

**PLANNING FOR RURAL DEVELOPMENT
WITH SPECIAL REFERENCE TO THE
PROVISION OF ENERGY IN GAICHANJIRU
LOCATION. MURANGA DISTRICT.**

BY

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**A Thesis submitted in 'Part'
fulfilment for the Degree of
Master of Arts (Planning) in
the University of Nairobi.**

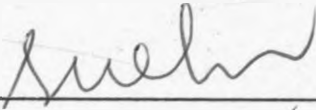
**JUNE 1985
Nairobi, Kenya.**

DECLARATION

"This Thesis is my original work and has not been presented for a degree in any other University".

Signed 
(Student)

"This Thesis has been submitted for examination with approval of University Supervisor.

Signed 
(Supervisor)

DEDICATION

This Thesis is dedicated to my parents
Mr and Mrs Mark Wainaina for their love
and many sacrifices.

AND TO

The future of parenthood.

GLOSSARY OF TERMS

1. Woodfuel - Fuelwood and charcoal
2. Fuelwood - Firewood or unprocessed Wood that is burnt.
3. Household - Number of people living in a house
4. Household use - Woodfuel burnt for household use, excluding the use in manufacturing of items for sale
5. Commercial Energy - Gas, electricity
6. Non-commercial Energy - Wood, charcoal,
7. Charcoal brigquette - Powdered charcoal struck together with a binding agent.

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Although I have received alot of help, guidance and encouragement from all the above - named persons the narrative, opinions and conclusions of this study are my own responsibility and should not be attributed to any of the above named persons or institutions. Any errors or omissions in this study are my own and are not due to any information or help that I received from all these generous individuals.

I wish to acknowledge the contribution of my brother Fackson Wainaina Kagwe to my education and well being and indeed that of the entire family. Indeed those were many sacrifices.

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Margaret Wainaina (Miss)

Urban and Regional Planning

ABSTRACT

The main focus of the study is on the role energy plays in rural development.

Kenya continuously recognises the role played by rural areas in national development and therefore the study examines the current energy situation in the location with respect to the various linkages energy has with other basic needs. The study underlines such aspects as accessibility, availability, quantities and qualities of woodfuel and location of areas as important in the acquisition of woodfuel.

The study also establishes that energy supply is a constraint in the rural development process. It is shown that the problem of rural development in the location revolves around the predominance of agriculture in a situation of land scarcity and fragmentation in the face of increasing population. It is argued that before rural development can advance sufficiently to absorb surplus rural populations the aim of rural development should be to efficiently organise resources so that they can increasingly contribute to comprehensive development in the rural areas. The study also shows that the provision of energy takes away a big portion of family incomes and this creates a conflict with the provision of other basic needs.

The study also shows that increased cultivation of the land and increased population growth and consequent land fragmentation has led to poor agricultural production. The study has found that people are increasingly walking longer distances to get fuelwood. They are using inferior types of fuelwood and indeed agricultural residues and this further contributes to low agricultural production. Further it has been found that fuelwood will

continue to be important in the location at least in the short run.

The study has also underlined the need for development without destruction. Towards these problems the study has proposed and recommended ways of maximising on the utilisation of existing resources within the study area through conservation. Measures that are suggested include:- agroforestry, family planning and fuel substitution amongst others.

The study also calls on the Government to subsidise the price of "jikos" in order to allow for faster diffusion of the technologies because presently the prices of the "jikos" are beyond the economic capability of the people. It also calls on the government to train more agricultural personnel especially for followup purposes. The study further calls for the strengthening of the service centre strategy to enhance rural development.

The study finally suggests followup research.

	<u>PAGE</u>
<u>TABLES OF CONTENTS</u>	
1. Title of Thesis	(i)
Declaration	(ii)
Dedication	(iii)
Definition of terms	(iv)
Acknowledgements	(v)
Abstract	(vii)
List of tables	XII
List of figures	XIII
List of Maps	XIV
List of charts	XV
Plates	XVI
Appendix	XVII
2. <u>CHAPTER ONE - INTRODUCTION</u>	
1.0 Problem Statement	1
1.1 Energy Crisis	1
1.1.1 Kenya Energy Situation	5
1.1.2 Locational Energy Situation	8
1.2 Objectives of the Study	10
1.3 Study Assumptions	11
1.4 Scope of the Study	12
1.5 Literature Review	13
1.6 Research Methodology	23
1.6.1 Questionnaire	23
1.6.2 Participant Observation	24
1.6.3 Primary and Secondary Sources of Information	24
1.6.4 Limitations	25
3. <u>CHAPTER TWO-ENERGY AND RURAL DEVELOPEMTN</u>	
2.0 Introduction	28
2.1 Rural Development Strategy	30
2.2 The role of Energy in rural development	34
2.3 National Energy policy options	37

(X)

<u>4. CHAPTER THREE - STUDY AREA</u>	<u>PAGE</u>
3.0 Location and Extent	42
3.1 Age, Sex Structure and Migration	46
3.2 Future Demographic Development	49
3.3 Relief and Drainage	50
3.4 Agro - ecological zone	52
3.5 Climate in the Agro - ecological zone	56
3.6 Soils and geology	56
3.7 Vegetation and land use	58
3.7.1 Wood and Bushed grassland	58
3.8 Socio-economic characteristics	58
3.8.1 Educational Institutions (primary schools)	58
3.8.2 Secondary Schools	59
3.8.3 Village Polytechnics	59
3.8.4 Administrative Centre	60
3.8.5 Agro Based Industries	60
3.8.6 Health Institutions	61
3.9 Agriculture in the location	62
3.9.1 Size of holdings and available Manpower	62
3.9.2 Current state of agricultural production	63
3.10 Commercial Activities	64
3.11 Transportation and Communications	64
3.12 Electricity	66
3.13 Women groups (Harambee)	66
3.14 Land tenure and Agricultural production	68
3.15 Problems of rural development in the location	70
<u>5. CHAPTER FOUR - GAICHANJIRU CURRENT SUPPLY SYSTEMS</u>	
4.0 The search for firewood	74
4.1 Potential sources of Energy in the location	75
4.2 Energy demand	78

	<u>PAGE</u>
4.3 Energy consumption (types of Energy used and end use devices)	78
4.4 Procurement of firewood	83
4.5 Distances to the sources of fuelwood	84
4.6 Selling prices for fuelwood	85
4.7 Rural household charcoal use	86
4.8 Selling prices for charcoal	87
4.9 Commercial Energy sources	87
6. <u>CHAPTER FIVE - CAUSES OF ENERGY SHORTAGE</u>	
5.0 Fuelwood. Causes for its shortage	89
5.1 Charcoal. Causes for its shortage	93
5.2 Impact of the shortage of woodfuel	95
5.3 Environmental effects	96
7. <u>CHAPTER SIX - POLICY IMPLICATIONS AND RECOMMENDATIONS</u>	98
6.0 Introduction	98
6.1 The need for conservation	98
6.2 Family planning	99
6.3 Overdependence on fuelwood and Agricultural Residue	101
6.4 Agroforestry	103
6.5 Recommendations on improved "jikos"	107
6.6 On the rural/urban relationship	109
6.7 National level	112
6.8 Research priorities	113
8. <u>CHAPTER SEVEN -SUMMARY AND CONCLUSIONS</u>	
7.0 Introduction	115
7.1 Conclusions	120
7.2 Bibliography	122
7.3 Appendix	131

XII

<u>LIST OF TABLES</u>	<u>PAGE</u>
1. Kenya. National wooduse picture 1983	6
2. Kenya. Classification of forest land 1975	7
3. Kandara division. estimates of population density for 1976 and 1982.	45
4. Muranga district. Population distribution by 1969 and 1979	45
5. Gaichanjiru location. Age/Sex structure in 1969	46
6. Kandara division. Age/Sex structure in 1969	47
7. Kandara division and Kenya. Age/Sex structure compared. 1976	48
8. Gaichanjiru location. Climate in the Agro - ecological zone	55
9. Kandara division. Farm sizes and families 1975	62
10. Gaichanjiru location. Participation in harambee groups in 1975	66
11. Gaichanjiru location. 4 - K club Activities in 1974 - 75	67
12. Kandara division. Gross Agricultural production in 1971	69
13. Gaichanjiru location. Sexual division of labour	74
14. Gaichanjiru location. Household uses of energy by fuel type	82
15. Gaichanjiru location. Distances walked to collect firewood by sub-location	84
16. Gaichanjiru location. Basic needs with which fuelwood is in conflict	90

<u>LIST OF FIGURES</u>	<u>PAGE</u>
1. Developing country exports. Purchasing power (1970, 1971, 1980, 1981)	20
2. The world. The threat from Desertification	21
3. The world. Influences on the environment	22
4. Gaichanjiru location. Cross sections between (i) Kariguini and Kagire centres (2) Githunguri and Mariaini centres	54

XIV

<u>LIST OF MAPS</u>	<u>PAGE</u>
1. Gaichanjiru location in National Context	9
2. Gaichanjiru location in Regional Context	43
3. Gaichanjiru location. Existing land uses	44
4. Gaichanjiru location. Drainage	51
5. Gaichanjiru location. Agro-ecological zone	53
6. Gaichanjiru location. Communications and Market Centres	65

XV

LIST OF CHARTS

PAGE

1. Kandara division. Current state of agricultural production 63
2. Gaichanjiru location. estimated average rural household sources. 83
3. Partial flow chart for environmental impacts of tree removal 102
4. Energy policy formulation model. 111

<u>PLATES</u>		<u>PAGE</u>
Plate 1.	Sawdust	77
Plate 2.	Improved jiko for sawdust use	77
Plate 3.	Women carrying firewood	80
Plate 4.	Wheelbarrows are also used for carrying firewood	80
Plate 5.	Traditional charcoal jiko	81
Plate 6.	Kenya ceramic jiko	81
Plate 7.	An example of types of firewood sold	88
Plate 8.	Women carrying sisal leaves	88
Plate 9.	Deforestation and soil erosion	97
Plate 10.	Deforestation and soil erosion	97
Plate 11.	Agroforestry	106
Plate 12.	Agroforestry	106

<u>APPENDIX</u>	<u>PAGE</u>
Appendix 1. Questionnaire	131

2 Chapter One - INTRODUCTION

1.0 Problem Statement

1.2 Energy Crisis

The emergence and development of civilisation has been closely associated with an increase in per capita consumption of energy, whether in the use of tools, weapons or cultivation of the land. Although animal, water and wind power helped in the evolution of man as a dominant species, there is no doubt whatsoever that the controlled use of fire was one of the things that led to civilisation.

Reynolds and Pierson have stated that where forests were available to be "mined", fuelwood opened up land for colonisation in all areas of the world by making available energy for man's survival in territories. They further say that in the United States of America (U.S.A) from the earliest settlement until 1900 fuelwood was practically indispensable to a large part of the society. Besides domestic heating and cooking wood was used as locomotive fuel and for generating steam and later electricity in industrial establishments.

They further report that on the basis of wood consumed in the 300 years of American history fuelwood accounted for more than half (estimated 28 billion cubic metres of standing volume) of the total volume cut from the forests and for more than twice as much as sawn timber.¹

Moss and Morgan (1980) argued that the world is in the midst of an energy crisis which threatens the continued existence of high standards of living in the more developed countries and which may prevent further development in the less developed countries

or even bring decline. The world's energy resources are largely finite. This is because the world has developed a dependence mainly on fossil fuels to achieve the industrial growth and high farm productivity characteristic of the more developed world. They further say that the global energy problem for the next two decades at least is hardly an immediate problem of a general shortage of energy resources. It is a problem of restricted supply combined with rising demand for one particular fuel - oil, and the economic and political issues which are involved.²

Attiga has said that the oil crisis began in 1973 with the formation of the organisation of petroleum exporting countries (O.P.E.C). Prices are now rapidly increasing that is \$2 per barrel in 1973 and over \$30 per barrel today. There is also reduced supply, reduced reliability of supply either for political motives or in order to defer gains to a more advantageous time. O.P.E.C action may be said merely to have precipitated a situation which would have occurred in the near future. It may also be claimed to have pushed many developing countries into coping with their energy problems before another 20 - 30 years of forest destruction could take place.³

Attiga has also argued that the United States energy consumption is as important a controlling factor in world oil crisis as O.P.E.C production. While the decisions of other power groups, particularly trading groups like the European Economic Community (E.E.C) countries are also important their effect on the oil crisis is much less. The decisions of the developing countries except in so far as they have other political implications are of little or no consequence in the issues of oil supply. The more developed

countries have raised the prices of their industrial goods so that the trading systems of the industrial nations and the oil producing nations have constantly promoted world-wide inflation, meeting its most serious levels in the third world countries, dependent on industrial and oil imports to sustain the development programmes began before the oil crisis. In their weak bargaining position they have little defence against rising prices of the mainly raw material goods which they export in return. Attempts to create equivalent organisations to O.P.E.C amongst the producers of other raw materials have so far achieved little success.⁴

In "the state of the Environment" the United Nations Environment Programme (U.N.E.P) has highlighted on the fact that the changed perceptions about the energy issue have led people to question how supplies of non-renewable fossil fuels would be available at acceptable prices and how such resources would last. In 1980 it was estimated that the worlds proved recoverable coal reserves would suffice for about 230 years at current consumption rates. Proved recoverable reserves of oil and gas were small; at the 1980 consumption rates, oil supplies would last for only 30 years. Gas supplies would last for about 50 years. Thus by the decades end it was very clear that new mixes of energy sources would be needed in future, that energy and environment relationships must be incorporated in national planning and that something must be done to increase the efficiency of energy production and reduce waste.⁵

It is further stated in the same text that the 1970's also saw another crisis popularly referred to as the other energy crisis. This was woodfuel which

provided 30 - 90% of the total energy used in developing countries. Debate about nuclear power generation which had began in the late 1960's in the United States was renewed also in the 1970's. By 1979 Nuclear energy provided about 7.6% of the worlds electrical power. There was uncertainty about the adequacy of uranium reserves for the future and this saw the birth of interest in alternative nuclear fuel cycles. Other renewable energy sources that have attracted increasing attention since the 1970's include hydropower, geothermal, solar, tidal, wave and windpower.⁶

Moss and Morgan has said that in the Mid - 1970's the world population was 4,000 million growing at 1.8% a year. At that rate it would double in 38 years with 900 million people being added by 1985 and thus it is 4,900 million people today. The growth rate in the developing countries is 2.7% and is expected to double in 26 years. The above high rise in population growth has serious repercussions on the availability of resources in general and energy in particular. It means that immediate actions have to be taken regarding the whole arena of national planning for resources.⁷

Kenya Energy Situation

Don Shakow and Phil Okeefe have said that Kenyas energy and development situation is a function of two sets of circumstances. The first is an economic structure rooted in 80 years of colonial rule and reinforced by its present development path. This is buttressed by a pattern of land use governed by the continued privatization of the countrys' limited endowments of natural resources.⁸

They further say that this energy situation has reached a crisis level but that Kenya is not unique in this, other developing countries are also faced with the same. They point out that the energy crisis is double edged and that it seriously affects both the modern, industrial and the rural sectors. They say that Kenya needs energy for development and energy for survival, but increasingly she finds that the energy crisis, fueled by a shrinking resource base cripples efforts to meet development goals while ensuring energy supplies.⁹

On Kenyas population growth the Beijer Institute has said that the rapidly growing population and rate of urbanisation have made Kenya particularly vulnerable to woodfuel shortages. At the present 4% annual rate of population increase, Kenyas population will double to 30 million by the year 2000, while the urban population which stands at the rate of 8 - 9% will have doubled by 1992.¹⁰

The institute has also reported that at present 40% of the country's earnings are spent on importing oil and only 6% of the population has electricity. They have projected energy demand to grow at 4.7% a year. Woodfuel (fuelwood and charcoal) is the most important energy source in Kenya. They have said that it accounts for about 75% of all requirements. This energy is indigenous coming largely from natural woodlands and forests with only a small proportion being supplied from Plantations.¹¹

The Institute has further estimated that Kenya has 19 million tonnes of wood a year which is available for

both heating and lighting. At present 5.7 million tonnes of wood a year is being drawn from the country's woodstock. By the year 2000 the figure will have risen to 16 million tonnes and the country will have a deficit of 30.6 million tonnes or 65% of wood demand as yield stock will be used up.¹²

The high population growth rate has been attributed to increasing fertility rates as well as declining mortality rates. This state of affairs has a range of socio-economic effects. It increases pressure on the land and on other resources and there is also increased fragmentation of the land. Increased clearing of the land for cultivation and the usually poor farming practices highly enhance the rate of soil erosion. This consequently lowers crop production and in fact productivity and development in general drops. The dependency burden increases as the proportion aged under 15 years increases. The resulting high rate of growth of the labour force complicates the problem of unemployment. Thus the increasing population requires more resources to meet basic needs such as energy, food, education, health care, water supply and housing.¹³

The situation of wood use as of 1983 looked as follows:-

TABLE No. 1

	1983	2000
Rural Population	13m	22m
Rural Wood Use	13m tonnes	22m tonnes
Urban Population	2m	8m
Urban Wood Use	6m tonnes	24m tonnes
Total Population	15m	30m
Total Wood Use	19m tonnes	46m tonnes

SOURCE: The Beijer Institute and the Ministry of Energy and Regional Development.

TABLE No. 2

The following table shows the classification of forest land in Kenya in 1975.

CLASS	AREA IN HECTARES
GAZETTED FORESTS	
Closed	953,000
Woodland	339,000
Bamboo	150,000
Grassland	204,000
Mangrove	45,000
	<hr/>
	1,691,000
Other	59,000
Private	124,000
	<hr/>
Total Forest Area	1,874,000
Total Country Area	59,604,000

SOURCE: Kenya Statistical Abstract, 1976

The current National development plan (1984-88) reports that the traditional role of forests in Kenya has been to provide people with fuelwood and raw materials for buildings, tools and implements. However technical and industrial development has resulted in forests being used extensively as raw materials for mechanical and chemical wood based industries, producing sawn timber panels, boards, pulp and paper.¹⁴

The President of the Republic of Kenya His Excellency President Daniel Arap Moi summed up the acuteness of the ecological degradation problem in Kenya in the following statement. "Our land and its great variety of plant and animal species is one of Kenya's greatest assets. These natural resources which are so crucial to the future wellbeing of our nation are however under the threat of desertification, destruction and even possible extinction".¹⁵

1.1.2 Locational Energy Situation

Since the International and National levels are too broad there is a need to study the local perspective in a more detailed manner. Within the Kenyan situation it has been found necessary to take a case study of Gaichanjiru location in Muranga District. This has been found representative of a typical localised rural community for the purpose of examining the typical energy problems experienced at this level. Further the factors which determine the process of energy supply with a view to providing information or light to the scope and magnitude of the energy problem at such a localised level.






It is hoped that this can give an opportunity for the determination of more effective approaches to energy supply and therefore a better understanding of the energy related problems.

PLANNING FOR RURAL DEVELOPMENT WITH SPECIAL REFERENCE TO THE PROVISION OF ENERGY IN GAICHANJIRU LOCATION.

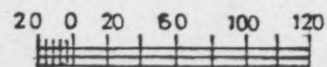


GAICHANJIRU
LOCATION:
NATIONAL CONTEXT

LEGEND:

-  INTERNATIONAL BOUNDARY
-  PROVINCIAL BOUNDARY
-  DISTRICT BOUNDARY
-  MURANGA DISTRICT
-  GAICHANJIRU LOCATION

SCALE 1:4,500,000



Map No.
1

(Source: NATIONAL ATLAS OF KENYA, Ed. 1970)

1.2 Objectives of the Study

1. To examine the current energy situation in the location.
2. To examine the problems of rural development in Gaichanjiru location with particular reference to the supply and use of energy.
3. To examine the factors accounting for the energy problems in the location.
4. To suggest measures for meeting future energy needs in the location and the creation of an awareness of energy planning and conservation.

1.3 Study Assumptions

1. Rapid and increased population growth is a major contributory factor to the continued clearing of vegetation for cultivation.

This enhances the need for increased energy supply and production of food crops while at the same time it has negative effects on the potentiality of the land and this leads to low agricultural productivity.

2. Agroforestry as a conservation measure plays a dual role in providing energy and also enriching the soils.
3. The provision of energy and its use must be intergrated with other sectors of development and institutional set ups in order to attain comprehensive development.

1.4. Scope of the Study

The study focuses on the role of energy in rural development. It examines both the problems of rural development and rural energy supply in Gaichanjiru location of Muranga District. It further examines the factors explaining the energy problems and suggests measures for meeting the future energy needs of the area and the need for the creation of awareness of energy conservation.

The first chapter is devoted to a general examination of the nature of the energy problem, objectives, scope, literature review and study methodology.

The second chapter is on general rural development as a concept and the role energy plays in rural development.

The third chapter is a description of the location and size of the study area, demographic, geographic and the socio-economic characteristics of the area.

The fourth chapter highlights on the Gaichanjiru location energy supply systems.

The fifth chapter is a look at the woodfuel shortages and the reasons thereof and impacts arising out of the shortages.

The sixth chapter is on policy implications and recommendations.

The seventh and last chapter is on summary and conclusions.

1.4 Literature Review

Since the 1970's, governments, non-governmental organisations and other interested individuals have tried to address the issue of energy, its demand and supply patterns and the future of it.

However those efforts have largely been frustrated by the lack of a definite and clear cut policy on energy conservation. However the Ministry of Energy and Regional Development has recently come up with a policy document which has not yet been made official.

All the same despite the absence of an energy policy many works and researches have been done that might relate directly or indirectly to this particular study and the following are worthy of mention.

Moss and Morgan have stated that the study of rural energy production and supply is of particular importance in that it affects both economic and social change greatly. There is a close relationship between development and non-commercial energy use but between commercial energy (mainly non-renewable fuels, hydro-electric and Nuclear power and gross national product the relationship is less clear amongst the developing countries which includes the study area in question. Several of the African countries are particularly low on both the energy and gross national product scales. Low levels of energy production and supply mean a dependence on human and animal labour and low levels of agricultural production. A low level of development in turn limits the use of available energy and restricts both the choice of fuels and the introduction of more modern and flexible forms of energy supply. There is little likelihood in most of the developing countries of a reduction in the demand for fuelwood in the next decade. There are problems of the high rate of population growth, rising prices of alternative fuels and difficulties of supply. Other problems include those

of developing and applying new energy technologies and these suggest that wood consumption will increase. This is likely to be at a scale which will create production and distribution problems and will be accompanied by ecological degradation.¹⁶ These factors are true in the location.

Adeyoju (1975) has said that 3rd world energy problems are concerned mainly with the maintenance and improvement of energy supply while at the same time finding the extra energy needed for development. This supply has to be adequate, not only in quantity but in the several different forms required. He continues to say that frequently in the literature on the subject, lack of adequate data has led to gross assumptions concerning the nature of third world rural economies. Broadly the arguments are that rural areas are largely subsistent in their economic activities. Rural areas receive some goods supplied by urban areas such as Kerosene for lighting and cooking and gas. Otherwise they depend on their own wood, crop stalks and animal dung for their various energy needs. Their use of such resources depends on availability which in turn is related to the quality of the environment and the density of population.¹⁷ Again this relates directly to the study area.

Haswell has said that although energy provision is one of the most fundamental aspects of economic development, until recently energy issues were largely ignored by the development economists who preferred to concentrate mainly on problems of industrial growth, mining, import substitution and food production. Moreover, the rural areas were additionally inhibited in achieving development by the resource immobility. Their lack of knowledge of the techniques needed to improve even the agriculture on which they depend, their lack of entrepreneurship and inventiveness.¹⁸

In 1979 the world bank report on world development referred to firewood, charcoal, plant and animal residues as non-commercial energy although it also admitted that they were often bought and sold. It further says that there is an acute scarcity of reliable information and this calls for more attention to data gathering and research. Unfortunately, not only have field surveys mostly been lacking, but those that have taken place have had to face major difficulties of measurement due to variation in quality of species, variation in moisture content and the problems of measuring with any accuracy the various bundles of stacks of wood.¹⁹

Earl has said that rural energy production includes wood, crop residue, animal dung, the waste from processing certain fruits and nuts, vegetable oils, the by products of processing certain plant materials for example sugarcane, maizestalks, cassava stalks, bean stalks and so on. Wood, charcoal, sawdust and bark constitute other forms of rural energy. Of these wood is probably the most important accounting for 83% of non-commercial energy. Rates of wood production and consumption vary considerably with wood availability, the availability of alternative fuels, cooking habits, heating requirements, quality of available wood, preference for fuelwood or charcoal, and the choice of the cooking stove. The estimates which are available are based on visual estimates at a particular moment. Important details such as seasonal variation, the determination of the general pattern of wood use and its relationship to other fuels is usually lacking.²⁰

The world bank further says that fuelwood consists mainly of carbon and oxygen with a variable proportion of moisture. Most species burn but they vary in their quantities such as calorific value, tendency to spark,

tendency to smoke and effectiveness as different forms of processed fuels or in different kinds of stoves. There are therefore preferred fuelwood species particularly in the commercial supply to towns. Wood can be burned in open fires and the rate here is often difficult to control. Charcoal is advantageous because it produces more heat and can be effectively controlled and produces little smoke.²¹

O'Keefe on land tenure and fuelwood in Kenya has said that there has been a reduction in access to forests as individual land ownership has been acquired.²² This is true in the location. Martha Novick on energy scarcities and African Development has said that demand management and energy conservation are frequently held out as important partial solutions for the developing countries in their struggle with the energy crisis conditions. She raises an important question on whether conservation and demand management will be sufficient or even marginally effective in reducing the growth in energy expenditures and consumption. She asks another basic question on whether basic changes in the structure and direction of development are not necessary in order to alter patterns of energy consumption in a more lasting way. The author contends that the answer to this question is crucial for the planning and investment programmes of developing countries. The increasing prices of oil in the third world have threatened whole economies of some countries. The very security of nations, to say nothing about the welfare of millions of third world people will be at stake. O.P.E.C Nations appear to be oblivious to the harm they are causing.²³

Supporting evidence in our local newspaper say that "the 16% to 24% increase announced recently is expected to add \$2 billion to the trade deficit to African nations -----the higher costs have the developing countries with politically difficult options. They can scale down development plans. They can force citizens to make painful sacrifices in consumption through higher prices or rationing or some, the wealthiest, can go deeper into debt by borrowing from commercial and multinational banks.²⁴

As regards the issue of balance of payments the quarterly economic review of 1980 said that although it is extremely difficult to disaggregate petroleum imports from the other factors active in a country's balance of payments dilemma, it is clear that for many sub-saharan African countries, oil imports have exacerbated if not precipitated crisis. All but the strongest exporters have experienced growing deficits as a result of the price increases and some including Kenya, Madagascar, Tanzania, Mozambique, Zambia, Ghana and the Sudan have had acute difficulties with payments.²⁵

The United Nations in 1979 said that the degree of impact of a balance of payments deficit varies with the share of petroleum in the overall import bill, the prospects for exports of goods and services, the cushion of already accumulated foreign exchange reserves, the prospects for capital inflow and measures to restrain the demand for imported fuel, either through substitution, where ever possible by indigenous energy supplies.²⁶

Brokensha has reported that Kenyans in the Mbere division of the Kirinyaga District have been forced to modify their former wood-burning habits and that wood

use changes depending on the availability of supply and patterns of land adjudication. Firewood in mbeere division first appeared for sale in 1976. Previously firewood was gathered as a free good although persons with higher incomes could make financial arrangements to be supplied. Local views greatly changed because previously the sale of firewood for income had been regarded as a sign of poverty but today trees are regarded as an acceptable source of cash revenue.²⁷

David Hughart has observed that the poorest of the poor in the rural areas will be the hardest hit by the energy scarcity. This is because they tend to use less energy or spend more time developing energy sources or reducing other necessary expenditures.²⁸

Effects of the fuelwood scarcity on nutrition and health of the people is already evident in some West African rural areas where there is now a trend to reduce the number of daily cooked meals from two to one. The idea of cooking food for less than the desired length of time is another response to fuel saving. This can be nutritionally damaging as most grains need longer cooking times in order to break down into nutrient substances. In parts of West Africa, observers have noted a tendency to cook meat less thoroughly thus increasing the likelihood of parasitic diseases.

On the vicious cycle of environment degradation, poor agricultural practices and deforestation Spears has noted that as population pressure increases larger areas of forest will be cleared to create land for cultivation or grazing. Continuous fuelwood collection and the harvesting of commercial timber add to the pace of uncontrolled deforestation. The results particularly

in densely populated areas include soil erosion, flash flooding, drying up of perennial streams and desertification. The problem is worsened when people substitute animal dung and crop residues for scarce firewood, they decrease the fertility of their land. As traditional sources of fuel become more expensive and more difficult to obtain people will be more willing to change their customary ways. Others trends will probably encompass the acceptance of small scale technologies of renewable energy if they can be introduced with sensitivity to cultural factors.²⁹

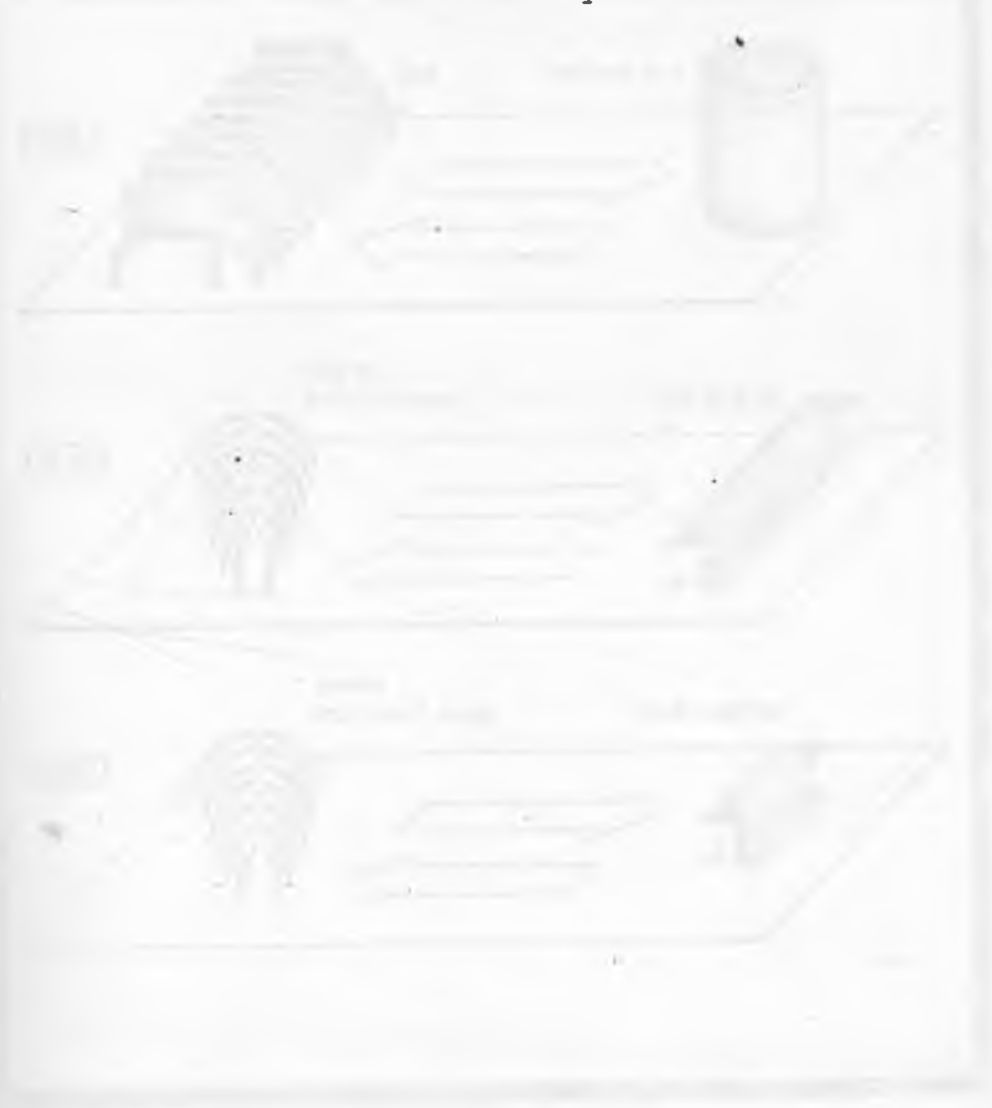


FIGURE 1

3 Purchasing power of developing country exports

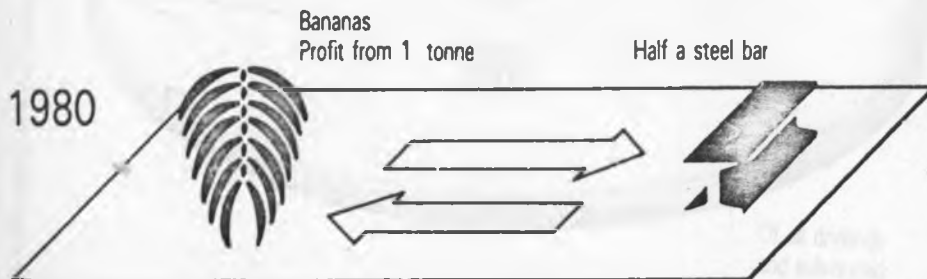
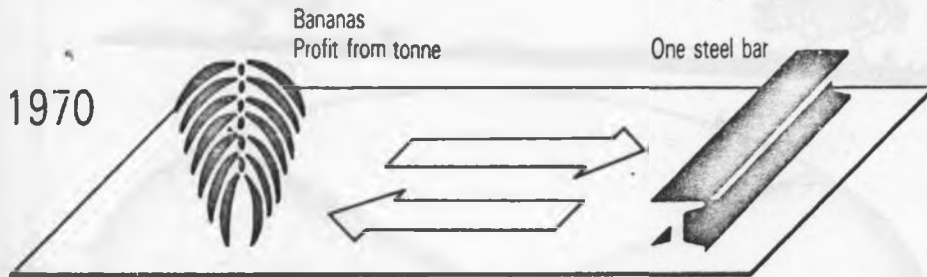
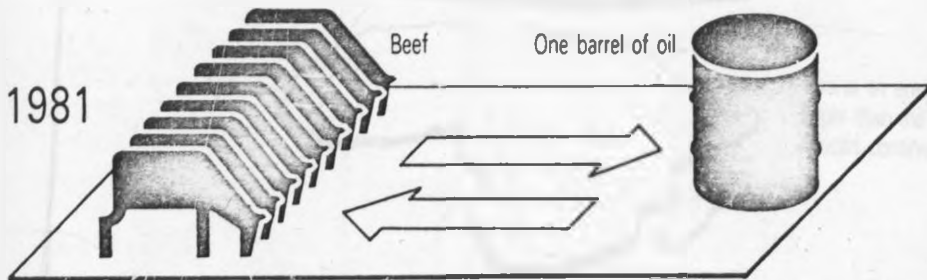
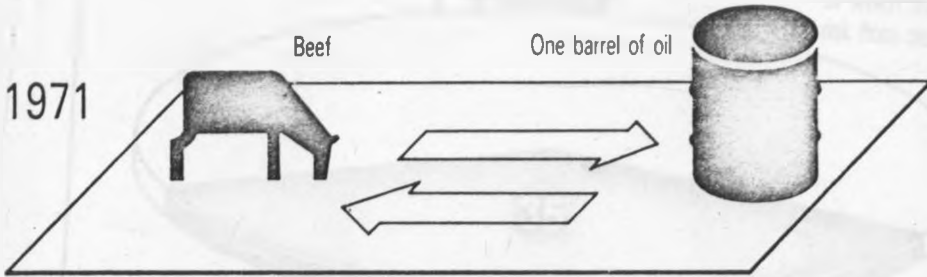
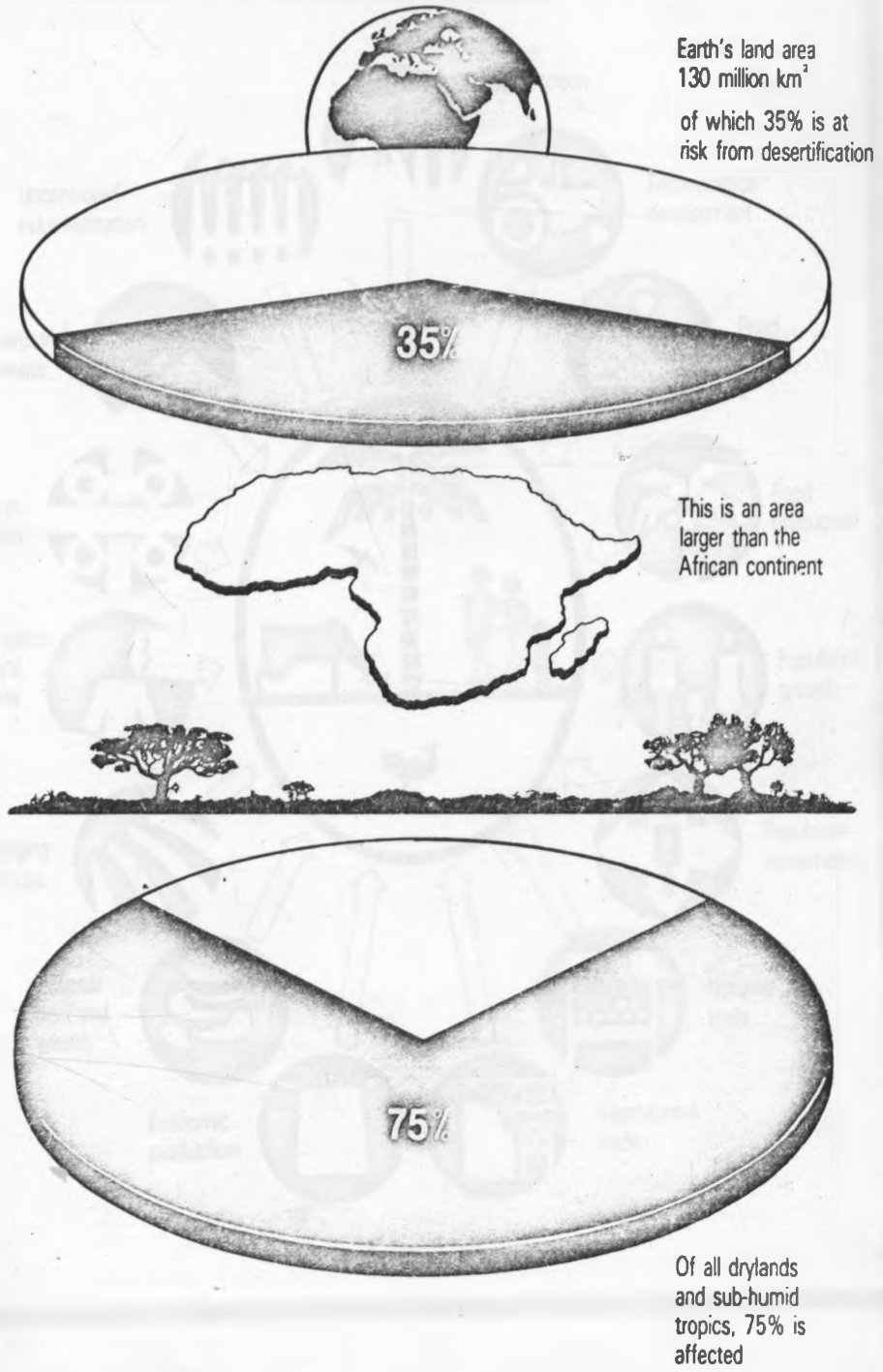


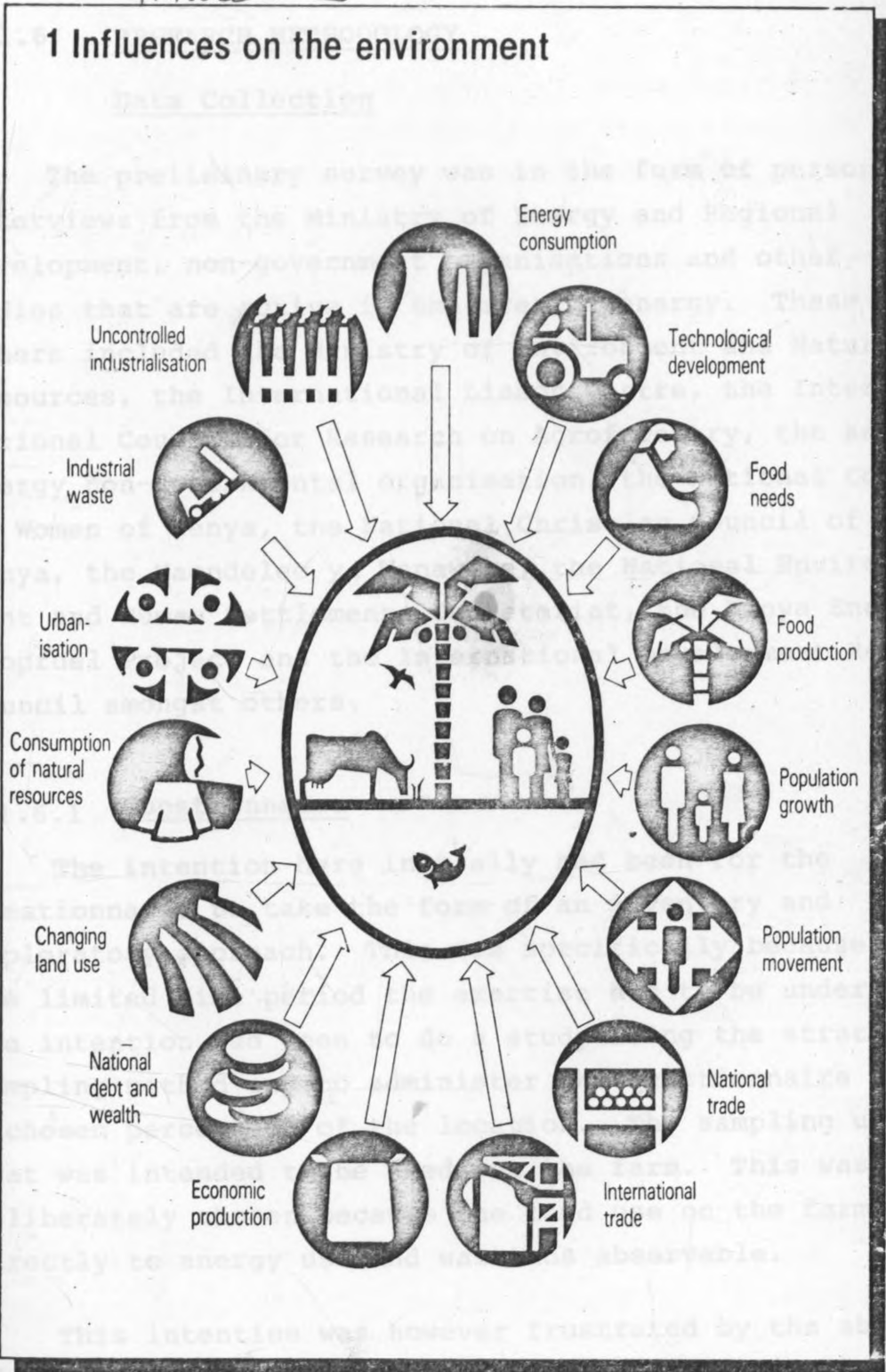
FIGURE - 2

8 The threat from desertification



SOURCE: UNEP

FIGURE - 3



SOURCE : UNEP

1.6 RESEARCH METHODOLOGY

Data Collection

The preliminary survey was in the form of personal interviews from the Ministry of Energy and Regional Development, non-government organisations and other bodies that are active in the area of energy. These others included the Ministry of Environment and Natural Resources, the International Liason Centre, the International Council for Research on Agroforestry, the Kenya Energy non-governmental organisation, the National Council of Women of Kenya, the National Christian Council of Kenya, the Maendeleo ya Wanawake, the National Environment and Human Settlements Secretariat, the Kenya Energy woodfuel Project and the International Development Research Council amongst others.

1.6.1 Questionnaire

The intention here initially had been for the questionnaire to take the form of an inventory and exploratory approach. This was specifically because of the limited time period the exercise had to be undertaken. The intention had been to do a study using the stratified sampling method and to administer the questionnaire to a chosen percentage of the location. The sampling unit that was intended to be used was the farm. This was deliberately chosen because the land use on the farm related directly to energy use and was thus observable.

This intention was however frustrated by the absence of the grown ups in the homes at the time the study was undertaken. They are actively engaged almost all the year round working in the coffee plantation neighbouring the lower side. The method was abandoned in favour of Mass interviewing at "barazas", market places, church gatherings and in the women group meetings. This method proved a great success especially with the help of the

local administration.

The question were directed at establishing the present energy resources in the study area, the energy consumption patterns, the socio-economic characteristics of the people, peoples perceptions of the problems related to the use of energy and its availability and the future of energy in the area.

In interviewing general information about household uses of energy was sought. An attempt was made to get feelings and opinions of the respondents especially the women about a variety of issues. For example their satisfaction or dissatisfaction with their present fuels and cooking devices, their perceptions of problems related to fuel availability and their expressed needs and preferences regarding future energy practices.

1.6.2 Participant Observation

In this method an attempt was made at recording general information about village characteristics, actual practices associated with fuel collection and use, general land use and agricultural practices and their resultant effects on the land.

1.6.3 Primary and Secondary Sources of Information

This included collection of information from relevant government Ministries, non-governmental organisations, official documents and public reports.

1.6.4 Limitations

The non-availability of information due to the absence of representative respondents from households has greatly limited the accuracy that was otherwise intended in this study. Also limiting was the lack of data on energy at the locational level. The use of a questionnaire in households was not achieved due to the factor of limited time. The author had only four weeks in the field and a study of this nature requires more time in order to record actual amounts of wood used say for breakfast, lunch and supper. Also more time is needed to observe better seasonality changes in the use of woodfuel.

Transportation to the various sublocations was another handicap due to the infrequent and sometimes total lack of any form of transportation.

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Chapter Two

ENERGY AND RURAL DEVELOPMENT

2.0 Introduction

Uma lele has said that countries in the third world continuously recognise the role played by rural areas in national development. The food and agricultural organisation of the United Nations has as its third objective in the constitution as bettering the conditions of rural populations. Hence the need for bettering the rural areas is of international concern. In Africa South of the Sahara this has been justified by the fact that between 85 and 95% of the nearly 320 million people in the area live in the rural areas.¹ Most of them survive on very low incomes if any which are largely based on low productivity agriculture and livestock. Their production is oriented mainly towards subsistence needs as agriculture constitutes the largest sector in their gross national product. By emphasising on rural development, the governments recognise this process as a way of steering overall economic growth.

Uma lele has said that Kenya like other developing countries of the third world, has 90% of her population living in rural areas of which 70% consists of small-holder farmers whose gross annual per capita income is more than Kshs. 500/=, 2% are landless and 12% are semi-nomads. That the mainstay of the economy is agriculture stresses the importance of increasing rural productivity. Consequently there has been increasing consideration given to the rural sector in the drawing of national objectives, as has been reiterated in the National Development Plans.²

The current development plan has stressed that the key strategy is to direct an increasing share of the total resources available to the Nation towards development of the rural areas.³

Philip Mbithi, while giving an insight into the historical perspectives of this strategy, observes that it is due to the cumulation of rural problems that the subsequent tailoring of policies and programmes to remedy these problems has been a major preoccupation of the Independent Kenya Government.⁴

Hence it has been a fundamental objective of the Government to improve the overall standard of rural life by fighting what is commonly regarded as the three evils - Disease, Ignorance and Poverty. These are the very factors that characterise life in rural areas, the ones which rural development strategies have to address themselves to. The rural sector is faced by many problems that are attributed to:-

- (a) Existence of poor resources for development.
- (b) Underdevelopment of resources.
- (c) Rapid growth of rural population with the national growth rate approximated at 4.1% per annum
- (d) High population densities which reduce agricultural production per capita and
- (e) Low income levels that are attributed to:-
 - (i) Lack of Capital
 - (ii) Lack of essential inputs
 - (iii) Marketing problems
 - (iv) Lack of skills in management and production
 - (v) Poor production methods.

The Kenya Government has used several strategies to improve the overall economic conditions of the rural population. These include the special rural Development programmes, District Development planning - especially with the new strategy of District focus for rural development, Rural Water programmes, Rural Electrification programmes, Rural Access Road programmes, and the Establishment of Cooperative Societies among others.⁵

2.1 Rural Development Strategy

In an all embracing sense rural development is a comprehensive approach to a better balanced, broader based development approach in the rural areas.

Rural development as a strategy may also be described as a set of economic and social development activities peculiar to the process of transforming the traditional sector as a whole. These activities require a set of planning techniques different from those used for the modern sector. It also includes activities outside the agricultural sector which require rural community activity. These include the building and the maintenance of feeder roads, village schools, and clinics among other community activities. Included also is the promotion of family planning and family well being.⁶

Uma lele has defined rural development as improving the living standards of the Mass of the low income population residing in the rural areas and making the process of their development self sustaining. She says that the improvement of the standards of the subsistence population involves:-

- (1) The mobilisation and allocation of resources so as to reach a desirable balance over time between the welfare and productive services available to the subsistence rural sector.
- (2) Mass participation requires that resources be allocated to low - income regions and classes and that the productive and social services actually reach them.
- (3) Making the process self sustaining requires development of the appropriate skills and implementing capacity and the presence of institutions at the local, regional and National

levels to ensure the effective use of existing resources and to foster the mobilisation of additional financial and human resources for continued development of the subsistence sector.⁷

In its goals for the second development decade the United Nations equated development with the far reaching transformation of the socio-political and economic structures, Institutional relationships and processes in the rural areas. This is of course linked to the overall development of a people or a Nation in accordance with their aspirations choices and resource endowments.⁸

The full and efficient utilisation of available resources has been a recurring theme in many policy documents since independence. The current development plan (1984-88) has in fact as its theme the mobilising of domestic resources for equitable development.⁹

The government sees rural development as a means of affecting balanced economic development, creation of employment opportunities as a means of facilitating the local people to participate in the development process.

Thus broadly stated the goal of National development is the social and economic transformation of all the people and sectors of the economy for their well being and advancement. To this end the current National development plan (1984-88) has as its basic strategy the alleviation of poverty and the provision of incentives and income earning opportunities to the people in the rural areas.¹⁰

On the rural- Urban balance the current National development plan says that the greatest potential for increasing the National output lies in the rural areas, where over 80% of the Nations population resides.

Moreover effective rural development is an antidote for excessive migration to the urban centres and hence serves indirectly to alleviate poverty in the urban areas. The plan further says that the rural areas depend critically on linkages between the rural areas and urban areas. The latter provide markets for rural production and are the sources of inputs for rural activities and consumer goods for rural households. Hence rural development requires ready access to urban markets because without that access the rural people cannot aspire to more than a pure subsistence livelihood.¹¹

Uma lele says that rural development as a strategy has of recent received a lot of attention as seen in:-

- (1) an explicit interest in promoting participation of the lowest income groups through rural development programs.
- (2) development has been viewed more broadly from the perspective of improved welfare as well as of increasing agricultural production.
- (3) there has been a clear recognition of the financial, manpower and institutional constraints encountered in rural development.

The above the author says has identified the need to find ways of making maximum use of these resources and of augmenting the existing rural potential over time.¹²

An even more recent rural development strategy is the District focus for rural development. It is based on the principle of a complementary relationship between ministries representing a sectoral approach to development and the district where the various sectors are joined in common support of rural development activities. The responsibility for the operational

aspects of district specific rural development projects has been delegated to the districts, but the responsibility for broad policies and the planning and implementation of multi-district and National programmes will remain with the Ministries.

The main objective of the strategy is to broaden the base of rural development and encourage local initiatives that will complement the Ministries role in order to improve problem identification, resource mobilisation and project implementation at the local level.¹³

The Role of Energy in Rural Development

One way of looking at the link between Energy and rural development is to examine the problems arising from the continued mining of forests and vegetation cover, the problems encountered in the supply of energy and the continued reduction of the resource base. Other related problems include the resulting environmental damage and degradation, the rising fuel costs, the competition with other basic needs and the resulting long term implications of food shortages, drought and desertification..

An attempt at examining the above shows that it is of considerable scope and touches on almost every aspects of the development process.

The study of rural energy production is of particular importance in Kenya in view of the extreme dependence of most of the rural areas on local energy resources. This importance can be further seen through the ways in which the exploitation of the energy resources affects both economic and social change. In Kenyan rural areas wood is the chief domestic fuel. It is also an important fuel for a large part of the urban population and has now acquired a commercial value. In Kenya and particularly the study area, the high rate of population growth, rising prices of alternative fuels, competition of energy with other basic needs, the difficulties of supply together with major problems of developing and applying new energy technologies suggest that wood consumption will increase

Studies have shown that this increase in wood consumption will increase at a scale which will create production and distribution problems which will be

accompanied by both ecological and environmental degradation.

The United Nations Centre on new and renewable sources of Energy reported that woodfuel is the single most important energy source in Kenya and it accounts for about 75% of all its requirements. This resource is indigenous and it comes from the national woodlands and forests with only a small proportion being supplied from government owned plantations. These natural forest areas are being depleted firstly to make more land available for agriculture and secondly because in many areas more than the equilibrium supply of wood is removed thus eating into the forest capital. Clearly Kenya cannot go on using woodfuel as it does at present without making adequate arrangements to renew this energy source. The only practical alternatives to wood fuel are oil products including liquid petroleum, gas and electricity. These require considerable foreign exchange to import or produce. Kenya has an acute shortage of foreign exchange, therefore the guaranteeing of an adequate wood supply to meet Kenyas future energy requirements is an essential part of this country's energy strategy.¹⁴

In the same venue it was reported that the principle use of woodfuel in Kenya is the household. Fuelwood is used in the rural areas while charcoal is mainly used in the towns. Cooking is the most important application accounting for between 60 - 75% of total household use. Space heating and water heating are the next two important uses and together with cooking they account for about 95% of the total energy use. The remaining 5% of woodfuel is used for ironing and lighting.¹⁵

The Beijer Institute has reported that Kenyas development in common with the experience of other developing countries is contingent on the adequate provision of energy supplies. Moreover the provision of these supplies will occur at the expense of overall supplies of capital and foreign exchange. Unfortunately Kenya is experiencing levels of energy demand in excess of available supplies. The exhaustion of the wood supply is being aggravated moreover by the tendency for users to convert from wood to charcoal as rapid urbanisation proceeds in Kenya. The wood charcoal transition is therefore an essential aspect of the overall fuelwood issue.¹⁶

There is a dire need of planning for energy resources to be integrated with other forms of development. The objective of this is to achieve near and long term economic and social development goals. Success in achieving these goals requires that energy sources of the proper type and magnitude be made available to sustain the evolution of various sectors of society. Developing objectives embody both economic and demographic futures with which energy constraints and requirements must be associated. Policy must be based upon sufficient information on a regional as well as a national basis if local imbalances are to be identified and corrected. The competing uses of land for food exports and fuel each of which has energy and foreign exchange requirements and impacts must be adequately addressed in an attempt to develop an analytical framework of energy planning.

On energy conservation the current development plan (1984 - 88) has clearly stipulated that the strategy to improve energy efficiency in Kenya must have two parts:-

- (1) to reduce the high cost of oil imports by reducing oil use.
- (2) to increase the efficiency of wood and charcoal production and use.

The plan further clarifies on the fact that the National Energy Conservation Strategy will be based on cooperative effort between Government and the private sector. Government will provide policy advice and incentives, and the private sector will implement improvements in products and energy use practises.¹⁷

In the case of woodfuel and charcoal conservation the plan stipulates that the development and improved reforestation approaches, charcoal production methods, stove designs and cooking methods will receive greater attention. Given that much of the technical information to bring success in the above activities exists, the Government will therefore coordinate, promote and disseminate this information across the country.¹⁸

Mungalla in his Thesis has said that only a full assessment of the situation would enable the formation of relevant solutions. For example if the magnitude of the woodfuel demand for every ecological region is known then an estimate could be made of the area needed for afforestation with fast growing exotic and indigenous species. The new woodlots he says would provide fuelwood, charcoal, fencing posts and construction posts among other products. In addition employment would be generated in the rural areas thereby alleviating the chronic unemployment problem and checking on the current flow of people from those areas to the already overcrowded urban areas.¹⁹

National Energy Policy Options

The Beijer Institute has observed that the rapidly escalating demand for wood resources in Kenya requires

major supply side efforts. The attempt to augment wood supply entails a challenge and an opportunity both to avoid crisis and to articulate a component of development strategy. Both food and energy requirements dictate that sufficient indigenous resources and associated technologies be developed. The enhancement of the domestic wood resource base has been identified as being able to establish conditions which are consistent with development objectives. The wood resource enhancement policies that have been identified include a major emphasis on agroforestry, peri-urban plantations, replanted forests, industrial plantations and the enhanced Management of Natural forests.²⁰

On rural energy policy Beijer Institute have reported that the provision of satisfactory energy supplies in the rural areas for the improvement and maintenance of rural energy production and for the continued supply of energy has both short and long term implications. In the short term it has to cope with current energy shortages and unreliability of supply and it also has to identify environmental deterioration and seek to prevent it. In the long run, it needs to develop energy uses, production and distribution in the interests of a viable rural economy.²¹

They have further stated that Kenyas energy policy must be concerned with the following aspects:-

- (1) There is need for improved energy supply to meet increasing demands from the anticipated increase in population and in part from the anticipated shift of part of that population from rural to the urban areas with the accompanying changes in energy use and supply.

The following are the possibilities for rural energy development policy:-

- 1) fuel substitution: the use and search for conventional sources of fuel and power.
- 2) fuel substitution: non-coventional sources of power and search for an alternative energy technology.
- 3) The improvement of fuelwood production systems and forestry management.
- 4) greater efficiency in energy production and use.
- 5) The diffusion of energy innovations and the application of spatial variation to policy as many of the problems and their solutions are location specific.²²

For this reason then this study hopes to highlight on the afore mentioned problems, their causes and effects and the possible solutions and the formulation of the relevant policies at the local level in the study area.

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Chapter Three - STUDY AREA

Location and Extent

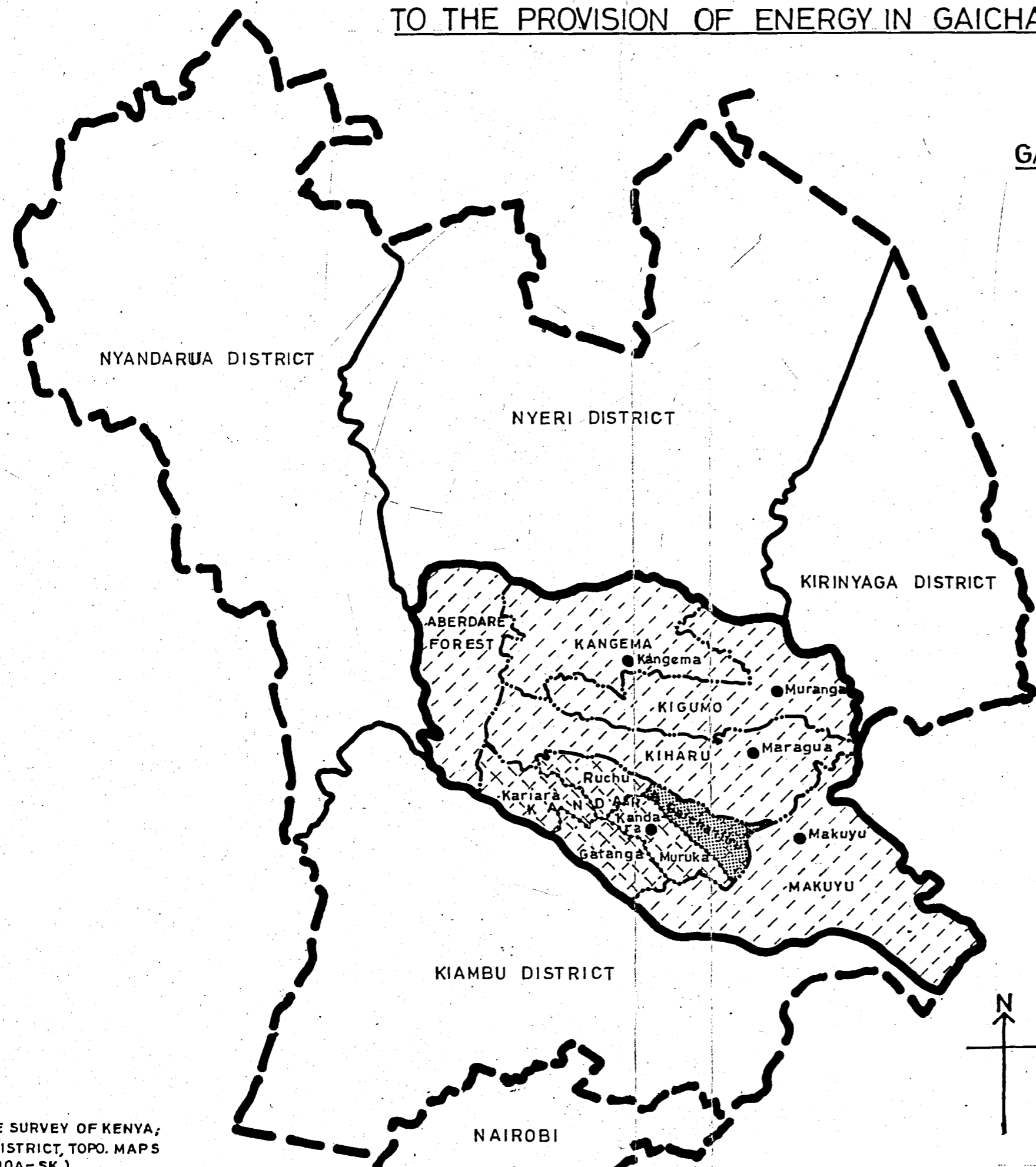
The study area is Gaichanjiru location, which is situated in Kandara division of Muranga District in the Central Province. It lies approximately 37° East and 1° South. It is approximately 70 kilometres north of Nairobi and 35 kilometres from Thika town. The division is bordered to the West by the aberdare ranges and aberdare forest and to the north East by Kigumo division and to the South by Kiambu District with Chania river forming the boundary between Muranga District and Kiambu District. It has an area of 76 square kilometres and a total population of 37,087 people according to the current Muranga District development plan (1984-88). The location has an average density of 486 persons per square kilometre and a total of 7,032 households.¹

Gaichanjiru location is one of the most densely populated areas in Kenya with a population density of 27 persons per square kilometre. The birth rate is above the national average of 3.8.1. administratively, Gaichanjiru location has got six sub locations, namely Kagumoini, Kariti/Kagunduini, Ngurweini/Kagira, Githunguri, Mariaini and Kabati/Gitura.²



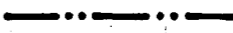
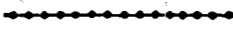
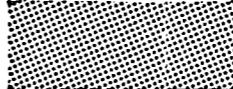
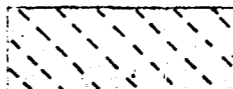


(See Map Numbers I and II)

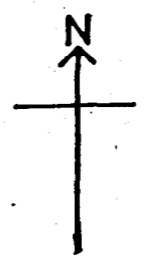
PLANNING FOR RURAL DEVELOPMENT WITH SPECIAL REFERENCE TO THE PROVISION OF ENERGY IN GAICHANJIRU LOCATION

GAICHANJIRU LOCATION: REGIONAL CONTEXT

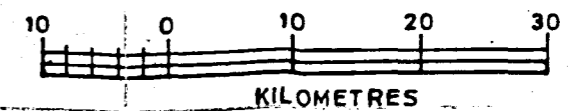


LEGEND:

-  PROVINCIAL BOUNDARY
-  DISTRICT BOUNDARY
-  DIVISION BOUNDARY
-  LOCATION BOUNDARY
-  GAICHANJIRU LOCATION
-  KANDARA DIVISION
-  MURANGA DISTRICT
-  URBAN CENTRES



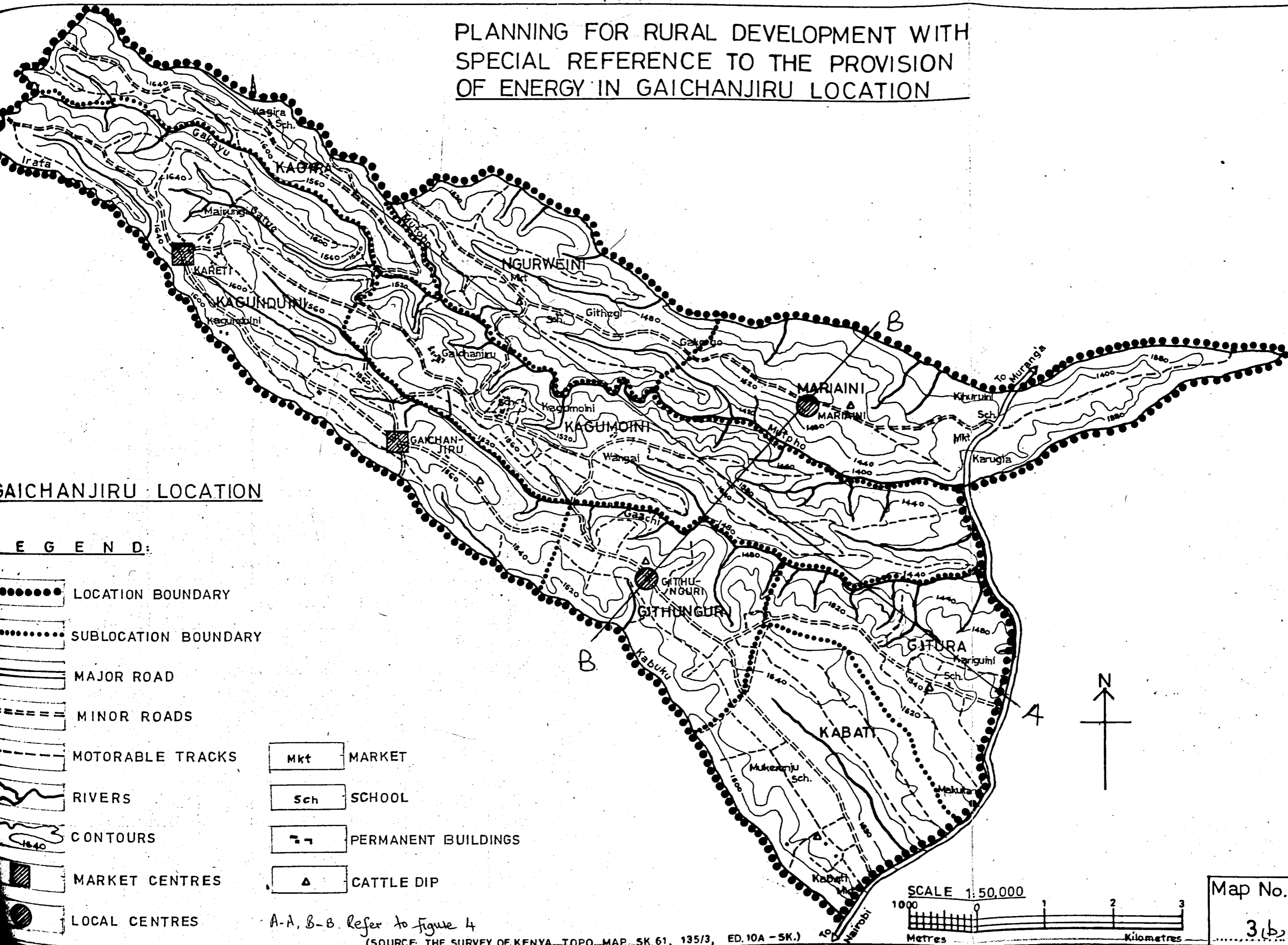
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Map No.
2

(SOURCE: THE SURVEY OF KENYA, MURANGA DISTRICT, TOPO. MAPS SK. 61, ED. 10A-SK.)

PLANNING FOR RURAL DEVELOPMENT WITH SPECIAL REFERENCE TO THE PROVISION OF ENERGY IN GAICHANJIRU LOCATION



GAICHANJIRU LOCATION

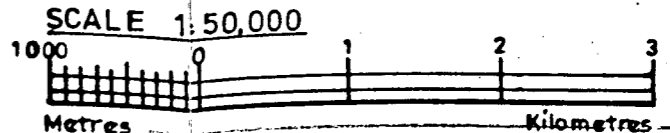
LEGEND:

- LOCATION BOUNDARY
- SUBLOCATION BOUNDARY
- MAJOR ROAD
- MINOR ROADS
- MOTORABLE TRACKS
- RIVERS
- CONTOURS
- MARKET CENTRES
- LOCAL CENTRES

- MARKET
- SCHOOL
- PERMANENT BUILDINGS
- CATTLE DIP

A-A, B-B. Refer to figure 4

(SOURCE: THE SURVEY OF KENYA TOPO. MAP SK. 61, 135/3, ED. 10A - SK.)



Map No.
3(b)

TABLE No. 3

The following table shows divisional estimates of population density for 1976 and 1982 on the basis of the 1969 census.

Location	1976		1982	
	No. of Inhabitants	Persons Per Sq Km	No. of Inhabitants	Persons Per Sq Km
Gatanga	39,800	448	48,455	544
Ruchu	22,080	320	26,826	389
Muruka	44,001	478	53,463	581
Gaichanjiru	34,916	453	42,423	551
Kariara	17,017	185	20,671	225
Kandara division	157,894	377	191,838	458

SOURCE: Planning community development centres in Kandara Kubel foundation 1976

The inference that can be drawn from the above table is that the study area has one of the highest numbers of people per square kilometre and this implies that there is pressure on the resources in the area. It is further observed that densities increase with the years (this is seen when comparing the figures for both 1976 and 1982) and this clearly calls for conservation as discussed in Chapter 6.

The above is to be compared with the following table which shows the population distribution by division in 1969 and 1979 for Muranga District.

TABLE No. 4

Division	Area Sq.Km	1969 Population	1979 Population	Density 1979	Average Annual Increase
Kandara	421	125,805	181,721	430	3.75
Kigumo	438	96,773	135,116	308	3.39
Kangema	341	89,315	132,912	388	4.08
Kiharu	407	96,425	138,182	339	3.66
Makuyu	643	36,992	60,402	93	5.04
TOTAL	2,476	445,310	648,333	261	3.83

SOURCE: Central Bureau of Statistics 1969 and 1979 census

The inference that can be drawn from the foregoing two tables is that as regards energy provision in the location in relation to population size and rate of growth there is a clear need for conservation as discussed in Chapter 6 on family planning. The division, that is Kandara division wherein lies the study area is clearly the most densely populated area in the whole district.

On the dependency burden in the location the following table shows that it is quite high as compared to the national figures.

3.1. Age, Sex Structure and Migration

The following is the breakdown of the age/sex structure in the Gaichanjiru location 1969 (in per cent of total population)

TABLE No. 5

Location	Males upto 15 Yrs	Above 15 Yrs	Females upto 15 Yrs	Above 15Yrs	Total Population %
Gaichanjiru	27.7	18.9	26.7	26.9	27,818
Kenya	25.7	24.4	24.8	25.1	10,942,704

SOURCE: Planning community development centres in Kandara division by Kubel foundation 1976

The above invariably means that more resources have to be found to meet energy and other basic needs as discussed in Chapter 5.

The Census results of 1969 showed a grossly unbalanced composition of age and sex structure within

the population of Kandara division. This is quite typical for an out migration area.

The following table shows the age and sex structure in Kandara division in 1969.

TABLE No. 6

Sex	Age	Upto 15 Years	Above 15 Years	Total(in%)
Male		34,746	24,161	46.8
Female		33,684	33,214	53.2
Total(in %)		54.5	45.5	100.0

SOURCE: Planning community development centres in Kandara. Kubel foundation 1976.

The inference that can be drawn from the above table is that the fact that there were 37.5% more females above 15 years of age than males of that age - group in the region can only be attributed to large scale out migration in search of jobs mainly in the industrialised areas of Thika and Nairobi.

The following table shows the breakdown of the Age/Sex structure in the locations of Kandara division in 1969 (in per cent of total population).

TABLE No. 7

Location	M A L E S		F E M A L E S		Total Popu- lation (= 100%)
	Up To 15 Years	Above 15 Years	Up To 15 Years	Above 15 Years	
Gatanga	27.8	19.0	27.0	26.2	31,775
Ruchu	27.6	19.6	26.5	26.3	17,594
Muruka	27.9	18.8	26.7	26.6	35,058
Gaichanjiru	27.5	18.9	26.7	26.9	27,818
Kariara	26.7	20.7	27.0	25.6	13,560
Kandara Di- vision	27.6	19.2	26.8	26.4	125,805
Kenya	25.7	24.4	24.8	25.1	10,942,705

SOURCE: Planning community development centres in Kandara.
Kübel foundation 1976.

The above breakdown of the age/sex structure in the five locations of Kandara division reveals that Migration of the adult males occurs more frequently in the densely populated areas of Gaichanjiru (study area) Muruka and Gatanga and less of this is observed in both Ruchu and Kariara locations.

The above patterns can be attributed to the fact that the system of equal partitioning of the shambas in case of inheritance has left smaller and smaller farm units. This implies that the agricultural yields are insufficient for the subsistence of the farm family. Further conclusions include the fact that since there has been no development in the promotion of work places outside agriculture in Kandara division, the age/sex structure is very likely to show an even more unbalanced

picture than ten years ago.

The economic and social effects resulting from migration on this scale should not be underestimated since the role of married women in cases of long term absence of the husband is a very difficult one, as was stressed by the international labour organisation (ILO) in 1975.³ Moreover there are many difficulties in trying to promote agricultural production, since families in this situation are usually not likely to fulfil the necessary capital and manpower requirements associated with all aspects of agricultural production. Thus this competes directly with the need to fulfil other basic needs.

3.2 Future Demographic Developments

The population estimates based on the crude rate of natural increase (see table number 5) are certainly too high, since the rate of out migration will most likely grow in future, the more so as the work place potential in the growing industrial centre of nearby Thika becomes more developed.⁴

Relief and Drainage

The study area and relief characteristics may be better understood when examined from the Divisional scale. For the purpose of this study it is noted that Gaichanjiru location, the study area, forms part of the Kandara division. This is because due to the limitation of time the actual locational data was not available.

The division lies on the foothills of the aberdares and the altitude rises gradually from the west towards the east where the highest areas of the division lie within which Gaichanjiru location is located. The general altitude ranges from 1,550m to 2,250m above sea level. The upper part of the division is characterized by very pronounced deep valleys with very steep gradients. Notable here are the almost parallel ridges which run in a West - East direction.

The division is characterized by subparallel streams with steep longitudinal gradients draining the wet slopes and forming a consequent radial pattern of valleys with steep hill-slopes and narrow interfluves. The major rivers within the division are Chania, Kiama, Mutomo and Thika. In addition to these rivers the division has very many streams which form tributaries of these major rivers and this is where Gaichanjiru location lies.

The division receives more than 875mm of rainfall annually and this together with the relatively high precipitation means that alot of ground water is retained in the volcanic rocks and this makes most of the rivers and streams to flow throughout the year.⁵

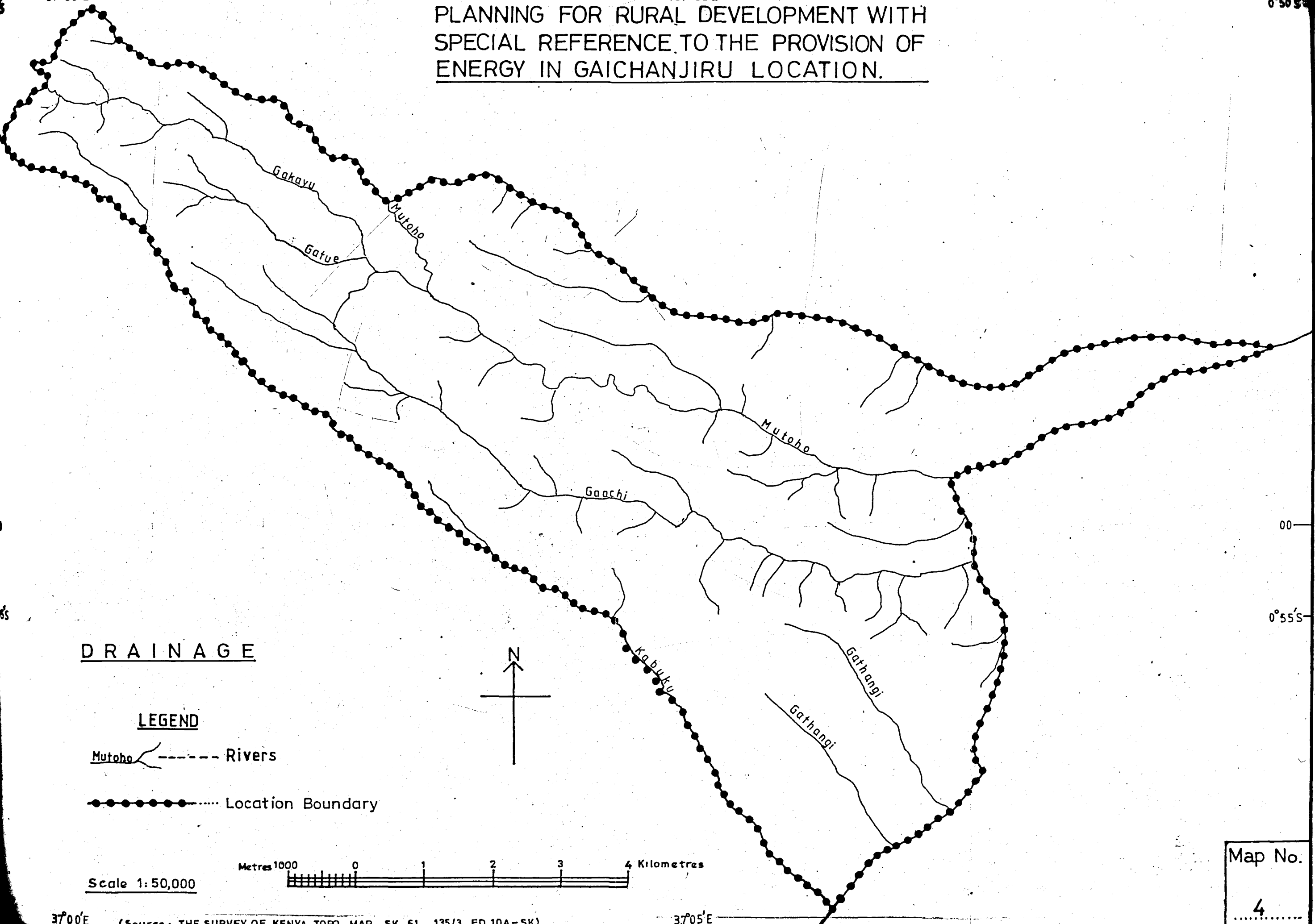
This perennial flow is further regulated through the hydrological stabilisation generated by the forest vegetation in the elevated parts of the division where the porous basement system soils drain freely. These streams provide water for human and livestock needs as well as for industrial uses especially in the coffee factories.⁶ (See Map Number 4)

PLANNING FOR RURAL DEVELOPMENT WITH SPECIAL REFERENCE TO THE PROVISION OF ENERGY IN GAICHANJIRU LOCATION.

37°00'E

37°05'E

0°50'S

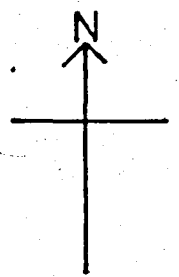


DRAINAGE

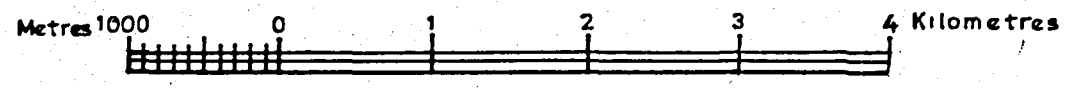
LEGEND

Mutoho Rivers

Location Boundary



Scale 1:50,000



Map No.

4

37°00'E

(Source: THE SURVEY OF KENYA TOPO. MAP SK. 61, 135/3, ED.10A-SK)

37°05'E

0°55'S

00

3.4 Agro Ecological Zone

The location falls under one agro-ecological zone, namely the main coffee zone. This has a medium and long cropping season. The yield potential in this zone is very good. The first rains are experienced in the months starting Mid-March to May and June and the second rains are experienced from Mid-October to December.

Other crops, besides coffee include maize, beans, potatoes, pawpaws, cabbages, kales, tomatoes, bananas, citrus fruits, avocados, pineapples, cassava, sugarcane and arrowroots. These crops are grown for both subsistence and commercial purposes.⁷

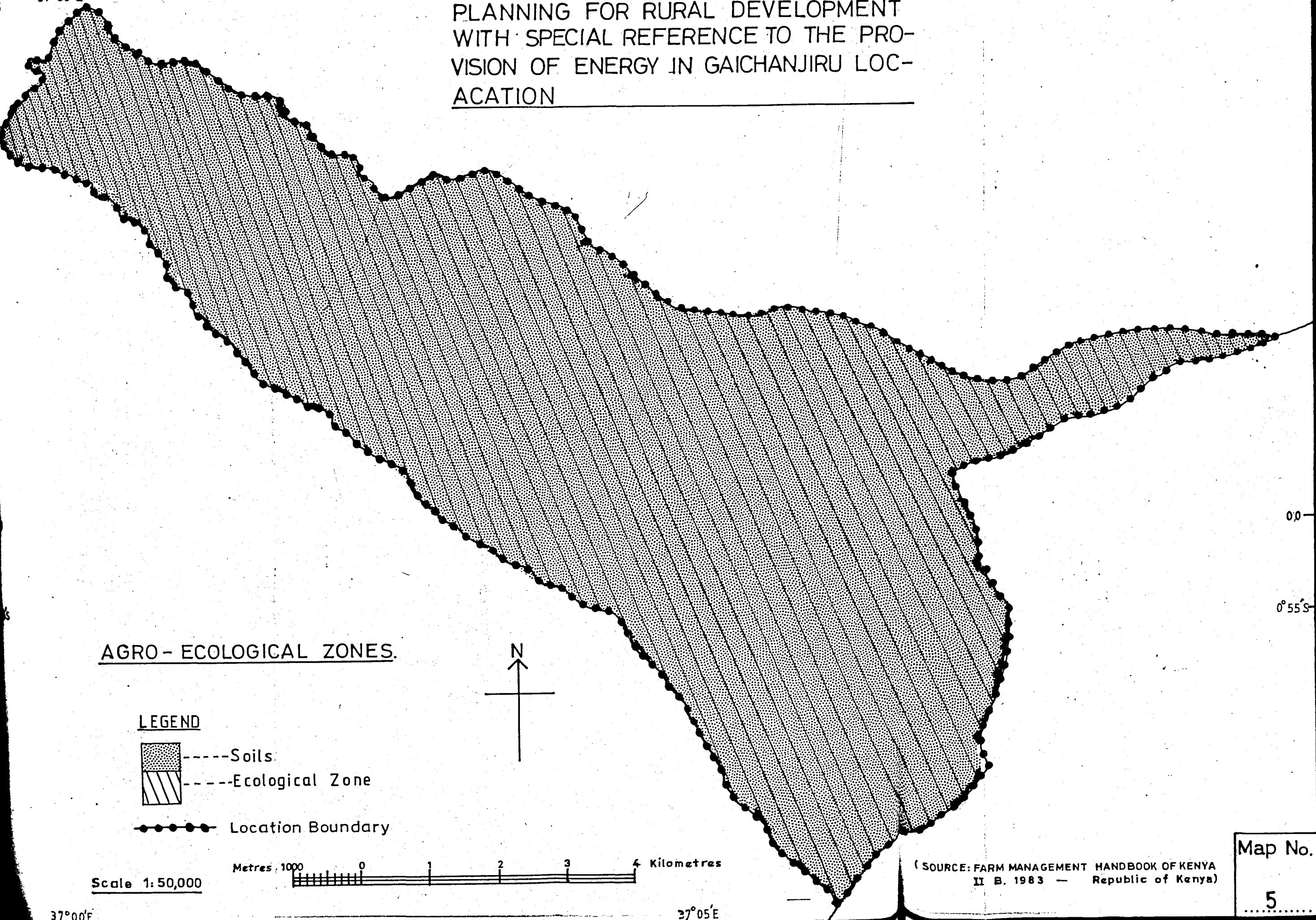
(See Map Number 5)

37°00' E

37°05' E



0°50' S


PLANNING FOR RURAL DEVELOPMENT WITH SPECIAL REFERENCE TO THE PRO- VISION OF ENERGY IN GAICHANJIRU LOC- ACATION

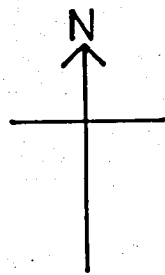


AGRO - ECOLOGICAL ZONES.

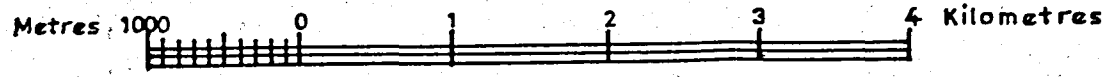
LEGEND

-  ----- Soils
-  ----- Ecological Zone

 Location Boundary



Scale 1:50,000



(SOURCE: FARM MANAGEMENT HANDBOOK OF KENYA
II B. 1983 — Republic of Kenya)

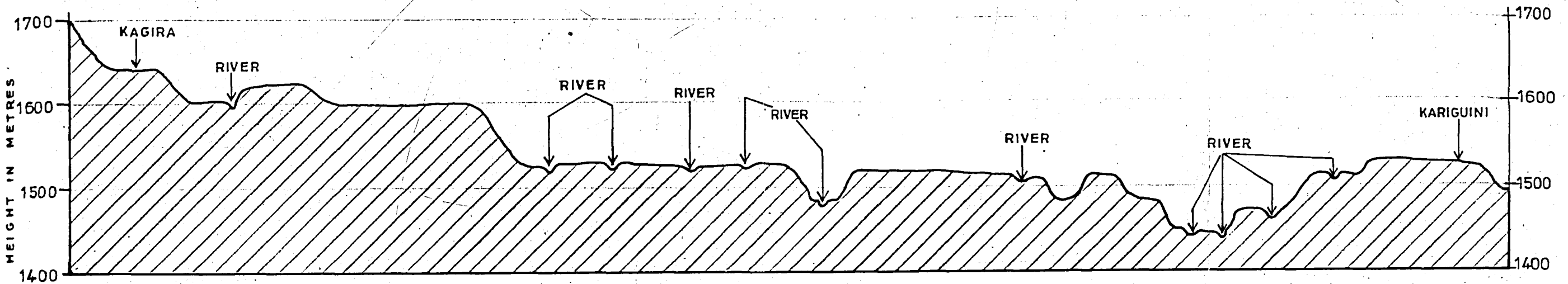
Map No.
5

37°00'E

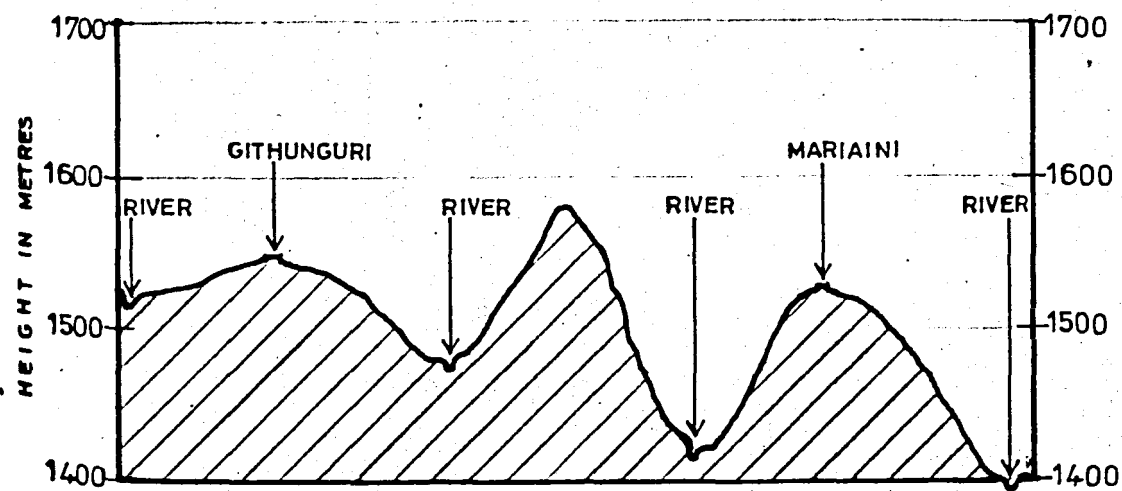
37°05'E

PLANNING FOR RURAL DEVELOPMENT WITH SPECIAL REFERENCE TO THE PROVISION OF ENERGY IN GAICHANJIRU LOCATION.

A CROSS SECTION BETWEEN KARIGUINI MARKET AND KAGIRA : A-A. (Refer to map (3b))



A CROSS SECTION PASSING THROUGH GITHUNGURI AND MARIANI CENTRES : B-B. (Refer to map (3b))



HORIZONTAL SCALE - 1:50000
VERTICAL SCALE - 1 cm. = 50 metres.

Fig. No.

4

CLIMATE IN THE AGRO-ECOLOGICAL ZONE

Agro Ecological zone	Altitude in metres'	Annual mean Temperature in °C	Annual Average Rainfall in mm	60% Reliability of Rainfall	
				1st Rains in mm	2nd Rains in mm
1 Main Coffee zone	1500 - 1670	19.7-18.8	1300 - 1620 1180 - 1400	550-820 450-650	320-480 280-400

3.5 Climate in the Agro-Ecological Zone

The two most significant components here are rainfall and temperatures. Gaichanjiru location (the main coffee zone) receives an average of between 1300 - 1620mm of rain per year. The temperatures range between 19.7 - 18°C.

The heavy long rains fall around the middle of March to May and June. While the short rains start in the middle of October upto December.

The lower parts receive less rain than the higher areas but it can be said that except in extreme conditions like the recent long drought (1984) conditions rainfall does not pose any major problem to the growth of crops.

A close look at the climatic conditions in the division shows that they are influenced by altitude and therefore changes in elevation have a marked effect on both rainfall and temperatures. Thus the higher areas of the division and the location experience more cooler conditions than the lower areas.

3.6 Soils and Geology

Most of the location has well drained, extremely deep, dusky red to dark reddish brown, friable clay with acid humic topsoil (humic nitocols) and pisolitic or petroferic material (eutric Nitosols; with nitochromic cambisols and chromic acrisols, partly pisolitic or petroferic phase).⁹

Rock formations within the division consist of volcanic formations mainly of the tertiary age which originated from the aberdares. In addition there exists pockets of sedimentary rocks within the river valleys. According to Owgweny the major geological formations here comprise of tertiary and quaternary lava.¹⁰

The hilly terrain in the location makes the problem of soil erosion very serious. The soils pose a problem in that over population has decreased the land productivity capacity in the location. The stoniness of the soil in certain areas of the location makes cultivation difficult.

Soil degradation and loss is also due to erosion which is caused by running water, rainfall, slope and poor land management. The extent of soil erosion is evidenced by the siltation of the Tana river and the dams downstream. Soil analysis have revealed that the soils in the location are deficient in some nutrients. Organic manures are not readily available in the location and so will not replace chemical fertilisers in the near future because crop residues are used to feed livestock and for energy purposes.

The problem is further aggravated by over-grazing, deforestation, bush burning, clearing and cultivating of unsuitable areas without erosion control measures. This is most serious in the grass/coffee zone on the steep slopes of the location.¹¹

3.7 Vegetation and Land Use

The major vegetation zone in the location corresponds to the climatic conditions of the location. Land use corresponds closely to the ecological zone.

3.7.1 Wood and Bushed Grass land

This covers the study area amongst other areas of the division. The land is dominated by bracken and sedges. The pastures are Kikuyu grass with a high percentage of molasses grass. Here tall species of sateria and panicum grass are also common.

Agricultural potential is highest in this zone. Intensive agriculture is practised, with crops including coffee, maize, beans, cassava, potatoes, sugarcane, tomatoes, cabbages, citrus fruits and so on. Livestock is also reared in the area which is generally capable of supporting one stock unit per 1 - 1.5 hectares.

Given the present population growth rate in the area and the increased land fragmentation there is a need to use the resources in a conservative manner.¹²

3.8. Socio-Economic Characteristics of the Location

The major constituents of the socio-economic infrastructure that will be considered here includes, educational institutions, administrative centres, growth centres, women and men groups.

3.8.1 Educational Institutions (Primary Schools)

The rate of enrolment at all levels of education in Kenya has risen tremendously since independence. Government decision in 1974 to abolish fees for primary

level of education has greatly contributed to this in the location and indeed in the whole country.

Probably the most notable feature about primary schools in the division and the location specifically is the high rate of enrolment which averaged 6.7% per annum between 1971 and 1976.¹³

Purely for administrative purposes the division is divided into East and West. Kandara East wherein lies Gaichanjiru location, had 38 primary schools with a total student population of 29,195 in 1983. In 1984 Kandara East had a total of 42 primary schools with a student population of 14,984. From information gathered from the district educational office, Kandara East had an increase of 3 primary schools.¹⁴

3.8.2 Secondary Schools

The division has had a fairly high increase of secondary schools. Perhaps this is a consequence of the many primary schools.

According to the district education office annual report the division had a total of 43 secondary schools comprising of 25 day secondary schools and 9 boarding/day secondary schools. There are 9 full boarding secondary schools all with a total enrolment of 8,583 students. Except for the boarding/day secondary schools the other are extensions of the existing primary schools.¹⁵

3.8.3 Village Polytechnics

The location has only one village polytechnic in the Kagunduini sublocation. Reports show that it had a total student enrolment figure of 71 in 1983.

In 1984 it had an enrolment of 73 students. Subjects taught at the polytechnic include masonry, carpentry, mechanic, domestic science and joinery.¹⁶ The relationship between education and energy supply can be seen in the sense that schools can be used to diffuse environmental education and possibly they can establish demonstration units for tree nurseries.

3.8.4 Administrative Centre

There is a chiefs camp at Kagunduini sublocation and this serves as the main one for the whole location.

The government policy on tree nurseries is that all chiefs should establish nurseries and produce 2,000 seedlings per year and distribute them to the people. In this exercise they will be assisted by assistant chiefs.

3.8.5 Agro Based Industries

The location has no industries because it is basically an agricultural area with coffee being the main cash crop. Other crops are mainly grown for subsistence and they include maize, beans, bananas, potatoes, sorghum, peas and a variety of root crops including cassava, yams and sweet potatoes. Others include vegetables that is cabbages, tomatoes, kales, brinjalis, karera, tindora and courgettes.

The location has both society and individual owned factories for coffee processing. The society owned factories are more than the individual owned factories. The coffee husks from the coffee could be used as charcoal briquettes or for manure in the farms in order to lessen the energy shortage and increase farm productivity.

There are mainly posho mills in the area (at least one in every market centre) and they all use diesel power to run.¹⁷

Health Institutions

Information received from the district statistics office revealed that the location has only one hospital (Gaichanjiru) and it is run by the mission. Other facilities are two dispensaries which are at Githunguri and Ngurweini respectively. Other health facilities are privately run and they are spread all over the location in the various market centres.¹⁸

The contribution of health institutions to the demand and supply of energy can be seen in the area of the time spent to go to hospital and this conflicts directly with the need to provide for other basic needs.

Location	Population	Health Facilities	Distance to Hospital	Distance to Dispensary
Gaichanjiru	1000	Hospital	0	10
Githunguri	500	Dispensary	15	0
Ngurweini	500	Dispensary	15	0
Other centres	1000	Private health facilities	10-20	10-20

3.9 Agriculture in the Location

3.9.1 Size of holdings and Available Manpower Capacity

The study area is basically an agricultural area with over 90% of the people living on the farm and earning their living from small scale farming activities.

During the last few years farms in Kandara division have become considerably smaller. While in 1969 there were 22,544 farm units with an average size of 1.82 hectares, in 1976 their number had reached 30,306 and their average size had decreased to 1.35 hectares. From the following table it can be seen that Gaichanjiru location (study area) had the smallest land size where it was below 1 hectare per farm.¹⁹

TABLE No. 9

Farm size and families in Kandara division in 1975.

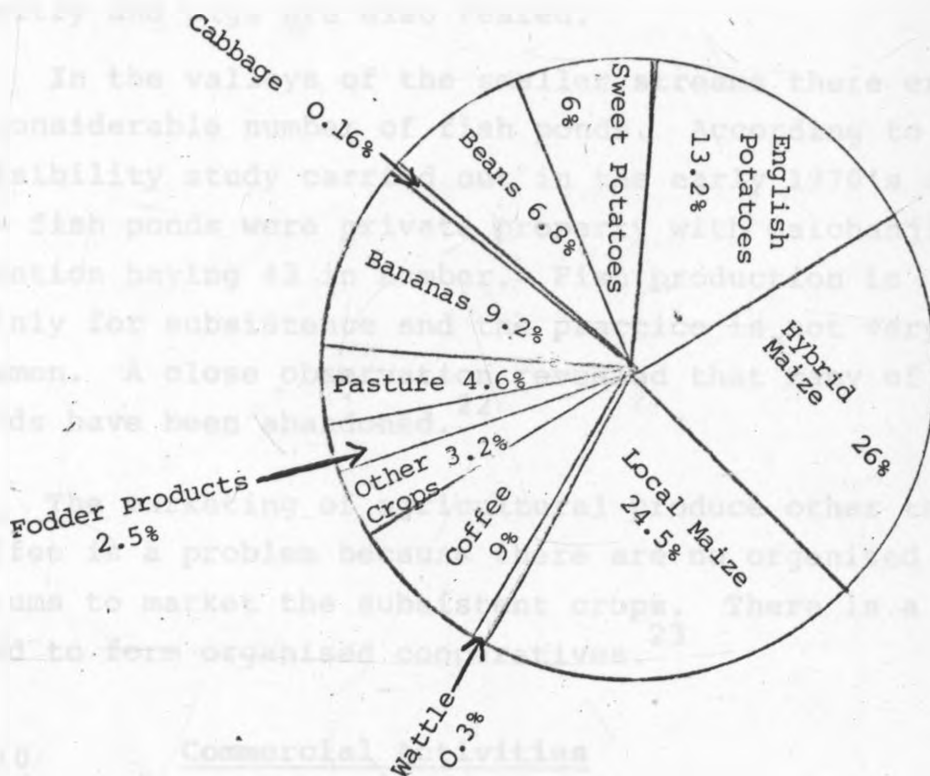
Location	Total Agriculture land (in ha)	Total No of Farms	Average Farm size (in ha)	Average Family size
* Gaichanjiru	7,200.0	7,508	0.96	4.65
Gatanga	8,772.1	6,300	1.39	6.33
Ruchu	6,849.2	4,301	1.59	5.13
Muruka	9,116.1	8,303	1.10	5.30
Kariara	9,004.8	3,894	2.31	4.37
Kandara Division	40,942.2	30,306	1.35	5.21

* Study Area

SOURCE: Planning community development centres in Kandara division Kubel foundation 1976.

The Manpower capacity of the families is hampered by the out migration of the male adult population as discussed in subsection of this chapter. This out migration leaves women and this is worsened during the coffee harvesting season.²⁰

Chart No. 1



SOURCE: Planning community development centres in Kandara in Kandara division by Kubel foundation

3.9.2 Current State of Agricultural Production

The relatively small size of farms, together with the subsistence requirements of the farm families, has resulted in an extreme diversification of agricultural production. The importance of different crops with respect to the percentage of agricultural land used can be seen from the above pie chart. The whole circle = 100% of the available agricultural land while the size of each segment is in proportion to the average used for the respective crops.

Other crops include sorghum, peas, cassava and yams. Vegetables include tomatoes, kales, brinjalis, karera tindora and courgettes.²¹

The average farmer also keeps cattle and goats. Most of the milk and beef produced is locally consumed. Poultry and pigs are also reared.

In the valleys of the smaller streams there exists a considerable number of fish ponds. According to a feasibility study carried out in the early 1970's all the fish ponds were private property with Gaichanjiru location having 43 in number. Fish production is mainly for subsistence and the practice is not very common. A close observation revealed that many of the ponds have been abandoned.²²

The marketing of agricultural produce other than coffee is a problem because there are no organised forums to market the subsistent crops. There is a need to form organised cooperatives.²³

3.10 Commercial Activities

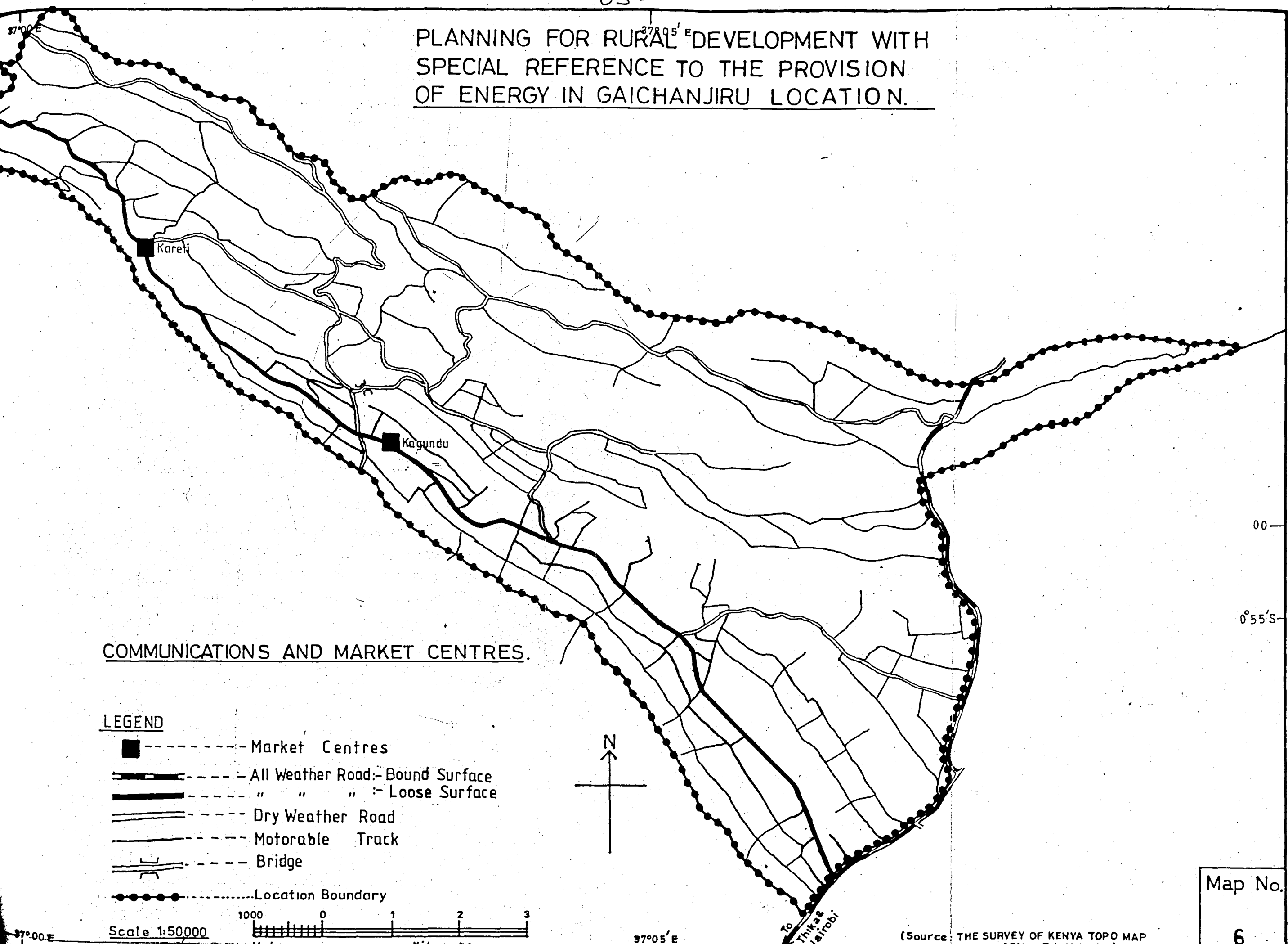
There are 9 service centres in the location on the main lines of communications and are well connected by secondary and rural access roads.²⁴

3.11 Transportation and Communication

The location is well served by a minor road network which is only dry weather.

Telephone facilities are few but they are on the increase. They are mainly to institutions and a few individuals. The main means of transport for both goods and people are roads.

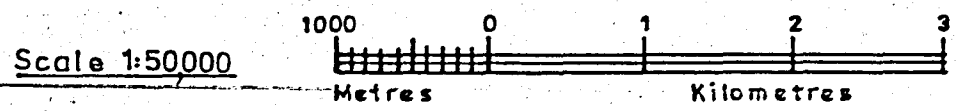
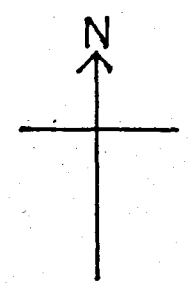
PLANNING FOR RURAL DEVELOPMENT WITH SPECIAL REFERENCE TO THE PROVISION OF ENERGY IN GAICHANJIRU LOCATION.



COMMUNICATIONS AND MARKET CENTRES.

LEGEND

- ----- Market Centres
- ▬----- All Weather Road:- Bound Surface
- ▬----- " " " : Loose Surface
- ▬----- Dry Weather Road
- ▬----- Motorable Track
- ▬----- Bridge
- Location Boundary



To Thika & Nairobi

(Source: THE SURVEY OF KENYA TOPO MAP SK. 61, 135/3, Ed. 10A-SK.)

Map No.
6

3.12 Electricity

The location is poorly served with electric power. In the location is only found in Kagunduini and Gaichanjiru service centres. The only two boarding schools that is Githunguri Girls and Gaichanjiru boys have installed their own diesel generators.

Plans are underway under the rural electrification programme to supply all the coffee factories with electric power.²⁶ The limitations in the use of electricity for the ordinary farmer is in the initial down payments involved and consequent electricity bills.

3.13 Women Groups (Harambee)

There are over 88 women groups in the location. They are scattered all over the sublocation. They engage in many income generating activities notable among them: poultry keeping, bee keeping, farming activities and they also make monetary contributions every month and buy their members whatever they need.

Harambee development schemes have proved that by mobilising local savings capacity and underutilised labour, they can contribute to the improvement of the rural infracturature in the social as well as in the economic sphere.²⁷

The following is a table showing participation in Harambee groups in 1975.

TABLE No. 10

Location	No. of Inhabitants	No. of Groups	Member ship	Members in % of population
Gaichanjiru	33,764	88	8,119	24

SOURCE: Planning community development centre in Kandara. Kubel foundation 1976.

The social services department reported that participation is lowest compared with other locations in the division.

The following is a table showing 4K club activities in 1974 - 75 in the location.

TABLE No. 11

Activities of 4 - K Clubs in 1974 - 1975

Location	No. of Clubs ^s		No. of Members		No. of Crop Projects		No of demonstra- tions	
	1974	1975	1974	1975	1974.	1975	1974	1975
Gaichan- jiru	2	3	92	93	35	62	88	12

SOURCE: Planning comunity development centres in Kandara division Kubel foundation 1976.

The importance of table numbers 8 and 9 can be seen in the actual recommendations as made in chapter 6..

The women groups and 4K clubs need to be strengthened and increased in number in order to be used in diffusing the conservation information.

Land Tenure and Agricultural Production

The land tenure system in the location is freehold. Technically it is known as free, simple and absolute proprietorship interest in land. The location can be characterized as being a high potential area and due to the natural conditions discussed earlier in this chapter there are no obstacles to realising high profit from agricultural production per unit area of land. The available statistics, however reveal that gross agricultural production did not reach the estimated value of about 116 million K.shs (estimate for 1971) but was valued at only about 88,3 millions Kshs in 1971 which was distributed among the different locations as shown in table number 12 next page. From table number 12 it can be seen that, the per capita income from agricultural production, the average of which was 656 Ksh per annum, is declining constantly. In 1974 it was 635/- Kshs due to the decrease of the average size of farm holdings.²⁸

Generally on the level of individual holdings agricultural production is diversified to a rather large extent, with virtually each farm growing the main crops for home consumption as well as a cash crop (coffee).²⁹

The application of fertilisers and insecticides is generally restricted to coffee which is the cash crop. Agricultural residue which otherwise could be used as manure is used instead to satisfy energy needs.³⁰

The freehold pattern of land tenure affects the supply of energy in that energy is not free like it used to be before the land was adjudicated. One can either be given or buy otherwise procurement of energy through any other way would amount to trespass.³¹

TABLE No. 12

Gross Agricultural Production in Kandara Division, 1971 (not included: subsistence Production)

Product	Kandara Division		Percentage of total value of each product				
	Value (in Kshs)	Percentage of total value	Gatanga	Ruchu	Muruka	Gaichanjiru	Kariara
1. Loc. maize	1,072,750	1.21	33.5	10.3	3.9	15.6	36.7
2. Hybr. maize	1,411,130	1.60	3.7	18.6	67.0	8.0	2.7
3. Engl. potatoes	3,166,200	3.58	25.6	1.4	63.9	6.8	2.3
4. Sweet potatoes	374,000	0.42	38.5	37.5	8.0	8.0	8.0
5. Beans	798,000	0.90	20.3	9.0	30.1	22.6	18.0
6. Banana	480,000	0.54	7.3	78.1	8.3	6.3	-
7. Cabbage	498,000	0.56	6.0	27.1	6.0	7.2	53.7
8. Passion fruit	30,520	0.04	38.5	38.5	-	23.0	-
9. Pineapple	42,000	0.05	-	100.0	-	-	-
10. Tea	870,000	0.99	-	18.4	-	-	81.6
11. Coffee	66,812,000	75.65	36.6	13.2	31.9	14.0	4.3
12. Pyrethrum	24,880	0.03	-	3.5	-	-	96.5
13. Wattle	2,000,000	2.27	-	50.0	-	-	50.0
14. Poultry	179,530	0.20	1.8	35.1	1.1	60.1	1.7
15. Sheep	495,200	0.56	54.1	2.0	14.6	20.2	9.1
16. Pigs	1,552,400	1.76	-	3.1	0.3	96.6	-
17. Zebu	4,127,250	4.67	11.3	30.7	35.5	16.0	6.5
18. Graded cattle + Grade crosses	4,377,700	4.97	12.8	41.1	10.4	16.5	19.2
Total Value	88,311,560	100.00	31.0	16.2	30.2	15.0	7.6
Average per capita income from agriculture	657/84 Kshs	-	807/65 Kshs	764/-Ksh	712/10Ksh	445/62Ksh	464/15

SOURCE: Planning community development centres in Kandara. Kubel' foundation 1976

3.15 Problems of Rural Development in the Location

There is overpopulation as discussed in section 3 of this chapter. This can be seen in the light of the area of the location and its population as compared with the other divisions. The average farm size in the location is 0.96 as compared with the divisions which is 1.35 as shown in table 9. This means that the land is highly fragmented and has to support an average family size of 4.65 as shown in table 9.

There is lack of employment facilities in the location as discussed in subsection 3.1 of this chapter. This means that there is a high rate of seasonal and permanent out migration of the male adult population and this leaves women and children with the large share of the agricultural work especially during the coffee picking season.

The prevailing settlement structure which can be described as nucleated brings about problems in the provision of such services as water, health, schools and so on.

On the issue of the marketing of produce other than coffee, there is a problem because there are no organised cooperatives. This is coupled with the supply of farm inputs which is also another problem because they are not delivered in time and this generally affects the level of development.

In summary then the issues that have been discussed here include the physical characteristics of the area, the socio-economic base of the area, the land tenure system and the general problems of rural development in the location. Their relationship with the demand and supply of energy in the location is discussed in chapters 4 and 5 of this study.

REFERENCES

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Chapter Four - GAICHANJIRU CURRENT ENERGY SUPPLY SYSTEMS

4.0 The Search for Firewood

Collecting firewood like all other tasks in the location used to involve a strict division of labour based on sex. Today however sex based roles are changing in the location as elsewhere. Collecting firewood however is still predominatly a womans task. Traditionally children played a major role but now with so many in school their contribution is much less.

TABLE No. 13

SEXUAL DIVISON CF LABOUR

Tasks done by Women	Tasks done by Men and Women	Tasks done by Men
1) Harvesting	1) Land preparation	1) Land Pre- paration
2) Weeding	2) Milking Cows	2) Grazing Livestock
3) Planting	3) Applying manure to crops	3) Taking livestock to rivers
4) Fetching fire- wood	4) Compulsory Communal work at cooperative societies and cattle dips	4) Prunning coffee
5) Fetching water		
6) Threshing		
7) Gathering food for livestock		
8) Preparing food		
9) Tending poul- try		
10) Winowing		
11) Compulsory Comm- unal work in schools and churches.		

In this opening section the traditional role of fuelwood in the location is considered. Firewood used to be regarded as a free good, abundantly and conveniently available to all. The notion of scarcity which was common in regard to water, food or livestock was inapplicable to firewood.

Secondly the importance of firewood in the preparation of food is considered. Firewood is the centre of life because it is used to prepare food.

Thirdly firewood is of symbolic significance used not only for cooking but as the centre for important social activities. Long ago every home had a logfire, outside the compound for keeping wild animals away and serving as a focal point where story telling and other conversations were held. However there is no clear order of preference for firewood as regards the various uses because accessibility is the dominant consideration.

4.1. Potential Sources of Energy in the Location

An inventory approach to the energy sources in the location showed the following. A family's fuel supply is primarily satisfied by the availability of the energy sources. The availability of supply is determined by the resource base and access to the resources. For instance, the physical environment provides trees as a resource for fuelwood. Access to this supply is determined by several factors such as seasonal availability, preference, energy input for example, labour time and monetary inputs for either the cost of the wood or hired labour to fell the trees.

The potential sources of energy in the location include trees, charcoal, agricultural residue including

coffee husks, coffee stems after pruning, coffee twigs and branches, sugar cane stalks, cassava stalks, banana leaves, arrowroot stalks, cabbage stalks and tomato stalks after harvesting. Sawdust from Thika Town is also used to some extent. Included also in the lower part of the location is sisal stems and their dry leaves which are mainly gathered from the neighbouring sisal estates in the Makuyu division. This usually lands the women in trouble with the Makuyu police because the practice essentially amounts to trespass and thus is illegal. Also with time the distances have become too long sometimes exceeding 8 kilometres and so there is no future to this since the sisal is on private property. Coffee husks are used but to a very small and negligible scale. Pieces of deadwood, bush and weeds from the garden are also used. Fruit trees after pruning are used too.

In general the amount of woodfuel available depends on how much money one has to purchase wood or how much land is available for one to grow trees. Other factors include personal attitudes, knowledge about usefulness of trees, the agricultural zone and the household sizes. As mentioned earlier important also is the seasonal availability of firewood, energy inputs for example labour time and monetary inputs for either the cost of the wood or hired labour to fell the trees.

Agricultural residues and other supplementary sources discussed earlier also to a large extent depend on seasonal availability, for example at the time the survey was conducted the country had just been undergoing a severe drought and so the agricultural residues were not much since there had been hardly any crop to harvest.



PLATE 1 SAWDUST

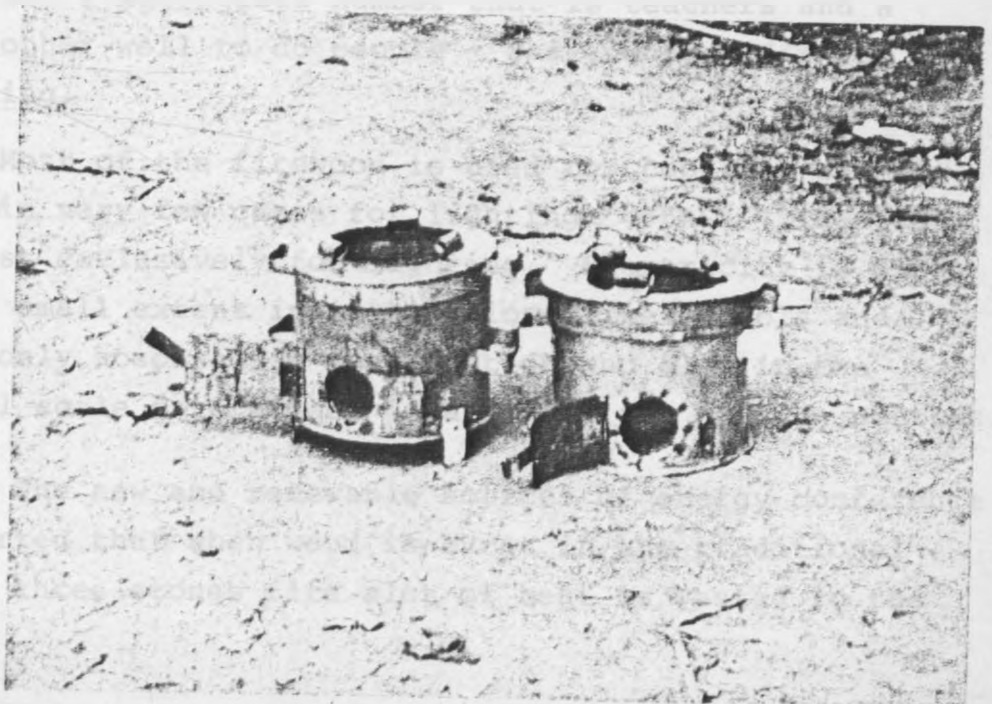


PLATE 2. IMPROVED JIKO FOR SAWDUST USE

4.2 ENERGY DEMAND

Energy demand in the location is governed by the following factors although in general it is true that the demand is high but it is not without its limitations. Land in the location is privately owned and therefore woodfuel can only be obtained as a free good on one's own land or as a gift from a friend, a relative or employer. Otherwise fuelwood is purchased from neighbours or from the local store.

Selling prices of wood and charcoal are to be found in sections 4.6 and 4.8 respectively.

4.3. Energy Consumption (types of Energy used and End use Devices).

Types of energy used as discussed earlier include firewood, charcoal, agricultural residue, saw dust, sisal products and so on.

The end use devices include for everybody the traditional open fire, for a few the traditional jiko and for a negligible number that is teachers and a few other well to do people - gas and paraffin for cooking.

Most of the firewood is used for cooking, warming and in very few cases for lighting. Paraffin is used almost exclusively for lighting. Electricity is used to a small extent in institutions like schools and the only hospital in the location and also in the small scale enterprises in a few of the service centres.

The new and renewable sources of energy conference reported that when wood is burnt in the traditional open three stones fire alot of heat is wasted to the

surrounding and this greatly contributes to increased wood consumption. They also estimated that when charcoal is burnt in the traditional jiko, 95% of the heat produced escapes into the surrounding and only 5% actually does the cooking.¹

The impact of the traditional jiko on the rate of reducing forests is very extensive. If say 100 trees are cut to make charcoal, the heat from 95 trees is lost to the atmosphere and only 5 trees are used properly. The situation is quite critical considering that there are not enough trees to cut down.²

This invariably means that something has to be done to cut down on the excessive consumption. The Kenya renewable energy development project (KREDP) claims that the Kenya ceramic jiko one of the many jikos that have been developed is very efficient compared to the ordinary jiko or the traditional open fire. They claim that it uses less charcoal or wood, that it is safe from contact burns, that it burns charcoal or wood for longer periods, that it is faster in cooking meals and that it produces less carbon monoxide. (See Photographs in Chapter 6).



PLATE 3. WOMEN CARRYING FIREWOOD



PLATE 4. WHEELBARROWS ARE ALSO USED FOR CARRYING FIREWOOD.



PLATE 5. TRADITIONAL CHARCOAL JIKO



PLATE 6. KENYA CERAMIC JIKO

The following Table Shows Household Uses of Energy by Fuel Type

Household Use	Fuel Type							
	Wood	Char-coal	Crop Residue	Paraffin	Electricity Institutions Local Business	Gas	Animal Dung	Other
Cooking	✓	✓	✓	✓	✓	✓	✓	✓
Lighting	✓			✓	✓			
Warming/ Heating	✓	✓	✓		✓		✓	✓
Ironing	✓	✓	✓		✓			

Table No. 14

As regards paraffin for lighting prices in the location varied greatly due to distances from the local market centres and also the sizes of the buying container. For example a bottle measuring 1 litre costs a minimum of 8 shillings while a container measuring 6 litres costs a minimum of 38 shillings.

As regards family incomes and type of fuel used there was evidence that the financial capability of a household determined the energy source and device used. This means that a few well to do families had gas for cooking, electricity, a jiko and so on.

Incomes for these people ranged from 300 - 400 shillings per month for those who were employed in the coffee estates. The majority however are not employed and if they have any subsistence crops then they sell but the incomes from the farm produce are not reliable.

Other incomes are derived from coffee sales but this is done on a very irregular basis. Payments are done on the basis of amounts and grades of coffee delivered to the cooperative societies and also it depends on the world coffee prices at any particular time.

4.4 Procurement of Firewood

Respondents in the study area reported that in recent years they have increasingly been forced to turn to the buying of fuelwood. Firewood is the dominant energy that was reported. It is used for cooking, heating water for bathing, warming and so on.

It was reported that fuels such as charcoal and animal dung are seldom used.

The study estimated that 40% of the people got their firewood by collecting it freely while 30% purchased their wood. An estimated 30% of the people got their wood from both free collection and purchasing. The following diagram illustrates the estimated average rural household sources.

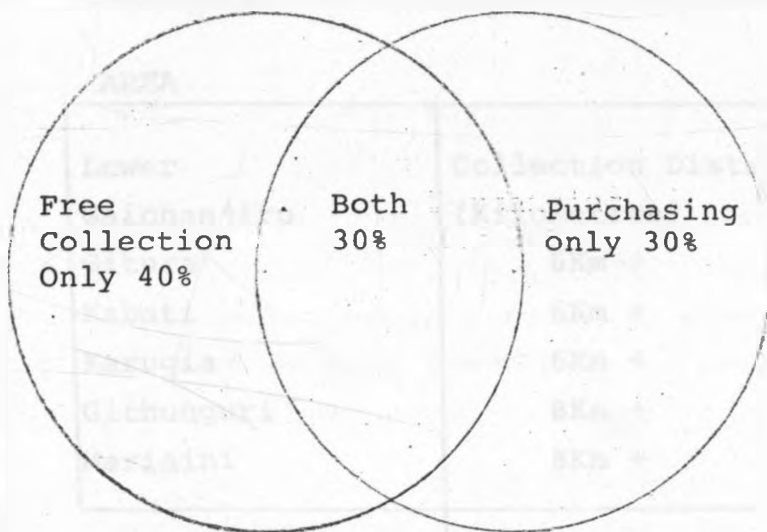


Chart No. 2

More than an estimated 75% of the people reported that they found the collection of wood a difficult job. All the respondents felt that wood collection had grown more difficult over the past 10 years. An estimated 10% of the people said that they had planted

trees during the past year but this had been done for building poles and fruit trees rather than for firewood.

4.5 Distances to the Sources of Fuelwood

Most households have been forced to modify their former wood burning habits. The study found out that people make one to four trips per week spending one to six hours for each trip. This is especially so in the lower zone of the location where people have to travel over 8 kilometres to distant sisal estates.

TABLE No. 15

Distances Walked to collect Firewood by Sub-Location

AREA	
Lower Gaichanjiru	Collection Distances (Kilometres)
Gitura	6Km +
Kabati	6Km +
Karugia	6Km +
Githunguri	8Km +
Mariaini	8Km +
Upper Gaichanjiru	To local centre & Distant Farms
Kagumoini	2Km +
Kagunduini	2Km +
Ngurweini	2Km +
Kagira	2Km +
Kariti	2Km +

The inference that can be drawn from the table No.15 is that in lower Gaichanjiru people have the option of walking to the distant sisal estates to collect firewood. They can also harvest their own trees or walk to the local service centre to buy wood or they walk to their distant farms to collect wood.

In upper Gaichanjiru it means that people rely more on buying wood from their local centres which are usually not more than 2 kilometres or else they harvest their own trees or walk to their distant farms.

4.6 Selling Prices for Fuelwood

For the households in the location fuelwood could either be bought as standing trees or headloads. Standing trees sell at an average price of 40 - 50 shillings depending on the size of the tree.

The price of a bundle of wood with an average of four split pieces averaging 75cm in length and 22mm in diameter sold at three shillings and fifty cents in upper Gaichanjiru and four shillings and fifty cents in lower Gaichanjiru respectively. This was the case because in upper Gaichanjiru there is more fuelwood coming from the upper forested areas and also because the distance is shorter as compared with the lower zone.

The people in the upper zone reported that they bought approximately 6 bundles per week and supplemented it with agricultural residues while those in the lower zone bought approximately 3 bundles and supplemented it with products from sisal.

The inference that can be drawn from this is that as more and more trees are cut from the upper forested areas either for the burning of charcoal or for use as fuelwood, there will be a vicious cycle created if

replanting is not done in a controlled manner. The water table in the upper catchment areas will be lowered, there will be increased soil erosion due to the removal of the vegetation cover, there will be increased silting of the rivers. This will invariably mean that agricultural production will be lowered. Other associated problems will be that peoples general welfare will be lowered and if this is continued over time it will lead to drought, desertification and possible death. Therefore plans must be made to keep down the pace of tree cutting with replanting. Other findings included the fact that an estimated three hundred shillings was a familys minimum income rising to four hundred shillings a month for those in employment. For those not employed figures were less than the above.

If firewood cost approximately eighty four shillings in upper Gaichanjiru per month than it means that firewood takes more than its fair share as compared with other basic needs in the upper zone.

In lower Gaichanjiru taking the three hundred to four hundred shillings to be constant then it means that approximately fifty four shillings was used on fuelwood procurement only. This clearly means that the issue of energy provision has already reached a critical stage and clearly something must be done.

4.7 Rural Household Charcoal Use

The use of charcoal in the location was found to be negligible. This was attributed to the fact that due to the absence of any number of trees that can sustain the business of charcoal burning people felt that having to buy charcoal is too expensive. This was especially due to the transport costs involved.

The only places that charcoal was used considerably was in the local market centres.

4.8 Selling Prices for Charcoal

The minimum price that was paid for a sack of charcoal in all the sublocations was 50 shillings. It then varied depending on who had supplied it and the particular distance that had been covered to any market centre.

The traders mostly sold the charcoal in bags and not in lesser quantities and thus discouraged most of the users.

4.9 Commercial Energy Sources

Electricity and bottled gas are not used by any measurable part of the population in the area. The possible reasons accounting for this include the fact that the electricity grid has just reached the area. The study found that many houses are still built with thatch. This is an indication of income levels and so the question of installing electricity in the immediate future is not a priority. Coupled with this is the initial amount of money involved in the down payments for the installation of electricity and consequent monthly charges.

As regards bottled gas its non-popularity is associated with the initial costs involved in purchasing the cylinder and the cooking stove. Distances from Thika town which is the nearest in terms of replenishing the gas are also insurmountable. Otherwise gas could be more cheaper than fuelwood but for the initial and transportation costs involved.

The use of commercial energy is limited to paraffin for lighting and diesel for running maize mills.



PLATE 7. AN EXAMPLE OF TYPES OF FIREWOOD
SOLD



PLATE 8. WOMEN CARRYING SISAL LEAVES

Chapter Five - CAUSES OF ENERGY SHORTAGE

5.0 Fuel: Causes for its shortages

The importance of analysing the reasons for the shortage of woodfuel alongside the lines of the whole socio-economic system cannot be over-emphasised.

As has been stated before, natural resources including fuelwood were in existence in abundance in the past. With the establishment of colonial rule there was the starting of a cash economy which had the following characteristics.

There was now a change in land tenure in the form of land adjudication which essentially meant that land was now privately or individually owned. There were now changes in the patterns of inheritance and there was the disolution of kin-based access to deadwood or living biomass.

Other factors include the start of the growth of cash crops which has meant that there is competition of land between agricultural food crops, cash crops and of course firewood.

Inequalities in the sizes of land or in fact in the possession of land has meant that some people have negligibly small sizes of land while others are indeed landless and this means that some families have no means of providing their own fuelwood from their landholdings.

The process of land adjudication was aimed at consolidating land so that people could not travel long distances to farm their land. However this was not fully achieved because approximately 15% of the people still travelled to distant places to cultivate. The people have actually tried to consolidate tasks in that they collect firewood on the same day they go cultivating.

The insurmountable distances involved nowadays in the collection of firewood has meant that this takes

family labour away from other essential activities for example food and cash production. The other important factor accounting for the present shortages of firewood is the need to satisfy basic needs, alongside satisfying other needs. This invariably means that there is a conflict of interest and the purchasing power of every individual household is very important. For the purposes of this study the following were considered as basic needs:-

- 1) Fuelwood
- 2) Nutrition
- 3) Housing, furniture and domestic implements
- 4) Clothing
- 5) Education
- 6) Health
- 7) Water
- 8) Transportation

The following is an illustration of the basic needs that are in conflict with fuelwood.

TABLE No. 16

Basic need with which fuelwood need is in conflict

	Area of Competition			
	Labour	Time	Money	Land
1) Nutrition	✓		✓	✓
2) Housing			✓	✓
3) Clothing			✓	
4) Education	✓		✓	
5) Health	✓		✓	
6) Water	✓		✓	
7) Transportation	✓		✓	

The Nutrition/fuelwood conflicts over land have their counterparts in conflict over the use of scarce incomes. Many small farmers in the location find

themselves being paid prices for their small quantities of cash crops which are not in keeping with the cost of basic needs they must purchase. Inflation in the past five or six years has affected both the basic needs and the prices they must pay for a fossil fuel for example kerosene for lighting. This phenomenon has meant that the response of many small holders has been to grow more of the cash crops and this has displaced more and more of their food acreage. This has put additional pressure on the fuelwood/food inputs while trying to get higher yields. As more and more food has to come off less and less land, labour inputs especially by women who are generally responsible for food production have to increase. This study established that reduced cooking time is desirable in view of the increased distances women have to travel to get wood.

The housing/fuelwood conflict lies in the area of competing land use and cash expenditure. Under conditions of land shortages very few families are actually able to grow adequate poles and large diameter trees for roof beams. For parents with sons who will need to be building their own houses, preparation must take place long in advance with savings set aside and/or trees planted for the event.

Needs for clothing and fuelwood compete directly only in the monetary realm, but given the rapid inflation of clothing prices and additional clothing needs are experienced when children are at school.

Education needs and fuelwood needs conflict most strongly in the area of cash expenditures. Education is perceived widely as a valuable investment. The satisfaction of the need for education also draws away labour from the conventional mode of fuelwood acquisition. since an increasing number of children

are in school. The increased number of girls in school reduces the labour power available not only for fuelwood haulage but for any tasks which might have reduced the labour burden of the mothers.

Health needs are met in a variety of ways. All of them costing money and time. Given that the location has only 1 hospital two dispensaries and health facilities that are privately run this means that high costs are incurred while travelling, other incidental costs for example buying food and also money paid if the facility is private.

Conflicts with the need for domestic water takes place in the realm of labour time allocation. For approximately 90% of the people drinking water was available within 3 Km of the homestead. Before women used to combine water and fuelwood gathering into multipurpose journeys. But with land adjudication this is no longer possible. Transport needs conflict with fuelwood needs in the area of cash expenditure and labour time. This is because there are relative weaknesses in the transport infrastructure in some parts of the location and this means considerable walks and/or waiting time in the pursuit of motor transport.

Another important factor that has contributed to the shortages of firewood is the increasing population densities. This has meant that land sizes are becoming increasingly fragmented. This together with the need to grow cash crops has led to serious competition in the use of the land and a consequent shortage in fuelwood supplies. This factor of increased population further leads to environmental degradation due to poor farming practices. This involves such practices as cultivation on hill slopes, overgrazing clearing of water sheds, burning bushes for cultivation

and so on. This has led to increased soil erosion, removal of plant cover and so under these circumstances no tree life can be supported. Coupled with the above is the widespread lack of knowledge and awareness of conservation and preservation of the environment.

There is also another factor that is increasing conflict over the maintenance of fallow land (provides fuelwood in some cases) as land and cash becomes short and additional labour time is needed in direct food production. Another factor accounting for the shortages is the commercialisation of fuelwood. Many people are poor and thus their purchasing power is low. The study found that the cost of wood at current prices of relying on purchased wood already exceeds the cash crop incomes of many farmers.

The seasonal changes also account for fuel shortages. Over half of the people answered in the affirmative when asked whether they used any agricultural residue. But at the time the study was undertaken (1984) the whole country was undergoing a drought period. Probably the figure would have been higher but for the fact of the drought.

5.1 Charcoal: Causes for its Shortage

The foregoing discussion on firewood is true of charcoal except that it is not directly produced in the location. This means that for any person contemplating to use it, it will be even more expensive and thus conflicts with a household's other basic needs. Many people answered that they do not use it because of its expense. Very few people had heard of or even seen the improved "Jiko".

Probably, given that fuelwood shortages have already been identified it might mean that there is

hope in the use of the improved "jiko" in as far as it uses less charcoal. What is needed is a comprehensive understanding of the peoples socio-cultural and psychological attributes before introducing any new technology.

5.2 Impact of the Shortage of Woodfuel

1. One of the impacts is that people will now have to walk further to collect wood. This will invariably mean that there will be a conflict with the need to fulfil other activities.

It also means that more time will now be spent on collecting firewood. Present estimates from the study area range from one to six hours per week. The total amount of wood collected will now decrease. People will increasingly collect twigs and brush and the planted trees will be highly threatened. People will also increasingly use crop residue and cowdung for fuel. The above will mean that agricultural production will be lowered due to the infertility of the land.

2. It also means that preferred species for charcoal trees which are slow growing (thirty to fifty years to maturity) will rapidly decrease. This will also cause a shortage of the most favoured construction timber and also wood for constructing granaries or for pestles and mortars.

3. Increasingly fuelwood will be sold and the prices will increase. There will be more middlemen and traders in the future.

4. Charcoal will be substituted for fuelwood and later charcoal will lose to kerosene, gas and electricity, given that people are rational and assuming that they will become rich. It is not certain however that fuelwood will be substituted completely in the short run.

5.3 Environmental Effects

1. There will be general environmental deterioration and degradation and an increase in soil erosion. This will result from the indiscriminate removal of the tree and vegetation cover, overgrazing, cultivation on hill slopes, clearing of watersheds, siltation and damming of watersheds and rivers and a general lack of nutrients in the soil.

2. The aesthetic appearance of the landscape will be greatly affected by the indiscriminate removal of the vegetation cover.

Chapter Six - POLICY IMPLICATIONS AND
RECOMMENDATIONS

Introduction



PLATE 9. DEFORESTATION AND SOIL EROSION

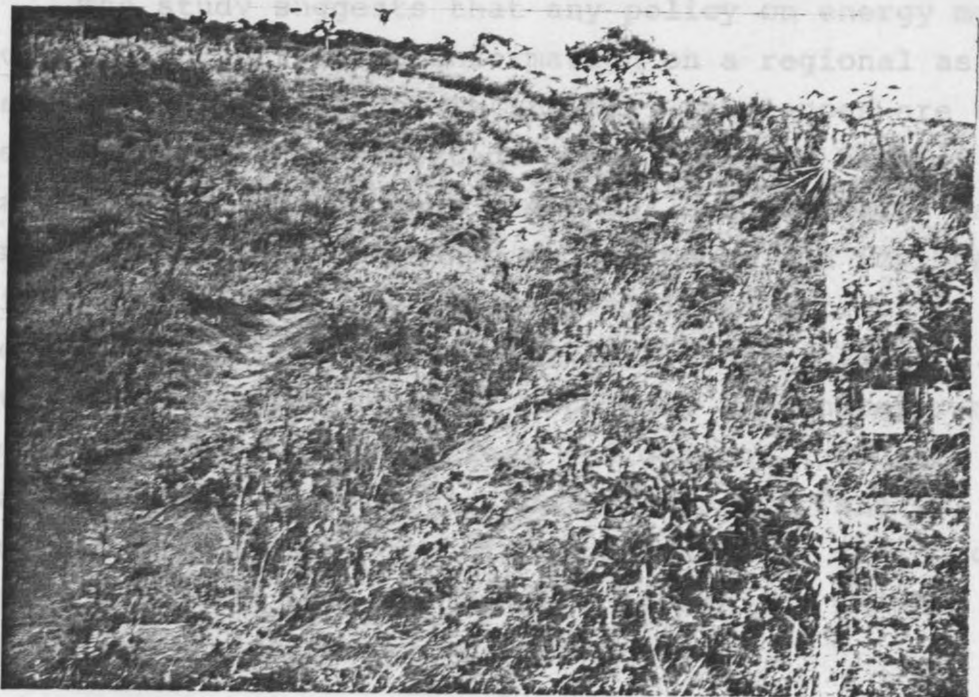


PLATE 10. DEFORESTATION AND SOIL EROSION

Chapter Six - POLICY IMPLICATIONS AND RECOMMENDATIONS

6.0 Introduction

This study recognises the useful role energy plays and will continue to play in rural development and national development as a whole. However there are some problems or constraints that have been identified both at the national and local levels. The following is a discussion of the findings and recommendations that the study suggests in order to overcome the problem.

There is an urgent need to address the issue of energy in an integrated manner. This means that coordination in energy and environmental relationships must be incorporated in national planning and the issue of the reduction of waste must be addressed.

The study suggests that any policy on energy must be based on sufficient information on a regional as well as the national basis if local imbalances are to be identified and corrected. The competing uses of land for food, cash crops and fuel, each of which has energy and foreign exchange requirements and implications must be adequately addressed in an attempt to develop an analytical framework for energy planning. It has been recognised that both food and energy requirements dictate that sufficient indigenous resources and associated technologies be developed. This is very important since the high and generally rising cost of fossil fuels will in the face of serious balance of payments problems impede development.

6.1 The Need for Conservation

The study recognises that in the face of scarce and limited resources and increasing population growth

there is a great need for conservation and the optimal utilisation of the resources. The study underlines the need to conserve the land, water and other natural resources and also the need to have intensified mass education programmes on conservation.

It is proposed that this can be done especially in "barazas" womens' and mens' groups, schools and institutions, adult literacy classes and also in churches. It is suggested that this education should cover such aspects as environmental protection and development without destruction. These programmes can be realised through the joint efforts between the locational development committee, Ministry of Energy and Regional Development, Ministry of Environment and Natural Resources and the Ministry of Agriculture.

One of the ways that this can be achieved especially in schools is through the school milk programme. The polythene bags for planting trees which are presently in short supply can be substituted by the school milk packets for planting trees. The study suggests that on these packets messages on environmental education, soil conservation and afforestation be imprinted. It is also recommended that the packets should be termite resistant.

6.2 Family Planning

It has been established in section 3.1 of chapter 3 that the location suffers from a high population growth rate. Coupled with this is the dependency burden which is being worsened by the fact that the proportion of children under 15 years of age has been increasing (Table Number 5 and 6).

Further it has been established that the increasing high population growth rate means that more resources have to be found to meet energy needs and other basic needs. For example food, education, healthcare, water supply and housing.

The goal in family planning has been identified as the need to reduce family sizes from the present 6 - 7 members and this will consequently ease the present pressure on the land. Another recommendation is out migration from the densely populated areas of the location to the less densely populated areas of the district for example to Makuyu division.

While the objectives above are clear there are however some constraints which would have to be overcome before these objectives are realised. These include cultural beliefs about family sizes and attachment to the land and also the lack of alternative employment opportunities other than employment on the farms.

However it is proposed that family planning as a policy be strengthened and expanded and the related public information programmes be readdressed. Public attitude towards family planning must also be readdressed. There is need to recruit more family planning educators and also there is need to address rural industrialisation given the existing resources in order to care for employment needs.

The agencies that have been identified include:- Ministry of Health and Ministry of Education. They should deal with aspects of sex education in schools and in adult literacy classes. Other agencies include the Ministry of Culture and Social Services, the Mass Media (Magazines, Newspapers and televisions where applicable). The various women groups, the locational development committee can be very useful in disseminating the information.

6.3 Over Dependence on Fuelwood and Agricultural Residue

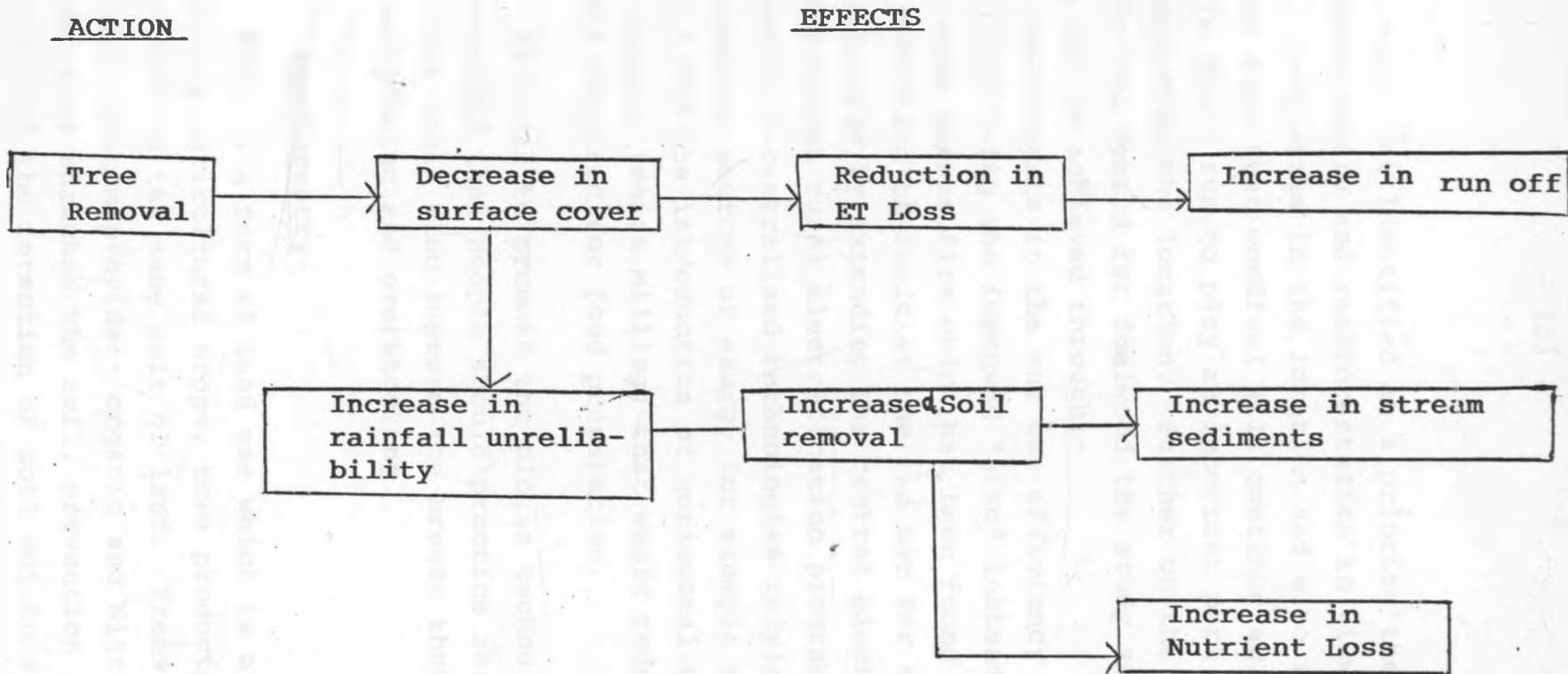
The intensive use of fuelwood and agricultural residue almost exclusively has meant that there's a very high demand for it and consequently there is increased vegetation removals and consequent deforestation. Further it has been established that increasing removal of the vegetation cover has led to increased soil erosion. It was also established that there is overgrazing which also contributes to soil erosion. Poor farming practices for example cultivating on hillslopes and lack of rotation of crops, failure to add manure or fertiliser to the soil and clearing of watersheds has resulted in increased erosion, siltation of the rivers and lack of the necessary nutrients for plant growth in the soil. This has meant that agricultural production has generally been on the decline. This problem has been worsened by people when they substitute animal dung and crop residues for scarce firewood because this has generally decreased the fertility of the land. The goal in this sector has been identified as the need to provide energy requirements sufficient for the needs of the people in the location and to conserve the available energy resources. . (See Chart No. 3)

In the long run it is recommended that alternative energy sources be provided.

The constraints that are to be overcome have been identified as lack of immediately adequate energy sources and the lack of technology among the people to harness and maximise in the use of existing energy sources.

It is proposed that the programmes towards the achievement of these objectives is to practice agroforestry, intensify afforestation and reafforestation and carry out intensive research into solar energy, generation of electricity and the use of biogas.

PARTIAL FLOW CHART FOR ENVIRONMENTAL IMPACTS OF TREE REMOVAL



This study has identified as a priority the programme of agroforestry and reforestation in view of the small land sizes in the location and also in view of the fact that woodfuel will continue at least in the short run to play an important part in energy provision in the location. Further on the need to reduce the demand for fuelwood the study suggests that this can be achieved through:-

The improvements in the end use efficiency of rural cooking by using the improved "jiko" instead of using the three stones fire which has been found wasteful, the switching of fuels at the end use for example, in principle by extending the central electricity grid (through rural electrification programme), by promoting decentralised technologies relying on indigenous sources of energy for example solar energy, biogas and the introduction of horizontal technologies for example (maize milling) that would reduce the energy required for food preparation.

In order to promote the biogas technology it is recommended that people should practice zero grazing and this would also improve the breeds thus reducing on overgrazing and overstocking.

6.4. Agroforestry

This is a form of land use which is aimed at producing agricultural crops, tree products and rearing livestock on the same unit of land. Trees in an agroforestry system provide:- organic and Nitrogen fixing matter that enriches the soil, prevention of soil erosion and the retention of soil moisture, an abundant source of fuelwood, other products for example fodder, fruits and poles. Thus in a nutshell agroforestry improves the overall farm economy through increased production.

The study suggests that the potential advantages in agroforestry must be weighed in evaluating and carrying out agrogorestry. Such planning must be consistent with other national goals for example food self sufficiency and increased income equity. The opportunity for introducing agroforestry must depend upon the acknowledgment of the fact that farmers are currently producing food and fuel themselves. In order to optimise this production it is suggested that assistance is needed in the development of systems which integrate agriculture and agroforestry. Thus the role of training, extension services, improved management, the introduction of new techniques and their financial implications must be addressed.

It is also recommended that the intervention regarding agroforestry should be homogeneous in general, but flexible enough to adjust to the specific conditions encountered within the different sublocations. The focal point of the intervention should be the mobilisation of existing skills, knowledge and resources of the farmers.

The study found out that in the location tree planting on farms is actively undertaken but not for the specific purposes of woodfuel supply. It is for this reason that it is recommended that the officers concerned have more concerted efforts towards this end. Farmers need to be made aware of the advantages of certain tree species.

The other strategies on afforestation include the strengthening of the chiefs and forestry department enforcement machinery, planting trees on farm plot boundaries, along river valleys, school compounds and hilltops.

The main agencies that have identified include the Ministry of Environment and Natural Resources, Provincial Administration, Schools and local initiative. The Ministry of Energy and Regional Development together with the Muranga Institute of Technology and Crafts Training Centre should deal with the programme of developing and producing the energy saving "jikos". The National Council of Science and Technology as well as the University of Nairobi can also be part of the programme especially in furthering research on the use of biogas and solar energy together with other alternative sources of energy. Besides the tree nursery at Karugia Market Centre, the Kagunduini Community Centre can also be used as a demonstration unit for agroforestry. Other agencies include the Maendeleo ya Wanawake Organisation, the Greenbelt Movement, the National Christian Council of Kenya, 4K Clubs, the Scouting Movement and any non-governmental organisation interested in the area of rural energy.

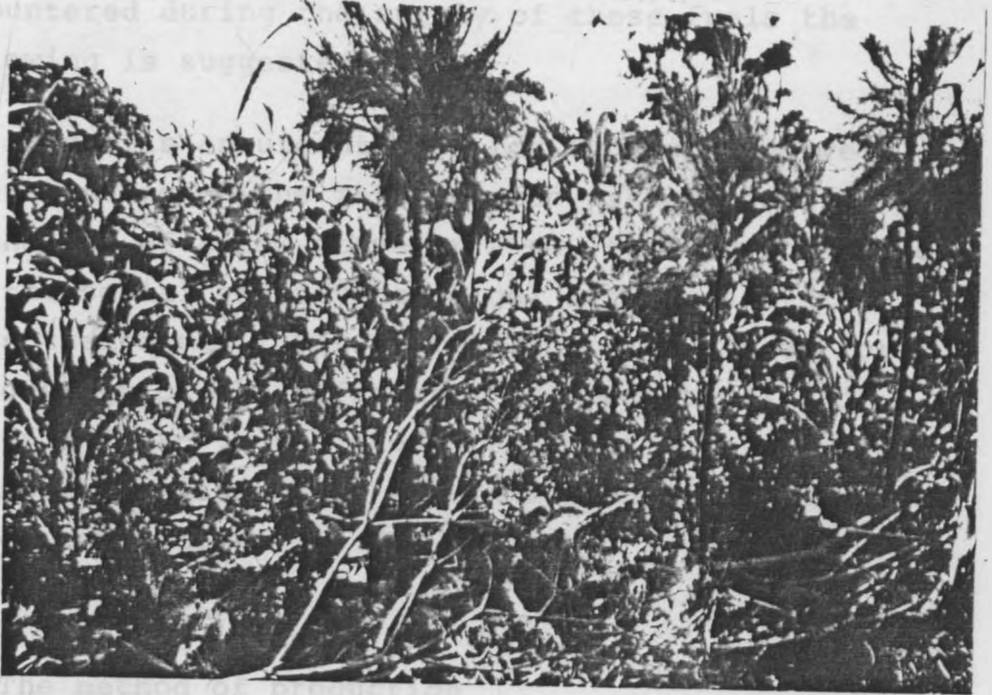


PLATE 11. AGROFORESTRY

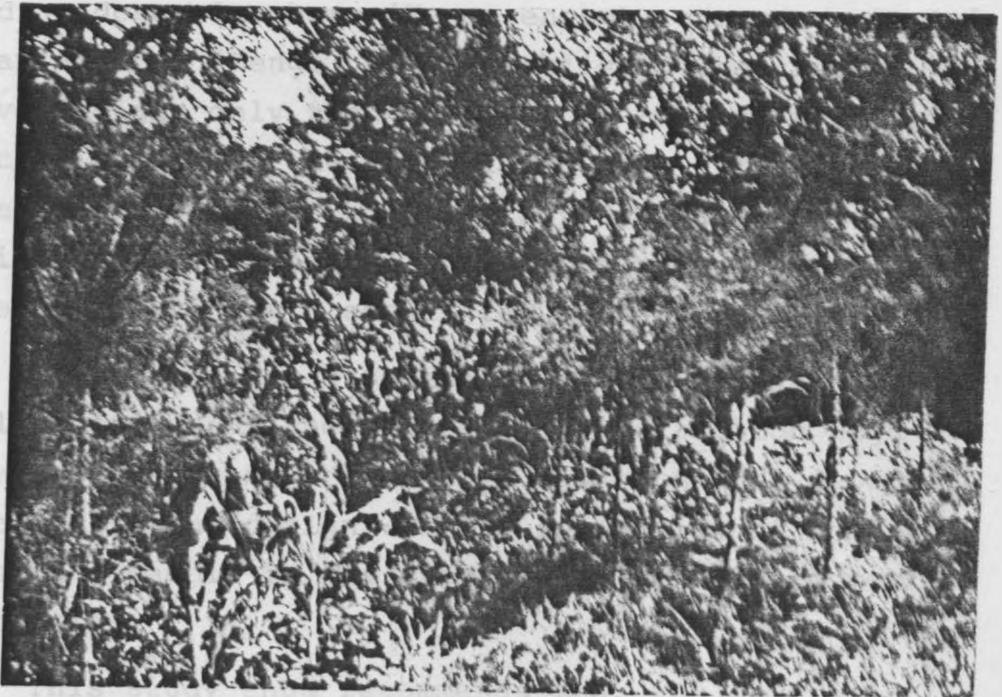


PLATE 12. AGROFORESTRY

6.5 Recommendation on Improved "Jikos"

Due to the rising prices associated with the purchase of alternative fuels and the difficulties encountered during the supply of these fuels the following is suggested.

There is an urgent need for a comprehensive understanding of the interrelated systems involved in the use of a new stove or a new fuel saving "jiko" and the social and psychological attitudes of the users themselves. For example there is a need for the improvement of the efficiency of wood stoves and charcoal "jiko". The study considers the following as important issue that should be addressed in any stove programme:-

- 1) The design principals
- 2) The method of production
- 3) The problem of diffusion of any new technology to the people.

The study considers the above important because studies done elsewhere (Kenya energy, non-governmental organisation) (Kengo) have established that recent stove designs only tend to focus on the end use that is cooking, while the traditional open fires have several end uses for example they are used for:- rapid boiling, lighting, space heating, reducing insects, providing a social focus and preserving food.

This study has also established the current selling prices of the new proved jiko are too high (the cheapest ranges from Ksh. 150/= onwards depending on the size and design). This is in view of the fact that many people in the area cannot be able to meet that price.

This study thus recommends that the government subsidise the prices of the stoves in order for the idea to pick up faster.



PLATE 13. AN EXAMPLE OF AN IMPROVED JIKO



PLATE 14. ANOTHER EXAMPLE OF AN IMPROVED JIKO

6.6 On the Rural/Urban Relationship

The study has established that effective rural development is an antidote for excessive migration to the urban centres and hence it serves directly in alleviating poverty in the urban areas. It also recognised that the critical dependence that exists between the rural and urban areas provides markets for rural produce and is also the source of inputs for rural activities and consumer goods for rural households.

This study recommends that in order to make the rural areas stop being subsistent there is a need to create more ready access in the urban areas for rural produce. This can be achieved for example through the formation of cooperatives which will ensure streamlined marketing.

The study further established that during the coffee picking season children from Kabati, Gitura, Karugia and Githunguri, sublocations stop going to school in order to pick coffee in the neighbouring coffee estates. It is recommended that this practice should stop. As regards regional development in general the study recommends that through the District focus for rural development strategy it is necessary to re-examine the development policies adopted in the country and those that affect energy in particular.

The service centre strategy should be strengthened in order to enhance regional development. This can be achieved through examining ways of establishing the most viable (as regards local resources) small scale activities. Development can also be achieved through the improvement of infrastructure and services for example roads, dispensaries, health centres, water and health services among others. This would mean that

the standards of living of the people would be raised if employment opportunities are created.

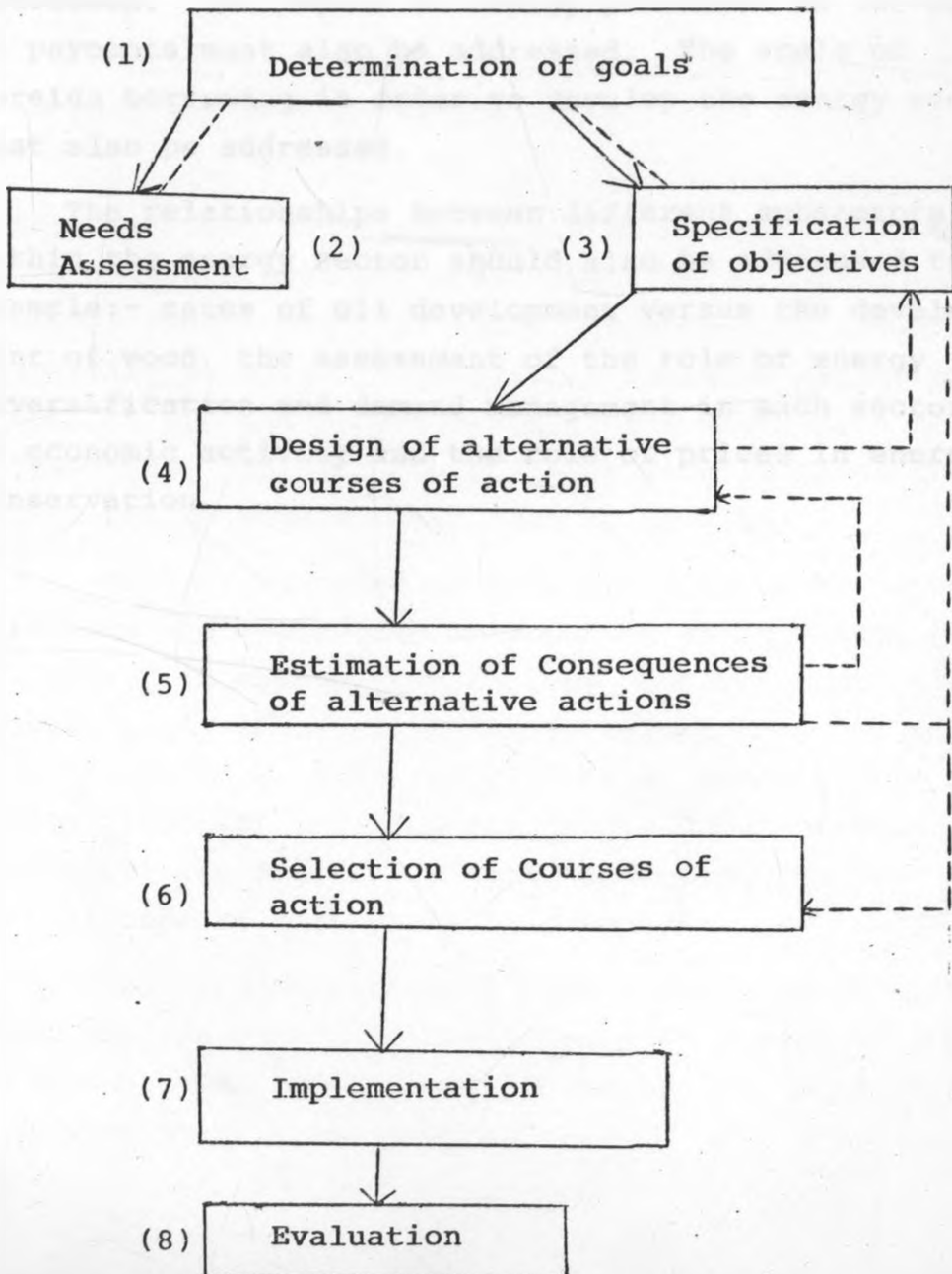
As regards cooperatives it is recognised that there is a need to broaden the functional scope of agricultural cooperatives by reorganising their activities to serve members more efficiently by ensuring punctual delivery of seeds, fertilisers and insecticides and also the elimination of the long delays in payments. This will minimise the competition energy has with other basic needs.



Poor Management of farms in the area has risen from the fact that the agricultural personnel are not very many. This study recommends that training be intensified in training the extension service workers and should be done on a regular basis in order to keep pace with new developments in either energy or agriculture.

The following is a recommendation on energy policy formulation model. After (Mayer and Greenwood 1980)

CHART No. 4



6.7 National Level

This study recognises that in order to address energy issues at the local level, the National level must also be addressed so that the resultant energy policy is an integrated one.

The study underlines the importance of the following issues at the National level.

The National energy policies in relation to other national goals for example energy investments relative to investments in other sectors must be addressed. The role of energy prices in the economy must also be addressed. The impact of energy purchases on the balance of payments must also be addressed. The scale of foreign borrowing in order to develop the energy sector must also be addressed.

The relationships between different subsectors within the energy sector should also be addressed for example:- rates of oil development versus the development of wood, the assessment of the role of energy diversification and demand management in each sector of economic activity and the role of prices in energy conservation.

6.7 Research Priorities

As found out in the study the major shortcomings in the study area are that there is lack of any data base and knowledge of the actual amounts of woodfuel used during different times of the day, whether the number of people in any given family affects the amount of wood used, whether certain species of trees are more preferable than others, whether a particular type of wood produces more woodfuel than others and to establish the efficiency of different cooking stoves.

Therefore this study proposes that something be done in the line of the above.

In view of the fact that the land in the study area has been made private and given that increased population growth has meant land has continued to be highly fragmented this study proposes that agroforestry and afforestation techniques focusing on fast growing species for the requirements of the study area be developed. The effects of these techniques on the land use in general must also be studied.

Further in order to ease pressure on the land as regards overdependence on woodfuel as an energy resource research is needed. This study proposes that selection and development of alternative and relevant energy sources be developed to suit the particular needs of the people. This study further proposes that a comprehensive study covering the social, cultural and psychological attributes of the people be undertaken.

This study recommends that there is need to monitor the various energy technologies with a view to evaluating on their performance and making any necessary changes to suit the people.

Further on the need to ease pressure on the land by diversifying energy sources other than woodfuel, this study proposes that the viability of rural electrification in the study area be studied.

This study also recommends that there is a need to forecast on energy demand and supply and also further research on energy policy should be conducted regularly in order to keep abreast with any new changes in the area of energy provision.

Chapter Seven - SUMMARY AND CONCLUSIONS

7.0 Introduction

The majority of Kenyas people live in the rural areas. Since her principle economic sector is agriculture there has been a continued stress on the importance of developing the rural areas. Many strategies have been advanced towards this end.

This study has examined rural development and the role energy plays in it.

In an endeavour to understand this role the study has examined the problem starting from the 1970's when there was an international outcry for the need to conserve energy resources and especially cut down on the use of oil as a fuel by developing alternative sources of energy.

The National energy policy, policy on rural energy have been closely examined. The policies on rural development have been closely tied with overall policies on National development.

This study has further attempted to analyse the current energy situation in the location. It has also examined the impact of energy as a basic need on other basic needs and indeed its impact on rural development.

This study has thus been seeking answers to the following questions.

- 1) What role does energy play in rural development?
- 2) How does the present energy situation look like in the location?

- 3) What are the possible reasons for the present situation?
- 4) What is the future of energy in the location from a local and national viewpoint?

While recognising the significant and important role played by energy in rural development a number of problems were identified which hamper this intention.

Ranking amongst the major problems is the one of increased and rapid population growth rates. This has meant that more and more land has to be cleared to meet peoples needs to grow food and graze their livestock. The increased population has also meant that land is increasingly fragmented. This is further worsened by the need to grow a cash crop so that there is direct competition between food crops and cash crops.

This problem is further worsened by poor agricultural practices whereby people increasingly till the soil without returning anything to it. There is also indiscriminate cutting of trees which coupled with overgrazing has over time resulted in excessive soil erosion. This state of affairs has robbed the soil of its very vital nutrients and has meant that general agricultural productivity is low. There has also been increased silting of the rivers.

Arising from the above therefore is the dire need to address the issue of energy in an integrated manner. This means that coordination in energy and environment with National planning and the issue of the reduction of waste must be addressed. This study recommends that any policy on energy must be based on sufficient

information on a regional as well as a national level, if local imbalances are to be identified and corrected. The competing uses of land for food and export crops and fuel each of which has energy and foreign exchange requirements and the implications must be adequately addressed in an attempt to develop an analytical framework of energy planning.

The study has specifically underlined the importance of the need to conserve resources and also to have development without destruction of the environment. In the area of afforestation the study suggests that for every tree cut, one must be planted in its stead. Regarding agroforestry it puts particular emphasis on its advantages in raising the overall farm economy through increased production.

The study points out that woodfuel at least in the short run will continue to be the single most important source of energy in the rural areas. In order to reduce the amount of woodfuel used in the rural areas the study lays particular emphasis on the need to promote the use of the improved "jiko" in order to ensure more efficient use of woodfuel. However the study underlines the importance of a comprehensive approach to any new technology in view of peoples inherent social, psychological and cultural attitudes that might hinder the introduction of change.

In view of the fact that people in the past have not planted trees specifically for energy, the study calls on the officers in the relevant Ministries to have more concerted efforts in this area and to ensure followup especially to ensure that the tree seedlings do not die.

The government is called upon to provide the tree seedlings freely and also to subsidise the improved jiko in order to popularise the planting of trees and the use of the new "jiko".

On the rural/urban relationship the study calls for the creation of markets for rural produce through organised cooperatives in order to stop the rural areas being subsistent. This will also reduce on the rural/urban migration because employment will have been created.

The study also calls for a stop in the use of child labour during the coffee picking season.

The study on long term recommendations points to the switching of fuels at the end use for example in principle by extending the central electricity grid (through the rural electrification programme).

It is also suggested that there should be the promotion of decentralized technologies that rely on indigeneous sources of energy for example solar energy and biogas production. In order to promote the biogas technology it is recommended that people should practice zero grazing, improve breeds and stop overstocking.

In order to bring about more effective regional development it is recognised that it is necessary to re-examine the development policies adopted in the country and those that affect energy in particular. The service centre strategy through the district focus for rural development strategy should be strengthened in order to enhance regional development.

This can be achieved through examining ways and means of establishing the most viable small scale

activities in the study area.

As regards cooperatives it is recognised that there is a need to broaden the functional scope of agricultural cooperatives by reorganising their activities to serve members more efficiently by ensuring punctual delivery of seeds, fertilisers, insecticides and also the elimination of the long delays in payments. This money will help in minimising the competition energy has with other basic needs.

The idea of afforestation can be enhanced further in schools by say 4K clubs, wildlife societies, geographical societies, boy/girl scout clubs, women and men groups, Adult literacy classes, the Mass Media, Maendeleo ya Wanawake, the Greenbelt Movement, Church organisations and so on can be used as forums to pass the message.

Conclusion

In conclusion it is recognised that this study has by no means exhausted the full scope of the subject. It has only examined the role energy plays in rural development. The importance of this subject has clearly been brought out not only in the study area but also as a general national policy need. Indeed if this is to provide the right guidance in the formulation of rural development policies then greater understanding of the full scope of the role energy plays has to be sought. Towards this end it is suggested that further research be undertaken in the following areas:-

The actual amounts of energy used during say breakfast, lunch and supper when wood is either wet or dry should be studied. Species of wood and the type of "jiko" that gives the highest efficiency should be identified.

On fuel substitution studies are needed to identify the most viable technology given peoples circumstances and resource endowments. Also needed are studies into the ways and means of effecting changes in the provision of energy towards a more community based approach especially in ensuring that people have conservation awareness.

The service centre strategy and its relationship with the District focus for rural development should be examined critically in order to identify its weaknesses in promoting regional development in the study area.

This study also recommends that there is need to monitor the various energy technologies with a view to evaluating on their performance and making any necessary changes to suit the people.

Further on the need to ease pressure on the land by diversifying energy sources other than woodfuel, this study proposes that the viability of rural electrification in the study area be studied.

The study also recommends that there is a need to forecast on energy demand and supply and further research on energy policy should be conducted regularly in order to keep abreast with any new changes in the area of energy provision.

Similar studies are recommended in other areas of different climatic and natural endowments. The relevance of the above studies is seen mainly with respect to finding ways of improving on the economy in general.

The above studies it is felt could form useful followups of the present study.

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ARTICLE

Government Printer The Nairobi Times June 1979.

A P P E N D I X

QUESTIONNAIRE

Name (optional)-----

Age -----

Sub-location -----

1. Sex : Male ----- Female --

2. Size of the houses -----

3. Type of the house (construction material) -----

4. Availability of facilities at home

Water on site -----

Electricity -- -----

Telephone -----

5. Land ownership:

Individual -----

Rented -----

Squatting -----

Other specify -----

6. Size of the land on site -----

7. If owned how was it acquired?

Inherited -----

Purchased -----

Other (specify) -----

8. Do you own another parcel of land elsewhere?-----

Size -----

9. Land use:

Farming -----

Other (specify) -----

10. If farming state -----

Types Acreage

11. Types of livestock and poultry (numbers):

- Cattle -----
- Pigs -----
- Goats -----
- Sheep -----
- Donkeys -----
- Rabbits -----
- Poultry -----

12. Do you belong to any community development organisation?

If yes explain the group/s activities

13. Is the head of the household employed - Yes ----- No -----

14. Upto what level did he go to school?

- Primary school -----
- Secondary school -----
- Post secondary education -----
- University + -----

DOMESTIC ENERGY USE (KEY)

15. Type of energy for domestic use:

- Electricity -----
- Woodfuel -----
- Kerosine -----
- Gas -----
- Biogas -----

16. After stating the particular type of energy used how much

of it do you think you use -----

17. Availability of stated fuel distance from source -----

18. What measures of soil conservation do you employ -----

19. Do you feel there is need to improve the energy situation
in your area?

Explain. -- -----

20. What do you see as the future of energy in your area?

Explain -----

21. What kind of "jiko" do you use?

Kerosene ----- Open fire ----- electricity -----

22. If you use firewood how much do you use in a day?

Stacks -----

23. What kind of food do you cook longest?

Githeri -----

Ugali -----

Rice -----

24. What time of the day do you do this?

Lunch time -----

Evening -----

25. How much money do you spend on firewood in a month? ..-----

26. Do you use wood from your own trees? Yes/No

27. If you gather wood who gathers it?.. Mother ----- Children-----

28. How often -----

29. Roughly how much is gathered during each trip? -----

135
18
J