still small because there are not enough fodder and dipping facilities and because of their expense. Exotic breeds in the district are represented by Friesians, Ayrshires, Guernseys, and Jerseys.

TABLE 4.3 LIVESTOCK POPULATION AND PRODUCTION
OF LIVESTOCK PRODUCTS, KITUI, 1977-80

	1977	1978	1979	1980
Beef Cattle Population	251,945	282,240	300,000	207,717
Beef Cattle Sales	3,222	21,694	23,384	N/A
Dairy Cattle Population	235	300	340	364
Milk Production (kg)	N/A	98,556	60,891	N/A
Ghee Production	N/A	16,355	12,265	N/A
Sheep Population	81,602	112,102	115,000	78,296
Sheep Sales	6,116	9,784	2,195	N/A
Goat Population	312,204	389,204	400,000	284,043
Goat Sales	26,248	62,184	65,000	N/A
Cattle Hides	5,086	15,041	27,236	16,943
Goat Skins	95,168	200,540	424,014	205,833
Sheep Skins	36,286	40,620	85,678	55,955
Calf Skins	N/A	N/A	3,359	1,334
Poultry Population	N/A	390,600	390,000	N/A
Poultry Sales	N/A	176,463	N/A	N/A
Beehives-Traditional	93,960	93,964	93,964	93,507
-Improved K.T.B.	53	360	500	860
Honey Production (kg)-Refined	50,000	55,800	11,312.3	N/A
-Crude	N/A	176,300	N/A	N/A
Beewax Production (kg)	12,550	361,500	N/A	N/A

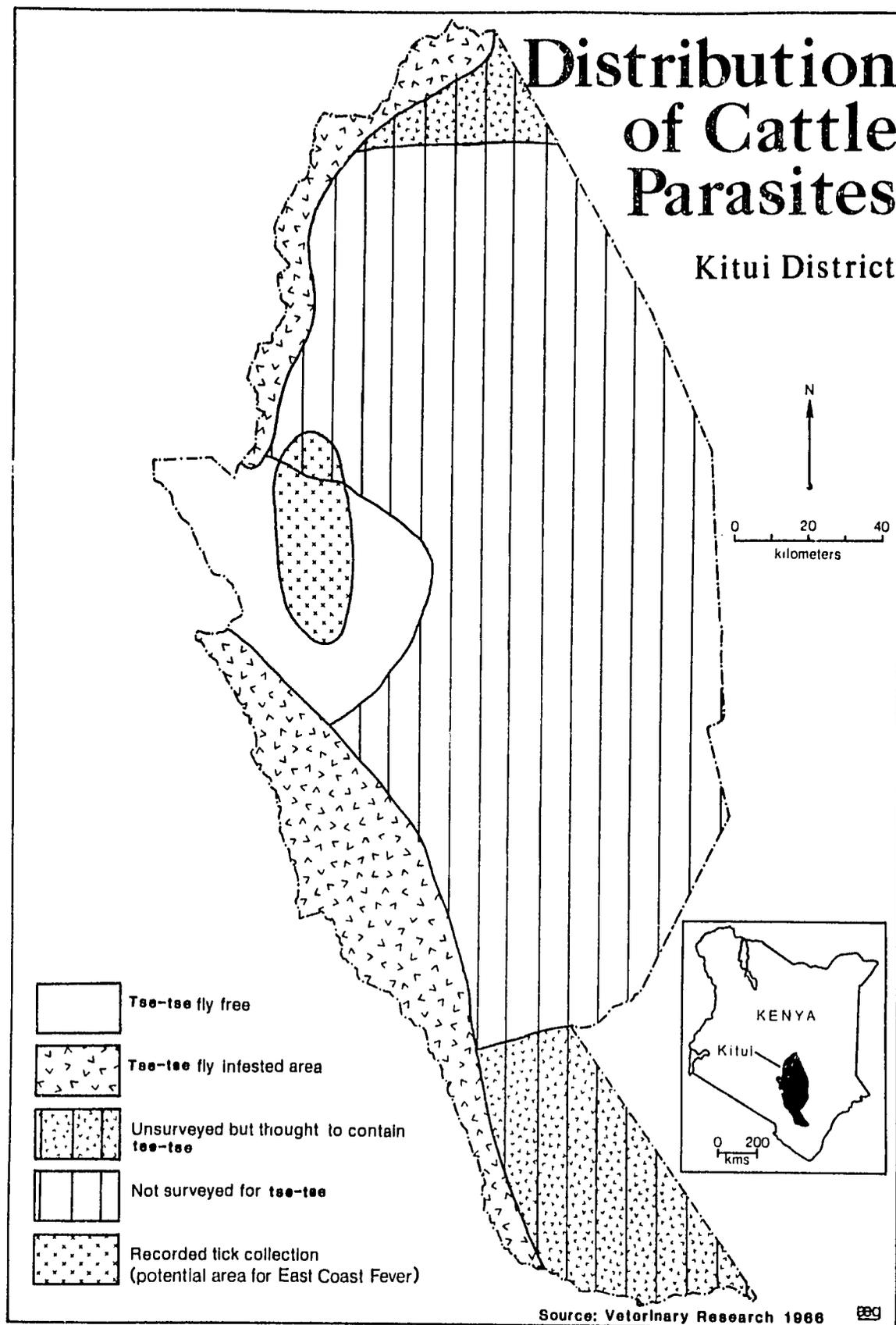
SOURCE: Ministry of Agriculture, Kitui District Annual Reports.

Indigenous sheep dominate the district, though there are plans to upgrade them. Goats are found everywhere in the district and perform well. Poultry are kept both for meat and egg production and are mostly local birds, although a few farmers keep grade poultry. Bee-keeping is practised everywhere in the district, with Kyuso Division leading in the production of honey. There are programs to improve beehives, and by 1979 there were already about 360 improved beehives in the district.

Table 4.4 lists the types of livestock diseases found in the district in 1979 while Table 4.5 gives some mortality figures for cattle during 1974-78. The most common cattle diseases are the tick-borne East Coast fever (ECF), anaplasmosis, and heartwater while goats are affected by CCPP, anthrax, mange, and worms. In addition, other protozoan diseases such as babesiosis and trypanosomiasis occur in cattle. The common sheep diseases are anthrax and worms while Newcastle disease, fowl typhoid, fowl pox, and salmonellosis are the main poultry diseases. Rabies is common in dogs in the whole district whereas helminthiasis, CCPP, and foot rot occur mainly during the rains. East Coast fever had the highest incidence during the period 1974-78 followed by anaplasmosis, then trypanosomiasis. The high incidence of ECF and anaplasmosis is due to the problems associated with tick control while that of trypanosomiasis is due to tse-tse infestation (refer to Figure 9).

Appendix C gives the name, location, stage, and conditions of some of the dips in the district by division. There are 35 cattle dips in working condition in the district to date and 14 under construction. These are concentrated in the Central and Mwingi Divisions, with few in the far Northern, Eastern, and Southern Divisions despite high livestock numbers. Dipping is not done as regularly as it should be due to problems associated with water,

FIGURE 9.



0 200
kms

TABLE 4.4: LIVESTOCK DISEASES, KITUI DISTRICT, 1979

DISEASE	TYPE OF LIVESTOCK AFFECTED	REMARKS
East Coast Fever	Cattle	The greatest killer of cattle. Kills every month. Killed 144 and 225 head of cattle in 1977 and 1978.
Anaplasmosis	Cattle	Also a very serious disease of cattle. Killed 106 and 212 in 1977 and 1978.
Foot and Mouth	Cattle	Several cases have been reported but vital statistics are lacking.
Trypanosomiasis	Cattle	Common in the district.
Helminthiasis	Cattle (Calf) Goats and Sheep	Starts after the rains Widely spread in the district. Nilzan is used for control.
Contagious Caprine Pleuro Pneumonia	Goats and Sheep	Kills many goats and sheep every month.
Foot Rot	Goats and Sheep	Occurs mainly during the rainy season.
Coccidiosis	Poultry	Has been a big problem but is now being brought under control.
Babesiosis	Cattle	Common.
Heartwater	Cattle	Common.
Anthrax	Goats and Sheep	Common in the district.
Newcastle Disease	Poultry	Another serious disease of poultry. Being controlled by vaccination.

TABLE 4.4: DISEASES OF LIVESTOCK, KITUI DISTRICT - 1979 (cont.)

DISEASE	TYPE OF LIVESTOCK AFFECTED	REMARKS
Fowl Typhoid	Poultry	Controlled by using Vaccines.
Fowl Pox	Poultry	Common.
Tetanus	Donkeys	Few cases have been reported.
Mange	Goats	Common.
Rabies	Dogs	Transmitted to dogs from wild animals like jackals, hyenas, and foxes, which are hard to vaccinate. Dogs are, however, being vaccinated. The disease is a menace to the whole district.
Salmonellosis	Poultry	Common.

SOURCE: Ministry of Agriculture.

funds and knowhow. The acaricides used in most dips are Delnav D.F.F. and Coopertox. A number of livestock diseases are controlled through vaccination campaigns, but inoculation is compulsory only for rinderpest. Blackquarter has also recently been kept under control in the district. It is the feeling of the DDC Kitui that vaccination should also be compulsory for diseases such as anthrax, blackquarter, foot and mouth, Newcastle, and fowl typhoid in the district.

TABLE 4.5: MORTALITY IN CATTLE DUE TO VARIOUS DISEASES, 1974-78

DISEASE	NUMBER OF CATTLE KILLED BY THE DISEASE				
	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
East Coast Fever	84	188	182	144	225
Blackquarter	52	-	-	-	1
Babesiosis	7	13	10	5	15
Anaplasmosis	89	119	144	106	212
Trypanosomiasis	33	83	72	26	42

SOURCE: Ministry of Agriculture.

Livestock production could improve and much environmental degradation caused by overgrazing and browsing could be avoided if fodder production were improved. This would require an improved credit system as well as a more efficient extension service. Presently, considerable overgrazing and ecological damage is reported in the district. Since most of the district has a livestock carrying capacity of more than 4 ha. per stock unit, the problem is not the number of cattle but poor management of both the cattle and the land (Daines, Njoroge, Njui, 1978). With proper management the environment could probably support (except during exceptionally dry periods) at least double the current number of cattle. The devegetation and

environmental degradation of rangelands occur during the dry periods, when bioproductivity is low. Ranchers therefore need to alternate grazing areas or reduce livestock numbers to provide a rest or revegetation period, which should generally be two years.

The constraints to livestock production in the district are as follows:

- (a) Droughts reduce fodder production and make water less available for livestock;
- (b) Overgrazing caused by poor management of both livestock and land;
- (c) Land tenure adjudication is not yet complete, making credit acquisition difficult. By 1979, a total of 29,163 hectares had been adjudicated in Matinyani, Changwithya and Ikutha Locations, and a total of 103,891 ha. were in the process in Matinyani, Mulango, Changwithya, Nzembani, Mutonguni and Migwani locations. Land conflict is also a major problem;
- (d) Credit is provided in the district by AFC and the Cooperative Bank, but lack of security makes it difficult to get loans;
- (e) Livestock diseases are extensive;
- (f) Inputs such as seeds, fertilizers, farm implements, pesticides, etc., are difficult to obtain;
- (g) Transport is a problem for extension staff.

Recommendations in the district plan of action (1979) include promoting fodder production to provide sufficient animal feed during the dry season, more cattle dips, expanding A.I. services, stepping up honey production,

establishing more ranches in the eastern statelands, developing irrigation schemes, land adjudication (covering Southern and Eastern in addition to Central and Northern Divisions), land registry and the building of land adjudication offices at Mwingi, Mutito, Mutomo, and Kisasi.

4.3 FORESTRY

All protected forests in Kitui District are managed for water catchment, soil conservation and aesthetic purposes. Because the trees are still immature, they are not sold for timber. However, they are cut for firewood and charcoal to a limited extent with about six cubic metres of firewood sold locally each month.

There are three forest stations managed by the forestry department in Kitui Town, Mutito, and Mumoni. Rural afforestation projects in Kabonge and Mai are managed from Mwingi Station. There are 43,657 hectares in established forests in the district (see Table 4.6 and Figure 8), which represents 1.4% of the total land area. Only Kabonge, Mutito, Nuu, Engamba, Makongo, Mumoni, and Gaikuyu are gazetted while Endau, Mutha, Mai, Mutuluni, Ndhaoni, Imba, Kyawea, and Muzewe have been approved and demarcated but not yet gazetted.

Trees that are found in the forests include gum, cypress pines, podo, and acacia. Podo and thorn trees have been destroyed by charcoal burners, and only a few are left in Endau and Mumoni areas. For afforestation work, the species that are raised in nurseries include Casia siamea, Aberia kakra, Cypress spp, Eucalyptus spp, Casia spectabilis, Acrocalpus flaxinifolia, Catrisrobusta, and Grevilea robusta.

TABLE 4.6: ESTABLISHED FORESTS IN KITUI DISTRICT, 1979

<u>FORESTS</u>	<u>HECTARAGE (ha.)</u>
Mumoni	16441
Mutito	1958.7
Nuu	3532.9
Engamba	2141.9
Makongo	3431.8
Gaikuyu	3076
Endau	6719
Mutha	2468.6
Mai	768.9
Mutaluni	809.4
Ndhaoni	809.4
Imba-Chakuyu	1376
Kyawea	63.2
Muzeve	48.2
Kabonge	12.5
Maimu	N/A
Mui	-do-
TOTAL	43,657.5

SOURCE: Ministry of Environment and Natural Resources, 1979.

constraints to forestry development in the district include:

- (a) Aridity: The topsoil in the district can dry up below field capacity for long periods of time, during which the survival percentage can drop to 30%. Watering facilities are, therefore, necessary during the dry periods. Projects have already been initiated which enable people to have water tanks, rock catchments, etc., for this purpose. School children have also been involved in this exercise.
- (b) Depletion of forests: Trees are cut in the district for charcoal and firewood, for tobacco curing, for building poles, and clearing for cultivation. While trees in the forests are not cut for timber, the indigenous people still clear for agriculture. Tobacco curers cut a lot of mango trees in the district, and depletion is particularly serious in Endau and Makongo.
- (c) Destruction of forests by fires: Fires are either caused by people clearing for cultivation or by honey hunters. In 1975, 100 gum trees were destroyed by fire at Mutito. In 1976, 60 hectares of bush and grass were damaged by fire at Mumoni while in 1978, there was a fire at Mutito which was put out before causing much damage.
- (d) Lack of funds: Although a lot is being done through the D.D.C. grants and other sources, other organisations like the National Council of Women could extend their services to the district.
- (e) Overgrazing: During the dry periods, livestock owners annually burn dry grass to give good grass stand when the rain comes. This destroys a considerable amount of biomass, causing damage to the ecosystem. Furthermore, destruction of trees due to overgrazing is serious in the areas of Kabonge and Museve.

The existing natural forests in the district are limited in wood production potential. They consist of trees which are rather stunted and slow growing. The rural Afforestation Extension Scheme was started in 1974

in the district, with the intent of establishing woodlots. In the past, afforestation had been limited to Mutito, Mumoni, and Kabonge Hills, but by 1979, it was envisaged that Makongo, Engambo, Nuu, and Gaikuyu would also be gazetted for afforestation. Ongoing afforestation programmes involve tree raising in nurseries and the planting of seedlings in hills. The current goal is to raise 50,000 seedlings and plant 50 hectares each year.

The afforestation projects which have been recommended for funding under the Rural Development Fund (R.D.F.) project by the D.D.C. are presented in Table 4.7. In addition, the Ministry of Natural Resources plans to plant 100 hectares of forest annually in Kitui District during the 1979-83 period.

Problems facing afforestation programmes in the district are as follows:

- (i) Lack of enough water for tree nurseries; dams often dry up during the dry periods.
- (ii) Lack of funds to buy items such as watering cans, pangas, jembes, shovels, pruning knives, garden rakes, wheelbarrows, polythene tubes, fertilizers and manure, and pesticides.
- (iii) Lack of manpower.
- (iv) Inadequate transport facilities.
- (v) Encroachment on ungazetted forests by people as in Endau Hills.

TABLE 4.7: AFFORESTATION PROJECTS TO BE FUNDED UNDER R.D.F. PROJECT, 1979-83

YEAR	NAME OF PROJECT	DIVISION/ LOCATION	AREA TO BE PLANTED	JUSTIFICATION	ESTIMATED COST
1978/79	Maai Hill Afforestation	Kyuso Ngomeni	50 ha.	Prevent soil erosion, act as water catchment. Provide wood fuel, poles, create employ- ment.	£3,100
	Endui Hill Afforestation	Mwingi Endui	50 ha.	-do-	3,100
	Syekuyu Hill Afforestation	Kyuso Ngomeni	50 ha.	-do-	3,100
	Mwingi Division Tree Nursery	Mwingi Div.	-	-	12,500
	Central Division Tree Nursery	Central Div.	-	-	12,500
1979/80	Maai Hill Afforestation	As Above	50 ha.	-	3,100
	Endui Hill Afforestation	-do-	50 ha.	-	3,100
	Syekuyu Hill Afforestation	-do-	50 ha.	-do-	3,100
	Mwingi Div. Tree Nursery	Mwingi	-	-	5,000
	Central Div. Tree Nursery	Central	-	-	5,000
	Kivou/Kanzanzu River Bank Afforestation Phase I	Mwingi/ Mwingi	40 ha.	-do-	5,000

TABLE 4.7: AFFORESTATION PROJECTS TO BE FUNDED UNDER R.D.F. PROJECT, 1979-83 (cont.)

YEAR	NAME OF PROJECT	DIVISION/ LOCATION	AREA TO BE PLANTED	JUSTIFICATION	ESTIMATED COST
1980/81	Maai Hill Afforestation	Kyuso/ Ngomeni	50 ha.	Prevent soil erosion, act as water catchment. Provide wood fuel, poles, create employ- ment.	£3,100
	Endui Hill Afforestation	Mwingi Endui	50 ha.	-do-	3,100
	Syekuyu Hill Afforestation	Kyuso Nygomeni	50 ha.	-do-	3,100
	Mwingi Division Tree Nursery	Mwingi	running cost	-do-	2,500
	Central Div. Tree Nursery	Central	-do-	-do-	2,500
	Kivou/Kanzanzu River Banks Afforestation	Mwingi/ Mwingi	40 ha.	-do-	3,100
	Kea Hill Afforestation	Mwingi/ Mwingi	50 ha.	-do-	3,100
1981/82	Maai Hill Afforestation	Kyuso/ Ngomeni	50 ha.	-do-	3,100
	Endui Hill Afforestation	Mwingi/ Endui	50 ha.	-do-	3,100
	Syekuyu Hill Afforestation	Kyuso/ Ngomeni	50 ha.	-do-	3,100
	Kea Hill Afforestation	Mwingi/ Mwingi	50 ha.	-do-	3,100
	Mwingi Div. Tree Nursery	Mwingi	running cost	-do-	5,000
	Central Div. Tree Nursery	Central	-do-	-do-	5,000
	Kivou/Kanzanzu River Banks Afforestation	Mwingi/ Mwingi	40 ha.	-do-	5,000

TABLE 4.7: AFFORESTATION PROJECTS TO BE FUNDED UNDER R.D.F. PROJECT, 1979-83 (cont.)

YEAR	NAME OF PROJECT	DIVISION/ LOCATION	AREA TO BE PLANTED	JUSTIFICATION	ESTIMATED COST
1982/83	Maai Hill Afforestation	Kyuso Ngomeni	50 ha.	Prevent soil erosion, act as water catchment. Provide wood fuel, poles, create employ- ment.	
	Endui Hill Afforestation	Mwingi Endui	50 ha.	-do-	£3,100
	Syekuyu Hill Afforestation	Kyuso Ngomeni	50 ha.	-do-	3,100
	Kea Hill Afforestation	Mwingi/ Mwingi	50 ha.	-do-	3,100
	Yenyaa Kyulungu Hill Afforestation		50 ha.	-do-	3,100
	Mwingi Division Tree Nursery	Mwingi/ Mwingi	running cost	-do-	5,000
	Central Div. Tree Nursery	Central	-do-	-do-	5,000
	Kivou/Kanzanzu River Bank Afforestation	Mwingi/ Mwingi	40 ha.	-do-	5,000
	Mutitho Hill Afforestation	Eastern Mutitho	40 ha.	-do-	5,000
	Uwu Afforestation	-do-	40 ha.	-do-	5,000
	Mwitika Area Afforestation	Eastern/ Zombe	40 ha.	-do-	5,000
	Kateiko Tree Nursery	Eastern/ Mui	40 ha.	-do-	5,000

SOURCE: Ministry of Natural Resources.

4.4 HUMAN SETTLEMENTS

4.4.1 Housing

In the rural areas of Kitui, housing is still mainly traditional, designed to reflect the cultural heritage and built using traditional techniques and local building materials. Recently a number of people have built modern houses in the rural areas. However, in Kitui and Mwingi towns, a serious problem of housing is developing. To date, the National Housing Commission (N.H.C.) has built ten rental houses in Kitui town and six rental houses in Mutomo.

4.4.2 Health

The District is served by four hospitals, nine health centres, twenty-two dispensaries, and two clinics (see Table 4.8).

TABLE 4.8 HEALTH UNITS IN KITUI DISTRICT

<u>Division</u>	<u>Hospitals</u>	<u>Health Centres</u>	<u>Dispensaries</u>	<u>Clinics</u>
1. Central	1 (Govt.)	2 (Govt.)	4 (Govt.)	2 (private)
2. Mwingi	2 (Mission)	1 "	5 "	-
3. Kyuso	-	3 "	5 "	-
4. Eastern	-	2 "	3 "	-
5. Southern	1 (Mission)	1 "	5 "	-
TOTAL	4	9	22	2

SOURCE: Ministry of Health.

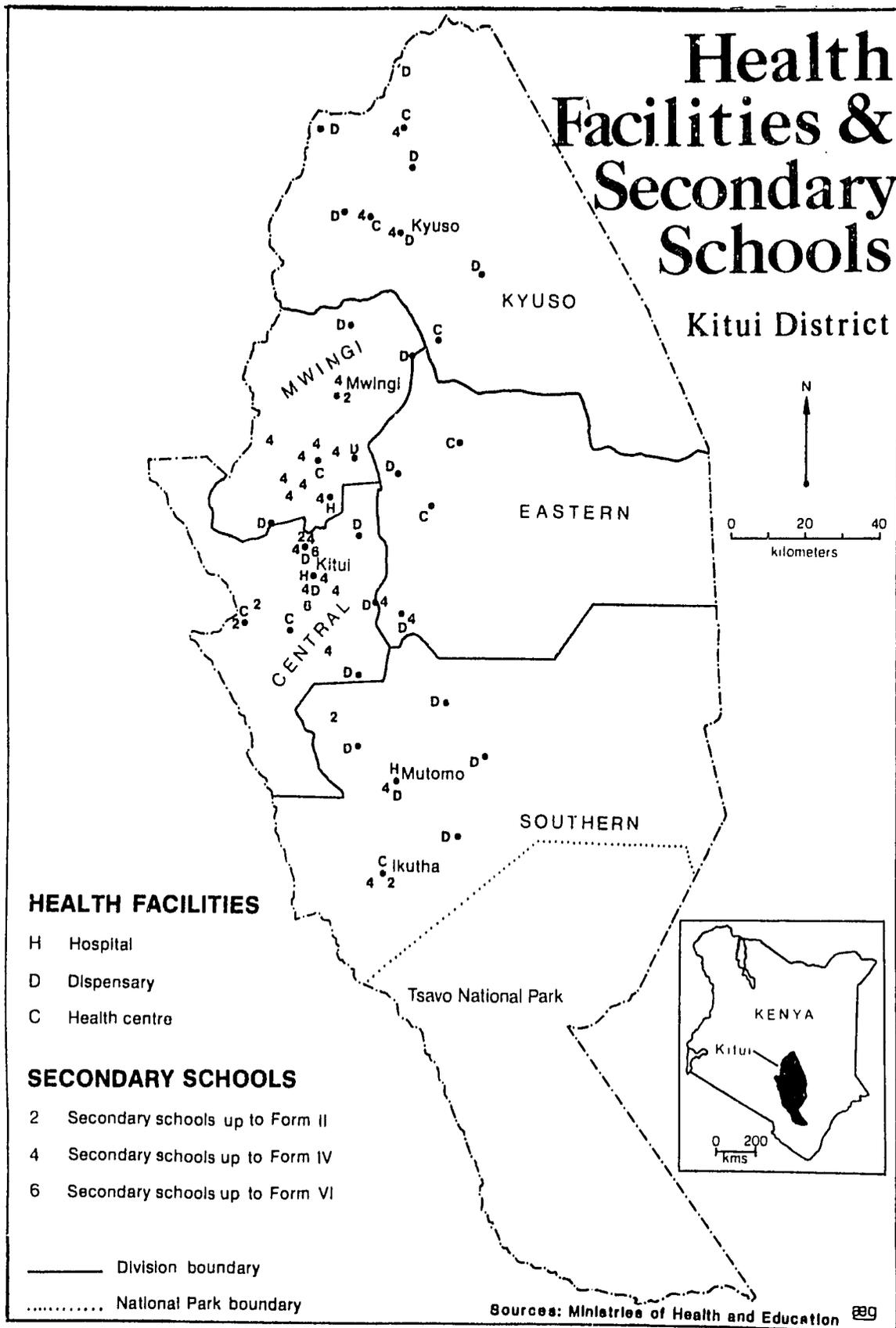
In most areas, the health facilities per population numbers are less than the national average. For the district as a whole, there are 0.97 hospital beds per 1000 population, compared to a national average of 1.12. Excluding Mwingi hospital and health care centre beds, there are 453 hospital beds for a population of 464,000. An additional 67 beds would be required to bring the district up to the national average. Furthermore, there are only three doctors in government hospitals and in Mission hospitals, or one doctor per 92,800 people, indicating a critical manpower shortage. Finally, there are nine health centres or one per 52,000 people. To reach the government target of one health centre per 20,000 people, Kitui requires an additional 14 health centres.

Table 4.8 and Figure 10 reveal a concentration of medical facilities in areas which are either densely populated or are high and medium potential areas, i.e., Central Division, parts of Southern Division, and Mwingi. The other areas in the district are even more poorly served by modern health care facilities than is indicated by the district-wide statistics.

The most prevalent diseases reported in the district during 1979 are diarrhoeal diseases, malaria, acute respiratory infections, skin diseases, and acute eye infection. There are also high incidences of malnutrition, measles, and gonorrhoea. Hospital records identify the killer diseases as malaria, diarrhoeal diseases, and measles.

Environmental health programmes in the district include enforcement of refuse collection and disposal services in all markets, inspection of commercial premises, immunisation services, and meat inspection. Health education programmes are also emphasized through schools, barazas, home visits, health units and by mobile units. The response of the people is quite good.

FIGURE 10.



Despite water shortages, they try to maintain high standards of cleanliness.

Kitui has had one of the highest infant and child mortality rates in the country, but the rate is declining due to increased medical services and living standards. On the other hand, Kitui is experiencing some problems of population pressure. Despite a population density of 20 persons per square km and a comparatively moderate growth rate, there are serious problems of land-population balance, particularly in the relatively densely populated areas of Central and Mwingi Divisions. As a result, the two programmes of maternal and child health care and family planning have been emphasized in the district. The maternal and child health programme includes ante-natal and post-natal care. In 1979, only 51 mothers attended post-natal services, while there were 13,286 ante-natal attendants. In the same year, there were 9921 child vaccinations. Attendance at clinics in 1979 was low. The best reception of the programme has been in Central Division, followed by Mwingi. However, considering the range of services offered, the overall attendance is low. The family planning attendants indicated a rising interest in the services available in the district. The most popular family planning methods were birth control pills, I.U.D.'s, foaming tablets, and condoms. Efforts being made to educate the people on these services include barazas, women's groups, and films sponsored by the Family Planning Association of Kenya.

4.4.3 Education

The school age population in Kitui in 1978 was estimated to be 170,408 with only 97,556 in primary school and 5,600 in secondary school. Educational opportunities in the district include primary and secondary schools,

day care centres, village polytechnics and some multipurpose adult training institutions.

In many parts of the district students have to travel long distances to the nearest primary school. In the schools 40% of the primary teachers are untrained. Tables 4.9 and 4.10 show primary school enrollment from 1975 to 1979 and the distribution and sponsorship of secondary schools in the district.

There are 250 secondary school teachers, of whom 66 are graduates and 104 are non-graduates (SI and UTs). Secondary schools are concentrated in the densely populated Central and Mwingi Divisions (see Figure 10). However, Mwingi is poorly served with government-aided schools. The major problem with harambee and private schools is that they are day schools and students have to travel long distances to attend them.

The general problems facing both secondary and primary schools in the district are lack of well constructed classrooms, a large proportion of untrained teachers, lack of water, lack of equipment, lack of access roads, underutilisation of present classes, and a high dropout rate.

TABLE 4.9 PRIMARY SCHOOL ENROLLMENT, KITUI DISTRICT, 1975-1979

1975	1976	1977	1978	1979*
81,370	82,607	88,812	96,671	119,321

SOURCE: Statistical Abstract, 1980.

*Provisional

In addition to primary and secondary schools, there are a wide range of service and training institutions in the district (see Table 4.11). The day care centres, village polytechnics, and the Better Living Institute play an important role in early and vocational training. There is, however, a great need for a teacher training college in Kitui.

TABLE 4.10 SECONDARY SCHOOLS IN KITUI

DIVISION	SPONSORSHIP			Total
	Government	Harambee	Private	
Central	6	8	3	17
Mwingi	1	7	3	11
Eastern	1	1	-	2
Southern	3	3	2	8
Kyuso	1	1	-	2
Total	12	20	8	40

4.4.4 Water Supply and Sanitation

Water scarcity is perhaps the greatest obstacle to development and the source of the main problems in Kitui District. The effects of the climatic conditions in Kitui on both agricultural practices and the availability of surface and ground water for domestic and industrial use were discussed earlier.

Much effort has been directed towards locating sources of domestic water supply. The existing sources include 30 springs and wells, 20 earthen dams and weirs, 23 boreholes, 19 rock water catchments, and 2 perennial

TABLE 4.11 SERVICE AND TRAINING INSTITUTIONS, KITUI, 1980

Name of Facility	No.	Service Offered	Average Enrollment Per Month	Senior Staff	Subordinate Staff	Problems etc.
FTC-Better Living Institute	1	Farmer training	240	8	46	funds
Village Polytechnics	6	Technical skills	50	1	3	funds, few students
Day Care Centres	260	Pre-school care	40	1	1	poor pay for teachers; training
Social Dev. Centres						
1. Mutune	2	Vocational training	20	7	7	funds
2. Mutito		Nutrition, Adult educ.	20-80			
District Training Centre	1	Adult educ.	27	1	2	funds
R.I.D.C.'s	-	-	-	-	-	-
Rural Health Training Centres	-	-	-	-	-	-
District Development Centres	-	-	-	-	-	-

SOURCE: District Development Plan, 1979-83.

rivers, the Tana and Athi. Ironically, these two rivers, the largest in the country, form the boundaries of district, leaving the internal areas destitute of water. Nevertheless, there is a possibility of future development of a viable source of both domestic and industrial water supply in Kitui.

Table 4.12 summarizes the sources, sponsorship, and extent of water supply in various parts of the district. The main sources of water supply, judging by the number of people served, are springs and wells, and earth dams and weirs. The population within 15 kms of one of these water sources is 194,800, only 40% of the total district population. The rest of the population must travel distances greater than 15 kms from their homesteads to obtain water. The problem is especially severe in Mwingi and Eastern Divisions. (The shortage of water in Mwingi is so great that the local people have a saying that, "you may ask for food, but don't expect a drop of water.")

Even the existing water supplies are unreliable. The numerous streams are only seasonal, the wells, springs, and boreholes often dry up during the long dry periods, and the earth dams and weirs easily become silted. High salinity levels in the groundwater limits domestic use of the boreholes and wells, especially in Mwingi Division. The shortage of clean water has a direct bearing on the high rates of bilharzia incidence in the district. In addition, hospital records show numerous cases of stomach complaints and infections. The problem of water supply in the district must be assessed in terms of the person-hours, costs, and health effects that are expended and endured in the process of searching for water. The shortage of water, moreover, inhibits the development of industries and commerce and creates serious waste disposal problems. Kitui town, with a population of more than 4,400, and Mwingi town, with more than 2,300 people, have no sewage disposal

TABLE 4.12 KITUI DISTRICT - WATER SUPPLIES, 1978

Place and Name of Project	Nature of facility					Sponsoring Agency	Maintenance Agency	No. of People Served	Present level of completion/operation	Reasons for limited functioning
	Bore-holes	Perm. rivers	Springs/wells	Dams, weirs	Rock catchments					
<u>Kyuso Division</u>										
Kamuwongo	x					C.C.	C.C.	5,000	completed	operating
Kava Mulinga	x					C.C.	C.C.	1,000	-do-	-do-
Mivukoni	x					C.C.	C.C.	1,000	-do-	-do-
Tharaka Syampiyu					x	C.C. & M.O.W.D.	C.C.	1,000	-do-	-do-
Tseikuru Well			x			C.C. & Catholic	C.C.	1,200	-do-	-do-
Katse Well			x			-do-	C.C.	5,000	-do-	-do-
Ukasi Rock Catchment					x	D.D.G.	-	2,000	50% of work done	under const.
Kyuso Rock Catchment					x	M.O.W.D.	M.O.W.D.	2,000	completed	functioning
Kiasyoni Rock Catchmt.					x	D.D.G.	-	1,200	completed	operating
Chiampiu Dam				x		D.D.G.	Local committee	1,500	completed	operating
Masyungwa			x			D.D.G.	-		60% complete	under const.
<u>Kyuso Division</u>										
Nziitu			x			D.D.G.				under const.
Katse			x			Catholic	local committee	1,000	completed	operating
Kimangau			x			Cath. Miss.	Cath. Miss.		completed	operating
Ngomeni Water Supply			x			M.O.W.D.		4,000	completed	operating
Tana River		x						17,000		
District Subtotal	3	1	6	2	4			40,900		

C.C. = County Council

M.O.W.D. = Ministry of Water Development

TABLE 4.12 KITUI DISTRICT - WATER SUPPLIES, 1978 (cont.)

Place and Name of Project	Nature of facility					Sponsoring Agency	Maintenance Agency	No. of People Served	Present level of completion/ operation	Reasons for limited functioning
	Bore- holes	Perm. rivers	Springs/ wells	Dams, weirs	Rock catch- ments					
<u>Central Division</u>										
Kwa Mutongo				x		C.C.	C.C.	3,000	completed	functioning
Kithumula			x	x		C.C.	C.C.	2,000	completed	functioning
Kwa Kitui				x		C.C.	C.C.	1,000	-do-	-do-
Mulango Borehole	x					C.C.	C.C.	2,000	-do-	-do-
B2 Yatta	x					Co-oper. Soc.	Co-operative		-do-	-do-
Kituo W/Project			x			C.C. & Unicef	C.C.	2,500	completed	functioning
Kisasi Wells			x			Catholic Miss	C.C.	1,500	-do-	-do-
Katumba W/Project			x			CARE	C.C.	2,000	-do-	-do-
Thiani W/Project			x			CARE	C.C.	1,500	completed	operating
Kitui town W/ Supply	x(4)			x		M.O.W.D.	M.O.W.D.	6,000	-do-	-do-
Mutune W/Supply			x			D.D.G. & M.O.W.D.	M.O.W.D.	1,000	-do-	-do-
Nzeu Mbitini Pipeline			x			D.D.G.	-	-	-	under const.
<u>Central Division</u>										
Massani W/Project				x		D.D.G.				under const.
Athi River		x						6,000		under const.
Kaambuya					x	D.D.G.				under const.
Kwakalio Dam				x		D.D.G.				under const.
District Subtotal	5	1	7	6	1			28,500		

TABLE 4.12 KITUI DISTRICT - WATER SUPPLIES, 1978 (cont.)

Place and Name of Project	Nature of facility					Sponsoring Agency	Maintenance Agency	No. of People Served	Present level of completion/ operation	Reasons for limited functioning
	Bore- holes	Perm. rivers	Springs/ wells	Dams, weirs	Rock catch- ments					
<u>Eastern Division</u>										
Mui Borehole	x					C.C.	C.C.	1,100	completed	functioning
Twambui W/Project				x		C.C. & MOWD.	C.C.	2,000	-do-	-do-
Nuu Springs			x			C.C. & MOWD.		2,000	-do-	-do-
Nyaai Springs			x			C.C. & MOWD.	C.C. & MOWD.	1,000	completed	functioning
Endau Springs			x			C.C. & MOWD.	C.C.	2,500	completed	functioning
Kadusya Springs	x		x			CARE	C.C.	1,000	completed	functioning
Mui Springs			x			CARE	C.C.	1,500	-do-	-do-
Makongo Springs			x			CARE	C.C.	2,000	-do-	-do-
Kavundu Rock Catchment					x	C.C. & Harambee	C.C.	1,500	-do-	-do-
Mui Kalitini			x			D.D.G.		2,000	Partly completed	
Kikuu W/Project			x			CARE	local committee	1,500	completed	operating
Zombe Springs			x			C.C.	C.C.	3,000	-do-	-do-
Mutito W/Supply			x			MOWD	MOWD	2,000	-do-	-do-
Nuu W/Supply			x			MOWD	MOWD	2,000	-do-	-do-
Kaluka Rock Catchment					x					under const.
District Subtotal	2	0	11	1	2			25,100		

TABLE 4.12 KITUI DISTRICT - WATER SUPPLIES, 1978 (cont.)

Place and Name of Project	Nature of facility					Sponsoring Agency	Maintenance Agency	No. of People Served	Present level of completion/ operation	Reasons for limited functioning
	Bore- holes	Perm. rivers	Springs/ wells	Dams weirs	Rock catch- ments					
<u>Mwingi Division</u>										
Thitani Boreholes (2)	xx					C.C.	C.C.	2,000	completed	functioning
Katutu Borehole	x					C.C.	C.C.	1,000	-do-	-do-
Kabati Borehole	x					C.C.	C.C.	2,500	-do-	-do-
Migwam Dam				x		C.C.	C.C.	3,000	-do-	-do-
Muttiale Dam				x		Cath. Miss.	Cath. Miss.	-	-	under const.
Kyoma Rock Catchment					x	C.C.	C.C.	2,500	completed	functioning
Chambyu Rock Catchment					x	C.C.	C.C.	2,000	-do-	-do-
Mwingi Town W/Supply			x			M.O.W.D.	M.O.W.D.	2,000	completed	functioning
Waita Rock Catchment					x	D.D.G.	M.O.W.D.	2,000	90% completed	under const.
Maukuni Dam				x		M.O.W.D.	M.O.W.D.	1,500		
Mbondoni Dams				x		M.O.W.D.	M.O.W.D.	1,000		
Mui Dam				x		C.C.	MOWD.	3,000	completed	
Katheka Dam & Borehole	x			x		C.C. & D.D.G.		4,000	partly completed	
Kwa Ngula Dam				x		D.D.G.		-		under const.
District Subtotal	5	0	1	7	3			26,500		

TABLE 4.12 KITUI DISTRICT - WATER SUPPLIES, 1978 (cont.)

Place and Name of Project	Nature of facility					Sponsoring Agency	Maintenance Agency	No. of People Served	Present level of completion/operation	Reasons for limited functioning
	Bore-hole	Perm. rivers	Springs/wells	Dams, weirs	Rock catchments					
<u>Southern Division</u>										
Mutomo Borehole	x					C.C. & MOWD.	M.O.W.D.	2,000	completed	functioning
Kanziko Borehole	x					C.C.	C.C.	1,000	completed	not funct. engine down
Mutha Borehole (1)	x					C.C.	C.C.	1,500	-do-	-do-
Mutha Mkt. Borehole (2)	xx					C.C.	C.C.	1,500	-do-	functioning
Kyatune Dam				x		MOWD, Harambee	C.C.	2,300	-do-	-do-
Malindi Sub/Loc				x		C.C.	C.C.	1,500	-do-	-do-
Kalive Dam				x		C.C.	C.C.	1,000	-do-	-do-
Kaayu Springs			x			Harambee	C.C.	8,000	-do-	-do-
Nguyuni Springs			x			-do-	C.C.	1,000	-do-	-do-
Ndilili Rock Catchment					x	MOWD. & C.C.	C.C.	500	-do-	-do-
Kasava Rock Catchment					x	C.C. & MOWD.	C.C.	500	completed	functioning
Ngali Rock Catchment					x	-do-	-do-	1,000	-do-	-do-
Itia well			x			C.C.	-do-	1,000	-do-	-do-
Kwa Mwandu Wells			x			-do-	-do-	500	-do-	-do-
Ikanga W/Supply	x					M.O.W.D.	M.O.W.D.	2,000	-do-	operating
Katothya W/Project					x	D.D.G.				under const.
Thua Kyamatu W/Project			x			D.D.G. & CARE				under const.
Katyothera Pipeline					x	D.D.G.			60%	under const.
Yambua W/Project					x	D.D.G.			60%	-do-
Nguni Dam				x		Ranage Management	C.C.	39,000	-	-do-
Athi River		x						5,000		
Matinga Dam				x						
Kutha Well			x							
District Subtotal	6	1	6	5	6			69,300		
GRAND TOTAL	21	2	31	21	16			180,300		

SOURCE: Kitui District Development Plan, 1979/83 and Ministry of Water Development.

systems. As indicated earlier, the water shortage has also made it difficult to meet health standards in the skin and hide bandas. The problem calls for a concerted effort to establish permanent and reliable sources of water supply, perhaps using the rivers Tana and Athi more effectively.

4.4.5 Transport and Communication

The road network in the district has over 2,600 km of classified roads, but the majority of these are of very low standard due to a lack of proper maintenance. Seventy-nine percent of the classified roads are class D and E (see Table 4.13 and Figure 11).

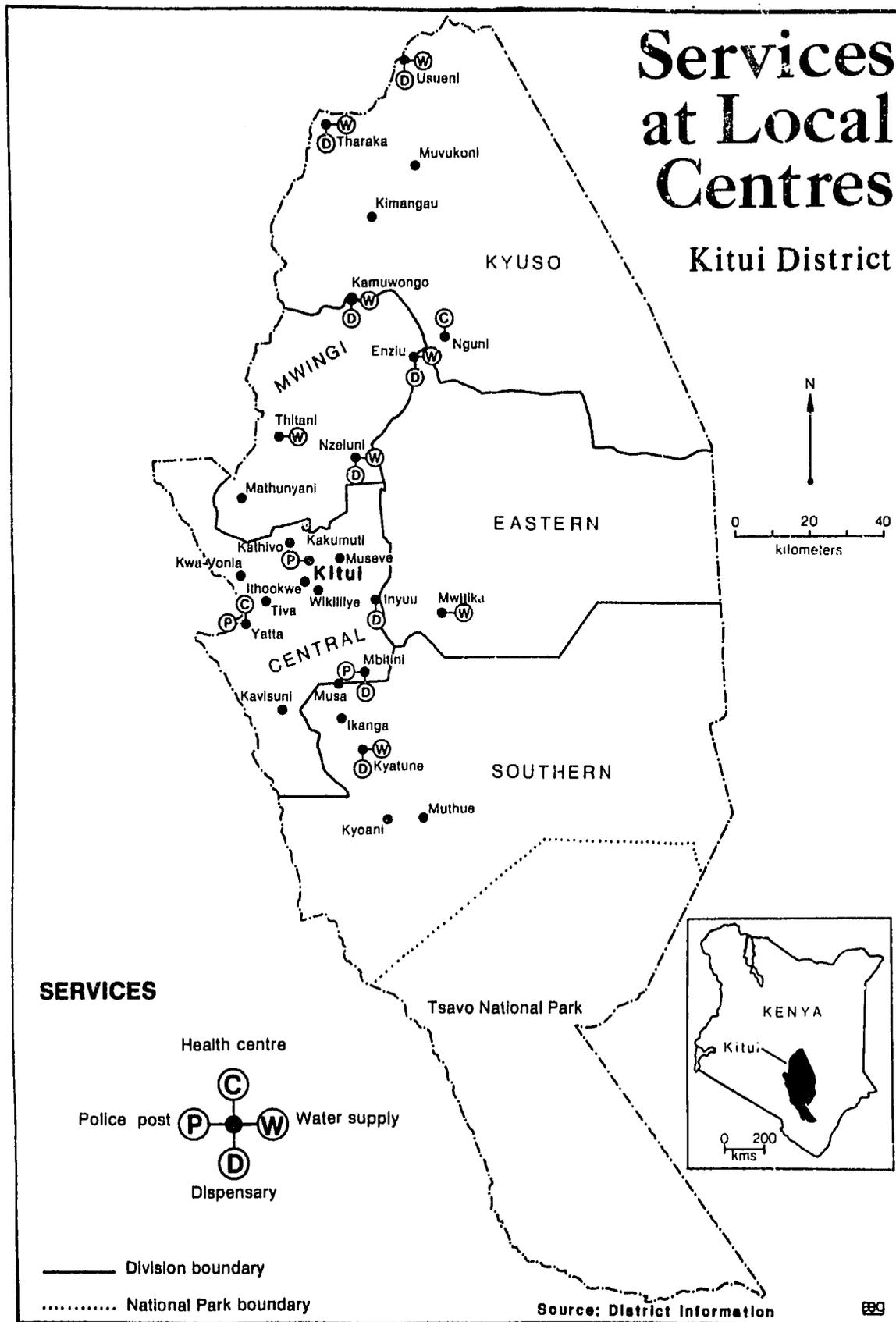
The road density in the district is 0.085 km of road per sq km, one of the lowest in the country. The number of kilometres of road per 1000 persons is also rather low. Bus and matatu services in the district are very inadequate due to the poor road maintenance and long travel distances in areas of low population density.

TABLE 4.13 ROAD NETWORK IN KITUI

Type	Length
1 International Trunk Road (A road)	161 km
1 National Trunk Road (B ")	210 km
4 Primary Roads (C ")	193 km
11 Secondary Roads (D ")	701 km
50 Minor Roads (E ")	1376 km
TOTAL CLASSIFIED ROADS	2641 km

SOURCE: Ministry of Transport.

FIGURE 11.



Two transportation programmes, the Ministry of Transport and the rural Access Roads, are responsible for road improvement. The high intensity, concentrated rains produce torrential streams that wash out roads and crossings. Much work needs to be done at stream crossings. Roads tend to be concentrated in the densely populated and high- and medium-potential areas. Parts of Eastern, Kyuso and Southern Divisions are almost inaccessible.

There are two operating airfields, Ithookwe and Mutomo. A small airfield for light aircraft used by missionaries is also found in Ghai. Telephone services are available at Kitui, Mwingi and Mutomo towns. Information offices have also been established in Kitui and Mwingi. There are numerous sub-post offices, but these become inaccessible during the rainy period.

4.4.6 Energy

Electricity supply is inadequate in the district. The single phase electricity supply from Kindaruma hydroelectric power station currently serves only a few areas in the district: Kabeti market, Kitui town, Mulango Girls' Secondary School, Matinyani and St. Lwanga Secondary schools. Industrial enterprises in Kitui town and elsewhere in the district are hampered by the absence of a three-phase power supply and other urban centres such as Mwingi and Mutowo have no central electricity supply at all.

4.4.7 Market and Service Centres

Kitui is served by a hierarchical network of human settlements, which function as both service centres and growth centres. It is at these centres that essential services to their surrounding areas tend to be concentrated.

Table 4.14 lists the service centres in Kitui consisting of local, market, rural, and urban centres. The hierarchy is based on the level of

infrastructure development and the population served by each centre. Five infrastructural attributes are considered important in this system of analysis:

- Administrative and protection services
- Communication and transportation
- Social services
- Commerce
- Industry and power

TABLE 4.14 EXISTING SERVICE CENTRES IN KITUI

	Urban Centres	Rural Centres	Market Centres	Local Centres	
KITUI	Kitui Mwingi Mutomo	Ndoa (Mutito) Kyoso Migwani Kisasi Matinyani Ikutha	Mutune Katulani Mulango Nuu Mui Zombe Kanziko Voo Mutha Tulia Kabati Katse Tseikuru Waita Ngomeni Miambani Chuluni Endau	Kathibo Syongila Kakumuti Musebe Yata Tiva Kavisuni Nguni Ikanga Mbitini Inzui Mwitika Inyuu Kyatune	Kyobani Machue Mosa Wikililye Ithookwe Nzeluni Thitani Tharaka Kimangau Muvokoni Usueni Kamugwongu Mathunuani Kwa-Vonza

SOURCE: Kitui District Development Plan: 1979/83

Kitui has 28 local centres, each designated to serve a catchment population of 5,000 people and offering services such as a full primary school, several shops, a dispensary, a public water supply, and an open market. Figures 10 and 11 show, however, that this level of infrastructural development is not attained particularly in Eastern, Southern, and Kyuso divisions.

There are 18 market centres, each designated to serve a catchment rural population of 15,000 and a resident population of 2,000. They are expected to have such facilities as a police post, a public water supply, a primary and a secondary school, a sub-post office, telephone facilities, and a local bus service. The market centres, however, generally lack public water supply and telephone services and are difficult to reach by buses.

The six rural centres are expected to have a wider range of higher-order services, such as several full-scale secondary schools, several primary schools, a health centre, piped water, electricity, sewage disposal, banking facilities, and telephone and postal services. Again, these are rarely attained in Kitui. Rural centres are designated to serve a catchment area of 40,000 rural population and a resident population of 2,000 or over.

At the top of the hierarchy are three urban centres, designed to serve a rural hinterland of 10,000 - 150,000 population and a resident population of over 5,000. They are expected to have a high order of facilities. In Kitui, these centres appear moderately developed and are quite dispersed.

4.5 COMMERCE AND INDUSTRY

Commercial and industrial activities in Kitui are only a minor contributor to the economy of the district, which is dominated by subsistence

agriculture. It is estimated that about 8,600 people are employed in commerce and industry in Kitui.

The number of registered traders in the district in 1980 was small, so that essential services are scarce, and people must travel long distances to procure them.

Credit and finance facilities available in the district include the Trade Development Joint Board, which operates under the Ministry of Commerce, the Kitui County Council, and the Ministry of Commerce, which contribute to a joint fund for development loans to traders. The contribution from Kitui County Council has been Ksh. 1.8 million per annum, while the Ministry of Commerce gives Ksh. 140,000 per annum. Loans are given from the joint fund to individual traders up to a ceiling of Ksh. 10,000 at an interest rate of 6-1/2% per annum. The ICDC in liaison with the District Commercial Department gives loans from Ksh. 10,000 up to a ceiling of Ksh. 5,000,000 for big business traders. A third source of finance is the Kenya Industrial Development Bank, which, through the Kenya Industrial Estates, provides funds for big projects such as the Kitui ginnery project. Apart from the credit and financial facilities, traders benefit from trade seminars and courses organised by the district trade department.

In spite of the above facilities, the development of commerce in Kitui has been hampered by a multitude of problems. Prior to advancing loans, the financial and credit sources require security assets, which prospective traders do not have. The poor communication and transport network in Kitui renders many areas inaccessible, limiting market size, increasing marketing costs, and increasing property risks for the trader.

Trade in foodstuffs fluctuates with the weather, sometimes causing severe losses to both the farmers and traders. Frequent famines result from

droughts which deplete surplus incomes, thus reducing investment capacity. Famine triggers a vicious cycle of poverty and despair among the farmers in Kitui. The district would benefit greatly from projects directed at solving the water problem.

The lack of business, accounting, and management skills among the traders causes frequent business failures, which the Department of Commerce is trying to overcome. Most of the 29 markets are periodic as is common throughout most rural areas of Africa.

Kitui's industries include a medium-scale cotton ginnery in Kitui town (the largest industry in the district), a bakery, a number of skin and hides bandas, and handicraft centres. Other small scale activities include: making of galvanised iron, water tanks, brick making in Kitui town, furniture making in Kitui and Mwingi towns, motor car repairs and tailoring in Kitui town.

In spite of being one of the largest districts in the area, Kitui has only 0.01% of the total industrial operatives in the country. Since cash crop production in Kitui is very low and unreliable, no food processing industries have been developed.

The cotton ginnery of Kitui town has 40 permanent staff, and during the cotton processing season employs about 100 casual labourers. Its input factors consist of raw cotton from Kitui and Machakos, water, and electricity. The cotton is brought to the ginnery at high transport costs. The recent construction of another cotton ginnery at Machakos (Makueni) will seriously undercut the already limited supplies to Kitui ginnery and may render its operation uneconomical. Waste products from the factory consist of dirty water from the factory and dust from the cotton processing. The effluents from the factory are dumped into an open pit near the factory, posing an

environmental hazard to the surrounding environment. The workers are not provided with dust-proof masks or clothes and hence are exposed to dust and noise pollution inside the factory. However, the factory plays a significant economic role to the district and the country at large, providing employment, stimulating cotton growing in the region, and producing needed cotton fibres for cloth industries. The seeds extracted from the cotton ball are sent to Thika for oil extraction.

The bakery employs 20 people and produces 300 loaves of bread per day. However, wheat flour has to be transported from other distant districts, and its shortage often interrupts the bakery's operations. There is little waste matter from the bakery.

The district has about 22 skin and hide bandas scattered in the major market centres. Usually manned by two men, they consist of open structures where fresh skins and hides from slaughtered livestock are exposed to open air. The bandas rarely have good water supply and often constitute a health risk. Their waste matter is dumped into open pits, which become breeding grounds for insects and harmful organisms. The smell from these bandas is also repellant. The general lack of water supply compounds the problem. It is imperative that health authorities enforce high sanitary standards in areas where these bandas are located.

There are numerous handicraft centres often run by women's organisations in Kitui. The main activities undertaken include:

- | | |
|------------------|-----------------------|
| a) bead making | d) poultry keeping |
| b) basket making | e) soil conservation |
| c) goat keeping | f) vegetable growing. |

It is estimated that 2,732 women are involved in these activities. Bee-keeping by men is an important traditional activity in the district. Kitui

produces most of the honey in the country. The prospects for developing this industry are considerable, and the government is currently introducing commercial bee-keeping in the district.

Despite its remoteness, Kitui District has considerable potential for industrial development, especially small-scale cottage industries. Bee-keeping and honey production can be increased to become an important industry, and fruit growing can also be developed. Kitui has good soils for brick and tile making. The vast semi-inhabited areas of Kitui could be used for livestock keeping, especially if the tsetse fly menace can be eradicated, thus boosting both meat and hide industries in the district. Wood carving is a traditional art in Kitui and could be expanded alongside the tourist industry. There is an urgent need to construct a Rural Industrial Development Centre (R.I.D.C.) in Kitui town to facilitate rapid development of small and large scale industries in Kitui.

The problems hampering industrial development in Kitui include the harsh climate, lack of good sources of capital, and lack of electricity and infrastructural development. The Kamburu-Kindaruma hydro-electricity plants lie at the boundary of Kitui and Machakos, only 60 km from Kitui town. This power could easily be supplied at the required level to facilitate the growth of commercial and industrial activities. With the present rate of population growth in the district, the changing lifestyles, and the economic demands, the commercial, industrial and agricultural sectors need to be developed to provide employment and income to the district.

4.6 EMPLOYMENT AND INCOME

As would be expected of a district predominantly characterised by subsistence agriculture and largely lacking in industries and commerce, there is widespread underemployment and unemployment in Kitui. Income levels are among the lowest in Kenya.

Table 4.15 shows the extent and trend of wage employment in Kitui from 1969 to 1977. The numbers and the rate of increase are low compared to most districts in Kenya.

The earnings accruing to the district are similarly very low. (See Table 4.16).

TABLE 4.15 WAGE EMPLOYMENT IN KITUI, 1969-79

Year	1969	1970	1971	1972	1973	1974
Number	3,392	3,789	4,007	4,188	4,140	5,350

Year	1975	1976	1977	1978	1979
Number	5,608	5,559	5,709	6,261	6,787

SOURCE: Statistical Abstract (Kenya) 1979 and 1980.

TABLE 4.16 EARNINGS IN KITUI DISTRICT, 1969-79

Year	1969	1970	1971	1972	1973	1974
Earnings (K £'000)	445.0	621.4	571.6	1072.3	1297.8	1574.7

Year	1975	1976	1977	1978	1979
Earnings (K £'000)	1,796.6	2,197.5	2,458.1	2,715.1	3,212.6

SOURCE: Statistical Abstract (Kenya) 1979 and 1980.

V. ANALYSIS OF TRENDS AND PROBLEM IDENTIFICATION

5.1 TRENDS

The purpose of this section is to examine changes in the environment over time. This information can then be used to measure the improvements in the environment due to development activities as well as to identify problems in their early stages so that preventative action can be taken.

In the physical and natural environment, soil erosion is an increasing problem limiting crop yields and slowly destroying the soil's capability to continue producing both important crops and pasture for grazing cattle. In the arid and semi-arid portions of the district, livestock can devegetate an area and compact the soil by trampling. When the rains come there is insufficient vegetation to soften the impact of the raindrops or slow the runoff, and the unprotected fertile topsoil is swept away by the water. Without vegetation to slow the runoff and capture the silt, little water infiltrates into the ground. Consequently, even less vegetation grows the next season to support the already high number of cattle. In the marginal areas, erosion from farming on steep slopes without conservation measures reduces crop yields.

There is insufficient evidence to determine whether devegetation and erosion has increased the water shortage problem by causing more of it to run off quickly and less to stay in the groundwater. Water is the most severely limiting natural resource in the district. Periodic droughts causing famines punctuate the district's history, and water shortages increase disease incidence. With increasing human and livestock populations the shortage is being felt more severely.

In the human environment, although the rate of population increase is not as high as in other parts of the country, the ability of the land to support the population is being strained. From 1969 to 1979 the population increased 35%. There is a high dependency ratio, and many adult males leave the district in search of wage employment. The fertility rate exceeds the national average. There is little evidence of any change in this rate of population increase as family planning practices have not been adopted by a significant proportion of the population. In the rural areas, traditional attitudes toward family size are still maintained by a large proportion of the population.

Trends in land uses directly reflect the population increase. Central and Mwingi Divisions, the most fertile areas, have high population densities and high rates of population increase, which results in more intensive agricultural use of the land. In the drier areas, overgrazing is a problem due to poor pasture management practices. Simultaneously, increasing herd sizes and decreasing pasture productivity are accelerating problems with erosion and desertification. Livestock diseases are also common, but efforts by the Livestock Ministry have eradicated diseases in certain areas (see Figure 9).

The area's aridity naturally limits forest growth, but the poor land management practices of overgrazing, burning, and tree cutting without replanting are depleting the district's forests. Fuelwood requirements are causing extensive tree cutting in many parts of the district, often leaving areas virtually barren of trees.

No trends were identified in the health field, but diarrhoeal diseases, malaria, and malnutrition, diseases related to or caused by environmental

factors, are among the most prevalent diseases. Education facilities, although improving, are still below the national average.

Infrastructure development is made more difficult by the harsh climate and low-level cash economy of the district. Although water supplies and roads have been constructed in the recent past, many more are needed. Road maintenance is made more difficult by the severe climatic conditions with seasonal dry periods and high-intensity rains. Siltation of water courses has also made surface dam maintenance difficult. No sewage treatment is available in the major towns.

Commercial and industrial development has been slow due to the infrastructure limitations, and businesses experience periodic problems with transport and water supply. As a consequence, wage employment and income levels have not increased as rapidly as the national average.

In summary, a continuation of these trends indicates that in the future Kitui will have improved roads, water supply, and services in scattered locations. Uncertain water availability will continue to limit crop yields and livestock production as well as commercial and industrial development. Heavy siltation resulting from soil erosion will continue to slow water supply programmes unless better land management practices are adopted. Without water and soil conservation, periodic droughts and famines may continue in the district.

The following pages summarise the major environmental issues, problems and constraints which development projects should address.

5.2 PROBLEM IDENTIFICATION

5.2.1 Water Shortage

Most of Kitui District is classified as a semi-arid and arid zone. Rainfall is less than 30 inches per year and most of it is concentrated in the two rainy seasons. The high-intensity rainfall quickly runs off the hard, parched soil and carries heavy silt loads down the normally dry river beds. Drought is a common feature, and less than 5% of the rural population are in reach of piped water in the district. Lack of water is the main constraint to development, limiting agricultural and livestock productivity, forest planting, industrial development, improvements in health, education, and market center development.

Location: Throughout the district except along the Rivers Arhi and Tana.

5.2.2 Soil Erosion

As a semi-arid and arid area, the district is particularly susceptible to soil erosion. The dry seasons followed by concentrated high intensity rainy periods make the soils easily eroded. Where poor land management practices such as overgrazing, deforestation, or cultivation on steep slopes have stripped the land of vegetation, there is nothing to hold the fertile topsoil, and it is swept down to the rivers by the runoff from the rains. The remaining soil is hardened by the impact of the raindrops, baked by the sun, and thus less water seeps into the ground, reducing vegetative growth the next season. The productive topsoil silts the rivers and dams, reducing the dam's capability to supply water. Without the good topsoil, crop yields

and pasture quality are declining, and famines will continue to increase.

Location: Throughout the district, but particularly severe in Southern Division.

5.2.3 Population Pressure on Limited Resources

Population in Kitui increased 35% from 1969 to 1979, with much of the increase concentrated in the marginally productive lands of Central and Mwingi Divisions. Since nearly all of the population earn their living from the land, having a large enough productive piece of land is very important. The district's limited water supply and periodic droughts lead to malnutrition, famine, and increased disease incidence. According to the District Development Plan, without reversal of soil erosion trends, "chronic famine is inevitable, with its frequency and severity increasing each year." Nevertheless, Kitui has a fertility rate above the national average and the population is continuing to increase despite the inability of the land to consistently support the current population.

Location: Central and Mwingi Divisions.

5.2.4 Credit Limitations

To receive loans or credit in Kitui, a farmer must have registered land as collateral. But by 1977, only 104 sq kms had been adjudicated and thus most farmers and traders cannot get loans for agricultural inputs as well as for improvement of an existing or commencement of a new business.

5.2.5 Limited Wage Employment Opportunities

With increasing population and the rapid erosion of productive soil, more Kitui residents are seeking wage employment. Industrial development is

limited by water and power shortages, and small businesses are limited by the difficulties of obtaining credit.

5.2.6 Transportation

The road density per sq km is one of the lowest in the country, and the majority of the existing roads are of very low standard. Roads are poorly maintained, suffering from severe erosion and wash outs during the rains. Bus and matatu service is limited due to the poor roads and long distances.

5.2.7 Energy

Electricity is available only in Kabeti Market, Kitui town, Mulango Girls' Secondary School, Matinyani, and St. Lwanga Secondary Schools. Three-phase power supply necessary for industrial purposes is not available anywhere in the district. Most domestic energy needs are met by wood and charcoal, but with the increasing population, forest resources are being depleted. Wood gathering is becoming more difficult and time consuming, and charcoal prices are rising.

VI. R E C O M M E N D A T I O N S

This chapter presents options for addressing some of the problems described in Chapter 5. A short description of the advantages and disadvantages of the various options is also included. Where one option seems preferable, recommendations have been made. The number of the recommendations corresponds to the numbers assigned to the problems in Chapter 5.

6.1 MONITORING OF TRENDS

Little hard data is available for assessing positive and negative trends in the Kitui environment. In many cases "background" data is needed to assess the environmental impact of a development action or lack of action. Of the trends discussed in Section 5.1 it is recommended that the district officers of the various ministries, with technical assistance from the National Environment Secretariat, select sites for monitoring the following factors:

1. Water Supply

Is increasing devegetation and erosion resulting in less infiltration of water to the groundwater table? If yes, are water supply sources such as rivers, wells and springs drying up earlier in the season than before? Sites with and without soil erosion and devegetation should be monitored for water yield. Weirs should be installed to measure stream flow, and boreholes should be dug to measure groundwater yields.

2. Soil Erosion

Is soil erosion actually reducing crop and pastureland yields? Several agricultural and pasture sites should be selected for monitoring. Criteria used in the selection should be the soil type, slope, rainfall, and land management practices. Erosion from two sites with similar soils, slopes, and rainfall but different land management practices should be compared. Where possible comparative yields should also be noted.

3. Water Quality

Diarrhoeal diseases are quite common in the district. At selected sites drinking water should be monitored for disease-carrying organisms and siltation. The water quality should be tested periodically as the water sources dry up. Any industrial discharges should also be tested.

6.2 RECOMMENDATIONS FOR IDENTIFIED PROBLEMS

6.2.1 Water Shortage

Several options for addressing Kitui's water needs (see section 5.2.1) include:

- (a) build large-scale structures (e.g., dams) to capture rainfall runoff;
- (b) build small-scale structures (e.g., gutters and rain tanks) to capture rainfall;
- (c) pipe water from the two perennial rivers;
- (d) adopt soil-conservation/revegetation measures (including re-forestation) to help water infiltrate and recharge the groundwater table.

Discussion:

Conservation measures are needed in the district to reduce famine incidence as well as to conserve water. As the rainfall is concentrated in two seasons, means of capturing and storing the excess rainwater are needed. Since the current heavy siltation severely shortens the useful lifetime of existing dams, investment in structures which collect rainwater directly or can filter the sediment would be preferable. Option (c) is feasible only for locations near the rivers.

Some combination of (b), (c), and (d) is probably the best available means of supplying water to the district. Option (a) should only be implemented if conservation measures are constructed and practised in the area first.

6.2.2 Soil Erosion

Several means of reducing soil erosion are mentioned below:

- (a) on cropland: using contour plowing, constructing terraces and cut-off drains, and planting grass strips. Terraces which are mounded also trap water and make more moisture available to the crops;
- (b) on pastureland: resting areas for 2-3 years, constructing terraces and cut-off drains, planting fodder, harvesting and feeding the livestock, and, if necessary, reducing herd sizes;
- (c) on roads: designing the road along the contour, shaping the road so it drains to ditches on either side and constructing periodic cut-off drains to carry the water away from the road;
- (d) to reclaim gullies: constructing gabions and planting napier grass.

Discussion:

All these measures are needed. Training and means of maintaining conservation structures must accompany their implementation.

6.2.3 Population Pressure on Limited Resources

Several options are suggested to address the issue of increasing population pressure on limited resources.

- (a) widespread adoption of family planning practices which limit family sizes;
- (b) increased food aid and famine relief;
- (c) encouraging people to move out of the district and settle elsewhere;
- (d) increasing wage employment opportunities in Kitui and food production in more fertile areas so Kitui people can purchase food.

Discussion:

Option (b) and (c) are currently being implemented, but are insufficient to meet the need. Option (a) will need to be adopted as a long-term solution and (b), (c), and (d) will need to be increased as short-term approaches.

6.2.4 Credit Limitations

Options for addressing this need include:

- (a) accelerating the land adjudication programme;
- (b) forming more cooperatives to provide additional loan sources.

Discussion:

Land adjudication is necessary for a long-term resolution of this problem. In the meantime cooperatives can meet some of the needs for loans and acquisition of agricultural inputs.

6.2.5 Limited Wage Employment Opportunities

Options for addressing this need include:

- (a) providing basic infrastructural development including water, transport, energy, and communications needed for private, commercial, and industrial development;
- (b) encouraging industrial development which uses natural resources of the district and recycles or reuses water and wastes;
- (c) providing business and occupational training in the polytechnics, adult education courses, and other training institutions.

Discussion:

All of these options should be adopted. Of particular importance in this limited natural environment is selecting an industry or cluster of industries which is not water intensive and which can re-use waste heat, waste water, and industrial by-products. Roads and markets outside the district are also needed.

6.2.6 Transportation

A programme to upgrade existing roads, improve drainage design, and ensure regular maintenance is needed.

6.2.7 Energy

Options for addressing the energy needs of the district include:

- (a) bringing electricity from a hydro-electric plant on one of the major rivers;
- (b) increasing forest plantings;
- (c) using renewable energy sources such as wind power and solar energy.

Discussion:

Presently the number of trees planted is fewer than the number cut each year for domestic fuel. Until an alternative energy source is found, individuals and the government must increase tree planting. Meanwhile, alternative technologies should be tried at schools, hospitals, industries, and service centres.

APPENDIX A: BOREHOLES IN KITUI DISTRICT, 1979

NAME, LOCATION AND NUMBER OF BOREHOLES	DEPTH (m)	DEPTH AT WHICH WATER WAS FIRST STRUCK		YIELD AND QUANTITY (m ³ /h.)
		first (m)	second (m)	
1. Ngai 696 38°10':0°38'	162.77	76.2	N/A	Yield indefinite, good (awest) water.
2. Ngomeni 919 38°20':0°42'	93.88	51.02	76.2	2.795 m ² /h extremely hard and saline, high in Mg. May cause gas- tric problems in animals.
3. Waita Location 573 38°05':0°50'	132.59	42.67	129.54	1.364m ³ /h. Permanent good water.
4. Waita 573 38°05':0°50'	152.4	20.12	N/A	0.136m ³ /h, permanent good water.
5. El Dera 96 38°03':0°56'	124.36	N/A	N/A	0.136m ³ /h. Saline.
6. Mwingi 104 38°03':0°56'	90.53	8.23	N/A	Slightly saline 0.863m ³ /h, fit for human consumption.
7. Nguni Market 3912 38°19':0°48'	45.73	23.78	N/A	pH 7.9, very hard, contains Ca and Na, fair organic.
8. Enziu 3922 38°15':0°51'	58.23	18.29	N/A	pH 8.3, very hard, fair organic purity, good taste, yields 2.84m ³ /h.
9. Kangondi 3760 37°36':1°05'	198.12	34.44	60.96	Good quality water, permanent. Yields 0.318m ³ /h.
10. Kangondi 3766 37°39':1°05'	152.4	31.09	140.21	Permanent, good quality, yields 1.514m ³ /h.
11. Yatta, 1595 37°40':1°06'	82.30	64.01	N/A	10.909m ³ /h.
12. Yatta 1508 37°42':1°08'	112.78	97.84	N/A	3.916m ³ /h, good quality.
13. Yatta 159 37°44':1°13'	100.59	85.35	-do-	0.273m ³ /h, good quality.

APPENDIX A: BOREHOLES IN KITUI DISTRICT, 1979 (cont.)

NAME, LOCATION AND NUMBER OF BOREHOLES	DEPTH (m)	DEPTH AT WHICH WATER WAS FIRST STRUCK		YIELD AND QUANTITY (m ³ /h.)
		first (m)	second (m)	
14. 127, 37°53':1°01'	24.69	N/A	N/A	abandoned.
15. Migwani 2196 37°53':1°02'	67.06	29.57	59.74	8.045m ³ /h, permanent, excellent quality.
16. A.D.C. 2191 34°48':1°09'	121.92	32.0	103.63	6.273m ³ /h, permanent, very slight- ly saline.
17. Yatta 1573 37°45':1°09'	172.21	21.34	N/A	0.636m ³ /h, good quality.
18. Mile 20 135 37°55':1°12'	66.14	36.58	-do-	8.201m ³ /h, good quality, permanent.
19. Military 95 37°55':1°13'	91.44	15.85	87.78	4.955m ³ /h, good quality water.
20. Yatta (Kimatta) 430 37°38':1°20'	97.54	70.10	N/A	7.505m ³ /h, permanent, clear and good water.
21. Mumbuni (Yatta) 1972 37°42':1°22'	91.75	64.01	-do-	7.15m ³ /h, permanent, clear and cool water.
22. Mbaikini 2427 37°33':1°24'	92.97	86.87	-do-	0.068m ³ /h, not permanent.
23. 3453 37°32':1°29'	88.7	24.38	82.30	8.182m ³ /h, permanent good water.
24. Water Treatment Works Kitui 3328	44.96	31.09	N/A	0.045m ³ /h.
25. Ithokwe 1622	134.11	53.34	-do-	0.432m ³ /h, permanent, good quality.
26. Ithokwe 4355	44	N/A	9	27.273m ³ /h, public water.

APPENDIX A: BOREHOLES IN KITUI DISTRICT - 1979 (cont)

NAME, LOCATION AND NUMBER OF BOREHOLES	DEPTH (m)	DEPTH AT WHICH WATER WAS FIRST STRUCK		YIELD AND QUANTITY (m ³ /h.)
		First (m)	second (m)	
27. Water Treatment Works--Ithokwe 3326	61.57	5.49	N/A	0.227m ³ /h.
28. Ithokwe 4028	152.2	20	-do-	0.432m ³ /h, moderately hard, pH 8.4, fit for consumption.
29. Ithokwe (Kitui Town) 438	60.96	53.65	-do-	9.545m ³ /h, good, permanent water.
30. Ithokwe 4183	110	55	97	Negligible amount of water, good quality with fair amount of dis- solved solids.
31. Ithokwe 4136	94	48	60	20.5m ³ /h, good quality, about 27°C temperature.
32. Ithokwe 1738	64.3	35.06	N/A	11.364m ³ /h, permanent good quality.
33. Ithokwe 4299	120	30.8	-do-	0.395m ³ /h.
34. Ithokwe 4059	120	48.0	68.04	0.22m ³ /h, good quality but rather dirty.
35. Ithokwe 3795	60.06	36.28	48.17	17.273m ³ /h, good quality, permanent.
36. Mwingi 4363	151	N/A	20	Dry.
37. Kalinga 4223	129.8	41.1	118.9	6.0m ³ /h, fair quality for domestic and irrigation use.
38. Mui 1452	128.04	32.07	N/A	4.036m ³ /h, permanent good water.
39. Ikoo 3913	41.76	-	-	Borehole abandoned.
40. Ikoo 3907	91.46	18.9	N/A	3.71m ³ /h, good taste, moderately hard, safe, pH 7.8.
41. Nuu 1521	100.6	N/A	N/A	0.164m ³ /h, good quality.

APPENDIX A: BOREHOLES IN KITUI DISTRICT, 1979 (cont.)

NAME, LOCATION AND NUMBER OF BOREHOLES	DEPTH (m)	DEPTH AT WHICH WATER WAS FIRST STRUCK		YIELD AND QUANTITY (m ³ /h.)
		first (m)	second (m)	
42. Nuu 1522	42.68	-	-	Borehole dry.
43. Kitui Town 425	213.41	195.12	207.31	7.727m ³ /h, good permanent water.
44. Mulango Misaion 2179	42.07	4.57	54.87	2.718m ³ /h, permanent, very slightly saline.
45. African Development 2111	73.17	39.63	N/A	Yield not sufficient.
46. Ikanga 3883	81.7	6.09	N/A	2.72m ³ /h. Water clear.
47. Ikanga 3884	36.58	3.35	N/A	0.98m ³ /h, moderately hard, pH8.2.
48. Ikanga (Mutomo) 2260	174.39	48.78	140.24	2.046m ³ /h, permanent, good water.
49. Mutomo 464	84.21	41.76	50.29	5.0m ³ /h, clear water, permanent.
50. Mutomo 452	73.17	N/A	N/A	8.42m ³ /h, clear water.
51. Mutomo 3198	75.29	6.10	48.77	5.910m ³ /h, permanent, good taste.
52. Mutha 3242	39.93	16.76	N/A	12.72m ³ /h, permanent water.
53. Mutha 538	152.40	99.37	143.26	1.44m ³ /h, permanent good water.
54. Kanziko 496	145.39	121.92	143.56	1.091m ³ /h, good permanent water.
55. Graphite Co. Kanziko 1948	121.92	27.43	112.78	1.364m ³ /h, good permanent water.
56. N.H. HQ/Taavo Nat. Park 3165	14.93	-	-	Borehole dry.
57. Endau 1543	60.96	-	-	Borehole dry.
58. Endau 1300	97.54	11.58	-	1.52m ³ /h, permanent but salty.
59. Ndiandaza 3643	97.54	53.35	85.35	1.81m ³ /h, believed to be good quality water.
Means	94.8	43.25	86.32	4.48m ³ /h = 985.6 gals/hr.

SOURCE: Ministry of Water Development.

APPENDIX B: ESTABLISHED AND PROPOSED RANCHES IN KITUI DISTRICT, 1979

NAME OF RANCH	LOCATION	AREA IN HECTARES	REMARKS
Mbeu	Katse	2,000	Co-operative ranch, making good progress, started in 1970. The ranch was formed to specialise in goat ranching.
Mikuyuni	Yatta	7,000	Co-operative ranch started in 1972. Making good progress although the ranch is void of grass so only browsers can persist. Was sub-divided into settlements. There were 180 goats which were never dipped. The mortality was as a result as high as 2-1/2% per week.
B ₂ Yatta	Yatta	22,000	Co-operative ranch making good progress, started in 1973. Has a total of 548 members. There are about 4,000 head of cattle. Has received a loan from AFC.
Ngunyumu	Ikutha	12,000	Group ranch coming up already adjudicated. Started in 1974.
Diocese of Kitui	Yatta	2,024	Demonstration ranch, doing well. It was part of Mikuyuni ranch. It has a dam from which irrigation water is drawn to grow crops, a tree nursery and fish farming is also practised. Rears sheep and goats. Started in 1976.
U.K.A.I.	Yatta	4,000	Not adjudicated. Started in 1976. Private. Has purchased male goats.
Mutindwa	N/A	N/A	Started in 1978. Individual ranch.
Sinandu	N/A	N/A	Started in 1978 as a group ranch.
Mlangoni Suti-Moja	N/A	N/A	Started in 1979 as a group ranch.
Mwakini	Yatta	8,000	A company ranch started in 1974 and making good progress. Has about 60 members and about 2,000 head of cattle. Operates on trustland. Although the ranch operates as a group ranch each member looks after his cattle. The best ranch--is well managed.

APPENDIX B: ESTABLISHED AND PROPOSED RANCHES IN KITUI DISTRICT, 1979 (cont.)

NAME OF RANCH	LOCATION	AREA IN HECTARES	REMARKS
Nzake-Migwani	Migwani	7,000	A group ranch making fair progress. However, is being threatened by settlements.
Nguni	Ikutha	9,379	Group ranch making slow progress. Water was being installed in 1976.
Sosoma	Ngomeni (Stateland)	304,000	Co-operative ranch with about 905 members. Coming up. The problem of water availability can be solved by rock catchments.
Enziu-Katika	Endau	4,000	Group ranch not making any progress due to bad management.
Usuando/ Kaviti	Zombe	600	Group ranch. Has about 50 members. Was planned for goat ranching.
Mutwangombe	Endau	2,000	Was formed on co-operative basis. Progress is poor because of land ownership problems.
Twaathi	Mivukoni	102,445	Co-operative ranch coming up well. The ranch has been registered. Membership is 300.
Kamuvukoni	Mutha (Stateland)	260,000	Company ranch. Progress not very good. There are about 600 members. Lease being acquired.
Nziu	Endau (Stateland)	150,000	Company ranch, making good progress. There are about 700 members. Lease being acquired.
Masesithi	Iseikuru (Stateland)	Unknown	Co-operative ranch. Making good progress. On a very good site with water.
Karure	Mwingi	24,000	Group ranch. Grazing site set aside by the colonial government. Has been controversial in the past.
Kyaago	Voo	Unknown	Group ranch coming up well although in a famine-stricken area.

APPENDIX B: ESTABLISHED AND PROPOSED RANCHES IN KITUI DISTRICT, 1979 (cont.)

NAME OF RANCH	LOCATION	AREA IN HECTARES	REMARKS
Mui	Mui	Unknown	Group ranch. Controversial because of clan rivalry.
Winumba	Ikatha	Unknown	Group ranch coming up well.
Ethengathi	Ikuthe	Unknown	-do-
Masyungwaika	Hivukoni	-do-	-do-

SOURCE: Ministry of Agriculture.

APPENDIX C: OPERATIONAL AND PROPOSED CATTLE DIPS IN KITUI DISTRICT, 1979

DIVISION	LOCATION	STAGE	CONDITION
<u>CENTRAL DIVISION</u>			
Kisasi	Kisasi	Complete	Not working.
Mbitini	-do-	Not complete	-do-
Ivovoa	-do-	-do-	-do-
Katangasua	-do-	-do-	-do-
Maliku	Mulango	Complete	Working.
Kyambiti	-do-	-do-	Not working.
Syomunyu	Yatta	-do-	-do-
Kawango	-do-	-do-	Working.
Ilika	-do-	-do-	-do-
Kwa Vonza	B ₂ Yatta	-do-	-do-
Mutune	Changwithya	-do-	-do-
Kwamutunge	Matinyani	-do-	-do-
Kyabani	-do-	-do-	Not working.
Chamia Kilonzo	Changwithya	-do-	Working.
B.L.1	-do-	-do-	-do-
Ngegi	Nzambani	-do-	-do-
Inguu	-do-	-do-	-do-
B ₂ Yatta Camp	B ₂ Yatta	-do-	-do-
Mubeve	Miambani	Not complete	Not working.
<u>MWINGI DIVISION</u>			
Katutu	Mutonguni	Complete	Working.
Masokeni	-do-	-do-	Not working.

APPENDIX C: OPERATIONAL AND PROPOSED CATTLE DIPS IN KITUI DISTRICT, 1979 (cont.)

DIVISION	LOCATION	STAGE	CONDITION
<u>MWINGI DIVISION (cont.)</u>			
Matinga	-do-	-do-	Working.
Thoka	Migwani	-do-	-do-
Kyome	-do-	-do-	Not working.
Nzuli	Migwani	Complete	Not working.
Migwani	-do-	-do-	-do-
Kea	-do-	-do-	Working.
Nzauni	-do-	-do-	-do-
Mbitini	-do-	-do-	Not working.
Kavyalyani	-do-	-do-	-do-
Itoloni	Migwani	Complete	Not working.
Thitani	-do-	-do-	-do-
Muthongini	-do-	-do-	-do-
Kyamboo	-do-	-do-	-do-
Kisole	Endui	-do-	Not working although they have enough money to purchase acaricides.
Waiba	-do-	Nearing completion	Danish project.
Usiani	Mutonguni	-do-	-do-
Mikuyuni	-do-	Proposed	Self-help project.
Kyome	Migwani	-	Danish project.
Ndaluni	-do-	-	-do-
Kwakasovi	-do-	-	Self-help project.

APPENDIX C: OPERATIONAL AND PROPOSED CATTLE DIPS IN KITUI DISTRICT, 1979 (cont.)

DIVISION	LOCATION	STAGE	CONDITION
<u>MWINGI DIVISION (cont.)</u>			
Kalalwa	Mwingi	-	Danish project.
Kwamburu	-do-	-	Self-help project.
Nzeruni	-do-	-	-do-
Kwamanzi	-do-	-	-do-
Wamwathi	-do-	-	-do-
<u>KYUSO DIVISION</u>			
Mikiti	Katse	Complete	Working.
Nguni	Ngomeni	Proposed	Self-help basis. It already has finances.
Mikumiaiyi	-do-	-do-	-do-
Katse	Katse	-do-	-do-
Siungu	Tseikuru	Proposed	-
<u>SOUTHERN DIVISION</u>			
Nguni	Ikutha	Complete	Not working.
<u>EASTERN DIVISION</u>			
Kaai	Nuu	-do-	-do-
Uwa	Mutito	-do-	-do-
Makongo	Zombe	-do-	-do-
Ndetemi	Endau	-do-	-do-

SOURCE: Ministry of Agriculture.