DP11

MERU

DISTRICT ENVIRONMENTAL ASSESSMENT REPORT

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

In cooperation with ETMA
and the United States Agency
for International Developement

August, 1985

M E R U D I S T R I C T

ENVIRONMENTAL ASSESSMENT

REPORT

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IN CO-OPERATION WITH THE

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

AND THE

SOUTH EAST CONSORTIUM FOR INTERNATIONAL DEVELOPMENT'S
ENVIRONMENTAL TRAINING AND MANAGEMENT IN AFRICA (ETMA) PROJECT

AUGUST, 1985

FOREWORD

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

(i) that it is a facet of Government policy to bring environmental factors into the mainstream of policy-making in order to optimise use of scarce resources for the overall national good;

(ii) that the Government has recognised the district as the primary unit of planning in order to effectively bridge the gap between the grassroots and the higher policy-making levels. To this end, the Government has established district development committees and the District Focus to decentralise decision-making and policy administration; and

(iii) that incorporation of environmental considerations at the planning stages of any project or programme would help avoid the costly correction of environmental degradation that would otherwise ensue. This makes clear the need to ensure the integration of development planning and environmental management objectives at the district level.

Thus this report, parallel to others in the series, is geared toward making a contribution to the implementation and future formulation of the District Development Plan for Meru District. Its aim is that the development of the District takes place without the destruction of the resource base upon which it depends, so as to ensure a sustained and enhanced quality of life for the people of Meru. It is hoped that the recommendations

contained in this report, and the plan of action to be adopted during the workshop will form a truly useful basis for the management of the environment of Meru District in the dynamic context of the District's development.

The report is divided into four chapters. Chapter I presents a brief overview of the environment of Meru District. Chapter II examines in some detail 21 environmental issues relevant to district planning. Chapter III summarises the priority environmental problem in each division. Chapter IV includes the appendices and reference.

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

The Government Ministries based in Nairobi for basic information and data, the Meru District Commissioner whose enthusiasm boosted the morale of our research team; the District officers; Departmental heads, chiefs and assistant chiefs for their valuable information and data; the Meru County Council for providing their facilities at Leopard Rock in Meru National Park; the Kenya B.A.T. Branch Manager at Mitunguu Settlement Scheme; the National Museum for a conducted tour of historic places in the district; the people of Meru who provided insights which helped attune the report to the realities of the district and to the multitude of other people, including the National Environment Secretariat (NES) multi-disciplinary team whose contribution made this report possible.

The National Environment Secretariat team that carried out the research and preparation of this report included:

Mr. F.K. Lelo	-	Team Leader (Ecologist/Education)
Mr. P.M. Mungai	-	Chemist
Miss S. Maghanga	-	Economist
Mr. M.L. Kirui	-	Chemist
Mr. V.K. Njuki	-	Geographer/Sociologist
Mr. C.M. Kibocha	-	Research Assistant
Mr. P.K. Njuguna	-	Ecologist
Mr. T. Downing	-	Consultant with National Environment Secretariat

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

D.R. KAMAU
DIRECTOR
NATIONAL ENVIRONMENT SECRETARIAT

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

This Report discusses the relationship between environment and development in Meru District. The purpose of the Report is to identify:

(i) The environmental potential of the district
(ii) The environmental consequences of development and
(iii) The environmental constraints on development.

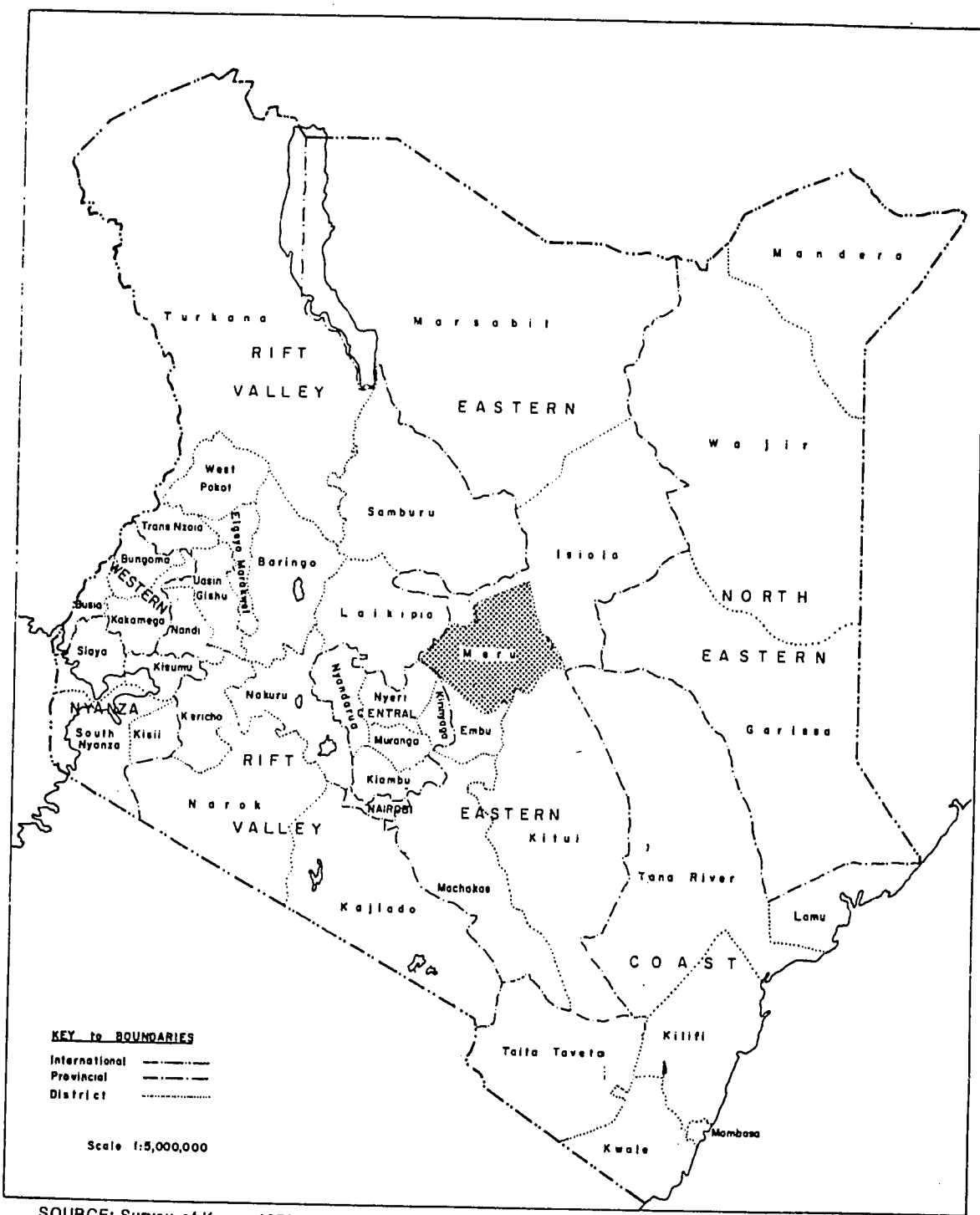
Meru is one of the largest agricultural districts in the country but it suffers from environmental consequences of a rapidly increasing population, accelerated land fragmentation, reduced production of food crops in favour of cash crops, accelerated deforestation and increased rates of urbanization. The effect of these factors is to overburden the available services and to deplete the district's resources.

Suggestions and recommendations are made on ways of reducing environmental degradation and of conserving the natural resources. The improvement of the basic infrastructure is highlighted and the development of the marginal lands underlined as a key step towards increasing productivity in the district.

1.2 GENERAL BACKGROUND

Meru District lies to the east of Mount Kenya whose peak cuts through the south-west border. The district shares borders with the agricultural districts of Laikipia, Nyeri, Kirinyaga and Embu as well as the marginal districts of Kitui and Isiolo. It straddles the Equator, lying within less than 1° on either side of it. Longitudinally, it is within 37° and 38°28' east. Meru town, the district headquarters, is 259 kilometers from the capital city of Nairobi and 746 kilometers from Mombasa, the main port. Figure 1 shows the location of Meru District.

The district covers an area of 9922 sq.km., nearly one third of which is forest reserve and national parks. It is divided into seven administrative divisions, namely: North Imenti, South Imenti, Nithi,



SOURCE: Survey of Kenya, 1970

FIGURE 1. LOCATION OF MERU DISTRICT

Tharaka, Tigania, Igembe and Timau. Timau division is a new settlement area which was created in 1982 and into which people are still moving. The divisions are further sub-divided into 40 locations and 137 sub-locations. Political representation in the district is through seven elected members of parliament representing the seven constituencies. Table 1.1 gives a breakdown of these divisions.

TABLE 1.1 POLITICAL AND ADMINISTRATIVE UNITS IN MERU DISTRICT, 1983

Administrative Divisions	Number of Locations	Number of Sub-Locations	Corresponding Constituency
Nithi	6	30	Meru South
South Imenti	6	15	Meru Central
Tharaka	3	11	Meru South-East
Igembe	7	20	Nyambene North
Tigania	8	22	Nyambene South
North Imenti*	7	34	Meru South-West
Timau	3	5	Meru North-West

* A part of North Imenti is in the Meru North-West Constituency. The Municipality is in North Imenti.

SOURCE: Kenya, Meru District Development Plan 1984-1988 and National Environment Secretariat Team.

The Meru belong to the Bantu group. Linguistically, they are closely related to the three neighbouring tribes: the Kikuyu, Kamba and Embu with whom the[y] also share many cultural traits. The Meru recognise nine territorial s[ub-g]roups defined on the basis of dialectical differences. These are Miutini, Igoji, Mwimbi, Muthambi, Chuka, Igembe, Tigania and Tharaka. The natural environment is reflected in their way of life. With the new settlement schemes and a more individual system of land tenure, however, many of these sub-divisions are not so obvious any more.

CHAPTER 2

PHYSICAL AND NATURAL ENVIRONMENT

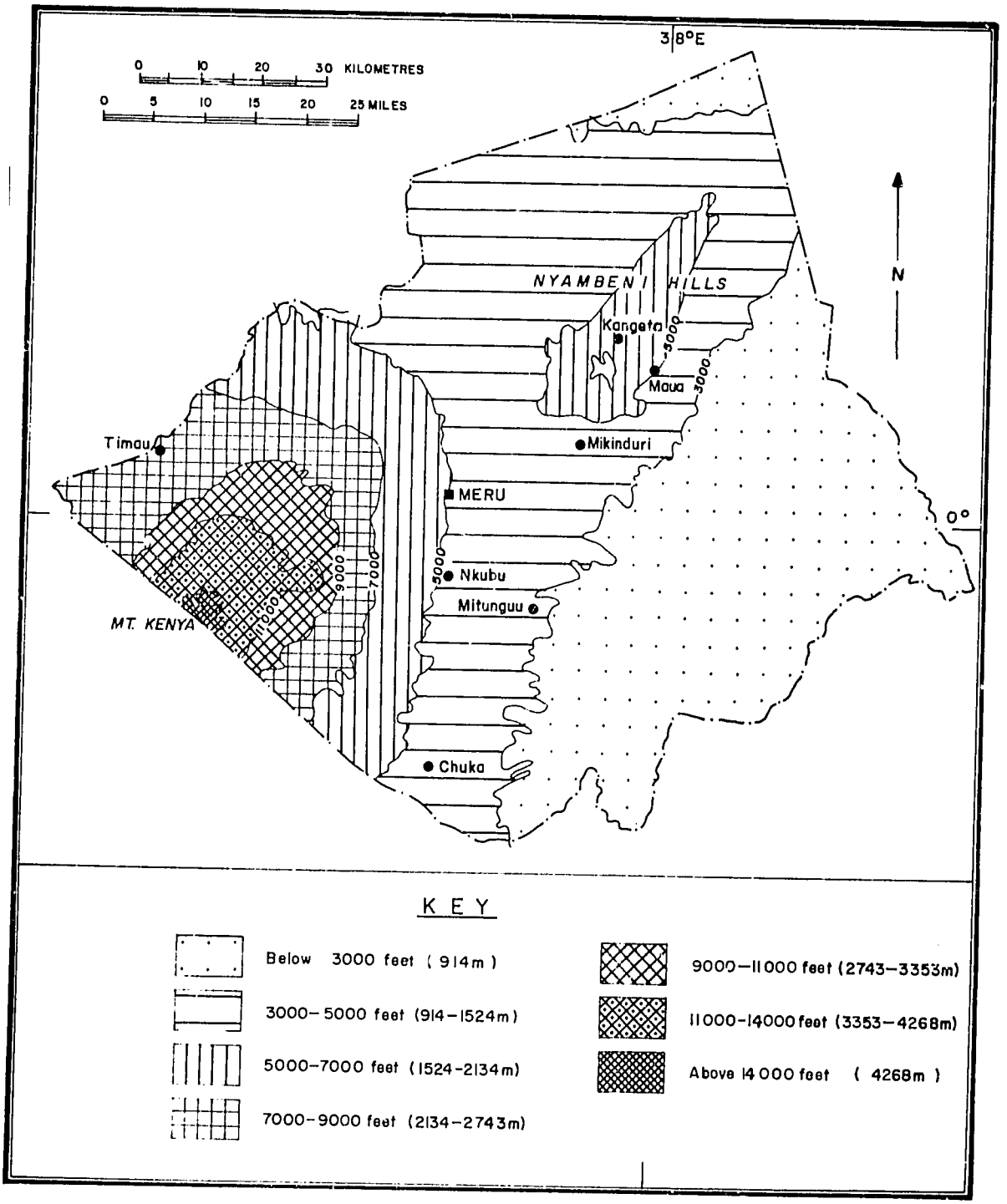
2.1 TERRAIN

2.1.1 Topography

Meru District is dominated by the two great massifs of Mount Kenya and the Nyambeni range both of which lend striking diversity to the physical landscape. These two elevations affect not just the physiography, but also the entire environmental potential of the district. At its highest point on Mt. Kenya which is also the highest point in the country, the district rises to 5199m (17058ft). The land then slopes gently from west to east, finally reaching an altitude of 335m (1100ft), near the Tana River. This tremendous range of altitude gives the district a more diverse climate, (figure 6), as well as a very wide range of agro-ecological zones, (figure 9). Figure 2 shows the topography of the district.

Not all the Mt. Kenya massif is within Meru District (its peak is a meeting point of three districts: Meru, Nyeri and Laikipia) but the northward and eastward slopes which are in the district have gentle slopes. The terrain of most of the district attests to the volcanic nature of both Mt. Kenya and the Nyambeni range. Between 2782m and 3894m on the slopes of Mt. Kenya, for example, there are three massive hills, Rotundu, Ithanguni and Ndua which were once subsidiary vents of the main volcanic pipe. The northern slopes of the mountain are pock-marked with adventive cones and vents which are steep and rocky. Matei, in Kiirua, North Imenti, is an example of an adventive cone. The top of the mountain is craggy and serrated and its peaks are always covered with snow. The slopes, though gentle, are serrated by youthful streams which have carved deep incisions in its igneous bedrock. Some of the incisions, particularly on the southern versants, are gorges, several metres deep which render water collection difficult.

The Nyambeni range, elongated south-west to north-east rises sharply above the surrounding plateau. Summit elevation is to the south where the peak, Itiene, reaches 2514m (8247ft). The slopes of the Nyambeni are steeper than those of Mt. Kenya but the crests are much lower with



SOURCE: Survey of Kenya, 1970

FIGURE 2. TOPOGRAPHY OF MERU DISTRICT

very little land above 1829m (6000ft). On the eastern side of the range, rivers have cut deep valleys on the bedrock.

The district can be divided into three altitudinal zones - the highlands, 1524m (5000ft) and above, the plateau, 914-1524m (3000-5000) and the lowlands, the area below that. Most of the highland area is in North Imenti and Timau although there are small highland portions in South Imenti and Igembe. The land is slopey and the rivers swift flowing.

The plateau is a belt which runs north to south between Mount Kenya and the Nyambeni hills. It includes the divisions of Nithi, Tigania, South Imenti and most of Igembe. The eastern side around Tigania is rocky and the surface is roughened by steep inselbergs.

The plateau is separated from the lowlands by a clear break in topography. Between 1067m and 914m there is a distinct escarpment varying from 15m to 100m in height. This escarpment is radiated by many radial streams. From here the land gently descends to the Tana River. The lithology and structure of the eastern basement lowlands have yielded a landscape markedly different from the volcanic slopes to the west. The basement complex is in a state of maturity. Its erosional surface is characterised by broad interfluves and widely spaced streams. The terrain of the interfluves is gently sloping except where it is broken by inselbergs. Tharaka, Meru Game Park and the northern fringe are the lowland areas of the district.

2.1.2 Drainage

Meru District is one of the most well-watered districts in Kenya. The district is within two large drainage basins. North of the Meru forest and the Crest of the Nyambeni range, water drains towards the Uaso Nyiro River (Ngare Ndare). South of the watershed, where most of the permanent rivers of the district are located, drainage is to the Tana, Kenya's largest and longest river. The Tana River forms the south-east border between Meru and Kitui District. Figure 3 shows the drainage system in the district.

On the slopes of Mt. Kenya, drainage is in a typically radial pattern. Two major systems receive the runoff from the mountain slopes. North of Mitunguu, the Thingithu-Kazita system receives all the drainage while south of it, the Mutunga drains the area. Streams on the upper slopes of Mt. Kenya have steep-sided deep valleys and numerous rapids and falls have developed on their sources. Some of them form cliffs of over 30m. As streams

flow out onto the basement complex, their profiles gradually flatten and lateral ercsion becomes predominant.

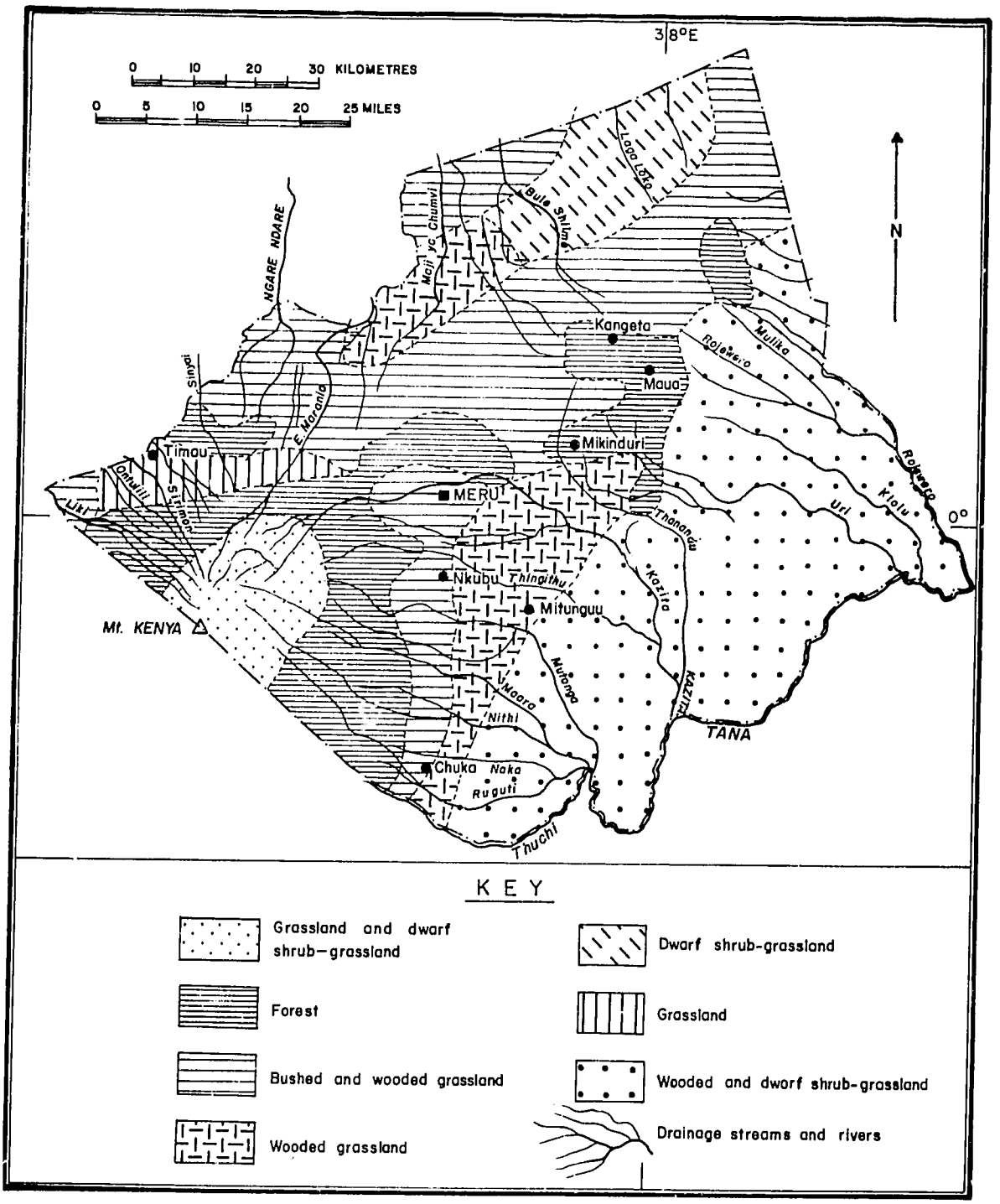
Streams flowing from the Nyambeni hills generally have courses at right angles to the trend of the feature. High orogrophic precipitation on the eastern slopes provides plenty of surface water but in the north-east, porous bedrock allows much of the drainage to flow beneath the surface. The Thanandu carries most of the runoff from the southern slopes while the Uri and Rojewero carries it from the eastern siopes. Although most of the streams north-west of the range are intermittent, they carry large volumes of water for several months of the year. They have carved sheer V-shaped valleys which erode extensively in the rainy seasons. None of them flows completely across the northern lowlands, and in the wet months, extensive swamps are formed.

2.2 GEOLOGY

The geology of Meru District comprises two natural sub-divisions, the volcanic rocks of Pleistocene to Recent and Tertiary eras and the Pre-Cambriam Basement systems. There are a few intrusives in the southern parts of Tharaka and a small part of North Nithi but these are so minor as to be insignificant. Figure 4 shows the geology of the district.

The Basement system, which is in a state of maturity, forms the floor on which all the remaining rocks of the area lie. It is on the southern flanks in the low lying areas (below 914m) mainly in Tharaka and the Meru Game Park. Other basement systems found in the district are due to post-volcanic erosion. Those around Mukinduri have exposed basement complex inliers which were part of a larger hill zone extending discontinuously from Shaba in the north into Kitui District in the south. The Basement system rocks are mainly sediments-grits, sandstones, shales and limestones that have been metamorphosed by heat and pressure or by impregnation by pervading fluids. Other types include heterogenous gneisses, granulites and schists of varied and complex origin.

The rest of the district is made up of volcanic rock, Tertiary volcanics on the uppermost reaches of Mount Kenya and on the southern slopes and Quaternary volcanics in the Mount Kenya forest, North Imenti, Igembe, and the Northern grazing area. Mount Kenya volcano was built by an eruption in Tertiary times and was alive as recently as the Pleistocene epoch (Table 2.1). Vulcanism finally ceased when a plug, the remains



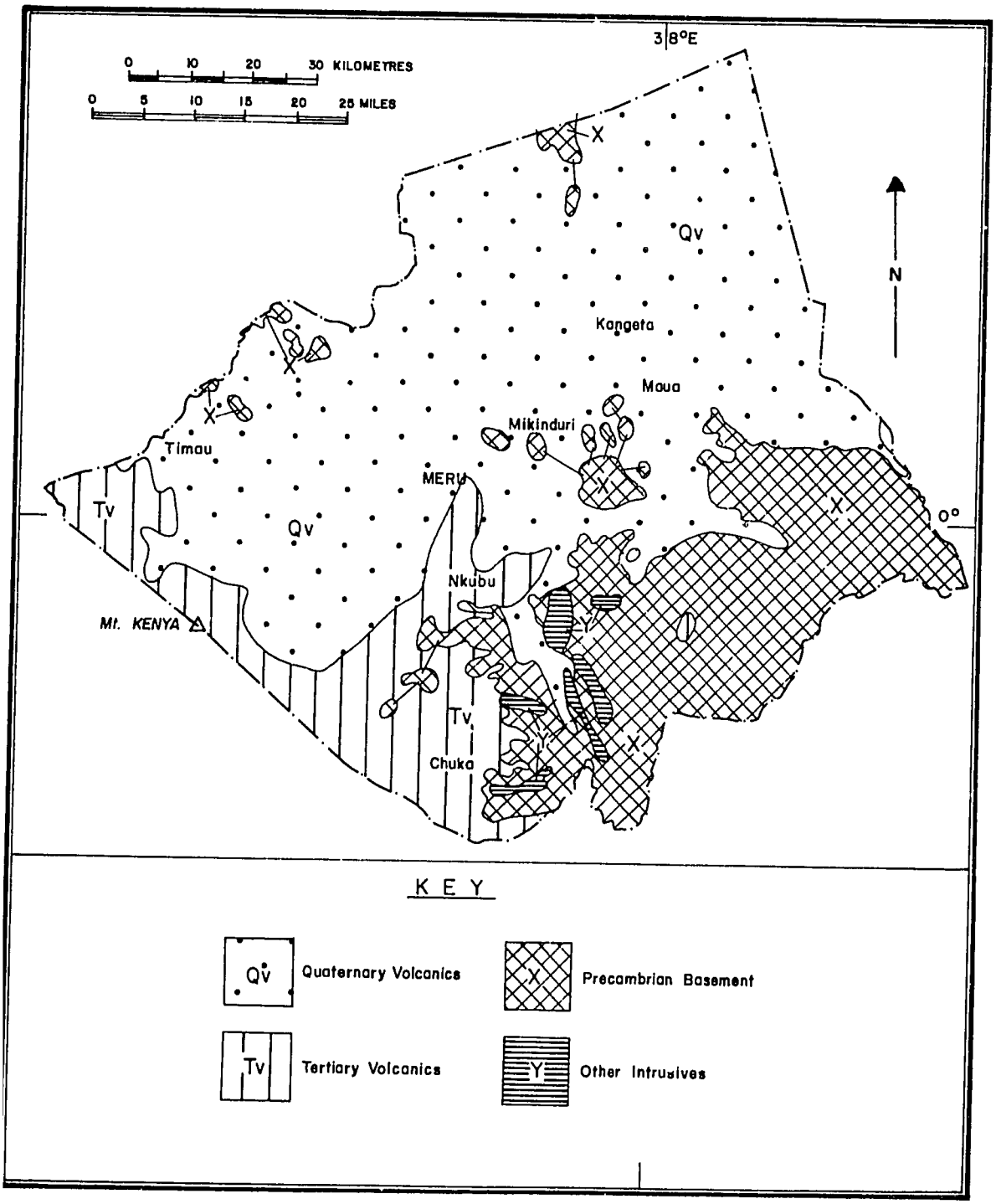
SOURCE: Survey of Kenya, 1970

FIGURE 3. DRAINAGE AND VEGETATION ZONES OF MERU DISTRICT

of which are the present main peaks, choked the feeder pipe. The upper and middle-slopes of the mountain are underlain by basalts, phonolites and kenytes which flowed from the central and subsidiary vents of the volcano. The northern slopes of the mountain are pock-marked with adventive cones and vents of mid-Pleistocene age. Many of these are above the Mount Kenya forest boundary or are in the northern unpopulated areas. Where these cones are in cultivated areas, however, they are a source of frustration to farmers because of the pyroclastic rocks which were strewn for miles around during the eruptions.

Nyakibeni extrusions commenced more recently than Mount Kenya's vulcanism, most probably they were parasitic activity to Mount Kenya's eruption. Upper Nyambeni lavas are of late Pleistocene times but Nyambeni parasitic activity continued into the Recent Epoch. North-west of the Nyambeni, the dense concentration of volcanic cones and vents indicate that vulcanism continued longest in this region, - well into the Recent Epoch. In the north-east, porous bedrock allow much of the drainage to flow beneath the surface creating major water problems for the Igembe people during the dry season.

The district has a variety of geologic materials which could have potential for economic exploitation. These are set out in Table 2.2 below.



SOURCE: Survey of Kenya, 1970

FIGURE 4. GEOLOGY OF MERU DISTRICT

TABLE 2.1

GEOLOGICAL SUCCESSION IN MERU DISTRICT

Chronology	Meru - Isiolo	Embu - Meru	Earth Movement and Erosional Phases
RECENT	Black cotton soil and kunkar Silts and gravels Nyambeni Parasitic Volcanic activity	Soils, laterites and calcretes	
PLEISTOCENE: Upper	Upper Nyambeni lavas	River gravels and sand Gravel beds Parasitic cones of Mount Kenya	
PLEISTOCENE: Middle			
PLEISTOCENE: Lower	Lower Nyambeni basalts Lake beds	Lower Nyambeni Basalts	(disturbance)
Pliocene	Mt. Kenya Parasitic activity Mt. Kenya Volcanic 1. Lower basalts 2. Upper Olivine basalts	Mount Kenya Volcanic series	End-Tertiary peneplaination
MIOCENCE: Upper			
MIOCENCE: Middle			(disturbance)
MIOCENCE: Lower			
EARLY TERTIARY			Sub-miocence peneplain (disturbance)
MESOZOIC			End-cretaceous peneplain
ARCHAEAN BASEMENT SYSTEM	BASEMENT SYSTEM		

SOURCE: Mason, P. - Geology of the Meru-Isiolo Area - 1955

TABLE 2.2 MINERAL POTENTIAL, MERU DISTRICT

TYPE OF MINERAL	AREA FOUND
Corrundum	Near Tana River
Iron Ore	Marimanti
Mica	Kiera Ridge
Ilmetite	Kinna
Crona	Magado Crater
Berly	Mitunguu
Sand	Tharaka
Building Stone	South Imenti

SOURCE: Geological Survey of Kenya, Bulletin No. II

At the moment, however, only building stone and sand are being exploited. The economic viability of exploiting the other minerals has not yet been established.

2.3 SOILS

2.3.1 Soil Categories and Properties

Soils in Meru District are closely related to the landforms and are therefore as diverse as the physiography. Of the 21 soil categories identified in Kenya (Kenya Soil Survey 1982), 17 of them are found in Meru District. A clear dichotomy exists between soils that have evolved in the highlands from recent volcanic parent and those that are derivative of the ancient basement rocks. Mount Kenya and Nyambeni lavas and basalts give rise to clay soils whereas the basement system granites and gneisses, usually of high quartz content, yield sandy soils. This difference has been intensified by climatic contrasts. Not only are the eastern lowlands endowed with a less fertile bedrock, but they also receive little rainfall which does not adequately decompose this parent material. The mountain slopes, by contrast, receive comparatively heavy rainfall, which has contributed to well-developed soil horizons. Figure 5 shows the main soil categories in the district.

Of the volcanic regions, the upper altitudes on the eastern and southeastern slopes have the most infertile soils. Heavy rainfall rapidly leaches out minerals in these soils, most are over-acidic, structureless and weak. In figure 5, these areas are labelled M4. In lower altitudes,

and in areas with lower rainfall, dark friable clays predominate. Here soils are not uniformly fertile, most probably because of erosion. A belt which is very infertile, for example, exists between Chuka and Meru and has soils that are minerally deficient and of acid reaction. North of Meru forest and south-west of the Nyambenis, however, there exists some of the highest crop yielding soils in the country. Most of the soils labelled R in Figure 5 and particularly the Nitosols (Kikuyu red loam) and the Phaeozems (prairie soils) are deep and fertile and of high water holding capacity. M_1, M_2 and M_5 are also areas with good soils. Table 2.3 amplifies the labelling in Figure 5.

The basement complex yields very sandy soils. Tharaka, on the eastern third of the district is covered with red sandy loams. Neither the ferralsols nor the luvisols so ubiquitons here are particularly fertile. There are inselbergs scattered throughout the area which are thinly mantled and rocky near the crest.

In the northern foothills of Mount Kenya, and in the lave plains to the north, dark brown clay loams (vertisols L_3) are found. These soils overlay hard volcanic lavas but are believed to have originated from volcanic ash. Where drainage is impeded, black cotton soils develop. Hardly any of this northern region is cultivated because of aridity, the lava blocks and stoney outcrops and the poor development of these soils.

TABLE 2.3 SOIL DISTRIBUTION IN MERU DISTRICT

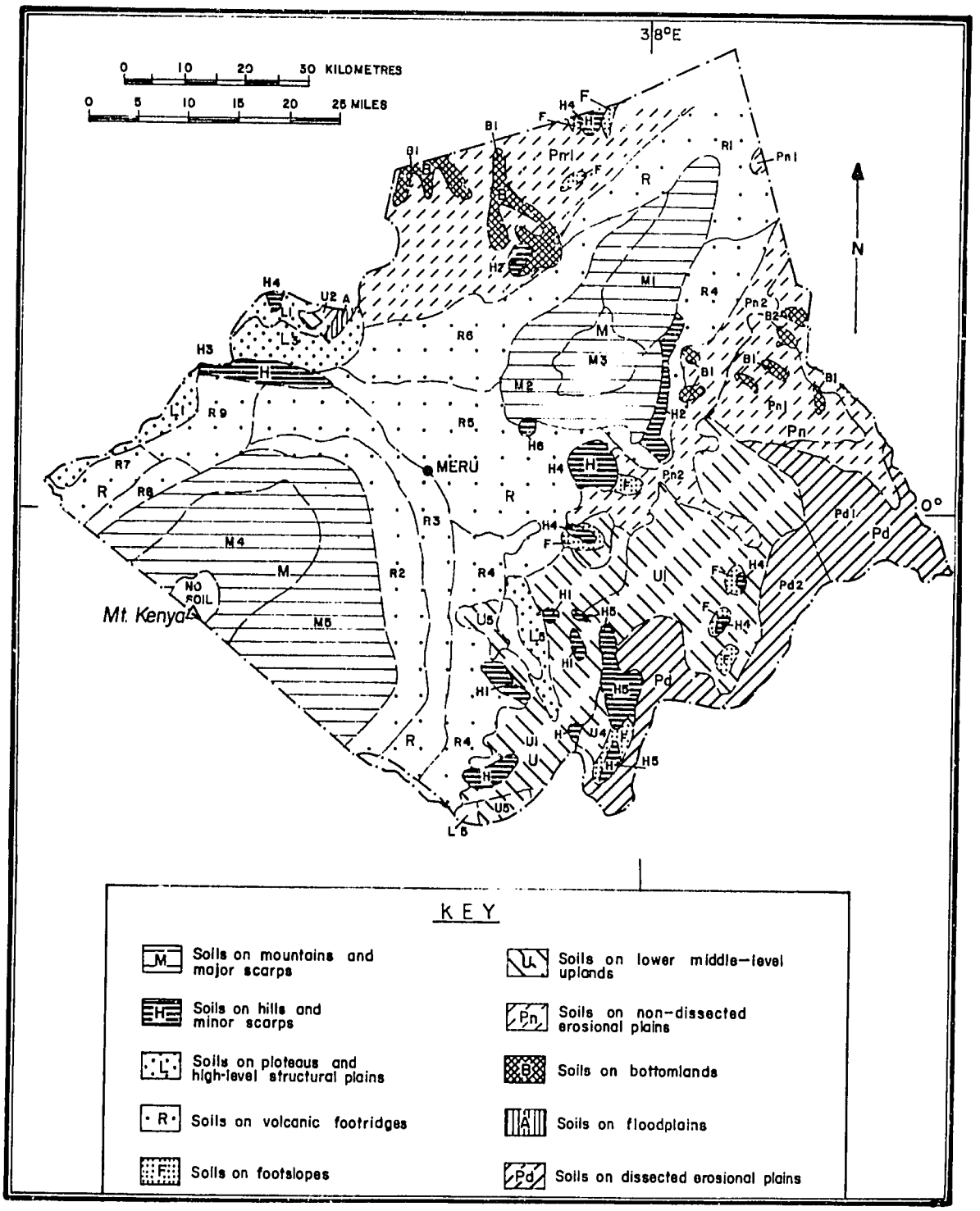
SOILS ON MOUNTAINS AND MAJOR SCARPS

Soils developed on olivine basalts and ashes of Mount Kenya

M1 = Well drained, moderately deep, dark reddish brown, smearly clay loam, with humic topsoil (mollic ANDOSOLS)

M2 = Well drained, deep, dusky red to dark reddish brown, friable clay (eutric NITOSOLS)

M3 = Well drained, shallow to moderately deep, dark reddish brown, friable, humic, rocky and stony clay loam (nito-humic CAMBISOLS, rocky phase)



SOURCE: Kenya Soil Survey, 1982

FIGURE 5. SOIL DISTRIBUTION IN MERU DISTRICT

M4 = Imperfectly drained, shallow to moderately deep, dark greysih brown, very friable, acid humic to peaty, loam to clay loam, with rock outcrops and ice in the higest parts (dystric HISTOSOLS, lithic phase; with LITHOSOLS, rock outcrops and ice)

M5 = Well drained, very deep, dark reddish brown to dark brown, very friable and smeary, clay loam to clay, with thick, acid humic topsoil; in places shallow to moderately deep and rocky (humic ANDOSOLS, partly lithic phase)

SOILS ON HILLS AND MINOR SCARPS

Soils developed on basic igneous rocks (serpentinites, basalts, nepheline phonolites; other basic tuffs included)

H1 = Well drained, very shallow to moderately deep, very dark brown, firm, stony and rocky, clay loam (LITHOSOLS, with vertoluvic PHAEOZEMS, lithic phase and rock outcrops)

H2 = Somewhat excessively drained, shallow to moderately deep, dark reddish brown, friable, gravelly clay, with acid humic topsoil (humic CAMBISOLS, partly paralithic phase)

H3 = Well drained, shallow, dark reddish brown, friable, rocky and stony clay loam (nito-chromic CAMBISOLS, lithic phase, with rock outcrops)

Soils developed on undifferentiated Basement System rocks, predominantly gneisses

H4 = Somewhat excessively drained, shallow reddish brown, friable, rocky and stony, sandy clay loam (eutric REGOSOLS, with rock outcrops and calcic CAMBISOLS)

H5 = Complex of excessively drained to well drained, shallow, dark red to brown, friable, sandy clay loam to clay; in many places rocky, bouldery and stony and in places with acid humic topsoil (dystric REGOSOLS; with LITHOSOLS, humic CAMBISOLS lithic phase and rock outcrops)

SOILS ON PLATEAUS AND HIGH-LEVEL STRUCTURAL PLAINS

Soils developed on Tertiary basic igneous rocks (olivine basalts, nepheline phonolites; older tuffs included)

L1 = Well drained, moderately deep to deep, dark brown, firm clay, with thick humic topsoil (ortho-luvic PHAEOZEMS)

L2 = Well drained to moderately well drained, deep, very dark greyish brown, firm and slightly cracking clay, with thick humic topsoil (verto-luvic PHAEOZEMS)

L3 = Imperfectly drained, deep, very dark greyish brown, very firm, cracking clay (chromic VERTISOLS)

L4 = Imperfectly drained, deep, dark greyish brown, firm clay (hardpan), abruptly underlying a topsoil of sandy clay loam (eutric PLANOSOLS)

L5 = Complex of:- moderately well drained, shallow, yellowish brown, friable, gravelly clay over petroplinthite rock (50-70%), (murram cuirass soils, with some LITHOSOLS)

poorly drained, deep to very deep, dark brown to very dark greyish brown, mottled, firm to very firm, cracking clay; in places moderately deep to deep over petroplinthite (VERTISOLS, undifferentiated and vertic GLEYSOLS)

L6 = Well drained, very deep, dark red, very friable clay (nitorhodic FERRASOLS)

SOILS ON VOLCANIC FOOTRIDGES

Soils developed on olivine basalts, ashes and other pyroclastic rocks

R1 = Well drained, shallow to moderately deep, dark brown, firm, very calcareous, stony clay loam, with rocky and bouldery surface; in many places saline and sodic, with inclusions of recent lava flows (LITHOSOLS and calcic XEROSOLS, bouldery phase and partly saline-sodic phase

Soils developed on Tertiary basic igneous rocks (olivine basalts, nepheline phonolites; older basic tuffs included)

R2 = Well drained, extremely deep, dark reddish brown to dark brown, friable and slightly smeary clay, with acid humic topsoil (ando-humic NITOSOLS; with humic ANDOSOLS)

R3 = Well drained, extremely deep, dusky red to dark reddish brown, friable clay with acid humic topsoil (humic NITOSOLS)

R4 = Well drained, extremely deep, dusky red to dark reddish brown, friable clay; with inclusions of well drained moderately deep, dark red to dark reddish brown, friable clay over rock, pisoferric or petroferric material (eutric NITOSOLS; with nito-chromic CAMBISOLS and chromic ACRISOLS, partly pisoferric or petroferric phase)

R5 = Well drained, deep to extremely deep, dark reddish brown to dark brown, friable to firm clay; in places gravelly (eutric NITOSOLS and nito-chromic CAMBISOLS; with chromoluvic PHAEOZEMS)

R6 = Well drained, moderately deep, dark reddish brown, firm, slightly cracking clay, with humic topsoil (verto-luvic PHAEOZEMS)

R7 = Well drained, moderately deep to deep, dark reddish brown, friable to firm clay, with humic topsoil (chromo-luvic PHAEOZEMS)

R8 = Well drained, moderately deep to very deep, dark reddish brown, friable to firm clay (nito-ferric LUVISOLS; with humic NITOSOLS)

Soils developed on ashes and other pyroclastic rocks from recent volcanoes

R9 = Well drained, very deep, dark reddish brown, friable to firm clay, with humic topsoil (chromo-luvic PHAEOZEMS; over buried NITOSOLS)

SOILS ON FOOTSLOPES

Soils developed on colluvium from undifferentiated Basement System rocks

F = Well drained, very deep, yellowish red to dark reddish brown, friable, coarse loamy sand to sandy clay loam (chromic LUVISOLS - with rhodic FERRASOLS and luvic/ferralic ARENOSOLS)

SOILS ON LOWER MIDDLE-LEVEL UPLANDS

Soils developed on intermediate igneous rocks (andesites, etc)

U1 = Well drained, very deep, dusky red to dark red, friable clay (nito-rhodic FERRASOLS)

Soils developed on undifferentiated Basement System rocks

U2 = Complex of well drained, shallow to deep, red to dark red, friable to firm, sandy clay loam to sandy clay; in places rocky (chromic and ferralo-chromic LUVISOLS; with chromic CAMBISOLS and Rock Outcrops)

U3 = Well drained, moderately deep to deep, dark red to yellowish red, friable to firm, sandy clay to clay, often with topsoil of loamy sand (chromic LUVISOLS and ferralo-ferric/chromic/orthic LUVISOLS)

U4 = Well drained, moderately deep to very deep, dark reddish brown to dark yellowish brown, friable to firm, sandy clay to clay; in many places with topsoil of loamy sand to sandy loam (ferralo-chromic/orthic/ferric ACRISOLS; with LUVISOLS and FERRASOLS)

U5 = Well drained, moderately deep to deep, dark red to yellowish red, friable, sandy clay loam to clay (rhodic and orthic FERRASOOS; with ferralo-chromic/orthic/ferric ACRISOLS)

SOILS ON NON-DISSECTED EROSIONAL PLAINS

Soils developed on basic igneous rocks (basalts, etc)

Pn1 = Well drained, shallow, very dark reddish brown, slightly calcareous, stony and bouldery, clay loam to clay (chromic CAMBISOLS, bouldery and lithic phase)

Pn2 = Well drained, very deep, dark reddish brown to dusky red, friable clay; in places bouldery (nito-rhodic FERRASOLS)

Soils developed on crystalline or sedimentary limestone and gypsiferous rocks (plio-pleistocene Wajir-El Wak beds)

Pn3 = Well drained, moderately deep, dark reddish brown, friable clay (chromic CAMBISOLS)

Soils developed on undifferentiated Basement System rocks

Pn4 = Well drained, moderately deep to deep, dark red to strong brown, friable to firm, sandy clay loam to clay (ferralo-chromic/orthic LUVISOLS)

SOILS ON DISSECTED EROSIONAL PLAINS

Soils developed on undifferentiated Basement System rocks

Pd1 = Complex of well drained, shallow to moderately deep, dark red to yellowish brown, non to moderately calcareous, stony sandy clay loam, over petrocalcic material or quartz gravel (calcic CAMBISOLS, lithic or petrocalcic phase; with chromic LUVISOLS, petric phase)

Pd2 = Well drained, shallow, dark red to yellowish red, stony loamy sand to clay (chromic CAMBISOLS, paralithic and stony phase; with ferralic ARENOSOLS, lithic phase)

SOILS ON BOTTOMLANDS

Soils developed on infill from undifferentiated volcanic rocks

B1 = Poorly drained, deep, very dark greyish brown, firm, moderately to strongly calcareous and slightly sodic clay, with humic topsoil (calcic CHERNOZEMS)

Soils developed on infill from limestones

B2 = Poorly drained, deep, very dark grey to very dark brown, firm, moderately calcareous, clay loam to clay, with humic topsoil (haplic CHERNOZEMS)

SOILS ON FLOODPLAINS

Soils developed on sediments mainly from olivine basalts

A = Imperfectly drained, very deep, dark brown to dark reddish brown, firm, moderately to strongly calcareous stratified clay loam to clay, with a deeper subsoil of varying salinity and sodicity (calcaric FLUVISOLS), saline-sodic phase)

2.3.2 Soil Degradation and Conservation

The soil erosion hazard areas in Meru District are Tharaka Division, the lower slopes of Mt. Kenya, the northern grazing area, and the western slopes of Nyambeni hills. These are the areas with shallow and sandy soils which are easily erodable and also more vulnerable to human interference.

Extensive burning in the eastern lowlands of Tharaka is recorded by travellers as long ago as eighty (80) years and is still common today. This has led to the progressive deterioration of plant cover, which, when followed by grazing bares the soil to slope wash and gullying. On the western slopes of the Nyambeni, erosion is caused by overgrazing on steep slopes.

Soil degradation is further aggravated by population pressure which has forced migration and cultivation into marginal areas as well as forest areas, the latter leading to indiscriminate felling of trees. In Kibirichia, for example, forest has gradually given way to potatoes. Meru is hilly and the cultivation on hill slopes without proper soil erosion preventive measures is yet another cause of soil degradation. The digging of quarries for building stone leaves gaping holes with loose soils which are easily moved by rainwater and wind. In Nithi Division, along the Mutonga River, building sand is extracted by washing off the soil thereby draining it away. These last two causes of soil erosion can easily be prevented through a development of awareness of the dangers of soil erosion.

Culturally, the Meru are conservationists. They are 'tree lovers' with many ceremonies centred around trees. There is also evidence that even before the British introduced modern farming methods, the Meru used to practise some form of terracing while cultivating on high slopes. Efforts at soil conservation should, therefore, incorporate these cultural practices. At the moment, conservation measures in the district include the sensitivitization of the people to the hazards of soil erosion. This is mainly done through barazas. Secondly, preventive soil erosion measures are taken by stopping the cutting down of indigenous trees from forests as well as the planting of new ones mainly exotic and fruit trees. Activities on the actual prevention of soil erosion have been very successful with most of the targeted plans actually achieved. Table 2.4 gives a breakdown of some of these activities in 1981.

TABLE 2.4 SOIL CONSERVATION ACTIVITIES AND ACHIEVEMENTS IN 1981

Activity	Target in metres	Achieved in metres
Cut-off drains		
1) by hand	28,771	26,771
2) by machinery	8,000	8,000

Activity	Target in metres	Achieved in metres
Bench terraces		
Fanya Juu	66,240	63,005
Grass strips	38,353	31,998
Trash lines	125,084	120,578
Artificial waterways		
Gully control	14,060	13,975
Stone terraces	1,124	1,124
Gabions	3,240	2,400

SOURCE: Kenya, District Agricultural Officer, Meru 1982

2.4 CLIMATE

The two high land masses of Mount Kenya and the Nyambeni range are the major determining influence on climate in Meru District. They mitigate high temperature and influence the amount of rainfall. On the highlands, the temperatures are lower and the rainfall heavier than on the lowlands, in effect dividing the district into two climatic regions. Inspite of the district being on the equator, the climate is not equatorial; rather it is highland savanna and warm steppe. The savanna areas in the district are characterised by warm, rather hot, temperatures with no marked seasonal variation and an uneven distribution of rainfall. Most of the areas above 914m have this climate. The steppe areas, on the other hand, are hotter and drier, mainly because they are low. Tharaka, Meru Game Park and the Northern Grazing Area are the warm steppe lands in the district.

Because Meru straddles the equator, climatic seasons are determined by seasonal variation in rainfall rather than by temperature differences. A distinct bimodal rainfall distribution divides the year into two rainy seasons. The basic control of these seasons is the movement of the sun's vertical rays. In March and September, the sun is directly over the equator in Central Meru District. As the vertical rays move away from the equator, a low pressure trough develops. Winds converge into this trough from the northeast and southeast, convergence produces upward motion of the moist air, (most of these winds are from the Indian Ocean), and precipitation commences soon after the equinox. Usually, rains persist five to eight weeks.

Figure 6 shows the mean annual rainfall in Meru District while Table 2.5 presents the mean monthly rainfall for 21 stations which have at least 10 years of record. At all the stations, the bimodal peak is readily apparent. The first rainy season begins in March. Rains become very heavy in April, which is the wettest month of the year and then begin to taper off in May. June to September are relatively dry months at all the stations before the rains commence again in October and persist into December. In some areas, there are the Gathano rains in July and August.

As can be seen from Figure 6, rainfall is heavier on the highest elevations and becomes progressively lower as the land becomes lower. Above the 2200m contour, rainfall is in fact so heavy that the soils become leached and flat land seasonally inundated. An important exception to this trend is the rainshadow on the northern slopes of Mount Kenya and the Nyambeni hills. Timau on the northern slopes of Mount Kenya at 2499m has much less rain than Marimba on the eastern slopes though the latter is lower, 1844m. Timau averages 884mm annually as compared to Marimba which averages 2208mm. Similarly, Muthara on the north facing slopes of the Nyambenis, receives an average of 1164mm per year as compared to Mukinduri which receives an average of 2221mm. Both stations are at the same altitude, Muthara is at 1478m while Mukinduri is on the 1405m contour.

A second key point about a rainfall in the district is that the lower it is, the more variable it becomes. Data in Table 2.5 includes not just the average annual rainfall but also the amount of rain that can be reliably expected in 6 out of 10 years. It can be seen from these figures that, on the whole, variability increases with lower rainfall. Muthara can reliably expect only 65% (763mm) of its annual average in 6 out of 10 years while Mukinduri can expect 84% (1875mm) of its annual average at the same level of reliability. Thus, compounding the limitations of low rainfall, high variability further constrains the agricultural potential of low-lying northern and eastern Meru.

The mean temperature does not vary greatly between places at the same altitude in Central Kenya because of the proximity to the equator. On average, temperature changes about 2°C for every 300m of altitude. What little temperature data is available for Meru District is presented in Table 2.6. Both Isiolo and Nanyuki are just outside the district but they are representative of places on the same contour. Isiolo is very hot throughout

the year with very little variation from month to month. Other places on the same altitude which would have similar temperatures are northern Meru and Tharaka. Evapo-transpiration is very high in these areas and unirrigated agriculture of anything but very drought resistant crops such as millet and sorghum is virtually impossible.

Nanyuki, on the other hand, has much lower temperature and in colder years, temperatures can be as low as 7°C. Other places with similar temperatures are Muchimukuru and Marimba. On the Nanyuki altitude (1947m) and above it, two crops of maize are impossible. Tea is the main cash crop here. The other two stations, Meru and Marienne are in the middle altitudes (about 1500m) and temperatures are comfortable for most crops, including coffee. The most productive areas of the district are found on this middle altitude belt. They include North Imenti, Nithi, parts of South Imenti and Southern Igembe.

Seasonally, the coldest months are July and August and the hottest February and March when the sun is approaching its zenith. Diurnal ranges are quite high particularly in the highlands and can exceed 10°C between midday and midnight.

2.5 VEGETATION

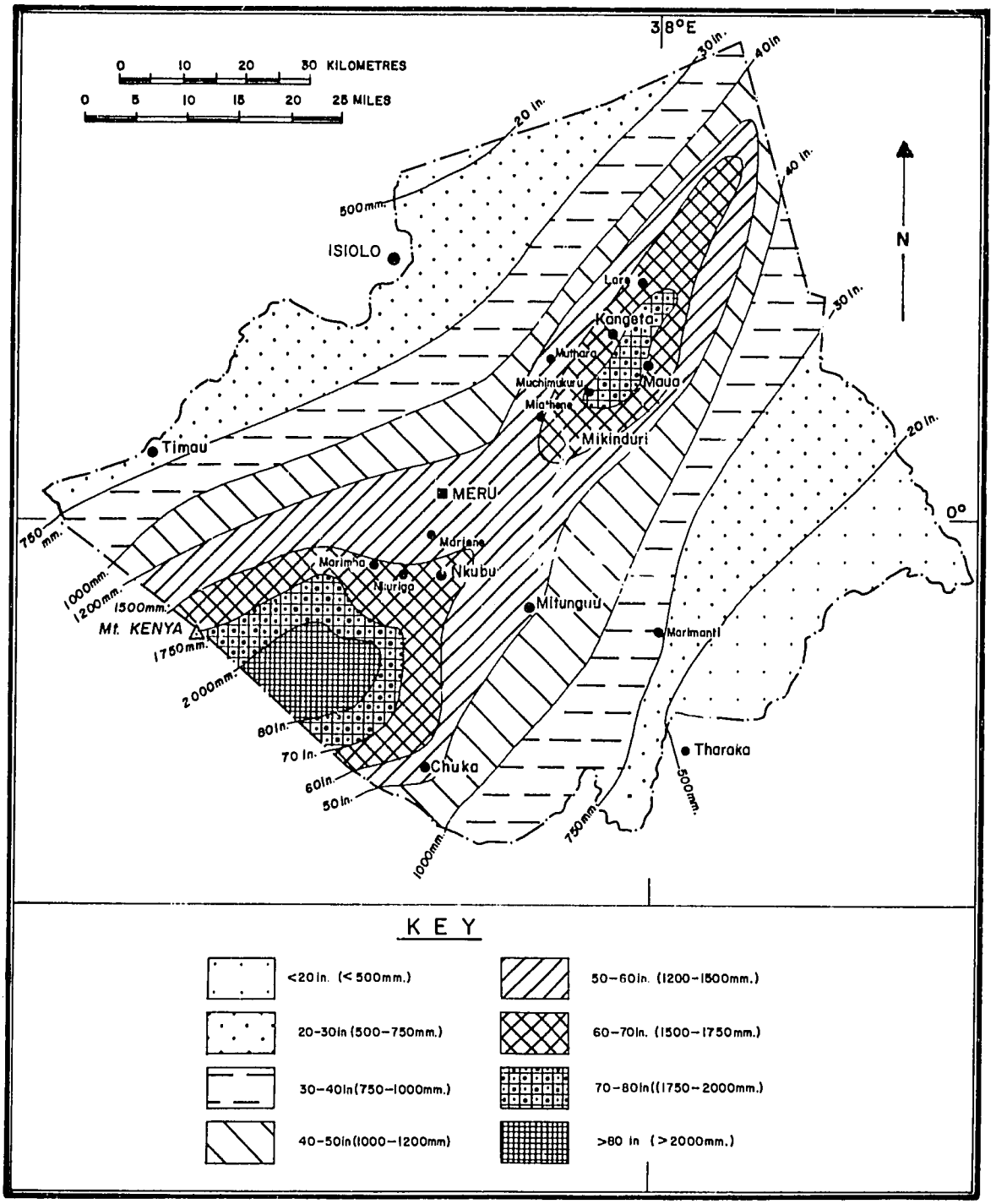
The variety of the natural vegetation in Meru District attests to the diverse environment. It ranges from forests on the mountain massifs to desert thorn-shrub grassland in the north. The basic control of this diversity is altitude. Higher altitudes, on the whole, mean more moisture, a denser, higher and more diverse plant cover. Lower altitudes, generally have less rain, less plant cover and less varied vegetation. There are, however, significant aberrations brought about by such factors as the rain-shadow effect and soil fertility. The vegetation zones are shown in Figure 3 as they are defined by the National Atlas of Kenya.

1. Grassland and dwarf shrub-grassland

This zone occurs above 3353m (11000ft) on the highest reaches of Mount Kenya. It is moorland tropical alpine vegetation of Senecio and Lobilia as well as scrubby plants dispersed amid tussock grassland.

2. Forest

All the area above 1524m (5000ft) is natural forest vegetation



SOURCE: Survey of Kenya, 1970

FIGURE 6. MEAN ANNUAL RAINFALL IN MERU DISTRICT

TABLE 2.5

RAINFALL FIGURES FROM VARIOUS STATIONS IN MERU DISTRICT

(having at least 10 years of records up to 1975)

No. and altitude	Name of Station	Years of rec.	Kind of rec.	Ann. rainf. mm	Monthly rainfall in mm											
					Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
8937002	Timau, Marania	43	Average	884	41	31	93	152	75	18	25	22	16	130	180	101
2499m			60% rel.[1]	741	17	14	67	116	26	5	5	11	0	105	129	35
8937019	Miatheni	27	Av.	1624	33	20	127	372	167	24	13	12	17	270	415	157
1433m			60%	1369	42	0	31	305	54	0	3	0	0	59	312	40
8937021	Oringo Seed Farm	28	Av.	1300	40	31	106	285	110	5	6	3	35	215	352	112
1430m			60%	888	39	7	29	192	50	1	1	0	0	47	252	34
8937031	Muthara	20	Av.	1164	27	34	106	249	96	17	7	8	9	228	288	84
1478m			60%	763	10	4	54	163	33	0	0	0	0	41	150	35
8937034	Timau, Ardencaple F.	19	Av.	698	15	17	51	126	87	48	49	72	45	77	77	36
2286m			60%	516	6	4	15	62	73	33	18	36	15	40	41	17
8937038	Meru Forest Station	24	Av.	1403	57	48	136	157	11	11	13	10	15	184	310	144
1585m			60%	1151	27	15	69	252	94	3	0	1	3	118	271	56
8937041	Lare	10	Av.[2]	2640	69	94	207	653	340	30	75	30	35	361	498	245
1775m			60%	1628	14	24	58	360	62	1	14	0	12	149	425	28
8937051	Meru,Agr.Department	14	Av.	1602	58	24	106	353	150	10	18	19	11	317	375	161
1555m			60%	1354	28	20	60	297	88	4	5	4	5	226	248	62
8937053	Mikinduri, Cath.Miss.	22	Av.	2221	79	43	179	520	247	22	16	17	21	318	557	202
1405m			60%	1875	31	14	98	421	149	1	3	6	0	149	421	128
8937060	Muchiimukuru	26	Av.	2525	37	70	216	666	254	22	25	45	45	495	528	12[illegible]
1905m			60%	2046	2[illegible]	15	146	627	192	15	22	18	32	206	391	63
9037011	Mwea, Mojwa (Mayna)	47	Av.	1479	61	33	125	316	174	17	12	17	23	250	318	135
1158m	Catholic Mission		60%	1220	23	10	46	286	114	0	0	0	4	131	276	79
9037034	Chuka	30	Av.	1500	43	32	134	369	177	20	30	32	25	184	332	123
1494m			60%	1190	22	1	64	299	116	6	20	12	13	133	300	62
9037065	Magutuni	17	Av.	1323	34	20	137	405	109	7	5	13	2	171	275	142
1158m																
9037074	Nkubu Sec. School	23	Av.	1765	49	31	141	470	174	12	19	22	23	251	425	142
1527m			60%	1525	25	22	103	340	66	6	13	9	14	191	380	38
9037085	Mitunguu	19	Av.[2]	1401	21	24	149	305	142	9	7	10	9	213	374	137
1189m			60%	1078	6	1	67	206	50	0	0	1	3	94	294	14
9037086	Nkuriga	18	Av.	1859	55	48	148	369	228	16	18	19	36	307	458	160
1844m			60%	1840	45	49	101	398	189	17	5	13	17	272	394	104
9037123	Chogoria For.St.		Av.	1979	61	41	163	482	229	55	82	71	37	215	350	91
1372m			60%	1625	39	10	82	439	136	36	32	26	26	195	272	67

No. and altitude	Nama of Station	Years of rec.	Kind of rec.	Ann. rainf. mm	Monthly rainfall in mm											
					Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
9037124	Marienne Coffee	18	Av.[2]	1914	62	77	157	398	184	22	13	20	27	361	443	154
1524m	Sub-Station		60%	1374	17	28	69	316	84	10	9	10	16	170	294	80
9037160	Marimanti	12	Av.[2]	879	19	33	79	268	97	10	2	1	3	88	225	54
610m																
9038006	Tharaka Chief's Camp	24	Av.	787	32	18	83	232	61	5	0	3	1	58	209	87
914m			60%	579	4	3	46	184	10	0	0	0	0	28	111	32

N.B. 1 - These figures of rainfall should be exceeded normally in 6 out of 10 years.

2 - High figures because of unusually wet years.

SOURCE: Kenya Ministry of Agriculture and Livestock Development, 1983

TABLE 2.6 TEMPERATURE DATA, MERU DISTRICT

No. and altitude	Name of Station	Kind of records	Temperature in °C												Years of rec.
			Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year	
8937003	Isiolo	Mean max.	30.8	32.3	31.7	30.1	29.9	29.5	28.9	29.4	30.8	30.9	28.6	29.0	30.2	
1104m	Part Time	Mean temp.	23.2	24.3	24.6	23.9	23.8	23.2	22.6	22.9	23.8	24.2	22.6	22.2	23.5	21
	Met. Station	Mean min.	15.7	16.3	17.6	17.8	17.8	16.9	16.3	16.5	16.9	17.6	16.6	15.5	16.8	
	(Isiolo District)	Abs. min.	10.6	9.0	12.2	13.0	14.4	13.3	11.1	12.2	13.9	13.5	12.4	11.1	9.0	
8937022	Nanyuki	Mean max.	24.8	25.9	25.3	23.5	23.1	23.1	22.5	22.8	23.0	23.5	22.1	22.9	23.5	
1947m	Met. Station	Mean temp.	17.7	18.5	16.4	13.1	13.2	14.6	14.0	14.4	15.1	14.9	12.7	14.9	16.1	30
	(Laikipa	Mean min.	7.1	7.4	8.9	10.4	9.9	8.5	3.5	8.4	7.9	8.6	9.4	8.0	8.6	
	District)	Abs. min.	0.7	2.0	4.2	6.1	5.0	3.9	3.6	3.3	4.1	3.7	4.4	1.9	0.7	
8937038	Meru	Mean max.	23.0	23.9	23.9	22.9	22.0	22.0	21.5	21.0	21.7	22.4	22.8	20.7	22.3	
1765m	Forest Station	Mean temp.	16.3	16.8	17.7	17.1	16.7	15.8	15.5	15.6	16.2	16.7	17.0	15.7	16.4	5
	(operating	Mean min.	9.6	9.8	11.5	11.4	11.5	9.7	9.6	10.2	10.8	11.1	11.2	10.7	10.6	
	to 1963)	Abs. min.	4.4	5.0	4.4	7.2	7.2	5.6	4.4	4.4	5.6	7.2	4.4	7.2	4.4	
9037124	Marienne	Mean max.	24.1	25.1	25.1	23.7	22.8	21.7	20.7	21.4	23.9	24.3	22.5	22.9	23.2	
1524m	Coffee	Mean temp.	17.5	18.1	18.4	17.8	16.9	15.8	15.3	15.7	17.1	18.2	17.5	17.1	17.1	10
	Research	Mean min.	11.0	11.1	11.7	11.9	11.1	10.0	9.9	10.0	10.3	12.2	12.5	11.3	11.1	
	Sub-Station	Abs. min.	3.0	7.8	7.0	6.5	7.5	5.0	5.8	5.2	5.0	7.4	9.5	8.5	3.0	

SOURCE: Kenya, Ministry of Agriculture, 1983

which varies in height and tree type as the altitude gets higher. Moist montane evergreen forest is the natural community between 1981m (6500ft) and 2438m (8000ft). Broad evergreen species are dominant. These include olives, camphor, and (mukuego), Bridelia micrantha one of the most common construction trees in Meru. Under ample rainfall conditions, trees in this formation often reach heights of 40m and the canopy is storied and continuous. When the forest is disturbed, secondary vegetation is Kikuyu grass, Pennisetum clandestinum.

Above 2438m, there are coniferous trees such as cedar and podo. Above the coniferous trees are denser stands of bamboo Arundinaria alpina which give way to the alpine moorland. Most of the high altitude forest is largely undisturbed on Mount Kenya. Lower down, moist montane evergreen forest remains in Meru forest, the Nyambeni forest and Thunguru forest.

Between 1524m (5000ft) and 1981m (6500ft) is moist and dry intermediate forest with the notable exception of the northern slopes of both massifs. Trees are shorter, about 20m, and largely evergreen though in the lower parts they are even shorter and mixed with deciduous trees. There is also a similar degradation of species in lower altitudes. Species such as the fig (Muringa), (Muhuti) and(Mvuli) as well as the famous Meru Oak are found here. The lower Imenti forest and the southern Nyambeni at Kiega and Thuuri are covered with this intermediate forest.

When forest is cleared, secondary vegetation is star grass Cynodon dactylon in the intermediate forest and false Kikuyu grass and bracken Pteridum aquilinum in the less fertile upper forest areas. Some scholars prefer to divide this forest zone into three - the high bracken zone, Kikuyu grass zone and star grass zone, the basis being secondary rather than primary vegetation.

3. Bushland and wooded grassland

The wooded-savanna is a transitional zone between the forest and the dry areas. Natural vegetation is tall grassland with scattered low semi-deciduous trees, generally less than 10m in height. Common trees are acacia, (Mugaa) and (Murama). The best example of this vegetation is Kiera hill in the Njuguni forest. Grasses in this zone include red oats, bamboo grass and needle grass. As it gets drier, towards the lowland the vegetation changes to more grass and fewer trees - the wooded grassland.

4. Wooded and dwarf shrub-grassland

In Tharaka and the Meru Game Park is the bushland thicket formation dominated by an assemblage of deciduous bushes and short trees mainly of the acacia type. As the land gets drier to the north and extreme east, sansevieria, a succulent, is found near bushes and thickets. (Muthithi) and (Mutete) appear here as small and disfigured trees. Desert thorn scrub prevails as dwarf shrub-grassland in the north. Vegetation is stunted, scrubby, with widely-spaced bushes and trees and little grass cover. The dominant bushes here are acacia and commiphora, but many of the plants found in the Tharaka area are found here in a stunted form. Secondary vegetation in this northern zone is aucher's grass which provides good fodder.

5. Grassland

At Timau is a rainshadow area where forest has given way to short grass savanna. This is mainly a ranching zone. This is an atypical zone in that it is dry and cold and it is also in the highlands.

2.6 WATER RESOURCES

2.6.1 Surface Water

There is plenty of surface water on Mount Kenya and the eastern and south-eastern Nyambenis. The Forest Act as a catchment area, orographic precipitation is high and most of it is well retained by the volcanic rocks in this region. Here, the rivers are permanent and large enough to keep the dry eastern lowlands well-watered.

In the north, on the other hand, there is a critical shortage of surface water. Rainfall is low in the rainshadow areas and the northern lowlands and the basement system soils drain too easily. In the dry season, many people in this part of Tigania and Igembe make round trips of over 15km in search of water. Northern Nyambeni is similarly short of water although it receives plenty of rainfall. Porous bedrock allows much of the drainage to flow beneath the surface. Boreholes and springs are widely used here.

The district has potential for hydro-electricity with all the waterfalls and the swift-flowing rivers, but this too, is largely untapped.

Data on the quality of surface water was not available but judging from the heavily leached soils of Mount Kenya, it can be estimated

that the water downstream would be laden with silt and minerals. The only other polluting agent is coffee processing (see Section 4.4.4). Surface water in Meru District should be suitable for all aspects of farming and can be economically treated by conventional methods to make it safe for drinking.

2.6.2 Underground water

Appendix 1 gives information on the boreholes in Meru District. The average borehole depth is 108m though this varies from as low as 21m in Nkabune to 213 in Meru town. Nearly half of the boreholes are in Tamau. This is probably because the large-scale farming that has been practised here for many years made the digging of boreholes economical. Two of the boreholes, Muthambe and Kanyakine were drilled in 1976 and 1977 by the Ministry of Water Development to serve Muthambe Girls School and the Kanyakine Catholic Mission.

Only two of the boreholes had been tested at the time of writing this Report. Data on the quality of the water is set out in Table 2.7.

TABLE 2.7 QUALITY OF UNDERGROUND WATER, MERU DISTRICT

No.	Ph	Cond	Turb	Colour	Total hardness	Alkalinity	Chloride	Fluoride	Remarks
C4233	8.6	910	5.0	5	2.0	488	21.3	3.32	Fair
C4251	8.8	422	110	200	2	237	11.5	1.04	Contaminated

2.7 FISHERIES

Fisheries is a largely untapped industry in Meru District. Part of the reason for the under-development of fisheries is that the Meru are not fish eaters by tradition. Fish was a prohibited food to everyone unlike chicken which could be eaten by the children but not the adults.

More recently, the Fisheries Department has succeeded in generating some interest in fish farming. Farmers are encouraged to utilise the free-flowing waters by leading it into ponds. A few of them in North and South Imenti have responded and current information indicates that about 500 small fish ponds have been set up. There are three large-scale fish farmers

in Timau. In warm waters fishes such as tilapia, zilli, T. mozambica, T. nilotica and Labes, do very well while trout is more suited to colder streams.

One of the handicaps to fish farming in Meru is the poor roads. It will probably be some years before the Meru can change their eating habits to fully accept fish as part of their diet. Any fish reared, therefore, would largely be for markets outside the district, mainly in Nairobi because the surrounding districts have similar dietary habits. The present state of roads in the district militates against the growing of a commodity with as low a shelf life as fish. More fundamental than the roads, of course, is the attitude towards fish which will need to be changed. Once these obstacles have been overcome, fish farming can be a major means of livelihood for many Meru farmers and can be a useful supplement to cattle keeping particularly with the repeated droughts that keep hitting Kenya. Fish is also a very good source of animal protein, a much needed food supplement in this region.

2.8 WILDLIFE

Nearly one-third of Meru District is either gazetted forest reserve or national park. Forest reserves cover an area of 1397 sq.km., Meru National Park 870 sq.km., and Mount Kenya National Park 380 sq.km. Mount Kenya Forest and National Park is at the high altitudes, above 2200m while the Meru National Park is in the lowlands at 600m. This wide range of ecological systems creates a home for a wide range of animal species in a largely undisturbed state.

No systematic counts of animals are available for the Mount Kenya National Park but elephants, buffalo, monkeys and baboons are among the animals found there. Meru National Park has 15 permanent streams. It is warmer than Mount Kenya National Park and more expansive. There is, therefore, a greater variety of game ranging from large herds of elephant to the rare white rhino. Table 2.8 below gives the population estimates of game in the Meru National Park. It should be pointed out here that this is an estimate with wide margins of error and that the size of herds is sensitive to changes in climate. There are other animals, such as the rhino, warthogs, ostriches and the lesser kudu, which have been seen in the Park but which were not recorded during this particular count.

TABLE 2.8 POPULATION ESTIMATES OF WILD HERBIVORE IN MERU NATIONAL PARK, 1979.

ANIMAL	POPULATION ESTIMATE
Buffalo	2845
Zebra	1307
Elephant	1183
Giraffe	921
Kongoni	460
Water-buck	313
Gerenuk	199
Grants Gazelle	157
Oryx	105
Eland	41
Impala	21
TOTAL	7552

SOURCE: Kenya, Rangeland Ecological Monitoring Unit, 1979

The co-existence of such large populations of wildlife with farmers is not totally harmonious. On one hand, population pressure pushes settlement and cultivation into game country and on the other hand wildlife keeps destroying the crops. Controversy remains over grazing rights in the Meru National Park which was formerly a grazing reserve for the Tharaka people, an especially useful reserve for the dry season. At the same time, the animals particularly elephants, monkeys and baboons keep destroying the crops. Cultivation at the fringe of the park is constantly at risk from wild game. Government has pledged to compensate for any damage by wildlife but the bureaucratic process involved before the claims are honoured is usually very long.

In 1981, for example, damage to crop by wild animals amounted to K.Shs. 9 million but only K.Shs. 2 million was actually paid to farmers. One side of Meru National Park has now been fenced to prevent wild animals from damaging the crops and to keep cattle away from the Park.

There are indications that there has been a decrease in wildlife in recent years. The major causes of wildlife reduction are poaching, fires,

removal of vegetation and infringement of the wildlife reserves by farmers. Poaching is not as rampant as it was before hunting was banned. In addition, there are guards in the parks and although they cannot fully eliminate poaching, they keep it under control. Fires are started by farmers to encourage the regeneration of plants. Whereas, in a controlled form, this is desirable, unchecked, the fires can destroy the natural vegetation so much that they destabilize the ecosystem. Further removal of the natural vegetation is caused by wild animals some of which are such selective feeders that they could totally eliminate certain plant species. This is a problem which can be controlled by careful cropping of these animals.

2.9 PROBLEM SUMMARY

A. Terrain

1. The ruggedness of the terrain encourages soil erosion and makes the building of an effective road infrastructure expensive.

B. Soils

1. Overgrazing and cultivation on hillslopes has aggravated soil erosion.

2. Low soil fertility in patches of the district necessitates the use of large amounts of fertilisers.

C. Climate

1. There is excessive loss of moisture in the lowlands because of the high temperatures.

2. Rainfall on mountain slopes is sometimes so heavy that it drains away the soil.

3. Rainfall in the lowlands is low and highly variable which when coupled with high temperatures makes agriculture in these areas uncertain.

D. Vegetation

1. The natural vegetation has gradually been transformed by fires and by the planting of crops.

E. Water Resources

1. Rivers and streams are subject to heavy siltation during the rainy season.

2. Surface waters are polluted by coffee processing.

3. Water supply limits agricultural productivity in the eastern and northern parts of the district.

F. Fisheries

1. Fish farming is a largely underutilised industry in Meru District.

2. A poor road infrastructure makes the marketing of fish difficult.

G. Wildlife

1. The encroachment of farmers on forests has reduced the land available to wildlife.

2. The farmers near the game reserves resent wildlife because it destroys the crops.

CHAPTER 3

HUMAN ENVIRONMENT

3.1 POPULATION

3.1.1 Ethnic Composition

Meru District is primarily a land of the Meru people who comprise 96% of the total district population. There are another 37 ethnic groups but their numbers are very small. The Kikuyu, who are the next largest group add up to only 1.3% of the total. Table 3.1 below gives the ethnic composition of the population in the district.

TABLE 3.1 ETHNIC COMPOSITION OF THE POPULATION IN MERU DISTRICT

Group	Male	Female	Total
Meru	3992247	408849	801096
Kikuyu	6050	4878	10928
Kamba	2786	2030	4816
Embu	1221	1069	2290
Turkana	928	720	1648
Boran	773	479	1252
Other Kenyans	3843	2775	6618
Non-African Kenyans	118	141	259
Non-Kenyans	609	626	1235
Not stated	21	16	37
District Total	408596	421583	830179

SOURCE: Kenya, Ministry of Economic Planning and Development, 1981

3.1.2 Population Distribution

Population distribution in the district is governed by the agricultural potential which in turn is controlled by the altitude, soils and climate. Since there is so much variation in the physiographic features (see Chapter 2), the population distribution is correspondingly uneven. Figure 7 and Table 3.2 show the population distribution in the district using the 1979 census data.

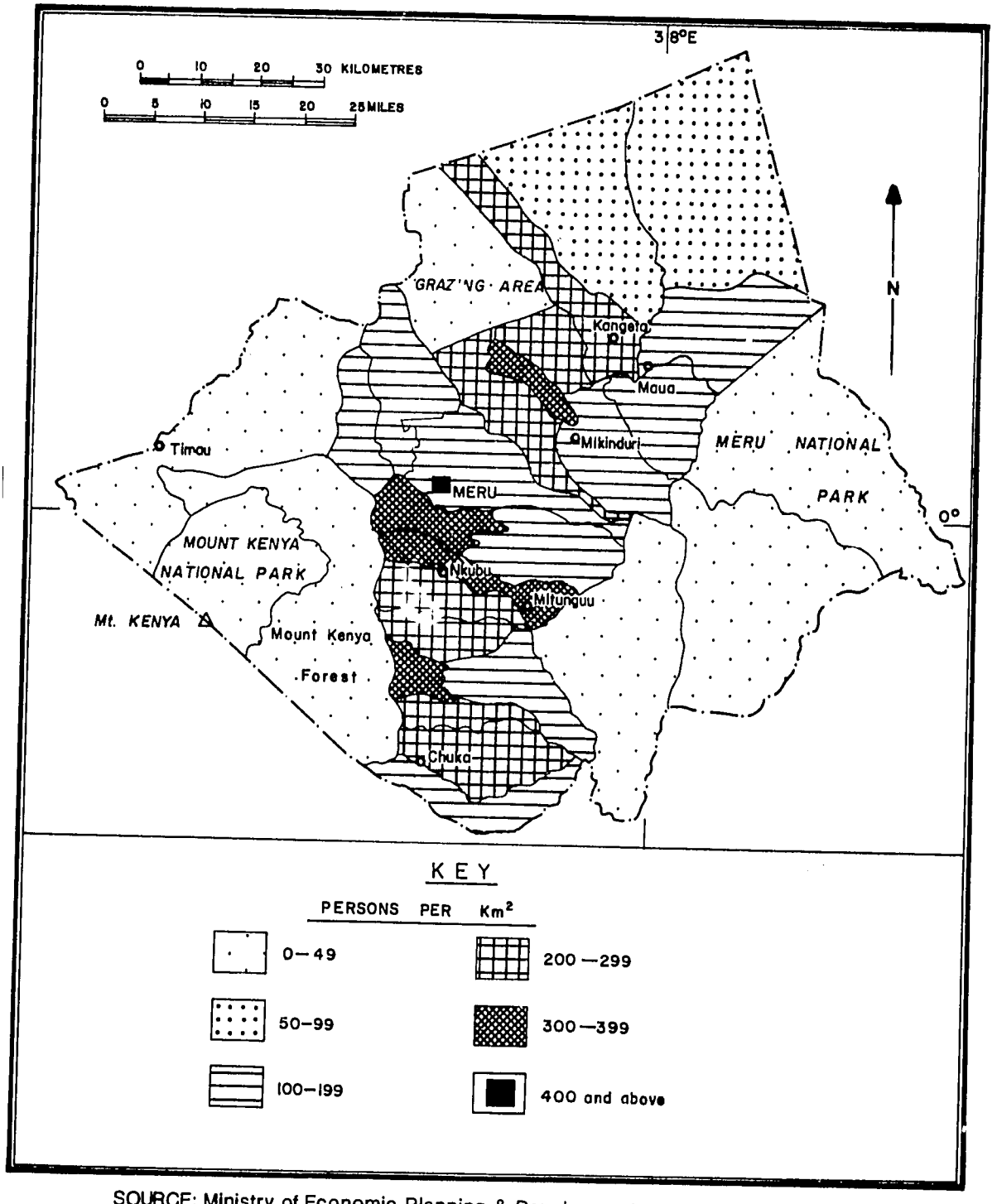
The bulk of the population is concentrated in the north to south middle belt between Mount Kenya and the eastern lowlands. This is the area between 914m-2134m. In this area, in each of the divisions, except Tharaka, there is at least one location which is a pocket of very dense population. These are the areas of high agricultural productivity. Densities in these locations are as follows: (In persons per sq. km)

Upper Abothuguchi	-	North Imenti	-	396
Nkuene	-	South Imenti	-	303
Chogoria	-	Nithi	-	390
Akithii	-	Tigania	-	367
Mutuati	-	Igembe	-	381

In the rest of this region, population thins outwards from these concentrations. Land pressure in this middle belt is intense and land fragmentation so high that further sub-division threatens to make the plots uneconomical to cultivate. This has resulted in new settlement areas in Timau, Tunyai and Kaare. The large-scale farms are bought by groups of individuals then sub-divided. Further migration is towards the marginal areas and the higher altitudes reserved for forest.

Above the 2134m contour on the Mount Kenya slopes and the Nyambenis it is too cold, the soils are leached by the heavy rainfall and the slopes are too steep for intense cultivation. Below 914m, it is too dry and hot for unirrigated agriculture. In effect, only about one-third of the district is well populated. Parts of Mount Kenya are completely uninhabited as are large tracks of the northern grazing area. Tharaka division has a population density of only 33 persons per sq. km.

Meru town is the principal town. It has a population of 72049 people and a density of 561 persons per sq. km. The other four urban centres and their populations are Nkubu (10324), Chogoria (856), Maua (1805) and Chuka (1361).



SOURCE: Ministry of Economic Planning & Development, 1981

FIGURE 7. POPULATION DENSITY IN MERU DISTRICT

TABLE 3.2 POPULATION DISTRIBUTION BY DIVISION, 1969 AND 1979

Division	Area Sq. Km	1969 Population	Density	1979 Population	Density	Population % Increase 1969-1979
Igembe	2572	124235	48	171597	66	38.1
North Imenti	1708	150548	88	221823	129	47.3
Tharaka	1496	37031	25	50277	33	35.8
Tigania	652	101148	155	140651	215	39.1
Nithi	640	102869	161	142285	222	38.3
South Imenti	392	75551	193	103543	263	37.1
TOTAL DISTRICT	9922	596506	60.1	830179	83	39.2

SOURCE: Kenya, Ministry of Economic Planning and Development 1981 and 1970

3.1.3 Growth Rate and Projections

The overall annual growth rate in the district during the ten years 1969 and 1979 was 3.4%. This is slightly higher than the national growth rate of 3.3% during the same period. North Imenti was the fastest growing division with an annual growth rate of over 4%. This was most probably because of the new settlements in Timau and also because of the municipality. South Imenti grew least during that period. It is most likely that South Imenti which is quite a small division has neared its maximum carrying capacity and that migration to other areas in the district was in fact from this division.

The growth of Meru town is difficult to assess accurately because the municipality boundaries keep changing. At the time of the 1969 census, the town was only 2 sq. km and had a population of 4475 people. In 1970 it was elevated to municipal status and its boundaries extended giving it an area of 270 sq. km. Population in this area was estimated at 53,000. (Debate on the reduction of municipal boundaries to 61 sq. km is ongoing and unsettled at the time of writing this Report), Working with these figures, the growth of the town has been about 3% which makes it relatively small.

Population projections based on analysis of fertility rates are given below for the years 1979-1999. The A column assumes the current fertility rates while the B column assumes a reduction of fertility to 4 children per family.

	A	B
1979	830,000	830,000
1985	1,059,000	1,027,000
1990	1,294,000	1,186,000
1995	1,584,000	1,343,000
1999	1,860,000	1,460,000

Child Population Projections, Meru District

	1980	1990
Under 5 years	200,000	290,000
5-14 years	270,000	390,000
Primary school age 6-12	190,000	280,000

SOURCE: UNICEF: Social Statistics Programme 1984

It can be seen that using the lower estimates the population of the district will nearly double, to 1.4m by the year 2000 while the more probable higher estimate indicates that it will have more than doubled, to 1.86m. It is difficult to see how the current resources can support this number of people. One way of coping with the problem is by migration out of the district but this has its limitation because most of the districts have similar population pressures. Changes in the economic structure of the district by either reclaiming the marginal lands through irrigation or by industrialising the agriculturally non-productive areas could contribute to increasing the resources available to the population. Of course, the only effective way of keeping the resource-population balance at an optimum level is by reductions in population growth.

3.1.4 Population and Family Planning

Traditionally the Meru valued children as a source of labour, a means of ensuring the perpetuation of the clan and an ostensible indication of wealth. Changes in agricultural practices, such as the replacement of millets by maize (children were needed to keep birds off the millet during the ripening period) has slightly reduced the need for children as farm hands. Secondly, the advent of monetary economy which is heavily dependent on education has increased the desire for schooling. But education is not cheap. The uniforms, building funds and sometimes school fees place a heavy financial burden on parents with large families. Over a period of time, this may act as a major deterrent to large families. At the moment, the average household size is 5.5 with wide variations between the pastoralists, who have relatively small families and the agriculturalists.

Childhood mortality is comparatively low in Meru District. Out of every 1,000 live births, 75 die before they are two years old (UNICEF Childhood Mortality in Kenya). This is compared to South Nyanza which has the highest mortality rate of 216 and Nyeri with the lowest of 49.

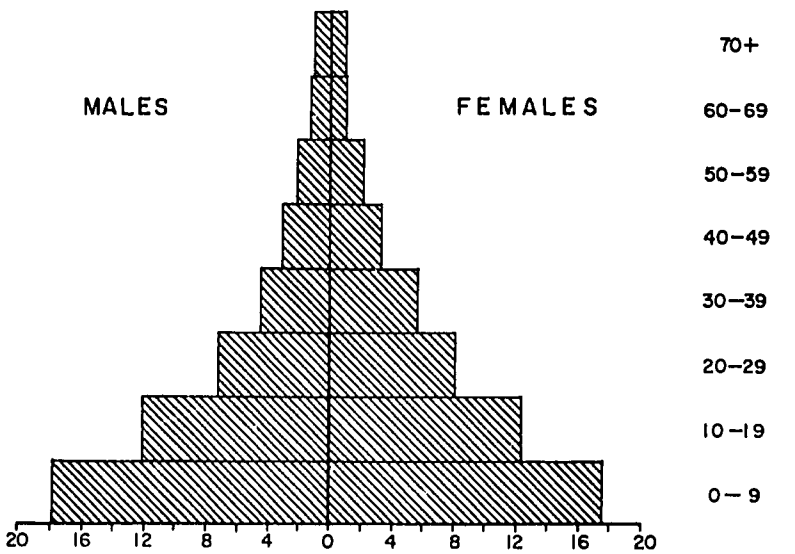
Family planning has not yet succeeded in curbing the high rate of population growth. There is still widespread fear and suspicion of contraceptives, the men particularly opposed to family planning. Social reasons for the relative ineffectiveness of family planning include a lack of sex education for young people and inadequate provision of meaningful activity for the youth.

3.1.5 Age-Sex Proportions and Migration Patterns

Table 3.3 and Figure 8 give the age-sex proportions and the age-sex pyramid for Meru District. It can be seen from this data that the dependency rate in the district is very high, nearly 50% of the population is under 15. This means that the resources in the district are under heavy stress to support a largely unproductive population. The resources will be stretched further in the future when this large young population scrambles for the exploitation of the current resources.

One response to resource and economic pressures in Kenya is migration out of the district. Significant female majorities begin to appear in the 20-24 age-group and continue to about age 65. A significant point to note about the data in Table 3.3 is that this trend is not very pronounced. The lowest sex ratio in all the age-groups is 87.1 for the 35-39 age-group. For all the other groups the sex ratio is around parity. This would imply that migration out of tne district is still relatively small. This may be partly because Meru is agriculturally a highly productive district and the available resources can at the moment adequately support the population and partly because in relative terms, the district is not much affected by wage employment out of the district.

In regions where males have migrated to urban or other rural areas in search of employment, the sex ratio, which is the proportion of males to females, is lower. The women often stay behind to tend family (shambas) giving rise to greater female majorities in areas of emigration. The sex proportions for various areas in Meru are shown in Table 3.4



SOURCE: Ministry of Economic Planning & Development ,1981

FIGURE 8. AGE/SEX PYRAMID,MERU DISTRICT1979

TABLE 3.3 AGE-SEX PROPORTIONS

Age	Male	Female	Total	Sex Ratio	Age-Group as % of Total Population
0-4	80520	79853	160373	100%	19.32
5-9	67462	67647	135109	99.7	16.27
10-14	53948	53612	107560	100.6	12.95
15-19	45807	48573	94380	94.3	11.36
20-24	32844	36667	69511	89.6	8.37
25-29	27558	29803	57361	92.5	6.90
30-34	21477	22543	44020	95.3	5.30
35-39	15046	17271	32317	87.1	3.89
40-44	13512	15285	28797	88.4	3.46
45-49	11680	12158	23838	96.1	2.87
50-54	9474	10459	19933	90.6	2.40
55-59	8122	7418	15540	109.5	1.87
60-64	6061	6198	12259	97.8	1.47
65-69	5250	4476	9726	117.3	1.17
70-74	3601	3433	7034	104.8	0.84
75+	5256	5212	10468	100.8	1.26
Others not (stated)	978	975	1953	100.3	0.23
TOTAL	408596	421583	830179	96.9	99.93

SOURCE: Kenya Ministry of Economic Planning and Development 1981

TABLE 3.4 SEX PROPORTIONS BY DIVISION 1979

Division	Males	Females	Sex Ratio M:F
North Imenti	112018	109805	102.0
South Imenti	51724	51819	99.8
Nithi	70494	71794	98.2
Igembe	83706	87891	95.2
Tharaka	24241	26036	93.1
Tigania	66413	74238	89.5
Meru Town	36691	35358	103.7

SOURCE: Kenya, Ministry of Economic Planning and Development 1981

Except for Tigania and to a smaller extent North Imenti and Meru town, the numbers of males are largely at par with those of the females. The most that can be said from this data is that some migration seems to have taken place from the drier parts of Tigania and perhaps Tharaka to North Imenti and especially the municipality. It is also possible that the men migrate with the entire family. This would partly explain the very large increase in population in North Imenti observed in Table 3.2 and it would be consistent with the migration being due to new settlements in Timau rather than in search of wage employment.

Data on inter-district migration is set out in Table 3.5. Again consistent with the foregoing discussion, it can be seen that 95% of all the Meru actually live in Meru district. Largest migration out of the district is to Nairobi and Mombasa and to the surrounding districts of Laikipia, Nyeri, Embu, Kirinyaga and Isiolo. In all the areas there is a male majority indicating that perhaps migration is in search of wage employment rather than to new settlements.

TABLE 3.5 DISTRIBUTION OF THE MERU PEOPLE IN KENYA 1979

District of Residence	Male	Female	Total
Meru	392247	408849	801096
Nairobi	6340	3741	10081
Nyeri	2917	1991	4908
Laikipia	2541	1318	3859
Embu	1373	1368	2741
Mombasa	1689	903	2592
Isiolo	1549	963	2512
Kiambu	1246	612	1858
Nakuru	1040	612	1652
Kirinyaga	754	291	1045
Other districts	5104	3056	8160
TOTAL IN KENYA	416800	423704	840504

SOURCE: Kenya, Ministry of Economic Planning and Development 1981

3.1.6 Conclusion

About one-third of Meru District has a dense population density resulting in severe pressure on land and other resources. One consequence of this is intensive cultivation of marginal lands and hill slopes which brings about soil erosion. Migration out of the district is still relatively small but it is expected to increase as the productive areas reach their maximum carrying capacity. There is room for increasing the potential of the marginal areas mainly through irrigation and the cultivation of drought resistant crops.

3. 2 ENVIRONMENTAL PERCEPTION

The people of Meru are traditionally very attached to the land which gives them their livelihood. Many of their traditions are closely interrelated with their environment. They believe that God lived on Mount Kenya and, therefore, the mountain was revered. Perhaps the most important characteristic of the Meru and environment is their reverence for trees. This has greatly protected the district's natural landscape.

Traditionally, all the trees were the property of the community except those actually planted by individuals. Large trees such as (Muringa) and Meru Oak were allowed to stand even if land was being cleared for cultivation. In addition, there were small sacred groves scattered round the countryside where religious sacrifices and ceremonies were held. The accession of a new (Mugwe) (religious leader) was marked with the planting of a tree. Many trees were recognised meeting places and landmarks. The Meru also left forests uncleared so that they could act as a buffer against enemies.

There is evidence that even before the introduction of modern methods of farming, the Meru were soil conservers. In 1938, Colin Maher found remains of stone terraces in Mwimbi and observed people in lower Chuka building terraces of stone along slopes. These terraces were evenly spaced along the contour. A plant called (Machiara) was also said to have been planted along slopes to prevent wash.

3.3 PROBLEM SUMMARY

A. Population

1. High population density in the productive areas of the district has intensified pressure on land and other resources and exacerbated soil erosion and environmental degradation.

2. There is a very high dependence rate implying that resources are being exploited in order to support a largely unproductive population. It also implies that pressure on resources will increase further as this large group of dependants moves through to the peak of the age pyramid.

3. Pressure on land caused by population pressure leads to fragmentation of land into uneconomical parcels. The sub-division of large-scale farms in Timau is of concern given the marginality of some of that land.

4. Marginal lands have fragile ecosystems easily disrupted by cultivation and settlement. Movement into these areas in search of arable land has brought about massive soil losses and devegetation.

5, The basic infrastructure is over-stretched. There is congestion in hospitals, water supplies are inadequate in the urban centres, and housing is a real problem for many wage-earners.

B. Environmental Perception

1. The Meru have a positive attitude towards environmental conservation which arises from their traditional attachment to the land. Any conservation measures which invoke these sentiments should be successful.

CHAPTER 4

LAND USE

4.1 LAND TENURE

In Meru District, land is the key factor in the socio-economic life of the population. The main categories of land ownership are shown in Table 4.1. Freehold land is land that was formerly owned by European settlers and has since adjudicated to private ownership, often through the establishment of smallholder schemes. This comprises only about 0.96% of the total land area of the district. Government land includes forest and other reserves, the Mount Kenya and Meru National Parks and alienated land that formerly belonged to European farmers in the 'Scheduled Areas' and is now leased to individual small and large-scale holders. Altogether, Government land comprises about 19% of the district land area. Trust land is former 'Native Reserves' and is now owned by smallholder farmers. It comprises nearly 80% of the total district land area. Of this, only 58% had been consolidated and registered for ownership by individuals in 1980. More recent data from the district agricultural office indicates that this figure may have increased to nearly 35% by the end of 1982. More than half of the Trust land available for smallholder registration has still not to be surveyed, adjudicated and registered.

TABLE 4.1 LAND TENURE, MERU DISTRICT, 1980

Category	Amount (Sq.Km)	& Total Land
1. Freehold Land		
Smallholder Schemes	95	0.96
2. Government Land		
Forest Reserves	1056	10.64
Other Government Reserves	4	-
Townships	5	-
Alienated Land	533	5.37
National Parks	311	3.13
TOTAL	1909	19.24
3. Trust Land		
Forest	341	3.44
Government Reserve	1	-
Townships	207	2.1
National Parks	870	8.77
Available for smallholder registration		
Already registered	579	5.84
Not yet registered	5920	59.67
TOTAL TRUST LAND	7918	79.8
TOTAL DISTRICT LAND	9922	-

SOURCE: Kenya, Ministry of Economic Planning and Development, 1983

4.2 AGRICULTURE

4.2.1 General Aspects

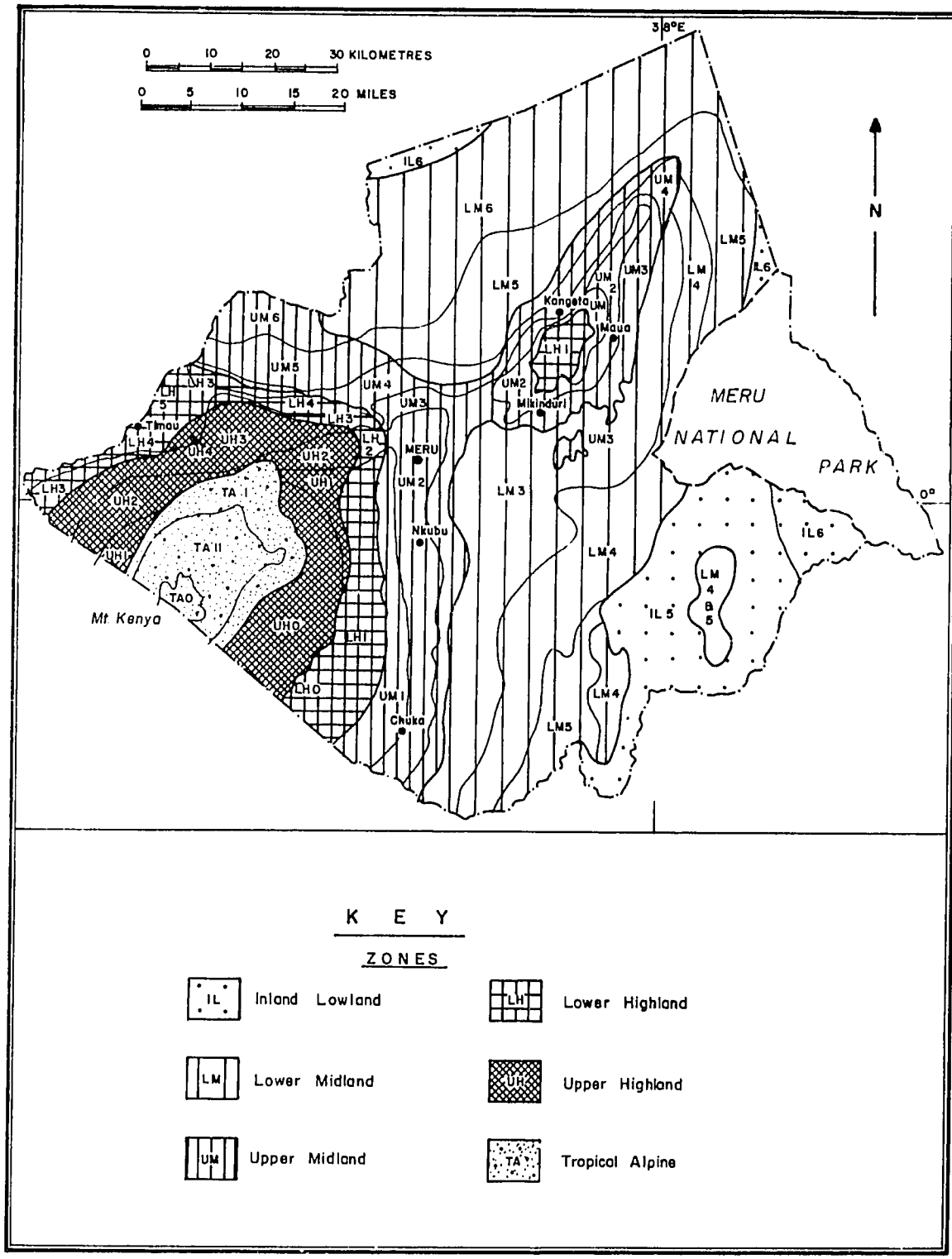
Meru is one of the most productive districts in Kenya. Successful and productive rain-fed agriculture is, however, limited to a comparatively small part of the district, but the output from this area is one of the highest in the country. Data on agricultural potential, agro-ecological zones and land availability is set out in Tables 4.2 and 4.3. Figure 9 is a map of the agro-ecological zones in the district.

From this data, it can be seen that out of the total district land area of 9922 sq. km., 3476 sq. km is taken up by townships and the municipality. (This area may become considerably reduced when the move to narrow down the municipal boundaries is effected). Of the remaining 6446 sq. km., 1124 sk km is not available for agriculture because it is under forest reserve or taken up by roads and rivers. Only 5322 sq. km is available for agriculture not all of which is productive.

The areas best suited to small-scale farming because they are well-watered and fertile are the agro-ecological zones (AEZ), LH and UM. Above these two zones in AEZ TA and UH, it is too wet and cold for most crops and the soils are not fertile. Below them, in AEZ LM and L, it is too hot and dry for virtually all but the drought resistant crops. In effect, then, only about 15% of the district land area has high potential agricultural land. This land is spread in little patches in all the divisions except Tharaka. Nearly 48% of this highly productive land is in North Imenti.

About 35% of the total district area is dry, marginal or rangeland. It includes Tharaka division, Meru National Park, the northern grazing area and the rainshadow areas of northern Igembe and north Mount Kenya.

Meru District, then, exhibits a gradually declining plane of potential from west to east in the Mount Kenya area and from north-west to south-east in Southern Nyambenis as well as from south to north on the northern slopes of both mountain massifs. Development of the district from colonial times has concentrated on the high potential areas which are now well catered for with infrastructure. The marginal areas which are largely undeveloped, act parasitically on the district's resources, thereby lessening the overall growth.



SOURCE: Ministry of Agriculture ,1983

FIGURE 9. AGRO-ECOLOGICAL ZONES,MERU DISTRICT

TABLE 4.2 AEZ AREA AVAILABLE FOR DIVISION AND PER HOUSEHOLD AND PERSON IN MERU DISTRICT

Division without township	Area Total Census 1979	In '00 ha. sq. km.										In ha.	
		Non- Agricultural Land			Agricultural Land	Area in Agro-Ecological Zones (AEZ)						Agricultural Land per household	Person
		Unsuitable Steep Slopes	Forest Reserve	Other- Roads Rivers Homesteads		TA	UH	LH	UM	LM	L		
North Imenti	1576	28	14	157	1377	9	331	283	417	337		5.10	0.92
South Imenti	390			65	325			52	171	102		1.80	0.32
Nithi	637	16	25	98	498			20	162	314	2	2.07	0.36
Tharaka	1495	37	89	92	1277*			-	-	381	896	13.46	2.53
Tigania	650	54	47	88	461			9	136	316		1.78	0.33
Igembe	1698	87	54	173	1384			6	242	1079	57	4.70	0.83
TOTAL RURAL AREA	6446	222	229	573	5322	9	331	370	1128	2529	955	3.97	0.71

* There was a slight computational error in the source material which has been adjusted.

SOURCE: Kenya, Ministry of Agriculture and Livestock Development, 1983

TABLE 4.3 AGRO-ECOLOGICAL ZONES AND AGRICULTURAL POTENTIAL IN MERU DISTRICT

AGRO-ECOLOGICAL ZONE	ALTITUDE	VERY GOOD AND GOOD YIELD POTENTIAL	FAIR AND POOR YIELD POTENTIAL	LIVESTOCK, PASTURE AND FORAGE
1. TROPICAL ALPINE				
TAO		Rocks and glaciers no land use		
TA I Cattle + sheep Zone		National Park		Limited grazing, cattle + sheep
TA II - Sheep Zone		National Park		Limited grazing
2. UPPER HIGHLAND ZONES				
UHO-Forest Zone		Forest reserve, bamboo thickets	Cathment area	Sheep and dairy
UHI-Sheep and dairy zone		Forest reserve, valuable timber	Cathment area	Sheep and dairy
UH2-Pyrethrun-wheat zone	2440-2740	Forest reserve on steep slopes, wheat, barley, peas, vegetables, pyrethrum	Maize, potatoes, plums, apples	Kikuyu grass, rye grass, oats, cloves. Suited for merino sheep and dairy cows
UH3-Upper wheat-barley barley zone	2230-2900	Wheat, barley, green onions, cabbages	Sunflower, potatoes, peas,	Natural grassland, clover, barley amani, merino sheep + grade beef cattle
UH4-Upper highland ranching zone		Not suitable for rain-fed agriculture		Natural grassland, cloves merino sheep and grade beef cattle

AGRO-ECOLOGICAL ZONE	ALTITUDE	VERY GOOD AND GOOD YIELD POTENTIAL	FAIR AND POOR YIELD POTENTIAL	LIVESTOCK, PASTURE AND FORAGE
3. LH-LOWER HIGHLAND ZONE				
LH 1-Tea-dairy zone	1830-2200	Forest reserve, cabbages, peas, potatoes, carrots, kales, tea, loquats.	Beans, plums, maize, pyrethrum.	Kikuyu grass, white clover, napier grass, fodder beets, dairy cows.
LH 2-Wheat/maize pyrethrum zone	1890-2130	Wheat, barley, sunflowers, linseed, potatoes, peas, almost all vegetables, pyrethrum, black wattle.	Beans, plums, maize, rapeseed, apples, pears, strawberries.	Kikuyu grass,napier grass, Nandi setavia, white clover, fodder beets.
LH 3-Wheat-maize-barley zone	2070-2220	Wheat barley.	Beans, peas, linseed, sunflower, potatoes, kales, green onions, avocadoes, maize.	Natural grassland, Rhodes grass, Nandi setavia.
LH 4-Cattle-sheep-barley zone	2070-2210	-	Barley, wheat, green onions, maize.	Natural grassland, barley Amani.
LH 5-Lower highland ranching zone	-	Not suitable for rain-fed agriculture.		Short grass savanna, no proper forage, severe erosion if over-grazed.
4. UM-UPPER MIDLAND ZONES				
UM 1-Coffee-Tea Zone	1520-1800	Cabbage, kales, maize finger millet, beans, potatoes, sunflower, onions, tomatoes, tea, Arabica coffee, bananas, mountain pawpaw, passion fruit, yams, avocadoes, black wattle, miraa, bananas, loquats.	Citrus, sweet potatoes	Napier grass, banana leaves and stems, potato vines.

AGRO-ECOLOGICAL ZONE	ALTITUDE	VERY GOOD AND GOOD YIELD POTENTIAL	FAIR AND POOR YIELD POTENTIAL	LIVESTOCK, PASTURE AND FORAGE
UM2-Main Coffee Zone	1280-1680	Finger millet, sorghum, beans, sweet potatoes, sunflower, cabbages, kales, tomatoes, onions, Arabica coffee, bananas, mountain pawpaws, loquats, avocadoes, passion fruits, citrus.	Maize, cassava, yams, sugar-cane in valleys.	Star grass, Napier and Bana grass, stems and leaves of bananas, sweet potatoes and maize.
UM3-Marginal Coffee Zone	1280-1520	Maize, sorghum, beans, sunflower, onions, cabbages, pineapples.	Sweet potatoes, pigeon peas, kales, tomatoes, Arabica coffee, cassava, citrus, banana.	Napier and Bana grass, sweet potatoes, vines.
UM4-Sunflower-Maize Zone	1520-1770	Sorghum, beans, sunflower, sisal.	Maize, finger millet, tobacco, tomatoes, onions, cassava, pineapples, sweet potatoes.	Open high grass savanna Bana grass, fodder legumes, saltbush.
UM5-Livestock-Sorghum Zone	1520-1770		Sorghum, maize, beans.	Mixed grassland, hay or silage for fodder sorghum.
UM6-Upper Midland Ranching Zone	-	Not suitable for rain-fed agriculture		Short grass savanna, shrubs like saltbush.
5. LM-LOWER MIDLAND ZONE				
LM3-Cotton Zone	910-1280	Millet, dwarf sunflower, katumani maize, sorghum, cowpeas, green grams, soya beans, chick peas, beans, sweet potatoes, virginia	Hybrid maize, onions, mangoes, macadamia nuts.	High grass savanna, Bana grass.

AGRO-ECOLOGICAL ZONE	ALTITUDE	VERY GOOD AND GOOD YIELD POTENTIAL	FAIR AND POOR YIELD POTENTIAL	LIVESTOCK, PASTURE AND FORAGE
		tobacco, cotton, sisal, cassava, castor, pineapples.		
LM4-Marginal Cotton Zone	760-1220	Millet, dwarf, sunflower, maize, dwarf sorghum, beans, castor.	Green grams, groundnuts, sweet potatoes, cotton.	Mixed medium grass savanna with red oats. Makueni guinea grass.
LM5-Lower Midland Livestock-Millet Zone	700- 910	Millet, beans, sunflower.	Green grams, pumpkins, onions, groundnuts, sisal, cow peas, Jojoba.	Mixed short grass savanna saltbush, silage of fodder sorghum.
LM6-Lower Midland Ranching Zone		Not suitable for rain-fed agriculture.		
6. L-LOWLAND ZONES (inner lowland)				
L5-Lowland Livestock-Millet Zone	610- 700	As in LM5, but with a little lower stocking rate		
L6-Lowland Ranching Zone	-	As LM6		Game cropping and game ranching with eland, oryx gerenuk and Grant' gazelle.

* Main determinant of AEZ is moisture supply and soils. The main zones refer to potentially leading crops in that zone.

SOURCE: Kenya, Ministry of Agriculture and Livestock Development 1983.

Over 90% of the district's population depend on agriculture. Farming is mainly small-scale with subsistence cash crops as well as dairy farming activities. Since most of the land is still unconsolidated, it is difficult to be accurate in the estimation of holdings but they exceed 133000. In addition, there are 8 large-scale farms in Timau which are being purchased by groups of individuals and in some cases, being sub-divided. There are also six (6) established ranches in Igembe and Timau and another eight (8) are being established for cows and goats in Tharaka and Nithi. Arable land could increase substantially if irrigation was used more widely.

In the high potential areas, pressure for land is very heavy. Many locations have an average of less than 1.5 ha. per household in the coffee zones AEZ, UN 1-3. Although in AEZ LM 3-5, there appears to be plenty of land, production-wise, it is close to maximum carrying capacity. Expansion of land to the north is also reaching its limit.

Because of the undulating nature of the land and the small size of the shambas mechanisation of agriculture is not widespread. Farmers, however, freely use pesticides, fertilisers and veterinary services and more so in the high potential areas where the purchasing power for these 'extras' is also higher. Farm labour is generally supplied by the family. Because of the bimodal rainfall pattern in most of the district, the planting and cultivation seasons are at about the same time. Each household is, therefore, busy with their shambas and spare labour for hire is scarce. This in itself is not a major problem because the shambas are small. During the coffee picking season, however, many children fail to attend school so that they can pick coffee either as a contribution to family labour or as a way of earning some money.

4.2.2 Crop production

The diverse climate in Meru District gives scope to the growing of a wide range of crops ranging from tea to cotton and from wheat to sorghum. The crops shown on Table 4.3 are the ones which are potentially suited to the area. After cash crops and subsistence crops, some of which are tabulated in Table 4.4, it is difficult to establish the amount of land available to fruits and vegetables. If all the potential shown in that table were to be exploited, then Meru could continue to be a leading district in agriculture.

The leading cash crops are coffee, tea, cotton and pyrethrum. Meru is the leading coffee growing region in Kenya contributing about 15%

of the total national coffee revenue. Coffee is grown by about 75000 families on land that averages 0.25 ha. The production rate is about 750 kg. per ha. per year. After the 1976 coffee boom, there was a large increase in the planting of coffee. Unfortunately, prices fell drastically after the boom and this has led to a drop in production. In 1977, 10325 tons were picked from 16000 ha. as compared to 12229 tons from 36000 ha. in 1982.

Tea, which is grown at altitudes of between 1981m and 2438m is cultivated by about 15000 smallholders each owining about 0.40 ha.The yield per ha. is roughly 2400 kg of green leaves per year. Kenya Tea Development Authority (KTDA) has provided very good and effective management as well as good returns to farmers. This has greatly increased yields. The main handicap tea growers have is a poor road infrastructure. Tea should reach the factory within six hours after picking but this is often difficult in the rainy seasons.

TABLE 4.4 MAJOR CROP PRODUCTION IN MERU DISTRICT - 1976 AND 1982
(All Figures are Estimated)

Cash Crop	Ha/Ton	1976	1982
Coffee	Hectares	16,000	36,000
	Tons	10,324.9	12,299
Tea	Hectares	5,760	6,126
	Tons	11,867.5	15,313
Cotton	Hectares	12,053	15,313
	Tons	3,689	2,100
Pyrethrum	Hectares	496	340
	Tons	142	150
Tobacco	Hectares	695	1,400*
	Tons	350	1,000
Sunflower	Hectares	695	1,725
	Tons	2,628.8	1,380
Barley	Hectares	324	400
	Tons	1,114	1,440

* From 1980 Annual Report

Cash Crop	Ha/Ton	1976	1982
Food Crops			
Maize	Hectares	36,130	90,700
	Tons	64,130	151,020
Wheat	Hectares	7,750	8,020
	Tons	15,500	14,436
Millet/Sorghum	Hectares	6,220	7,900
	Tons	8,678	6,675
Beans	Hectares	18,600	52,500
	Tons	8,127	35,250
Pigeon Peas	Hectares	3,276	3,200
	Tons	1,592	1,920
Potatoes	Hectares	7,750	11,000
	Tons	-	132,000
Bananas	Hectares	5,600	8,000
	Tons	-	96,000
Sweet Potatoes	Hectares	820	850
	Tons	8,200	6,800

SOURCES: 1. Meru District Data Sheet 1983
2, Meru District Develeopment Plan 1979-83

Cotton is the only cash crop for the dry regions. Production has been poor because of unreliable weather conditions, poor prices and delayed payments. The cotton ginnery at Meru processes about 3,500 tons of seed per year.

Maize is the most ubiquitous crop in the district. Both hybrid and katumani varieties are grown.

The main crop diseases and pests in the district are:

Disease/Pest	Crop
Coffee berry disease, leaf rust	Coffee
Armillaria, mites, sytitis	Tea
Thrips	Pyrethrum
Bollworms and stainers	Cotton
Stalk borers, keaf blight, naize streak	Maize

Disease/Pest	Crop
Beanfly, bollworms, aphids	Beans
Mosaic	Cassava
Banana weevil	Bananas
Aphids and mites	Citrus fruits
Blight	Potatoes

4.2.3 Livestock Production

Most of the district has potential for livestock development (see Table 4.3). In the high and medium potential areas, agriculture is generally integrated with livestock. As the land becomes drier, animals increasingly replace agriculture. Livestock farming is practised mainly on small-scale farms for cash and for household consumption. There are six (6) established ranches in the district, all in Igembe and Timau. /and Another eight (8) cattle/goat ranches are being organised in Tharaka and the eastern side of Nithi. Sheep, goats, poultry, bees, pigs and rabbits are also kept in the district. Table 4.5 gives an estimate of livestock in the district in 1977 and 1982.

It should be pointed out that these estimates have wide margins of error because they are based on the dipping and vaccination statistics collected by the veterinary office. General trends indicate large increases in poultry, bees, and grade cattle between 1977 and 1982 and decreases in zebu cows, sheep and goats. Tharaka division has the least number of grade cows. This is partly because of the poor resistance to disease of grade cows, as compared to the traditional cattle, coupled with the poor provision of veterinary services in the division. Nithi division has the largest number of grade cows, Timau the largest number of sheep, Tharaka the largest number of goats and Tigania the largest number of zebu cows.

Cattle are reared on a free range system in Tigania and Tharaka where beef cattle predominate while dairy farming is increasingly on a stall raising method (zero grazing). Fodder and pasture crops include sweet potato vines, napier and bana grasses, maize stalks and hay. Crop residues are in short supply because large portions of the high potential areas where they can be grown are taken up by cash crops. Sometimes supplementary feeding for livestock is provided by purchased feeds. These are mainly concentrates that include mineral salts and grain products.

TABLE 4.5 ESTIMATES OF LIVEATOCK - MERU DISTRICT, 1982

Livestock	N. Imenti	Timau	S. Imenti	Igembe	Tigania	Tharaka	Nithi	Total 1982	Total 1977
Grade Cattle	24,672	21,706	12,672	4,964	1,625	123	29,155	94,917	44,098
Beef Cattle (Zebu)	40,451	22,319	24,507	22,474	85,026	52,895	13,346	261,018	832,627
Sheep	46,540	89,216	48,085	15,607	25,611	70,151	17,314	312,525	469,260
Goats	21,463	31,245	5,493	35,281	62,290	131,912	35,170	322,854	647,461
Pigs	856	256	652	272	960	98	1,972	5,066	2,341
Rabbits	425	160	651	256	370	526	2,948	5,336	N/A
Donkeys	5,672	1,075	3,454	2,762	1,510	970	4,210	19,653	2,949
Poultry	176,756	15,677	192,160	286,751	83,450	42,018	136.071	932,883	318,445
Local Hives	3,650	158	411	1,105	1,819	50,652	17,398	75,103	27.150
KTB Hives	1,090	12	32	35	58	38	159	1,424	N/A

SOURCE; Meru District Data Sheet 1983

Rabbit keeping is a new activity in the district, while bee-keeping has been encouraged on a commercial scale. A workshop for making beehives has been established at Kaaga Rural Training Centre in Meru town and a honey refinery set up in Marimanti (Tharaka). Poultry keeping is increasingly popular in the district and the Ministry of Agriculture is intending to facilitate a loans scheme for poultry farmers. High cost of feeds has discouraged pig keeping in any large-scale.

Livestock production in the district has increased both in terms of number and diversity due to improved veterinary services and artificial insemination. An additional insemination centre has been opened at Chogoria to reinforce the services provided at Kinoru. The number of cattle dips increased from 177 in 1979 to 1982 in 1983. The current distribution of dips is 68 in North Imenti, 26 in South Imenti, 19 in Tigania, 6 in Tharaka, 45 in Nithi and 18 in Igembe. Further improvements of livestock management include the installation of milk packaging and cooling facilities at the dairy in Meru town.

The major problems and diseases in the district in descending order of occurrence are helminthiasis, anaplasmosis, mastitis, breeding related problems and eye infections. Widespread vaccinations and dippings have resulted in a substantial decline of tick-borne diseases, foot and mouth disease, rinderpest and anthrax. In 1980, for example, there was no reported case of either rinderpest or anthrax and only two (2) cases of foot and mouth disease in the district. The main problems associated with veterinary services in the district include delays in delivery of vital medicines and chemicals, ineffective acaricide solutions which build up tick resistance and inadequate provision of veterinary officers.

4.2.4 The Use of Agricultural and Veterinary Chemicals and Products

Farmers in Meru District use substantial quantities of agricultural and veterinary chemicals and products. Table 4.6 lists the main chemicals used in the district.

TABLE 4.6 AGRO-CHEMICAL USAGE, MERU DISTRICT, 1979/80

	Kg
Captafol	13833
Copper 50%	120629
Delan	10832
Aodrin	437

	Litres
Fenitrothion	80471
Dieldrin	5378
Fenthion	4186
White oil	615
Diazinon	528
Gusathion	450

Fertilisers used in the district are mainly phosphatic, nitrogenous and compound fertilisers applied either foliary or to the soil. While foliar fertilisers (stinfal and wuzal, for example,) are used mainly on large-scale coffee farms, the other fertilisers are used by small-scale farmers in the district. Available data on fertilisers is not very comprehensive and covers only part of the district. It would appear, however, that the most widely used fertilisers are Diamonium Phosphate (DAP), Calcium Ammonium Nitrate (CAN), Ammonium Sulphate and Triple Super Phosphate. It is difficult to assess the environmental significance of these chemical compounds since no monitoring has been done.

The main insecticides are organochlorines and organophosphates such as Gusathion and Diazinon. The main acaricide used for tick control in dips is Baadip. Fungicides include captafol, Delan and Copper compounds.

A few isolated cases of livestock poisoning have been reported mainly by diazinon. Long-term effects on the environment have not yet been noticed. The more immediate concern is that farmers, most of whom wear no protective equipment, may be hazarding their health from exposure to the toxic chemicals.

4.3 FOREST RESERVES

Meru is a well-wooded district. About 136 sq. km which is about 14% of the total district land is under gazetted forest. In addition, the two game parks, Meru and Mount Kenya cover another 1181 sq. km putting a total of over 25% of the district area under some forest cover. The main forest areas are around Mount Kenya, Chuka, Muchere, Chogoria, Meru and Nyambeni hills. Table 4.7 gives a breakdown of the gazetted forests in the district.

Dominant indigenous species in the forest include Meru oak, Vitex kiniensis, and Cordia abyssinica. Introduced species include

Cupressus lusitanica, Eucalyptus saligna and Pinus patula. Available data on the extent of forest in the last thirty years indicate that there is an accelerated reduction of forest. Table 4.8 gives data on the extent of Meru Forest between 1952-1982.

TABLE 4.8 EXTENT OF MERU FOREST 1952-1982

YEAR	HECTARES
1952	182400
1972	169422
1977	56244
1980	52236
1982	37959

SOURCE: District Forester, Meru 1982.

It can be seen that in 1982 the size of Meru forest was only 20% of the size in 1952. Some of the causes of this very fast deforestation are the encroachment of the municipality on the forest. Kinoru Technical High School in Meru town, for example, has been allocated 30 hectares from the forest for expansion, the Agricultural Society of Kenya has been allocated 100 hectares for a new showground site. Other causes include indiscriminate felling of trees for timber and charcoal and the clearing of forest to make room for arable agriculture. In 1981, for example, nearly 3000m^3 of timber was sold from Meru forest earning the sawmillers a total of K.Shs. 315,299. The diminution of forest cover in the district causes unfavourable environmental consequences. Water catchments are reduced, woodfuel becomes increasingly unavailable, and soil erosion is exacerbated.

The Forest Department operates a rural afforestation programme in the whole district except in the gazetted forests. The aim of the programme is to raise seedlings for distribution to local people, and to give technical advice to people on afforestation. This programme runs 7 nurseries as shown in Table 4.9.

TABLE 4.9 RURAL AFFORESTATION NURSERIES, 1982

Nursery	Seedlings raised	Labour Force
Kinoru	124000	49
Chuka (Kaanwe)	32400	17
Nyambene	27400	17
Tigania	14600	19

Nursery	Seedlings raised	Labour Force
Tunyai	14400	14
Nkondi	13300	12
Mutai	6700	12

SOURCE: Forest Office, Meru

In addition, the Ministry of Agriculture has four nurseries for forest and fruit seedlings, at Ntombe in Tigania (3 hectares), Marimanti (1 hectare of seedlings for the semi-arid zone), Kilili in Igembe and Kamunjerie in Tigania. This last one is jointly run by the Ministry of Agriculture and the Diocese of Meru. B.A.T. has a large nursery at Mitinguu with a capacity of 3m tree and fruit seedlings which are preferentially given to tobacco farmers. All the forest stations, Table 4.7 have tree nurseries.

The Forest Department discourages indiscriminate tree felling by issuing four monthly licences at four shillings each to those who need fuelwood. With these, fellers are allowed to use only a panga and an axe and cutting is done under strict supervision of the forest guards. Only human transport is allowed for ferrying the wood out of the forest.

Inspite of widespread afforestation centres, the area under forest is becoming increasingly smaller. Several problems hamper effectiveness of the afforestation programmes. Transport is often unavailable to collect bud woods from Nairobi or Mwea and to follow up the farmers after they take the seedlings for planting. Some of the tree nurseries lack enough water and as a result, many of the seedlings dry up. A major underlying problem has been a failure of the Forestry Department to distribute tree seedlings which are compatible with the agro-ecological zones and with the agricultural demands of the farmers. Fruit trees, for example, maybe more easily integrated into the shamba, than indigenous species which are seen as 'eating' into arable land.

4.4 THE MARGINAL LANDS

About 35% of Meru District is in agro-ecological zones LM and L (Table 4.2). These two zones are hot with mean annual temperatures of 21°C and above, they have low and highly variable rainfall, usually less than 1000mm per year and the soils largely derived from the Basement System Rocks.

TABLE 4.7

GAZETTED FORESTS IN MERU DISTRICT

Forest	Productive area (ha)	Protective area (ha)	Bushland (ha)	Bamboo (ha)	Grassland (ha)	Total area
Meru Forest Station						
Includes part of Mount Kenya Forest, Upper Imenti, Lower Imenti, Nyambene, Kibithewa, Thuuri, Thunguuru, Kikingo, Maatha, Mutenjwa, Kiegia	11892.94	13101.00	7528.13	2179.97	3257.00	37,959.04
Chogoria Forest Station						
Includes Njuguni, Chogoria, Kijege, Mugi Munguni and Kiera	11200.00	11100.00	2353.00	3100.00	2658.2	30,411.20
Ontulili Forest Station						
Includes part of Mount Kenya Forest, Ngare Ndare and Timau Forests	17133.00	5391.91	1159.30	-	4020.9	27.705.11
Chuka Forest Station	13275.00	4425.00	1700.00	3400.00	500.00	23,300.00
Mucheene Forest Station						
Includes part of Mount Kenya and Upper Imenti Forests	9294.09	-	212.00	288.00	7685.91	17,480.00
TOTAL	62795.03	34017.91	12952.43	967.97	18122.01	136,855.35

SOURCE: District Forest Office, Meru 1982

The combined effects of these factors is to make most of this land unsuitable for rain-fed agriculture. Areas included in this category are Tharaka and Tigania Divisions, Meru Game Park, the northern grazing area and large parts of Igembe Division.

Given the rapid population increases and the limited area of high potential land, pressure to settle in this area is heavy. A substantial number of people have already immigrated to Timau and the wetter margins of Tharaka and Tigania and it is expected that migration will intensify as the population grows. The agro-ecological potential of these areas is not high enough to support large populations. Unchecked migrations to the marginal zones, therefore, will increase incidence of famine and irrevocably destroy the ecosystem. This is unless pre-emptive measures are taken early which will alter the production systems of both the immigrants and the pastoralists who are the main inhabitants of the drier lands.

Many of the immigrants to dry lands are farmers who come from very small-scale intensive cultivation areas. They bring agricultural outlooks totally unsuited to the more variable climate and less fertile soils characteristic of these areas. They find that forests grow more slowly when they are cleared, that soils erode very easily and the crop production is always at high risk because of drought. Pastoral populations, finding their grazing land limited by the farmers are forced to concentrate their animals in a smaller grazing area. The total effect of migration to marginal lands, then, is massive soil erosion and the disruption of the ecological systems. This in turn leads to a reduction in the production capacity of these areas and the constant threat of famine.

It has been estimated that drought affects Tharaka division every 2-5 years as compared to every 10 years in the higher zones. Between 1980 and 1984 this area has experienced drought of varying intensity. By July 1984, the food situation was so bad that over 50,000 families in the district, 12,000 of them in Tigania and 8,500 in Tharaka, were on famine relief. A bag of maize sold at K.Shs. 400/- instead of K.Shs. 250/- while a bag of beans sold at K.Shs. 1,400/- instead of K.Shs. 360/- a bag. (Bates 1984)

This situation is expensive to the whole country because funds, earmarked for development projects are channelled to famine relief. It also sets the affected community back in development because of its

crippling effect on the economy and the physical debilitation brought about by both underfeeding and poor feeding. The challenge, therefore, is to maximise production in these areas so that the parasitic effect of marginal lands on the general economy can be eliminated while at the same time increasing their maximum carrying capacity for the ever growing population.

Irrigation is seen as the panacea to marginal land development. Without underestimating the impact of irrigation on increasing agricultural productivity, and while in fact recommending it where it is feasible, several cautionary remarks need to be made. Irrigation schemes are expensive to set up and, therefore, large schemes are preferred because they are more economically viable. Before such schemes are increased, however, a critical evaluation of the existing ones needs to be made. Many Kenyans are highly individualistic outside the family groups and they find it difficult to operate in these large schemes. Secondly, irrigation requires technical expertise. Large government investment is required, at the front end, to create a strong infrastructure which can attract and hold competent senior staff required as technicians in the schemes. In the existing irrigation schemes in the country, retention of senior staff is a problem because they do not bring their families with them (the schools are poor and other social amenities lacking). The infrastructure should also be well integrated to the crops. In some of the irrigation schemes, for example, Perkerra, the choice of crop was decided not simply on the basis of agronomy but also on the basis of what could survive the 100 km journey over unmade roads to the nearest tarmac. Thus, although tomatoes or citrus may have been more suitable, chillies and onions are now grown.

Production could be increased further by careful integration of modern ranching methods with traditional pastoral practices. This integration is crucial. Pastoralists have livestock management practices developed over many years in a harsh climate. The higher survivability and relatively small eating capacity of the traditional cow, as well as the diversification of livestock species are two-key adaptive practices in an area of high drought occurrence. Mixed herds ensure that the resources are more efficiently used since each animal has a different feeding habit and they also are a means of ensuring that there is a variety of animal products. These are some of the factors that modern livestock farmers in dry areas need to be aware of without which the ecosystem, so carefully balanced by pastoralists, may be destroyed.

As the population increases in marginal areas, one of the main problems is going to be source of fuelwood. Planting of drought resistant trees needs to be done early. One way of doing this effectively is by integrating multi-purpose trees into the landscape along borders, rivers, around home compounds or along the roads.

The current practice of planting drought resistant crops in the marginal areas has been only moderately successful. One of the reasons for this is that the rainy seasons in the semi-arid areas of Meru averages about two months while the available crops reach maturity in three months or more. It follows, therefore, that the most important objective while developing crops for these areas is to aim at adapted varieties with a high probability of reaching maturity for about 80% of the seasons. Katumani maize is a quick maturing variety but yields are not very high. The question needs to be asked whether maize is the best crop for dry lands and whether traditional crop production, sorghum and millets, may not be what should be developed.

The ultimate aim of developing farming technology in marginal areas then, is to enable the evolution of stable farming systems which are less vulnerable to fluctuations in the physical environment. Priority areas are soil and water conservation, the development of adapted crop varieties, recycling of crop residue or animal refuse to maintain soil fertility, reducing the quantity but increasing quality of livestock, planned agro-forestry, and exploitation of water resources for irrigation where this is feasible.

4.5 PROBLEM SUMMARY

A. Land Tenure

1. Continued sub-division of land holdings, particularly in high potential areas in the district, has frequently left farmers with land parcels of uneconomical size.

2. Because so much of the land is still not consolidated farmers waste much time commuting between several pieces of land. Soil conservation measures in the unadjudicated areas are difficult because land ownership rights are not well defined. Accountability for conservation is, therefore, difficult to establish.

B. Agriculture

1. The increasing intensity of land use causes pressure on the natural resources such as water, soil and vegetation.

2. Inadequate rainfall on the lower and northern parts of the district limits the range and productivity of crops.

3. The emphasis on cash crops has limited production of food crops, reducing the ability of the district to feed the growing population.

4. There is large-scale use of chemical pesticides which will invariably contribute to environmental degradation in the long run.

5. Adequate veterinary services are hampered by inadequate finances, poor transport systems, shortage of qualified staff, the development of resistant tick varieties and reluctance of some farmers to utilise the available services.

C. Forests

1. Deforestation of fuelwood, charcoal and land clearing increases soil erosion and water siltation.

2. The afforestation programme in the district is hindered by lack of funds, personnel and equipment. This limits follow-up activities to monitor the growth of transplanted seedlings.

3. Agro-forestry may be better suited to the district than the ongoing afforestation programmes.

D. The Marginal Lands

1. Population pressure has pushed cultivation and settlement into marginal lands. This has intensified environmental degradation and increased chances of famine.

CHAPTER 5

INFRASTRUCTURE AND ECONOMY

5.1 HOUSING

In the rural areas, the responsibility of building residential houses lies with individual families. There is wide variation in the standard of houses reflecting economic differences. In the grazing areas of Tharaka, houses are semi-permanent, grass-thatched, mud-walls, small and round.

In the coffee zones, houses are more permanent, some are mud walls, tin roofs and rectangular, while others are permanent with stone walls, concrete floors and tin or tile roofing.

In the urban areas housing is provided by the Meru Municipal Council which is largely financed by the National Housing Corporation through a loan scheme. To date, the Council has 60 rental houses, 54 tenant purchase houses and 3 staff houses. Most of them are one bedroomed. The Council has plans to purchase 17 acres of land for constructing 83 housing units at Madaraka Estate for renting and 30 tenant purchase houses for medium and high income groups. Private individuals and organisations also provide housing in urban areas but the rents they charge are much higher than those of the Council.

As pressure for agricultural land intensifies with the population growth, rural-urban migration will increase. This will accentuate the shortage that already exists in the five urban centres - Meru, Chuka, Maua, Nkubu and Chogoria. At the moment, the Municipal Council has managed to meet housing needs for only a half of the applicants in the urban centres. As a result, slum areas have started to develop. In Meru town there are two such slums, Mjini and Majengo.

One bedroomed flats or maisonettes are the most popular size of house probably because many of the urban dwellers have left their families in the rural areas. A few larger, attractive houses are necessary to accommodate public servants in the district headquarters. These can act as an indirect inducement to them.

Construction of physical public amenities such as schools, community halls, churches is done by the public usually on a harambee basis. As a result, the poorer marginal areas have poor public facilities.

5.2 HEALTH

Health units in Meru district include hospitals, health centres and dispensaries. Table 5.1 gives a breakdown of the health units in the district.

TABLE 5.1 HEALTH UNITS, MERU DISTRICT 1984

Type of Unit	Goverment Maintained	Private	Mission	Total	Bed capacity
Hospital	1	-	4	5	970
Sub-hospital	1	-	-	1	100
Health Centre	8	-	-	8	-
Health Demonstration Centre	2	-	-	2	-
Nursing Homes	-	3	-	3	-
Maternity Hospital	-	2	-	2	55
Dispensary	33	-	43	76	-
Total Units	45	5	47	97	1125

SOURCE: Kenya, Ministry of Health, 1984

As can be seen from this table, the missionaries are key providers of health services in the district. Four out of the five hospitals are run by the missionaries - catholics, methodists and the P.C.E.A. - who also supplement the primary health care and laboratory services.

The distribution of these services is concentrated in the middle belt which was the area of initial colonial and mission settlement and which is also highly productive in agriculture. There is inadequate provision of health care in the marginal areas, but even in total, these units are not enough for a population of over 800,000 in Meru district. The only government hospital, and therefore the only one that offers free medical treatment, is overwhelmingly congested. It also serves North-Eastern Province. There are 9 doctors at the hospital and a rather constrained supply of para-medical staff. Shortage of staff houses for the hospital limits the supply of support staff. The district is poorly served with public health personnel having only 4 public health officers in the entire district.

This is a rather unfortunate position because many of the diseases in Table 5.2 are preventable through sound public health education. A strengthening of the public health personnel would help save time and money spent on curing disease that arise due to ignorance.

TABLE 5.2 NOTIFIABLE INFECTIOUS DISEASES, MERU DISTRICT, 1981

Name of Disease	Number of Reported Cases	Deaths
Malaria	2029	29
Gastro-enteritis	905	45
Amoebiasis	961	-
Upper Respiratory Throat Infection	913	46
T.B.	809	-
Ankylostomiasis	689	-
Gonorrhoea	655	-
Pneumonia	605	-
Measles	522	2
Dysentry	378	39
Syphilis	287	-
Infective hepatitis	225	-

SOURCE: Ministry of Health, 1981

This table reveals that the diseases with the highest incidence rates are malaria, gastro-enteritis and amoebiasis as well as URTI. Malaria, particularly the clinical type, is endemic in the irrigation zone near Nkondi settlement scheme. Gastro-enteritis is prevalent in the coffee zone especially in Guchura and Miigi where the rivers are heavily polluted. Amoebic dysentry is widely recorded in the Mukinduri area. Dysentry is brought about by contaminated water. Mainly around Meru town where the town effluent flows into the river. Other diseases recorded in 1981 are tetanus (21 cases and 16 deaths), whooping cough (97 cases and 6 deaths), meningitis (172), typhoid (28), Kalaazar (25 cases and 1 death). It is most likely that many more cases than these reported here never reached hospital and were, therefore, not recorded.

Even more disturbing than the infectious diseases is the incidence of nutrition related diseases. Table 5.3 gives a breakdown of cases of malnutrition as recorded in various health units in 1981.

TABLE 5.3 MALNUTRITION IN MERU DISTRICT, 1981

Station	Kwashiokor	Marasmus	Anemia	Ref. to Hospital
Meru Hospital	107	10	-	-
Lare (Igembe)	55	6	-	-
Paediatric Ward (Meru)	117	30	56	-
Ruiri (N. Imenti)	73	47	-	4
Mpukoni (Nithi)	84	24	-	-
Chuka	73	47	-	4
Gatimbi (N. Imenti)	83	23	-	7
Timau	384	285	-	-
Miathene (Tigania)	80	23	-	4
Total 1981	1056	495	56	19
Total 1980	817	-	-	-

SOURCE: Kenya, Ministry of Health, 1981

The drought conditions which have persisted since 1979 in some areas of Meru, have aggravated incidence of malnutrition. By September 1984, over one-half of the paediatric ward was occupied by malnourished children (Bates 1984), many of the children admitted had less than 60% of 'normal' body weight. Drought aggravates malnutrition, not just because people do not have enough to eat but also because their purchasing power is reduced in several ways. Drought reduces employability for the casual labourers, families sell some of their assets in order to purchase food, animals die and the food itself becomes very expensive. This is what has happened in Meru in 1984. It is suggested that food sent to the districts for famine relief should be enriched at source in order to reduce the high incidence of malnutrition.

5.3 EDUCATION

Meru district has a wide variety of educational institutions ranging from nursery schools and special schools to training institutions. There are 21 educational divisions to the 7 administrative divisions in the district. Table 5.4 gives a breakdown of the main educational institutions in the district.

TABLE 5.4 EDUCATIONAL INSTITUTIONS IN MERU DISTRICT

Type	Number of Institutions	Enrolment	Year of Record
Pre-primary schools	278	13042	1980
Primary schools	706	222892	1983
Secondary schools	101 (29 goverment maintained)	Unstated	1983
Primary Teacher colleges	2	740	1980
Village Polytechnics	18	1330	1980
Adult Education	544	14911	1982
Tuuru Home for the Handicapped	1	157	1980
Kaaga School for the Deaf	1	90	1980
Igoji School for the Blind	1	140	1980
Meru College of Technology	1	100	1984

SOURCES: Eastern Province Annual Report and Kenya, Ministry of Education

As can be seen from this table, there is inadequate provision of pre-primary education.

There are much fewer pre-primary institutions than primary schools and the number of trained teachers is only 32 out of a total of 278.

Enrolment in adult education classes fluctuates according to seasons. During the dry season, attendance can be over 2500 students but during the planting and harvesting seasons, it drops to more than half that figure. The figures given in the table above were recorded in June 1982.

There was no increase in the number of secondary schools between 1978 and 1983. They remained 101 but their enrolment nearly tripled during that period. At present, some secondary schools in North Imenti and Nithi are overcrowded.

Government took over four secondary schools and gave partial assistance to 16 others. There are, therefore, 29 government maintained schools, 16 assisted, 48 harambee and 8 private. Enrolment figures are available for the government maintained schools only. These had a total of 10940 pupils in 1983 as compared to 39993 pupils in 1978.

The highest enrolment is in primary schools. Table 5.5 gives enrolment figures for the years 1978-1984. A striking feature in these data is the very high drop out rate after each of the classes. After very high enrolment in Standard I in 1979, for example, (most probably because of the introduction of school milk) nearly 16000 pupils did not go to Standard II in 1980. By the time this cohort reached Standard V in 1983, 31819 or 53% of the original enrolment had left school. This is worrying. It is wasteful of resources and it indicates that universal literacy is still a long way from being achieved. Some of the reasons for dropping out of school include long distances to school particularly in Tharaka, as well as the lucrative miraa trade which attracts children into premature employment mainly in Igembe. Coffee and tea picking is also responsible for some drop outs but this is more on a seasonal basis. Other reasons for drops is the high costs of education in the form of building funds and school uniforms.

Environmental education is given varying emphasis in each of the schools. Many of them teach it incidentally as part of the main syllabus in topics such as nature study, rural science, geography and agriculture. Some of the secondary schools introduce it as part of the extra curricula activities - wildlife clubs, 4K club, and Young Farmers.

In Meru district, however, there are two outstanding examples of organised environmental education. One is at Gakando Primary School in Kibirichia, North Imenti. This school planted trees and constructed gabions in the compound. This effort so stimulated the local community that they joined in digging terraces in the school. The school is now a demonstration site for environmental education and through this effort, women in the area have formed soil conservation groups.

The other example is Kirwa Chiefs Camp also in North Imenti. Here adult education is integrated with environmental education. The students have a tree nursery which they tend and which has about 50000 tree seedlings. These they divide up between themselves during the planting season. They use empty school milk packets for planting the seedlings. This is an original way of involving the adults in the afforestation programmes as well as sensitivising them to the need to recycle waste materials.

Education at all levels is bedevilled with problems in this district. The road infrastructure is so inadequate that effective supervision of schools (even if there were enough inspectors and vehicles) is difficult.

TABLE 5.5 ENROLMENT IN PRIMARY SCHOOLS BY CLASS AND SEX IN MERU DISTRICT, 1978-1983

YEAR	STD I		STD II		STD III		STD IV		STD V		STD VI		STD VII		TOTAL		GRAND TOTAL	NO. OF SCHOOLS
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls		
1978	19954	18265	14300	13195	12032	11135	12680	12217	11621	11324	8268	7974	7635	7141	86490	81251	167741	634
1979	30692	29115	18045	16255	14145	12889	12688	11762	11584	11594	11117	10985	8373	7873	106644	100473	207117	661
1980	26350	25840	22528	21326	16378	15000	13805	12719	11535	11389	11195	11606	10399	9608	112190	107488	219678	666
1983	23918	23219	18069	17650	16216	16382	15680	16637	14005	13983	12930	13399	10766	10038	111584	111308	222892	706
1984																	222561*	

* Provisional

SOURCE: Kenya, Ministry of Education, Science and Technology for the years cited.

The marginal areas have such a weak economic base that they cannot provide the physical facilities of an acceptable level. Many children in these areas learn in temporary structures with inadequate rain and sun shelter. There is a very high proportion of untrained teachers. Because many schools have no staff houses, it is difficult to retain teachers who are not from the surrounding area. Because of this, results in the national school examinations are very poor. In C.P.E. Meru District has averaged between 130-140 mean standard scores in the last five years which is below the national mean of 150 standard scores.

The Meru College of Technology was opened in September 1983 and offers certificate courses in agriculture. Details of the course content are not available but it is hoped that teaching will be based on the broad agricultural experiences that the district offers.

5.4 WATER SUPPLY AND POLLUTION

The rivers of the district are the main water sources. The major rivers are Ruguti, Nithi, Maara, Mutonga, Kazita, Thanandu, Uri and Rojwero. These are mainly in the south-eastern part of the district. In the northern slopes of both mountains, the rivers are mainly seasonal but in the rainy season, they have large volumes of water. Other water sources include boreholes, springs and dams. Roof catchment is another source of water. Table 5.6 gives details of the functioning water supplies in the district.

TABLE 5.6 RURAL AND URBAN WATER SUPPLIES IN MERU DISTRICT

NAME	SOURCE	PRODUCTION CAPACITY M^3 PER DAY	TREATMENT/ INTAKE	POPULATION SERVED (CONNECTIONS)
Urban				
Meru	River	3072	Chlorination + alum + soda ash during rains	1726
Nkubu	River	15.5	Weir + filtration chamber	2020
Maua	Stream	89	Alum.	127
Chuka/Karingani	Spring	161	Chlorination	2836

NAME	SOURCE	PRODUCTION CAPACITY M^3 PER DAY	TREATMENT/ INTAKE	POPULATION SERVED (CONNECTIONS)
Rural				
Nkabune	River	105	Full	155
Kanyakine	River	225	Full	323
Timau	Spring	250	None	50
Tigania	Spring	732	Chlorination	327
Mitunguu	River	250	Full/weir + filtration chamber	105
Mwimbi	River	4594	Chlorination	1744

SOURCE: Kenya, Ministry of Water Development, 1982

The water supplies in this table have been constructed and are being maintained by the Ministry of Water Development. Supply to Meru town is grossly inadequate and is a major constraint in the development of the town. It is estimated that about 20% of the population in the town cannot be sure of obtaining their daily water supplies in any one day. A major increase in supply capacity is urgently required for the municipality.

In addition, there are another 18 water schemes constructed and maintained on a self-help basis. Farmers use this water for small-scale irrigation by leading it into furrows. Those who are not connected to the main water supply, use the furrows for their drinking water. Other sources of water are gravity for water supplies. These are the most ubiquitous, numbering about 130. They are constructed very simply by small self-help groups who do not have the financial capacity to pay for the technical and mechanical input required for the standard water schemes. These supplies deliver water in a raw state to homes. Although the initial cost of setting them up is low, they break down very often and in the long run, it would be more cost-effective to construct one major water scheme in place of several gravity fed ones. The Catholic Secretariat has set up an interesting water scheme in Tuuru. The intake consists of tunnels dug into the face of the hill and the pipes are tarred and covered with cloth to increase the life of the pipes. A tariff of 10/- per family is levied for an unlimited consumption.

As in most aspects of Meru economy most of these water schemes are in the middle productive belt. Of the larger water schemes, 24 out of 47 are in North Imenti as compared to 1 in Tharaka and 2 in Tigania. People who genuinely need water and who travel long distances in search of it, therefore, have not benefited from available water sources. The District Officer's office in Tharaka, for example, is served with water from Mitunguu 15 km away. The dry areas of Igembe are also very poorly served with water. In the northern slopes of the Nyambenis, rivers are seasonal and people here travel long distances in search of water. Dams and or boreholes are needed in these areas. Given the weak economic base of people in these dry areas, it is probable that they maybe unable to procure the water without support from government.

Water pollution by agricultural wastes is an important environmental problem in the district because the larger proportion of the population consume water in an untreated state. The main source of pollution is waste discharges from coffee which contains organic wastes and hazardous chemicals. Sometimes this water can have very high biological oxygen demand (BOD) if untreated. When this waste-water is discharged directly into streams, as is often the case, water quantity is severely degraded and the ecology of the stream life is badly disrupted. In addition, coffee factory waste-water often contains toxic chemical residues from the fungicides and insecticides that are used to spray the coffee. These are poisonous and dangerous to human and animal health. The problem is further compounded by the fact that peak coffee picking seasons are concentrated in five months of the year. This provides a peak load which is discharged to the streams in such quantities that the streams cannot supply enough dilution capacity.

Recirculation systems and other waste treatment procedures can reduce the extent of water use by coffee factories and the associated pollution. The Water Act of 1976 requires that all coffee factories have recirculation systems and storage pits capable of holding all waste water. In addition, water use is not supposed to exceed 5,000 gallons per ton of clean coffee, and none of it should be returned to any water course. Unfortunately, only a few of the factories follow these rules. The major constraint towards installation of a waste recirculation system is the high cost involved. At current coffee prices, farmers are reluctant to invest more money on pollution control measures in coffee factories particularly because they see no financial gains from the exercise.

Further pollution of the waters is caused by soil erosion during heavy rain periods particularly in areas of intensive cultivation on steep slopes. Some building sand is obtained by washing the soil off it with water. This causes further water pollution. At the moment, there is not enough data on the water quality in Meru district. It is estimated that the middle belt has heavily polluted waters. This is the area of dense population and intensive cultivation; it is also the coffee zone and it has steep slopes and many untreated gravity fed water projects. The many cases of water-borne diseases discussed in 5.2 confirm this supposition. Close monitoring of water quality is a high priority area so that preventive measures can be taken in good time.

5.5 ENERGY

The main source of energy in both rural and urban areas in Meru district is wood, either burned directly or made into charcoal. Approximate figures for consumption of various energy sources are available from the Household Energy Consumption Survey conducted by the Central Bureau of Statistics in 1978. This data is available at provincial level only. It is suggested that wood consumption in Meru district is higher than these figures indicated because there is a brisk trade of charcoal and building wood with other districts. Table 5.7 and 5.8 present some of this data.

TABLE 5.7 HOUSEHOLD ENERGY CONSUMPTION BY SOURCE, EASTERN PROVINCE, 1978

SOURCE	AVERAGE AMOUNT CONSUMED PER MONTH
Wood (kg)	434.2
Charcoal (kg)	42.9
Paraffin (litres)	4.5
Gas (kg)	0.4
Electricity (kw h)	0.4

SOURCE: Kenya, Ministry of Finance and Economic Planning 1981.

TABLE 5.8 PERCENTAGE DISTRIBUTION OF ENERGY USAGE EASTERN PROVINCE, 1978

SOURCE	USE			
	COOKING	HEATING	LIGHTING	OTHER
Fuelwood	81.85	17.89	-	0.35
Charcoal	81.85	17.92	-	0.24
Paraffin	12.44	-	87.17	0.39
Gas	100.00	-	-	-
Electricity	-	-	-	-

SOURCE: Kenya, Ministry of Finance and Economic Planning, 1981.

As can be seen from these two tables, fuelwood is by far the largest source of energy in the Province. The average monthly consumption per household was 434.2 kg which is considerably above the national average of 389.6 kg. The main use for wood was for cooking which accounted for 81.85% of fuelwood use while the remaining 17% was used for heating.

Charcoal usage averaged 42.9 kg per household that used charcoal. This was the lowest rate in the country. As with fuelwood, most charcoal use, 82% is for cooking and the rest for heating. People who use charcoal generally supplement it with fuelwood in the rural areas or paraffin and gas in the urban areas where the houses are not generally designed for the use of fuelwood.

Paraffin is principally, 87% for lighting and a little 12% is used for cooking. Household paraffin consumption per month was 4.5 litres, again the lowest in the country and well below the national average of 6.5 litres.

There is very little electricity use in Eastern Province, mainly because there are such few power lines. Consumption averages 0.4 kwh per month, the least in the country. The average national consumption is 11.7 kwh. Electrification in Meru district is at the initial stages. At the moment, electricity is only supplied to Meru town although several rural lines are under construction. The Kanyakine-Materi power line will cost about K.Shs. 8 million of which local residents have raised K.Shs. 2.5 million thereby attracting a government grant of K.Shs. 6 million. Another scheme is the Meru-Maua line where the survey has

been completed and construction is expected to commence in the course of the 1984-1988 Development Plan. This project is being aided by the Canadian Development Agency.

Gas is used almost entirely for cooking. The average consumption in the province averages 0.4 kg the lowest in the country and one-fourth of the national average of 1.6 kg. Distances travelled to sources of energy are on the whole, quite small. Sixty-six percent (66%) of households are within one kilometer from their source of fuelwood and over 83% are within two kilometers. For charcoal, about 71% of households are within one kilometer and 83% within two kilometers. Distances travelled to sources of gas and paraffin are slightly higher because these are usually purchased at market centres. Most households obtain their gas and paraffin from distances of between 1 and 3 km.

Such a high consumption of fuelwood has fundamental environmental implications. The combined growth in subsistence and urban demand for fuel will most probably grow as fast as the population because none of the alternative energy sources have so far been exploited cheaply. This is at the same time as land that is increasingly placed under agriculture is stripped of woody cover. As pressure for agricultural land increases, with the population, land which could be used for crop production is unlikely to be left in forest. The combined effect of this will be to advance the imbalance between supply and demand of wood, and hence, the depletion of the standing wood mass.

The main factor which will limit the extent to which available production and standing mass of wood can be consumed is the change from use of fuelwood to charcoal. Transporting firewood over distances of 80 km and above is no longer economical and, therefore, traders prefer to sell charcoal. But charcoal is a wasteful way of using wood. Most of the traditional charcoal kilns have very low conversion efficiency (about 9 kg of wood is needed to provide 1 kg of charcoal (Oppenshaw 1976). Additional wastage is caused by the practice of discarding of branches and twigs less than 4 cm during charcoal burning.

At the moment, Meru has substantial wood reserves and an advanced afforestation programme. The supply and demand position, however, has to be seen in a national context. As other districts run out of their wood reserves (this has already happened in parts of Central and Nyanza provinces) Meru district will become an exporter of wood, primarily as

charcoal thereby accelerating consumption. (Currently, there is a ban on the burning of charcoal but its impact has not yet been assessed).

If the position outlined above holds, it is estimated that the production of wood will be lower than the consumption in the next 25 years. The result will be an accelerated reduction of vegetation cover and the accompanying soil erosion.

Some ways of averting this involve a greater emphasis on agro-forestry. In addition, domestic fuel supplies could be grown in arable areas by planting multi-purpose trees. Wastage in consumption could be substantially improved by increasing the efficiency of charcoal kilns and charcoal stoves.

5.6 WASTE DISPOSAL

At present, there is only one sewerage system in the district, in Meru town. It was designed to serve a population of less than 10,000. With a population now of over 70,000, this system is totally inadequate. A large part of the town now depends on septic tanks. Raw sewage flows along the road and adjacent to the open market at Gakoromone before emptying into Kazita river. A significant number of cases of water-borne diseases has been recorded around this area (see 5.2). Plans for constructing another lagoon were expected to start in 1974 but work on the project has not yet started. The town is, therefore, at least ten years behind schedule on plans to get rid of waste. Inadequate water supplies and an overloaded lagoon places Meru town at very high environmental risk.

The other urban centres, Maua, Chuka, Nkubu and Chogoria use septic tanks for their waste disposal. The rest of the district generally uses pit latrines which are quite clean if well maintained. In high density areas, however, over-use of pit latrines poses major health hazards. They fill up very quickly and are a major source of germ infested flies.

Refuse from residential and commercial sources is poorly organised with individuals such as market organisers, having to burn it or bury it at dumping sites.

5.7 TRANSPORT AND COMMUNICATIONS

Meru district has a very poor road network. Classified roads have a total length of 1802 km of which only 280.9 km is of bitumen standard. Figure 10 and Table 5.9 give information on transport and communication facilities in the district.

TABLE 5.9 CLASSIFIED ROAD NETWORK IN MERU DISTRICT

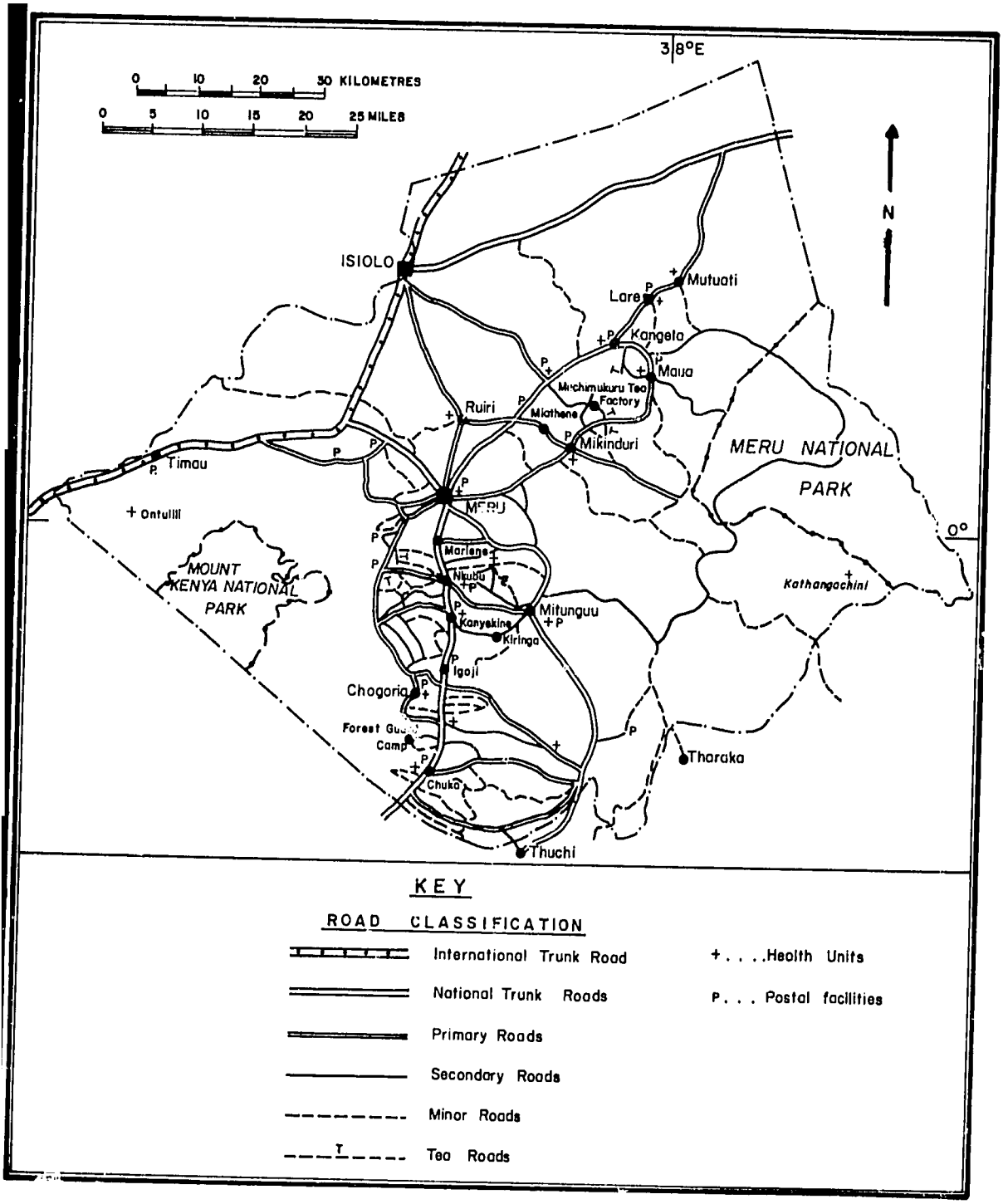
TYPE AND CLASS	BITUMEN	GRAVEL AND EARTH	TOTAL KM
International Trunk (A)	71.0	-	71.0
National Trunk (B)	126.1	65.5	191.6
Primary (C)	50.2	72.5	122.7
Secondary (D)	26.6	448.9	475.5
Minor (E)	6.4	885.8	892.2
Tea roads (F)	-	43.5	43.5
Goverment access roads (G)	0.6	5.0	5.6
TOTAL	280.9	1521.2	1802.1

SOURCE: Kenya, Ministry of Transport and Communications, 1984.

Only the medium and high potential areas of the district are well served with transport and communication facilities.

A part of the international road which links Kenya and Ethiopia passes through northern Meru. 71 km of it cut through the district between Nanyuki and Isiolo. This is a beautiful road (Class A, bitumen standard 3) but unfortunately it passes through a largely unproductive area of the district. National trunk roads link the major administrative and commercial centres. 65.5 km of this road is still loosely surfaced. The rest of the roads are all of gravel and earth with the exception of the road to Maua and a part of the road to Embu which are of bitumen standard. The steep terrain, and the heavy rains in many parts of the district make most of the roads virtually impassable in the wet season. Road maintenance in general is often inadequate, partly because of shortage of finance.

As a result, agricultural and industrial development in Meru district has been greatly impeded. Activities such as Artificial Insemination, Delivery of School Equipment and Agricultural Inputs, Transportation of Agricultural Produce to Markets Seasonally come to a standstill in the wetter parts of the district. Roads in the more thickly forested areas are impassable for most of the year.



SOURCE: Ministry of Transport & Communication, 1984

FIGURE 10. INFRASTRUCTURE OF MERU DISTRICT

It is hoped that completion of the new road to Embu will help to open up a larger part of the district. The road will be 51 km of bitumen standard, running from Thuci in Embu to Nkubu in Meru and traversing an area rich in coffee and tea, and subsistence farming. It will reduce travelling time from 3 hours 45 minutes on the old 70 km earth road to less than one hour between the two towns. This road, which was started in December 1980 is targeted to be completed in December 1984. It will greatly ease the transportation of agriculture produce and open up new markets for them outside the district. It will also increase the flow of tourists into the game parks. Negative effects of the new road include easier transportation of timber and charcoal, thereby increasing deforestation.

Transport vehicles include buses, (matatus), lorries, cars and donkey carts. Because of the poor road network, there is no reliable goods or passenger service for journeys within the district. Service centres in the district have inadequate public service facilities. Slightly more than three quarters of the district is without electricity and telephone facilities. There is one head post-office in the district, five full post-offices, and twenty sub-post offices. In addition, there are eleven telephone exchanges in operation. Many other areas need to be reached by telephone, but, given the cost of installation and the poor ability of the people to pay for the service, the opening of more telephone exchanges may not receive very high priority.

5.8 COMMERCE AND INDUSTRY

Commerce and industry are, after agriculture, the second most important source of income and employment in Meru district. They are likely to grow in importance as the population of the district increases. The major commercial activities are small retail businesses while industrial activity revolves around the processing of agricultural produce.

Table 5.10 gives a breakdown of main industries in the district.

TABLE 5.10 INDUSTRIAL ENTERPRISES IN MERU DISTRICT

INDUSTRY	NUMBER	NUMBER OF EMPLOYEES	LOCATION
Coffee factories	157	2673	All divisions except Tharaka.
Tobacco barns	100	855	All divisions

INDUSTRY	NUMBER	NUMBER OF EMPLOYEES	LOCATION
Pit-sawyers	62	310	All divisions except Tharaka.
Saw-benches	21	151	North and South Imenti
Main hotels	10	-	Municipality, Chuka, Meru National Park.
Car garages	10	-	Municipality, Chuka, Meru National Park.
Sawmills	8	278	6 in North Imenti, 1 in South Imenti, 1 in Nithi.
Tea factory	3	300	Tigania, North Imenti, and South Imenti.
Cotton ginnery	1	50	South Imenti

SOURCE: Kenya, Meru District Development Plan 1979-83.

In addition to these relatively larger industries, there are numerous small-scale industries scattered throughout the district with concentrations in the market and urban centres. They include furniture workshops, sheet metal works for making doors and window frames, tailoring enterprises, stone crushing, honey refining, posho mills, and block making. Some of these are financed by the Kenya Industrial Estates (K.I.E.) which has a very soft Loan Scheme designed to encourage small-scale industries. The main impediment to growth and diversification of industry is the inadequate infrastructure , particularly roads and electricity.

The coffee industry is the main polluting agent partly because it is the largest single industry and partly because the effluent from the coffee factories is so highly toxic (see section 5.4). In addition, some dust is inhaled by workers in the cotton ginnery, and in the sawing of timber. Effluent from the dairy flows into the municipal sewer, thereby overloading an already full lagoon. In the tea processing factories, workers are exposed to gases and dust in factory air as the leaves are fermented, dried and sorted. None of these exposures need pose major health hazards if basic precautionary measures, such as the wearing of protective masks, are observed.

Rural commerce is largely small-scale retail trade, which is the highest commercial activity followed by food catering services. In 1981, there were 4000 licenced traders in the district of which 2607 were retail traders. Table 5.11 shows the development of licenced trade between 1977 and 1981.

Credit availability is one of the main constraints to the expansion of commerce and industry in the district. Large loans, over K.Shs. 20,000 are mainly given by the Industrial and Commercial Development Corporation (ICDC), as well as the Commercial Banks. Traders are hesitant to utilise these large credit facilities because they fear losing the collateral, usually their land, if they default in repayments. The District Development Joint Loan Board is the most popular source of credit facilities. The interest rate is 6½% per year for loans of between K.Shs. 8000 and K.Shs. 20,000.

The Kenya National Trading Corporation has helped to stimulate rural commerce in the district through its network of agents for the distribution of various commodities such as sugar, salt, cement, soap and textiles. Because of the poor roads, many of the smaller market centres experience periodical commodity shortages.

There are a few direct environmental consequences associated with commercial activities. They include the sale of potentially hazardous products such as pesticides and drugs, eating in restaurants where the health facilities maybe inadequate and the cutting down of forests for timber.

TABLE 5.11 LICENCED TRADERS IN MERU DISTRICT 1977-1981

	Manufacturer	Wholesale	Catering	Motor-vehicle repair	Regulated Trade	Miscellaneous	Total
1977	25	106	870	21	2840	31	3893
1978	7	122	870	29	3159	41	4228
1979	8	112	902	28	3629	27	4706
1980	7	111	817	25	3856	10	4826
1981	7	128	707	31	2607	38	3518

SOURCE: District Trade Officer

5.9 EMPLOYMENT PATTERNS

Non-agricultural employment in Meru district is limited. Rural-urban migration has not been extensive (see 3.1.4) and the demand for employment is only recently beginning to increase as the population growth limits agricultural opportunities. Figure 11 shows the growth of wage

employment in Meru district as well as Meru town between 1974-1982. The sharp increase in wage employment between 1976-1980 was as a result of the boom in international prices of coffee. Opportunities for wage employment increased faster (53%) in the town than in the whole district (33%). The district increase was slightly lower than the population increase which is about 39%.

Table 5.12 gives the categories of wage employment in the modern sector in Meru town. The largest category is community, social and personal services which accounts for about 60% of employment. This is followed by agriculture and industry which showed signs of decline in 1982 after a steady increase in previous years.

The informal sector includes people in carpentry, tailoring, repair shops, food stalls all on a small-scale. It is an important source of employment for those not employed in the modern sector. Most of the employees, about 69% earn less than K.Shs. 700 a month and about 20% of employees in the district earn over K.Shs. 1,000. Comparable figures for Kenya as a whole show that about 57% of wage earners receive less than K.Shs. 700 per month while about 30% receive more than K.Shs. 1,000.

Since employment largely revolves around agriculture, it is also sensitive to fluctuations in the agricultural climate. The 1984 drought which is in its second year in Meru, had a significant impact on employment patterns.

5.10 CO-OPERATIVE AND SELF-HELP MOVEMENTS

5.10.1 CO-OPERATIVES

There are 78 primary societies in the district run by three co-operative unions in addition to the Kenya Farmers Association. Most of the co-operatives are agricultural, with coffee societies dominating the co-operative sector. Table 5.13 gives a breakdown of the active co-operative societies in the district. Those not entered in the table are currently dormant.

TABLE 5.13 CO-OPERATIVE ACTIVITIES IN MERU, 1983

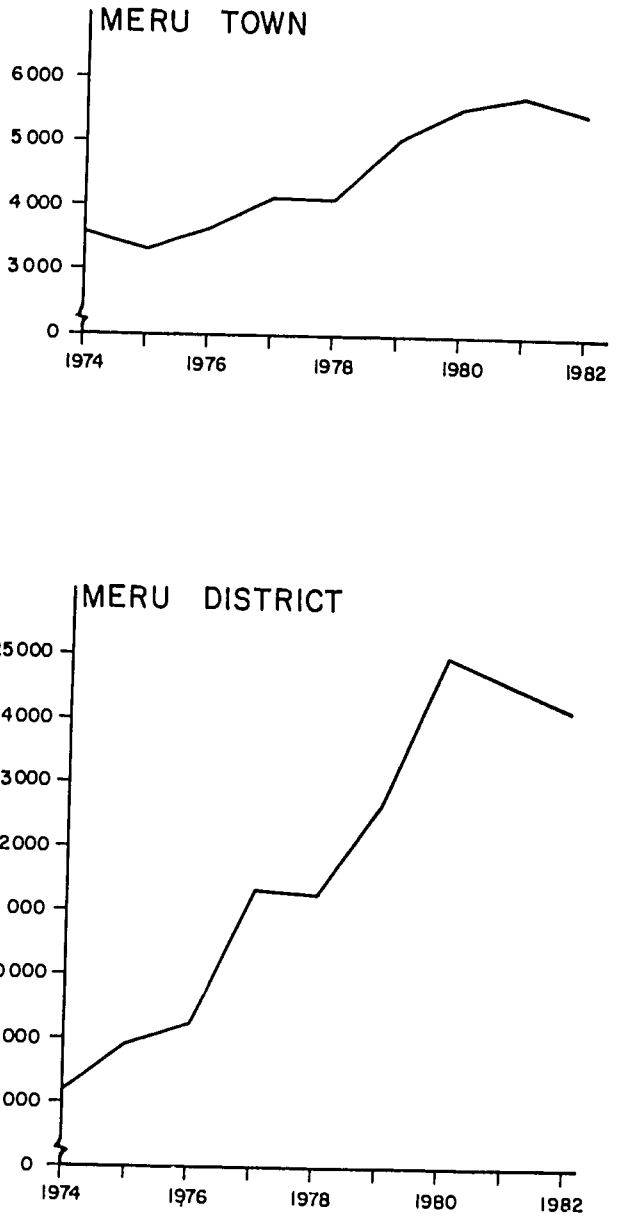
Activity	Number in 1983	Number in 1978	Members in 1978
Coffee societies	23	23	85056
Dairy societies	12	11	6870

TABLE 5.12

WAGE EMPLOYMENT BY INDUSTRY IN MERU TOWN, 1978-1982

Year	Agriculture and Forestry	Manufacturing	Electricity and Water	Construction	Trade Hotels and Restaurants	Transport and Communications	Business and Finance	Community Services	Total
1978	723	73	9	244	325	366	107	2254	4101
1979	939	61	11	256	397	365	774	2250	5053
1980	1051	72	11	618	408	346	135	3021	5662
1981	1175	86	12	632	420	138	140	3148	5751
1982	1077	104	19	120	471	218	182	3288	5479

SOURCE: Kenya, Ministry of Finance and Economic Planning, 1983



SOURCE: Ministry of Economic Planning & Development, 1983

FIGURE 11. WAGE EMPLOYMENT, MERU DISTRICT AND TOWN, 1974–1982

Activity	Number in 1983	Number in 1978	Members in 1978
Savings and Credit	12	11	4461
Cotton societies	6	1	17433
Multi-purpose	5	2	492
Farm purchases	2	-	-
Pyrethrum	1	1	1086
Ranching	1	1	980
Timber	1	1	16423
Housing	-	1	2583
Poultry	-	1	-

In 1983 the total membership was estimated at 164384, but a breakdown of membership per group is not available.

SOURCE: Meru District Development Plan 1979-1983 and 1984-1988

Problems relating to co-operatives include low educational levels of some of the members resulting in mismanagement. The dairy societies face problems of transport when excess milk has to be taken to Kiganjo in Nyeri. Money earned by these societies is invested in ventures such as buying large-scale farms, business plots in Nairobi, vehicles, and tractors. The rest is used to improve facilities such as increasing coffee factories, building a dam.

5.10.2 SELF-HELP MOVEMENT

The self-help movement has been responsible for a major part of development in Kenya. Through the harambee (self-help) spirit, people make voluntary contributions in form of cash, labour or kind towards a specific project.

The self-help movement us concerned with the entire range of social and economic activities including the building of churches, schools and water projects. Sometimes the government supports the projects either at the initial stages or by providing some of the recurrent expenditure. In Meru district, women groups are the most distinctive feature of self-help. They participate in nearly all development activities. In 1983, there were 700 women groups with a total membership of 27000. They contributed a total of over K.Shs. 2 million towards different development activities.

5.11 TOURISM

Meru district attracts a considerable number of tourists each year mainly because of Meru National Park and to a smaller degree, the Mount Kenya Game Park. Meru National Park is 870 sq. km and it has game in a relatively undisturbed state. It is the only place in Kenya where the white rhino is found. Inside the park are tourist lodges - Meru-Mulika Lodge and Leopard Rock. Another 8 medium class hotels are found in the Municipality.

Table 5.14 gives a breakdown of visitors to Meru National Park between 1977 -1982.

TABLE 5.14 VISITORS TO MERU NATIONAL PARK

YEAR	NUMBER
1977	36945
1978	32945
1979	25867
1980	22443
1981	23413
1982	21201

SOURCE: 1983 Statistical Abstract

It can be seen that there has been a gradual decline of visitors to the park. This is partly because of the poor roads and a shortage of high class hotels. In 1980 a total of K.Shs. 470589 was collected as park entrance and camping fee. The district has a higher tourist potential than is currently exploited.

5.12 PROBLEM SUMMARY

A. Housing

1. There is a general shortage of urban housing resulting in slums and overcrowding.

B. Health

1. The health units in the district are inadequate for the population.
2. Malnutrition exists in many parts of the district particularly in the drier areas.
3. Communicable and public health diseases are rampant in the district. Public health personnel needs to be strengthened.

4. There is a general shortage of trained medical personnel, drugs and equipment.

C. Education

1. The quality of education in the district has suffered because of shortage of trained teachers, ineffective supervision, poor physical facilities.

2. There is a very high drop out rate in the primary schools.

D. Water Supply and Pollution

1. Existing urban water supplies are inadequate for the needs of consumers.

2. Water pollution by agricultural wastes is a major environmental concern in the district.

3. There is heavy siltation in waterways as well as chemical residues which can lower the quality of surface water.

4. Uncontrolled water schemes upstream could reduce the amount of water available in the drier and lower parts of the rivers.

E. Energy

1. There is a looming fuel crisis in the near future unless afforestation programmes are intensified.

F. Waste Disposal

1. The sewerage system in Meru is a major health hazard. It is too full and part of it is open.

G. Transport and Communications

1. Roads are a major impediment to development in the district because they are so poor. Loose surface roads are impassable during the wet season.

H. Commerce and Industry

1. Industrial development is hindered by inadequate infrastructure such as roads and electricity.

2. Low credit worthiness is one of the main constraints to the expansion of commerce and industry. The establishment of large industries which can employ, and in the process, train young school leavers, is necessary.

I. Employment

1. Wage employment is in the coffee farms and in the towns, thereby encouraging migration into already densely populated areas.

2. Marginal areas lack enough sources of employment.

J. Co-operatives and Self-Help Movements

1. Many co-operatives suffer from poor management and a lack of qualified personnel. Loan defaulting is a major problem. More government supervision and technical input would help in making these movements more effective.

K. Tourism

1. Tourism is largely underdeveloped because of the poor infrastructure and inadequate facilities.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

This chapter summarises the main issues highlighted in the document and proposes a set of recommendations for dealing with some of them. It should be pointed out that the underlying concern of this discussion is environmental. Some of the problems raised and the recommendations made may not always reinforce certain trends in development particularly those that threaten the environment. The natural environmental potential, however, is the basis for all development and its protection, therefore, should be central to all activities.

6.1 MAIN TRENDS OF ENVIRONMENTAL SIGNIFICANCE

1. Population Growth

The rapid rate of population growth is the single most significant factor which threatens the environment. Over the last decade, the population of Meru has increased by nearly 40% with an average annual growth rate of 3.4%, which is slightly higher than the national average of 3.3%. At this rate, the current economic activities cannot support the population for much longer. Pressure on resources such as land is already acute. Increasingly in the next decade or so, consequences of fast population growth will pervade all levels of development in the district.

2. Land Use

As a direct result of population increases, land holdings are being

sub-divided into ever decreasing parcels. In divisions such as North Imenti where many of them are less than one hectare, it is difficult to see how the next generation of sons will handle issues of inheritance and further sub-division. Movement into marginal areas threatens the ecosystem by intensifying soil erosion and vegetation clearing. Careful and integrated development of the marginal lands is a priority.

3. Cash Crop Production

After the boom in coffee prices in 1976-1977, planting of coffee and other cash crops increased. Cash crops now take such a large proportion of the district that crop production hectarage is considerably reduced. This makes the district vulnerable to fluctuations in income because of the unpredictable nature of world markets of these cash crops. In addition, cash crops involve the use of agrochemicals, many of them hazardous to the environment.

4. Urbanisation

Urbanisation is a relatively new problem in Meru district but one that will grow. The growth of the existing urban centres and some new ones should be anticipated and planned for. Water supplies, health and housing facilities should be built with the population projections in mind and with the realisation that there will be an increased influx into urban areas over the next decade.

5. Socio-Economic Trends

Industrial and commercial development in the district has been slow and is hampered by the generally low state of infrastructural development. Additionally, there are wide variations in the socio-economic levels of the divisions.Tigania and Tharaka have a weak economic base which is aggravated by the poor provision of development projects.

6. Soil Erosion and Land Degradation

Topography, soil structure, climate and land use practices all contribute to making soil erosion one of the main environmental problems of Meru district. Acute soil erosion occurs in many of the high potential areas of the district because of a combination of steep slopes, high rainfall, and intensive cultivation. In addition to lowering land productivity, the high rate of erosion causes heavy siltation of the district's rivers and streams. In assessing causes of soil erosion, both the factors that contribute to high erosion potential and those that impede farmers from adopting conservation measures should be considered.

7. Deforestation

Both population and economic pressures play an important role in promoting tree cutting. Trees are cut down for fuelwood, charcoal and land clearing. Fuelwood and charcoal are the main sources of energy in the district as well as an important source of cash income for many people. In addition, pressure for land is forcing people to clear forest so that they can plant food crops.

8. Water pollution in Meru district is of particular concern because most of the people obtain their water supplies from surface streams and rivers. The main polluting agents of water are siltation due to soil erosion, agricultural chemical residues and waste water from agricultural processing particularly coffee.

6.2 RECOMMENDATIONS FOR ACTION

1. The expansion of family planning services in the district both in numbers and quality is a priority area. This should help in reducing the population growth. In addition, sex education should be more formally taught in schools.

2. Development of agriculture in the district should take cognizance of the land pressures. More zero grazing should be encouraged as well as the growing of other fodder crops besides grass. Early maturity crops suc as katumani maize should be encouraged in the drier areas. The morale of farmers could be lifted by the provision of easy credit facilities and better financial incentives for their food crops.

3. The cutting down of trees should be regulated for environmental protection and sustainable use. This should be at the same time as afforestation programmes are encouraged. Farmers should be required to have a set number of trees planted in their farms. Schools should make environmental education more central to the curriculum that it currently is

4. Factory waste discharges should be more strictly controlled through a rigorous enforcement of current water pollution regulations. Factories without recirculation systems should be required to install them and where money is the constraint for installation, loans should be made available for this purpose. There should be a more close monitoring of water quality throughout the district.

5. The high incidence of public health diseases in the district implies a need for more health education. Public health workers should be increased and schools used as dissemination centres for health information such as nutrition and communicable diseases.

6. The cause of the high drop out rate in schools should be systematically studied so that corrective measures can be taken. The number of secondary schools should be increased to cater for the large numbers in primary schools.

CONCLUSION

Meru District remains an area of great potential. The problems of a fast growing population, soil erosion, deforestation and environmental health threaten to undermine this potential. Environmental degradation in whatever form must be avoided so that the generations to come can enjoy as strong a resource base as we have enjoyed.

BIBLIOGRAPHY

Bates, R. — Meru District Field Report. Institute for Development Studies (IDS), University of Nairobi, September, 1984.

Bernard, F.W. — East of Mount Kenya: Meru Agriculture in Transition Ph.D. Thesis, University of Wisconsin, 1968.

Campbell, D and Migot - Adholla — The Development of Kenya's Semi-Arid Lands. Institute for Development Studies, University of Nairobi. Occasional Papers No. 36, 1981.

Kenya

- Ministry of Agriculture Annual Reports 1975, 1976, 1977, 1978, 1979 and 1980. Farm Management Handbook of Kenya. East Kenya. Part C 1983.
- Ministry of Co-operative Development Annual Report 1980.
- Ministry of Economic Planning and Development, 1981. (MEPD) Kenya Population Census, 1979 Vol. 1 Nairobi: Government Printer.
- Ministry of Education, 1980 Annual Report.
- Ministry of Finance and Economic Planning.
- 1970 - Kenya Population Census, 1969 Volume 1.
- 1980 - Employment and Earnings in the Modern Sector. Nairobi. Central Bureau of Statistics (CBS).
- 1980. Meru District Development Plan, 1979-1983 Nairobi, Ministry of Economic Planning and Development (MEPD).
- 1981 - Household Energy Survey, 1980 . Nairobi, Central Bureau of Statistics (CBS)
- 1983 - Statistical Abstract, 1982, Nairobi, Central Bureau of Statistics (CBS)
- Ministry of Health, 1980 Annual Report.

Geological Survey of Kenya:	Bulletin No. II Mason, P. Geology of the Meru and Isiolo area. Report No. 31, 1955. Schoeman, J.A. Geological Reconnaissance of the country between Embu and Meru. Report No. 17, 1951.
Kenya Rangeland Ecological Monitoring Unit	Technical Report No. 27, 1979.
Survey of Kenya	1970, National Atlas of Kenya, Nairobi.
Muthamia, M.	History of Political Organisation in Meru up to 1973. B.A. dissertation. University of Nairobi, 1974.
Mwanganthia, S.K.	Tea Development in Muthara location. Nyambeni Range 1959-1975. B. Ed. dissertation, University of Nairobi, 1976.
Njage, J.	Coffee Farming in Muthambe Location, Meru. B.A. dissertation - University of Nairobi, 1971.
Openshaw, K.	Woodfuel - A time for re-assessment. Unpublished manuscript. Faculty of Agriculture, University of Dar-es-Salaam, 1976.
UNICEF	Social Statistic Programme, 1984.
Whitin, Almy	Rural Development in Meru District. Ph.D. Thesis, Stanford University, U.S.A. 1977.

APPENDIX

TABLE 1. BOREHOLES IN MERU DISTRICT

Reference Number	Locality	Total Depth	Water Struck (m)	Water Rest Level (m)	Tested Yield m^3/hr	Date Completed
1. SA6	Camp Site	32.3	21.9		Nil	4-9-40
2. P144	Isiolo Road	50.29	-	Nil	Nil	10-6-31
3. C153	Timau	70.1	90.9	47.8	3.86	9-7-41
4. C154	Timau	42.6	35	18.8	0.75	13-5-41
5. C156	Embori Farm-Timau	77.7	-	-	-	10-2-42
6. C185	Timau	86.7	75	15.8	3.5	13-4-42
7. C571	Larangai Timau	78	55/67	49	5.0	30-8-47
8. C596	Arigshu	76	43/59	6	3.0	3-10-47
9. C638	Kisima	83	82	75	0.3	4-2-48
10. C639	Kisima	157	43/155	151	12.7	13-1-48
11. C650	Oldonya Timau	88	84	63	13.6	18-3-48
12. C660	Timau	82	79	59	3.6	16-4-48
13. C1139	Timau	49	-	Nil	Nil	18-2-50
14. C1215	Timau	107	52/76	49	0.6	26-10-50
15. C1261	Timau	41	30.4	76	-	4-1-51
16. C1360	Kisima	81	-	-	Nil	30-9-50
17. C1581	Buloi Timau	128	116	100.6	0.02	20-10-51
18. C1620	Shaba Mile Post-Timau	122	72/116	67	5.5	18-12-51
19. C1710	Timau	97	78	78	Nil	29-2-52
20. C1918	Ngare Ndare-Timau	167	85	54	Nil	26-2-53
21. C1980	Ngare Ndare-Timau	106.7	58.5	56.7	40.9	13-5-53
22. C2270	Chuka	156	69/144	60	-	12-10-54
23. C2314	Timau	92	31.85	26	-	11-11-54
24. C2597	Timau	106	52/59	43	0.6	5-11-56
25. C2977	Meru Town	213.3	124.9	115.8	-	20.12.59
26. C2986	Timau	166.1	56.3	56.3	-	14-12-59
27. C3023	Kisima	77.7	52.4	26.8	-	21-4-60
28. C3022	Kisima	97.5	74.7	55.8	-	1-4-60
29. C3137	Nkabune	21.03	15.6	13.11	0.1	1961

Reference Number	Locality	Total Depth	Water Struck (m)	Water Rest Level (m)	Tested Yield m^3/hr	Date Completed
30. C3139	Igoji	91.44	74/91.4	46.6	2.38	1961
31. C3294	Kiirua	184.4	88/146.3	-	0.13	8-6-64
32. C3295	Nkabune	21.3	15.2/19.8	8.5	5.45	21-5-64
33. C3310	Timau	152	109.7	70	0.86	1-9-64
34. C3316	Timau	64	27.4	-	0.12	8-10-64
35. C4251	Muthambe	201	75	76.2	2.8	9-10-76
36. C4272	Muthambe	123	106-108	60.45	5.46	13-11-76
37. C3233	Kariakomo	153.5	-	73.1	5.76	26-6-76
38. C4348	Kanyakine	154	18-88	24	-	27-6-77
39. C5404	Nkunga	200	170	156	3.8	7-5-84

SOURCE: Kenya, Ministry of Water Development, 1984.

APPENDIX

TABLE II MAJOR HISTORICAL EVENTS RELEVANT TO ENVIRONMENT

MERU DISTRICT 1750-1984

1750	Meru people move into Meru District.
1803	Famine of rain (Mbara ya Ngai).
1816	Famine due to locusts.
1866	Famine due to drought (Gakiiri).
1879	Famine caused by drought (Kibatau).
1891	Famine due to locusts.
1892	First white man enters Meru District.
1903	Famine of flour (mbara ya mtu).
1908	Meru town established as a government boma. The British take over Meru.
1911	Catholics establish a base in Meru.
1913	Methodists establish a base in Meru Town.
1914	Famine due to too much sun.
1922	PCEA set up a base at Chogoria.
1929	Demonstration plots for rotation, terracing, fencing. Also the hoe campaign.
1935	Coffee planted in Meru.
1952-56	Emergency Years.
1955	Livestock Development Centre opened in Marimba.
1960	Tea planted in Meru.
1963	Political Independence in Kenya.
1965	Countrywide famine, importation of yellow maize.
1980	ood shortages - yellow maize imported.
1984	rought - Famine relief in marginal areas. Importation of yellow maize.