MANAGEMENT OF NATURAL RESOURCES BY SMALL SCALE FARMERS: A CASE STUDY OF AGRICULTURAL LAND IN CENTRAL DIVISION OF MACHAKOS DISTRICT, KENYA

BY

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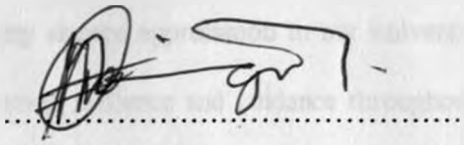
DECLARATION

This Thesis is my original work and has not been submitted for the purpose of a degree in any other University.



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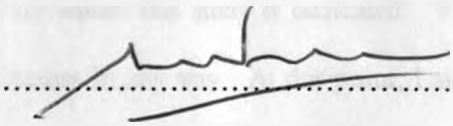

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DEDICATION

This study is dedicated to my mother Mary Mumbi Macharia for her love, sacrifice and support that has enabled me to go this far. May you live to be remembered by your grandsons, daughters and those that have heard or met you.

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LIST OF ABBREVIATIONS

AEZ	Agro-Ecological Zone
AFC	Agricultural Financing Corporation
ASAL	Arid and Semi-arid Lands
CBRO	Community Based Resource Management
FAO	Food and Agriculture Organisation
GIS	Geographic Informational Systems
GPS	Global Positioning Systems
ICRAF	International Centre for Agroforestry
ILRI	International Livestock Research Institute
KARI	Kenya Agricultural Research Institute
KEFRI	Kenya Forestry Research Institute
NGOs	Non-Governmental Organizations
ODA	Overseas Development Administration
PRA	Participatory Rural Appraisal
RAWOO	The Advisory Council for Scientific Research in Development Problems of the Dutch Government
SPSS	Statistical Package for Social Scientist
UNCHS	United Nations Centre for Human Settlement
UNEP	United Nations Environmental Programme

ABSTRACT

Most development undertaking in Kenya focuses on rural areas. A significant segment of Kenyans in these areas derive their livelihood directly from land where agricultural related activities dominant. Land use policies therefore need to incorporating sound natural environment management aimed at solving the country's socio-cultural, economic and environmental problems in the face of the growing population (Republic of Kenya, 1994) and decreasing land available to each rural household.

This study set out to establish the extent to which small scale farmers in the high and low potential agro-ecological zones of the Central division make use of their agricultural land. The five agro-ecological zones of the division were broadly classified into low and high AEZs for the purpose of comparing land use activities and other socio-economic attributes of the farmers. Administrative locations were then fitted in this broad classification where random sampling was then used to select the two areas of study. Seventy eight questionnaires were administered in the field, forty two and thirty six in the high and low potential areas respectively. Other types of data were collected by use of scheduled interviews, participant observation and focus group discussions.

In addition to the physical factors such as rainfall, soils and topography that were found to influence the use and management of agricultural land, the study established that the socioeconomic factors also do influence utilization of land. As a result of the increasing population in the high potential areas, the low potential areas have continued to receive high number of immigrants from the high potential leading to depletion of land resources. In the two areas, the problem of soil erosion was found to be acute due to human activities which has continued to exert a lot of pressure on agricultural land.

The study also established that resources such as land and money are generally controlled by men despite women being the main users and custodian of land. The roles of women unlike those of men were significant in all land use activities such as fetching of water and

fire wood, cooking, weeding, harvesting, grazing of cattle, soil conservation efforts among others.

This research calls for resource management strategies from the household to community level that will lead to alleviation of poverty in the face of increasing environmental degradation. The deciding actors should also involve the farmers at all levels in the conceptualization and designing of farming technological package in order to adequately address the problem of declining agricultural production.

Some of the recommendation suggested in this study include agroforestry practices, gender sensitization and community participation campaigns to enable both men and women to participate together in land use and resource conservation efforts, revolving loan schemes to be operated by *mwethya* groups which enjoys wider support from the household and also as groups which empower women and the need for market survey.

Finally, the study suggested a model that can be used for development of resources in the ASALs. It indicates among other things that management of resources and their use will depend on how best the outsiders (deciding actors) understand and appreciate the local actors (farmers) strategies and perception in as far as they relate to various resources.

CHAPTER 1. GENERAL INTRODUCTION

1.1 Introduction

Environmental resources use problems that are currently threatening our world include runaway population growth, land erosion, declining food harvests among others (Stern et. al. 1991). It has been observed that natural resources of Africa have been extensively exploited and utilized, in some cases to actual depletion (Okidi, 1983:2). In Kenya, the principal environmental problems include deforestation, land degradation and water scarcity (ODA, 1995). Resources such as water, soils, plants and ecosystems are increasingly under pressure from unsuitable land use resulting in soil erosion and resource depletion that has adversely affected small scale farmers in the rural areas (Republic of Kenya, 1994:3).

The most important natural resource in Kenya is land and any successful economic development depend on its intensive and productive utilization. This resource form an important national heritage that should be used for the benefit of Kenyans since it is a valuable asset that is associated with an intricate chain of interests based on the extended family concept (Shelter Forum, 1995). Among other things, it is essential for the sustenance of every living organism and primary to the existence of man socially, economically and politically. The first President of the Republic of Kenya Mzee Jomo Kenyatta once noted that:

> *land in Kenya supplies the material needs of life through which spiritual and mental contentment is achieved (In Shelter Forum; 1995).*

Leake (1927) points out that land is the ultimate factor in the development and progress of human race. It is not only a fundamental factor of production but also fixed in size and therefore requires proper planning for optimal utilization. Despite the heavy concentration of population in some areas, its full potential has not been realised (Republic of Kenya, 1966: 33). In most cases, how land is owned and farmed often holds the key to a nation's strength and stability (Abrahams, 1979).

Land related matters are associated with deep socio-economic and political interests (Republic of Kenya, 1994). This kind of attachment to land resource has been caused by the present land tenure system which has placed high demand for land in rural areas as a result of population increase. In Kenya, some of the best agricultural land which supported the economy due to their high productivity are mostly found in the high potential areas (Republic of Kenya, 1970). However, there is increasing evidence that the capacity of the land to produce is declining, largely due to the increasing population and the resulting land degradation (Wang'ati, 1994:23). As a result of the increasing population in the high potential areas, there has been spill over effects of excessive population into the marginal areas.

Kenya faces major challenge in planning for sustainable resource management in the arid and semi-arid areas (World Bank, 1994). This is in the face of limited arable land, water resources, rapid population growth, poverty, and limited financial capital. According to the NEAP report, these problems are a cause of concern to the government and the people living in this environment (Republic of Kenya, 1994). These areas have great potential for development if only the socio-cultural, economic and environmental subsystems under which the inhabitants of these areas survive could be exploited for effective planning at different stages and levels.

The fragile ecosystems are often seen as neglected in as far as their development is concerned. These areas are in themselves in a vicious cycle that involves natural and human factors. The human factors are seen as the only elements that can reverse or alter the natural factors. Marx recognised the role that man has in helping to change form. He argued that:

> *Man... can work only as nature does, that is by changing the form of matter. Nay more, in this work of changing the form he is constantly helped by natural forces. (Marx 1887/1954:50)*

This research aims at contributing to the development of the ASALs by understanding the socio-economic and environmental factors that influence agricultural land. Finally, it suggests a model for the development of the same areas in Kenya.

1.2 Statement of the Problem

The arid and semi-arid lands of Kenya comprise about 88 per cent of the country's land surface and supports 20 per cent of the total human population as well as more than 50 per cent of the total livestock population (World Bank, 1994). The ASALs are associated with fragile environments which are prone to degradation partly due to changing land use patterns.

The most extensive resource problem in the ASAL regions of Machakos district is the reduction in vegetative cover due to the high demand for agricultural land as a result of the increasing population. The depletion of vegetation cover has increased soil erosion both in the high and low potential areas of the district. According to the World Bank (1994), in this fragile ecosystem, environmental degradation is closely linked with population increase, immigration from upland areas to the low potential areas, expansion and concomitant increases in over-cultivation and overgrazing. According to Marsh (1864:36),

> *'... man has too long forgotten that the earth was given to him for usufruct alone, not for consumption, still less for profligate waste'.*

It is important to note that this usufructuary responsibility has often been neglected in terms of development planning in the ASALs.

In any society, conservation of resources is directly tied to the way people relate to land. In such societies, there are tremendous diversity in terms of people's access to land which can be considered at a variety of scales: differences within the household according to gender where there are differentiated roles between men and women; inequalities within a local community for instance large and small scale farmers; regional differences within

a country such as between urban and rural population and also at the international level where there are developed and developing countries (Elliott: 1994). Similarly, there are differences in the way people use resources which can also be considered at varying levels. For example, decisions regarding resource use differ between low and high income households, between public and private enterprise and within capitalist or socialist production.

Apart from land being an important factor of production, it also support the lives of different communities who live under different social organisation mostly influenced by their surrounding environment. These communities mostly depend for their livelihood on the little resources that are provided by land. Most of the settled communities in the ASAL are found in areas where some form of agriculture can be practised (World Bank, 1994). In Machakos district, population is concentrated where there are opportunities that can be exploited for the satisfaction of the basic needs of the inhabitants. These opportunities include water, fertile soils and where there are possibility of rainfed agriculture (Republic of Kenya, 1997).

In the high and low potential agro-ecological areas of the district, the immediate concerns is the availability of food (Republic of Kenya, 1993). Most of the farms in this area have been subdivided into uneconomical units such that the families cannot meet their food requirements. Vegetation cover has been depleted to the extent that what Tiffen et al (1994) once referred to as 'environmental recovery' in the district is slowly dying out due especially in the low potential areas due to the increasing numbers of immigrants from the high population areas. According to a World Bank report (1994), the ASAL have 'in the recent times, continued to witness a rapid population influx from the high potential areas'. This has simultaneously led to the use of technologies and practices that are largely incompatible with the ASAL environment.

Shelter Forum (1995) has pointed out that land is an important asset which every person would want to have and control. This means that in most cases, whoever control land

control resources found on it. As such, land is viewed differently by different communities in Kenya and elsewhere in the world. At the household level, gender access to land is influenced by various socio-cultural, economic and environmental attributes.
Studies on women and development in Africa reveal that most of the reproductive activities are undertaken by women. These activities include fetching water, fuel collection and childbearing. Were (1985:77) asserts that traditionally, 'business' was man's property and the work of women was in the house. As a result, women's workload increased as they were involved in both reproductive and productive activities.

The way land is viewed by different communities continue to a large extent to influences the management of land resources. Individual ownership of land has in most cases led to either good management or depletion of resources. In economic terms, land is an important factor of production. It is the source of food stuff which enables man and other living creatures to survive (Machyo, 1969). The socio-cultural attributes of land are also important and in a way determine the land use patterns when incorporated with the environmental factors.

Gill (1995) points out that, the driving force behind the envisaged process of environmental degradation is population growth since human settlement and food production are the largest user of land resource. Continued population pressure on land resources in the marginal areas of Machakos district which falls in the ASAL has resulted in expansion of farming onto marginal farming areas, with ensuing environmental degradation as manifested by soil erosion, losses of soil fertility, degradation of forests and vegetation, and removal of forest cover (Republic of Kenya, 1991).

Therefore, with the socio-cultural and economic changes which have brought about transformation in the land tenure system where individual ownership of land is the norm, those who own small parcels of land exert a lot of pressure on land since it provides for their daily socio-economic satisfaction. This is especially so in the high potential area of the study. On the other hand, those who have settled in the low potential agro-ecological

zones in the areas of Katheka-kai and Katelembo sublocations have tended to exploit the resources found in this fragile environment. Giri et al (1992:3) and Flury (1996:11) stresses the importance of investigating the interactions between rural activities and nature.

Machyo (1969:101) has noted that land as a form of wealth possesses characteristics which makes it differ from other forms of wealth and therefore gives it a special value. These special values include the issue of scarcity. Despite projects like land reclamation, the area added is negligible in global terms. Since land is scarce, how individual households use and manage the resources found on it forms an important question to any researcher. Such management practices calls for a combination of socio-cultural, economic and environmental view points that enables efficient use for present and future generations. The study intends to look into the question as to whether the community is aware of the consequences of their actions that leads to destruction or improvement of their surrounding in as far as agricultural land is concerned.

The UNCHS-HABITAT II (1996) para 28 note that eradication of poverty is essential for good environmental management. This is based on the framework adopted by the World Summit for Social Development and on the relevant outcomes of other major United Nations conferences, including the objectives of meeting the basic needs of all the people. This calls for optimal use of land in Machakos district as one of the areas in rural areas which is intended to provide employment for excess labourers since the main urban areas in this district namely Machakos, Athi River, Kangundo and Mwala can no longer fully absorb the excessive labourer from the rural areas. In the absence of alternative income opportunities, smallholder farmers are trapped in poverty (Wachter, 1996).

The conservation that is needed is one that is not concerned with nature alone "but with the total relationship between man and the world around him" (Pitt et al., 1991:1014). According to the UNCHS-HABITAT II (1996) para 29, sustainable development is essential since it gives full consideration to the needs and necessities of achieving economic growth, social development and environmental protection. To overcome current problems and to

ensure future progress in the improvement of economic, social and environmental conditions, the UNCHS-HABITAT II (1996) para 8 calls for the understanding of the living conditions of the people living in arid and semi-arid regions.

In Kenya, rural areas are regarded as the economic bedrock of the country's economy due to the high concentration of agricultural activities which account for 90 per cent of those stricken by poverty. Hardest hit by the food poverty is Eastern Province accounting for 59.50 per cent (Economic Survey, 1997). Machakos district receives 19,580 bags of relief grains monthly (East African Standard, 1997). This problem has its roots from the socio-cultural, economic and environmental characteristics of the area among other things. With a projected population of 979,543 in 1997, Machakos district is one of the district in Kenya where 65.86 per cent of the population live below absolute food poverty line.

Table 1-1 Population Living Below Poverty Line by Districts in Kenya

District	Percentage
Marsabit	85.83
Turkana	80.85
Isiolo	81.33
Samburu	79.34
Tana River	70.55
Makueni	69.86
Machakos	65.86
Kilifi	65.35
Kitui	64.47

Source: CBS, 1997

According to the UNCHS-HABITAT II (1996) para 118 (f) 'there is need to ensure that people living in poverty have access to productive resources, including credit, land ... and

that they have the opportunity to participate in decision-making in policy and regulatory environment that would enable them to benefit from employment and economic opportunities'. The conference also called for the need to promote access to credit and innovative banking alternatives with flexible guarantees and collateral requirements for women and people living in poverty (para 118 (g)).

Causes of poverty in Kenya according to Blom (1985) range from natural and environmental causes (eg drought, etc) to human factors such as high population, natural resource degradation, economic and cultural factors. This study attempts to address the problem of poverty in the area from a resource management point of view. Some of the elements of poverty eradication strategy listed by UNCHS-HABITAT II (1996 para 115) include policies geared toward reducing inequalities, increasing opportunities, improving and providing, as appropriate, access to resources, employment and income; promoting development and measures to improve economic, social and environmental conditions in rural areas; providing protection for those who cannot support themselves; recognizing the needs and skills of women; developing human resources; improving infrastructure, including communication facilities, and making it more accessible; and promoting domestic policies for meeting the basic needs of all.

Management of natural resources by the small scale farmers is a cross-sectoral issue, but given its importance, this study also addresses the relationship between gender and the natural environment. How do the local actors in the high and low agro-ecological zones

related to agricultural land and their immediate environment? What is land to them? The working hypothesis underlying this statement of the problem is that 'people's perception (which is influenced by their socio-cultural, economic and environment attributes) of land and the resources on it determine how best they manage and use the resources found on it'.

This study highlights the community perception of agricultural land and how the problems identified can be tackled from the bottom-up approach. The research also tries to establish whether the farmers who move to the low agro-ecological zones from the high potential areas are aware of the environmental consequences of their actions on land and the strategies they have adapted in order to for them to adjust in this new environment.

1.3 Study Objectives

The study focuses on management and use of agricultural land in as far as small scale farmers are concerned in Central division of Machakos district. The study specifically aims at understanding the relationships between local actors who derive their livelihood from agricultural land and their immediate natural environment. The study thus seeks;

(i) to assess the management and use of resources (i.e. agricultural land) from a socio-cultural, economic and natural environmental perspective, and

(ii) to propose policies that would contribute to improvement in the use of agricultural land and sustainable resource management.

1.4 Research Questions

The study intends to answer some of the following questions: What are the socio-cultural, economic and natural environmental factors that determining the use and management of agricultural land by the small scale farmers in Central division of Machakos district? Are there gender differentiated roles that play significant role in the use of agricultural land? What are the likely consequences of these differentiated roles for the future generation? Is the present form of agricultural land use system likely to affect the use of the same resource by future generations? What are the policies that would contribute to the improvement of agricultural land and preservation of the natural environments in the ASALs?

1.5 Study Assumptions

The following assumptions guided the study;

1 that the household is the major deciding actor as far as resource use and management is concerned. For any resource use and management policies to be used as basis for policies, one must first understand this institution,

2 that management of resources such as soil and vegetation cover on farmer's farms will improve if strategies and perceptions adopted by the local actors are compatible with good environmental management practices, and

3 that there is need to effectively manage the available natural resources for the benefit of present and future generations.

1.6 Justification

The Government of Kenya has emphasized the need for the development of ASALs (Republic of Kenya, 1994). This has led to a number of research aimed at establishing how best the areas can be developed. Research organisations and churches have gone a step further into assisting the communities in various developmental undertaking such as in the provision of water and high yielding varieties. The government has also provided infrastructure services for the people which include among others schools, roads and health centres.

In it's report, the World Bank (1994) has identified the following factors that hinder development of arid and semi-arid areas. These factors include, inadequate land use and land tenure policies and application of the national legal framework to the ASAL districts. The factors rotates around the deciding actors perceptions in as far as the use and management of resources are concerned.

This study contribute to the debate by focusing on the local actors perception of their environment and how their actions influences use and management of agricultural land. It attempts at proposing a framework that incorporate the household environment in the development of ASAL and subsequently uplift their standards of living.

According to Wagner (1994), there is a growing view that professionals' obligation is to the society and that policy for and management of natural resources is set to satisfy socio-

economic values of the community concerned unlike in the past when the 'natural resources professionals had traditionally operated on the premise that their primary commitment should be to the resources'. For this reason there is need to view natural resources as commodities. and their consumptive use the overriding social value emanating from the household.

Due to the different land use patterns in the arid and semi-arid areas based on the agro-ecological zones (Sombroek. et al. 1982 and Jaetzold et al., 1983), this study focuses its attention on two different AEZ of Central division. This was found necessary in order to establish the extent to which perceptions of the small scale farmers in the high and the low agroecological zones are related to use of land and subsequent conservation of resources.

The local actors socio-cultural, economic and environmental subsystems which fit in the national (or global) system plays an important factor at the household level in determining how resources are to be used. This is so because despite the apparent potential of the ASAL. public investment has predominantly been concentrated in the medium and high potential areas of the country (World Bank. 1994).

The UNCHS-HABITAT II conference (1996) recognised that the family is the basic unit of society (para 30 and 31) and the quality of life of all people depends. among other things on economic. social. environmental and cultural factors and the physical conditions. The household in the Akamba community was selected as the main unit of analysis since in

Kenya it is the building block of the society. An understanding of the socio-cultural and economic organisation of this community is therefore important since it influences the way land and its resources are managed and used.

At the household level, different gender roles continue to be performed based on the traditional and modern socio-cultural settings which need further investigation as a way of understanding how different members of the households cope with the challenges emanating from utilization of land. Peoples' behaviour as they relate to resources is important because it opens the way into understanding why communities act the way they do.

At present the survival strategy of most Akamba people is the exploitation of land resources in an attempt to provide for food sufficiency in their households. The environment is thus being increasingly destroyed so as to give room to agricultural land use practices. This calls for proper use of the available land especially in the rural areas where the demand for land is increasing as a result of increasing population growth rate. According to Wachter (1996:4) beyond certain population density thresholds, population growth increases the pressure on scarce resources and thus creates a need for more resource management systems.

Planning and management of this land and its resources would therefore ensure that land in the two agroecological zones is used for the benefit of present and future generations. At present, environmental concerns are not taken seriously as the small scale farmers in

both regions allow their land to be depleted of the available vegetation cover thereby giving way to soil erosion. The removal of vegetation cover causes severe soil erosion especially during storm rains thereby reducing the fertility of the very fertile soils that they need.

The high population especially in the high agroecological zones has led to indiscriminate cutting of trees and other vegetation cover without any replacement to give way to agricultural production. The saying that 'land is demanded for what it offers' has therefore been proved true. As a result households in the two regions continue to struggle sometimes independently (for those who have not joined community groups) or they have sought a short term solution of coming together in different *mwethya* groupings which have in a way helped to solve some of the problems they face (Mwangi, 1996).

This study will identify factors that influence decisions taken on land and its resources so as to propose recommendations that would enable maximum utilization of resource. Of all the natural resources, land is very important in African tradition where one's own land is held in very high esteem (In some cases the social significance of owning land assure that one will be buried on it). Unlike other forms of wealth, land is immovable (Machyo, 1989) and it is therefore essential for the provision of food, water and energy for many living systems and critical to human activity (UNCHS-HABITAT II:1996 para 109).

> *"The ownership of land is a much more complicated matter than the ownership of goods. The person who is in possession of goods and has the right to move them*

may usually be safely regarded as the owner, but the owners of land cannot take it away and demonstrate his ownership by putting it in some place of his own choosing" (In Report of the Mission on Land consolidation and Registration in Kenya 1965 1966).

Indication in the area of the study are that if little attention is given to small scale farmers in Machakos district, there will be in the long run depletion of the available resources since each individual farmer tries to use and conserve natural resources within his plot or farm as best as he /she can but often with little benefit of scientific knowledge of good land management. To guard against such development it is important to under take a study that explores avenues for concerted conservation effort. Such a study would provide information to researchers, NGOs and the Government and will this will subsequently assist in conceptualization, design and implementation of appropriate technologies for this group of farmers.

According to the World Bank (1994), few attempts have been made in coming up with practical models that lead to management and use of ASALs. Its report of 1994 was therefore one such attempt which looked at sustainable resources use by emphasizing the legal framework. It is hoped that the findings from this research will be used in other areas with similar AEZ.

1.7 Scope of the Study

The study limits itself to the two agroecological zones in the Central division of Machakos district that fall within the high and the low potential area. The location selected to represent the high potential zones was Mumbuni where Kasinga and Mung'ala sublocations were sampled. In the low potential agroecological zones Katheka-kai and Katelembo sublocations were sampled in Katheka-kai location. The study covers, household characteristics; ownership and access to land by gender; farming activities; and environmental situation of the study area.

1.8 Operational Definitions

Operational definitions are important in scientific research. In coming up with these definition, the researcher took note of an important observation made by Zonneveld (1972) that, "it is confusing to attempt to give old terms a limited scientific meaning: the only solution is to define your own concept before you start to write or talk about it".

1.8.0.1 Land

Refers to all natural media, except the sea, having 3-dimension space of hard ground, water or air, in which human habitants, working places, agricultural activities, utility corridors and open spaces may be initiated (Beek, 1978 and Taiti, 1996). According to Zonneveld (1972), this is a concept of "land" which make it synonymous with "environment" as it is used by the mandate of UNEP.

1.8.0.2 Land Use

According to Taiti (1996), land-use is the purpose and the way in which land is conquered and exploited. The definition of the Advisory Council for Scientific Research in Development Problems of the Dutch Government has been used which states that,

> *Land-use is the interaction between the user and the land. The land is determined by the physical aspects such as climate, relief, soil, vegetation, and fauna. These aspects vary to give rise to different types of land-use. The users of the land are determined to a great extent by the cultural and socio-economic aspects, varying per group and region, and this, again, gives rise to different types of land-use (RAWOO; 1988 and Taiti, 1996).*

1.8.0.3 Land Tenure System

Refers to the social relations established around land that determine who can use what land and how. This acknowledges that land tenure system and its set of tenure relations are interwoven and related to other societal structures and institutions, particularly family structure and its marriage and inheritance systems (Funk, 1988).

1.8.0.4 Gender

Gender differences are differences between men and women which are socially rather than biologically determined while sex identifies the biological differences between men and women, gender identifies the social relationship. Gender therefore refers not to women or

men but the relationship between them, and the way those relationships are socially constructed (ODA, 1995). Gender roles and relations vary according to historical, economic, political, cultural and religious factors. The issues addressed are not about women as a separate group but differences about access to and decision making on how land may be used depending on gender relations.

1.8.0.5 Sustainable Development

Sustainable development has been used to mean development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (World Commission, 1986).

1.8.0.6 Socio-economic

This include human population, organization, culture and economy. Each of these sub-components can be subdivided further into elements (Taiti, 1996).

1.8.0.7 Actors

Refers to individuals who are members of the households, communities and organizations who directly use natural resources *in situ* without much influence on their distribution (Sottas, 1996).

1.8.0.8 Local Actors

Refers to the local resource users who directly use resources on their land in an attempt to improve their standards of living. The term in this study refers to the small scale farmers.

1.8.0.9 Deciding Actors

This refers to officials in key positions of authority and who are charged with responsibilities of regulating access to key resources.

1.8.1.0 Strategies

This refers to deliberately devised course of actions and /or disposition intended to respond to any given set of conditions. In this study they will refer to those courses of actions by the local actors in response to the use of agricultural land (Sottas, 1996).

1.8.1.1 Perception

This refers to local actors knowledge, understanding, altitude, belief, norms etc, as they relate to agricultural land (Sottas, 1996).

1.8.1.2 Resource Management

This is the process of striking a balance between improving the well-being of people and causing undesirable environmental changes (O'Riordan, 1979).

1.8.1.3 Resource Conservation

This refers to human actions aimed at preservation of degraded land and planting of trees (Pitt et al., 1991).

1.9 Outline of Thesis

This study is divided into seven chapters. Chapter one focuses on the background of the study. It comprises the statement of the problem, objective of the study, research questions, study assumptions, justification, and operational definition of some of the concepts used. Chapter two outlines research methodology adopted, the selection of sample size, methods of data analysis and problems encountered in the course of venturing into this research. The highlights of chapter three include literature review of selected secondary data, the conceptual framework and the hypothesis of the study. In chapter four, information related to the division is given. The chapter contains challenges and opportunities available in the ASALs of the division and some of the socio-economic characteristics of the Akamba people.

Chapter five presents analysis of the household characteristics and land use characteristics with a discussion of important findings. Analyses of the relationship between some of the socio-economic characteristics and resource use and management in the two agroecological zones are highlighted in chapter six. In this chapter the null hypothesis is subjected to statistical tests. The last chapter focuses on the important findings, recommendations and conclusion of the study.

1.10 Summary

This section outlines the purpose of the research as well as the major factors hindering management and use of resources in the ASALs. Problems facing Machakos district as far as resource use and management on the small scale farmer's farms have been outlined. These problems are caused by both physical factors and man-made factors. Physical factors that have a direct bearing on the present state of this fragile environment include the types of soils, vegetation cover, and climatic factors among others. On the other hand, man related factors include social, economic and cultural factors.

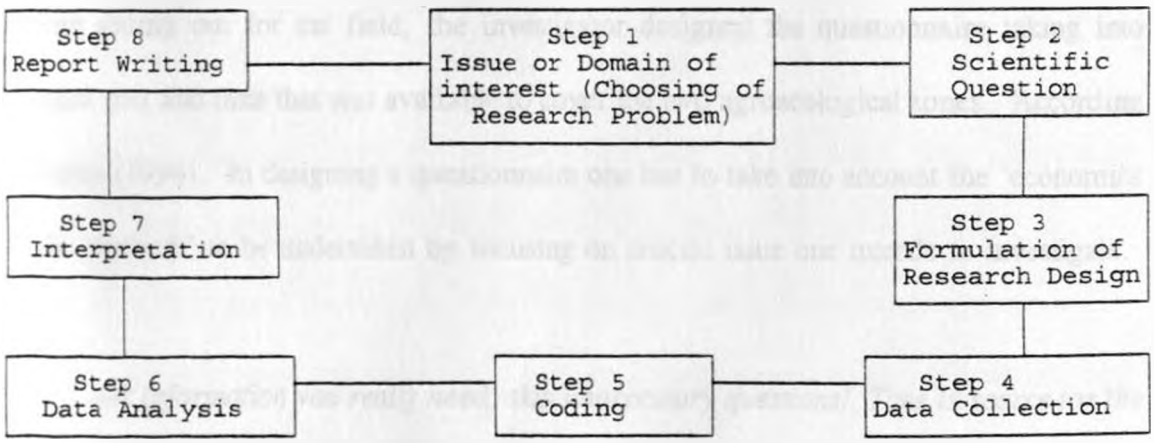
This study aims at investigating the influences of socio-cultural and economic factors on the management of small scale agricultural land. Recommendations will be suggested on how to improve resource use and management. Therefore, interventions aimed at alleviating the developmental challenges facing this region in as far as resource management and use for the benefit of the present and future generation can only be developed after understanding the dynamics of resource management at the household level as part of a larger system that influences the use of resources.

CHAPTER 2. RESEARCH METHODOLOGY

2.1 Introduction

The importance of research methodology in the social science discipline can never be underestimated. The methodology adopted is often influenced by a number of factors at the back of the researcher's mind. Some of these factors include how much the research will cost in terms of both money and time and the period between when one commit himself or herself to undertaking that kind of research and when the output of the research is required by either the researcher himself /herself or his client. These factors and others were taken into account when the researcher set out to undertake this kind of research. Figure 2-1 represent a model for the whole research process.

Figure 2-1. Research Process



Source: Reproduced from Bailey (1987:12) and Sottas (1994:8) with modification.

2.2 Secondary Data

This involved reviewal of literature related to the topic of the study. The analysis starts with a brief examination of the theories related to resource use. focus then shifts to the role of natural resource in development. gender and women rights to agricultural land. This data was used in the development of the conceptual framework.

2.3 Primary Data

Primary data was collected by the investigator and four trained assistants from questionnaires. participant observation, photography. focus group discussions and scheduled interviews with key informants from selected government ministries and research organisations in the district.

2.3.1 Questionnaire

Before setting out for the field, the investigator designed the questionnaire taking into account cost and time that was available to cover the two agroecological zones. 'According to Sottas (1994). In designing a questionnaire one has to take into account the 'economics of the research' to be undertaken by focusing on crucial issue one intends to investigate.

> *Ask information you really need, skip unnecessary questions! Time is scarce for the researcher as well as the respondents! (Sottas, 1994:6).*

Open ended questionnaire enables the respondents to freely express their views concerning such questions as "what ?" , "why?" and "explain" (Sottas 1994:7). During the collection of data. the researcher has to listen to what the respondents had to say and to be aware of yes or no answers which contained no qualitative information. Closed questionnaire were used for categorised data. This type of data however deny the respondents the liberty to freely express their own opinion unlike the open ended questionnaire (Young. 1949).

The questionnaire method has a number of advantages. It gives time to the respondent to answering the questions: the questions which are included in the list are standardised, real and create interest to the informant: the researcher do not make any administrative arrangement apart from the permit required from the government and a vast area and population can be studied (Goshi; 1993). Although this method is little prized within qualitative research. it has the credit when used cautiously and with discernment to collect quickly huge data (Droz, 1994:20-21).

It is however associated with the following disadvantages; it waste time and money especially if the respondent is uncooperative; it is limited to literate people and that one cannot be certain about the validity of the information and misinterpretation of questions. Further, 'there are some problems when showing up with paper and pen and when taking notes' especially considering that in some cases there was no prior arrangement (Sottas, 1994).

2.3.2 Focus Group Discussions

Since focus group discussions has continuing impact on policy formulation, programme design and the efficacy of resulting programmes (Russo, et al 1992), this was used in order to come up with land use policies that enables and facilitate improved natural resource use and management policies that incorporates the anticipated users of the of resources so as to facilitate community awareness of the problems associated with degrading environmental and natural resources use. The processes encouraged the exchange of views and facilitated identification of vested interests and their perceptions in the use of land resource (Sottas:1994:9).

2.3.3 Key informants

Key informants were taken to be people in the study area itself who are particularly knowledgeable in the topic under study. According to Young (1949), key informants are more reliable in giving information about physical geography, institutions and institutional roles. This group of people facilitated the reconstruction of past ways of living culture of Akamba community. This method was combined with participants observation to yield reliable information. Informants were drawn from community based groups, village committee members, Government bodies and NGOs involved in natural resources management.

2.3.4 Observation Method

This method was used in collecting data related to non-verbal behaviour in the study area which was used to supplement other methods of data collection.

2.3.4.1 Participant Observation

This was used to collect qualitative data and involved a conscious and systematic sharing, in so far as circumstances permit, in the life-activities and, on occasion, in the interests and effects of a group of the Akamba (Kluckhohn, 1989). It's purpose is to obtain data through direct contact and in terms of specific situations in which the distortion that results from the investigator's being an outside agent is reduced to a minimum.

In applying this method the researcher was aware that it was not only the investigator himself but also the members of the group being studied who regarded him as a participant. This meant that there was need to establish status within the Akamba community organisation to be able to acquire this type of data.

2.3.4.2 Non-Participant Observer

It is applied where field assistant are used to collect data form the respondents. In order to capture a visual impression of the most important characteristics of the study area, in the course of administering the questionnaire, the researcher used to meet with his assistant in the evening to evaluate and review important findings of that particular day.

2.3.5 Photography

Observation method was supplemented by photography. In the course of field survey, thematic photographs were taken to illustrate information about certain land use activities and natural phenomenon such as weeding, tree nurseries, rivers among others.

2.4 Field Interviews

This involved interviewing of 42 and 36 households in the high and low agroecological zones respectively. Standardized questionnaires were administered which were designed to meet specific objective of the study.

The following merits are associated with field survey; (i) flexibility due to personal touch; (ii) possibility of observing the behaviour of the respondents in as far as resource use and conservation are concerned and therefore determine the validity of the respondents answers; and (iii) it can be conducted in privacy to eliminate possibilities of interference.

On the other hand, field interviews are associated with the following demerits; (i) some of the sampled respondents may not be available and the researcher has to look for replacement which involves cost and time; (ii) hostility from respondents; (iii) respondents are not given time to consult other family members on issues related to past records since the questionnaire is in most specific to a selected member of the household; and (iv) sampled respondents might be inaccessible due to physical barriers.

2.5 Data Analysis

2.5.1 Coding data, Entry and Cleaning

In order to harmonise data collected from the field coding of open ended questionnaires was necessary which involved creation of codes to some of the field questions such as why and explain among others. After coding, all the questionnaires were then input into the SPSS computer programme. Qualitative data which could not be coded was filtered into useful information which was later used in the analysis. After data entry was complete, frequencies were generated which enabled cleaning of data.

2.5.2 Percentages

From a sample of 78 households in the two agroecological zones. valid percentages and cumulative frequencies were used in the analysis.

2.5.3 Correlation Analysis

This is used to shows the degree of association between two variables. In applying this statistical analysis. other related variables are insolated or held constant (Lapin:1987). In this study, it was used to measure the strength of how variables set out in hypothesis are related.

Correlation analysis uses coefficient of determination *r* which is a quantity between negative one and positive one (Lapin. 1983). This indicates that depending on whether *r* is positive or negative. it can signify the direction of the relationship between the two variables under

investigation. When the value of r is negative, the independent variable (x) variables inversely with dependent variable (y). On the other hand, when the value of r is positive, the independent variable (x) varies directly with dependent variable (y). When however the value of r is equals to 0, there is a zero correlation between the two variables.

2.5.4 Correlation of Determination r^2

This is used to examine the relationship between independent and dependent variables. According to Lapin (1987), it is a more useful measure of association than the Correlation Coefficient r. It is obtained by square root of Correlation Coefficient. This was used in the hypothesis testing where it was compared with the expected r^2 value of 0.05.

2.5.5 Chi-square (X^2)

This is the most commonly used test of significance for independence for tables containing nominal and ordinal variables. It is a name of the distribution and its not symmetrically shaped but skewed to the right. The Chi-square determines what a non-zero relationship would look like and compare the data with the independence variable to see how the two variables differ. The aim is to establish wether the wether the relationship is statistically significant from non-zero.

2.5.6 Cross Tabulations

In this study, this method has been used to describe the extend of occurrence of a phenomenon than studying its correlation. Contingency tables are used to place two

variables together in a single table in such a manner that their interrelations can be examined (Bailey, 1983). The column variable is normally across the top so that its categories form column vertically down the page. On the other hand, the second variable forms the row variable horizontally across the page.

Blalock (1981), points out that, by convention, the column variable forms the independent variable and the dependent variable forms the row. Percentages were used to find out wether change in independent variable results in a difference on the scores of the independent variable.

2.6 Data Presentation

Cumulative and valid percentages were used to show statistical distribution of variables. Household characteristics and other data generated from the analysis were shown by use of tables and graphs. Photographs were also used as well as maps of the study.

2.7 Sample Frame

In order to understand agricultural activities, two classification are available in Kenya - that of Sombroek et al (1982), called *agroclimatic zones* (ACZ), and that of Jaetzold and Schmidt (1983), called *agro-ecological zones* (AEZ). Jaetzold et al (1983) classification has been adopted for the present study as a basis for sampling. By use of this method five AEZs have emerged in Central division which are described as II, III, IV, V and VI as shown in Table 2-1.

In this study, the household formed the main unit of analysis and the household heads the main respondents. To ensure that each household head had equal chances of being selected, random sampling was first applied in order to identify the agroecological zone from which the research was to be carried out. This criteria was guided by Prewitt (1975:42) proposition that,

> *The size of the sample is determined by the costs of the study, with the homogeneity of the population, with the members of the traits to be drawn (simple random, multi-stage, stratified) and with the size of the sample error the investigator is willing to tolerate.*

The nine locations of the division were listed and along them their AEZ as identified by Jaetzold et al, (1983). Each location was assigned to its predominant AEZ, so that after sampling the socio-cultural, economic and environmental attributes could be captured as they relate to their respective zones. The AEZ were further generalised into high AEZ and low AEZ, as indicated in Map 2-2 for the purpose of carrying out this research. Table 2-1 displays the names of the locations which were chosen by random numbers.

The next step was to identify sublocations which fell in the high and low AEZ. After listing all the sublocations in the two AEZs random sampling was applied in order to identify the sublocations where this research was to be carried out. This lead to the choosing of two sublocations in each of the agroecological zones namely, Mung'ala and

Kasinga in the high AEZ and Katheka-kai and Katelembo in the low AEZ respectively.

Table 2-1. Sampling Frame

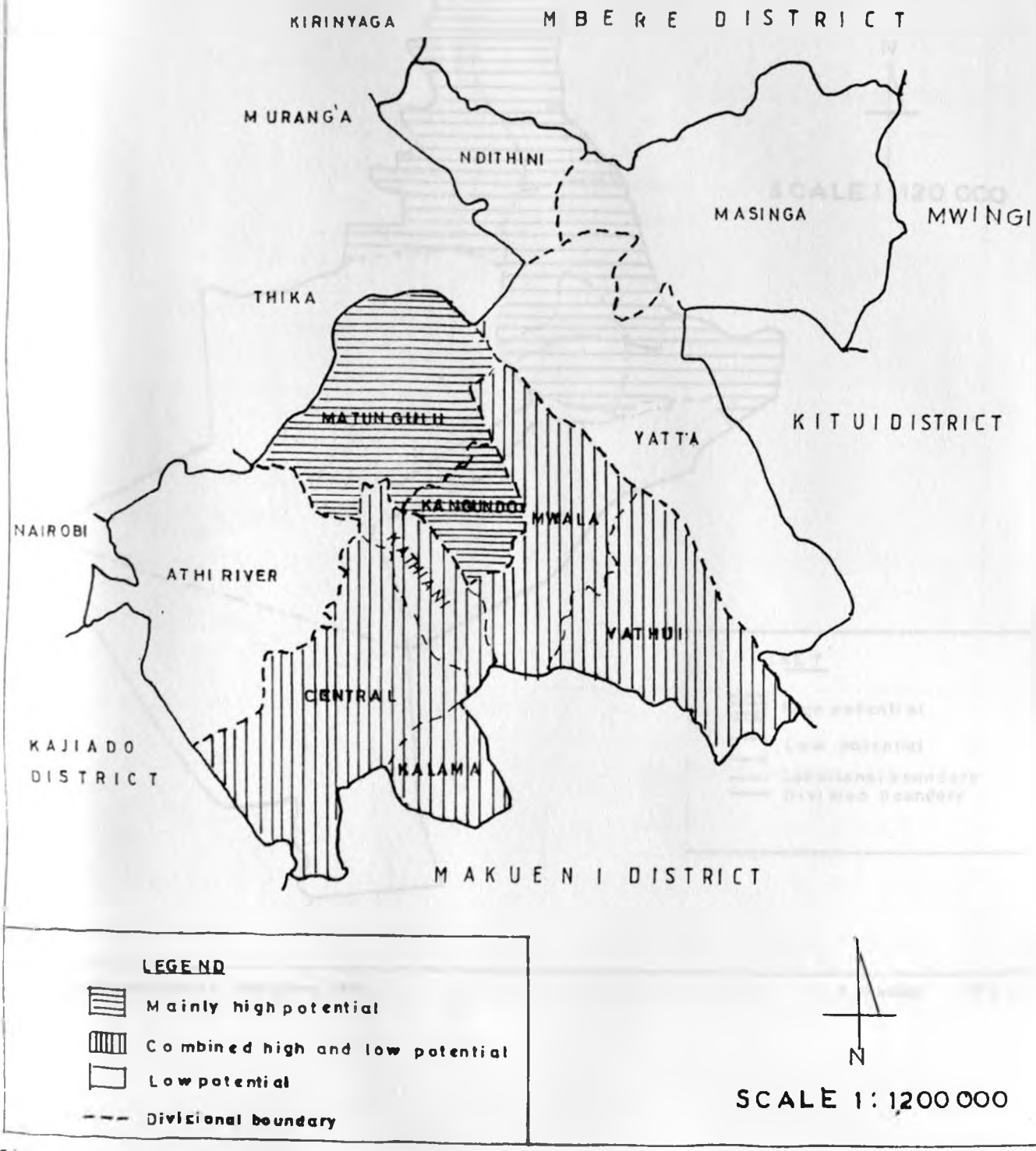
Locations in Central division	The 31 Sublocations	AEZ	Ranked broadly as high and low	Selected or not selected
Mumbuni	5	II	High	Selected
Muvuti	2	II	High	Not selected
Katheka-kai	4	VI	Low	Selected
Kiima-Kimwe	5	V	Low	Not selected
Machakos Township	2	III	High	Not selected
Kimutwa	4	VI	Low	Not selected
Mutituni	3	III	High	Not selected
Mua Hills	3	III/IV	High	Not selected
Ngelani	3	III	High	Not selected

Source: Management Handbook of Kenya, 1983.

The high AEZ had a household population of 2,102 households. A sample percentage of 20 per cent of these households was taken resulting in approximately 420 household being selected to be interviewed. On the other hand, in the low AEZ 20 per cent of 1,821 households were selected to be interviewed. This gave a total of 360 households.

MAP 2.1

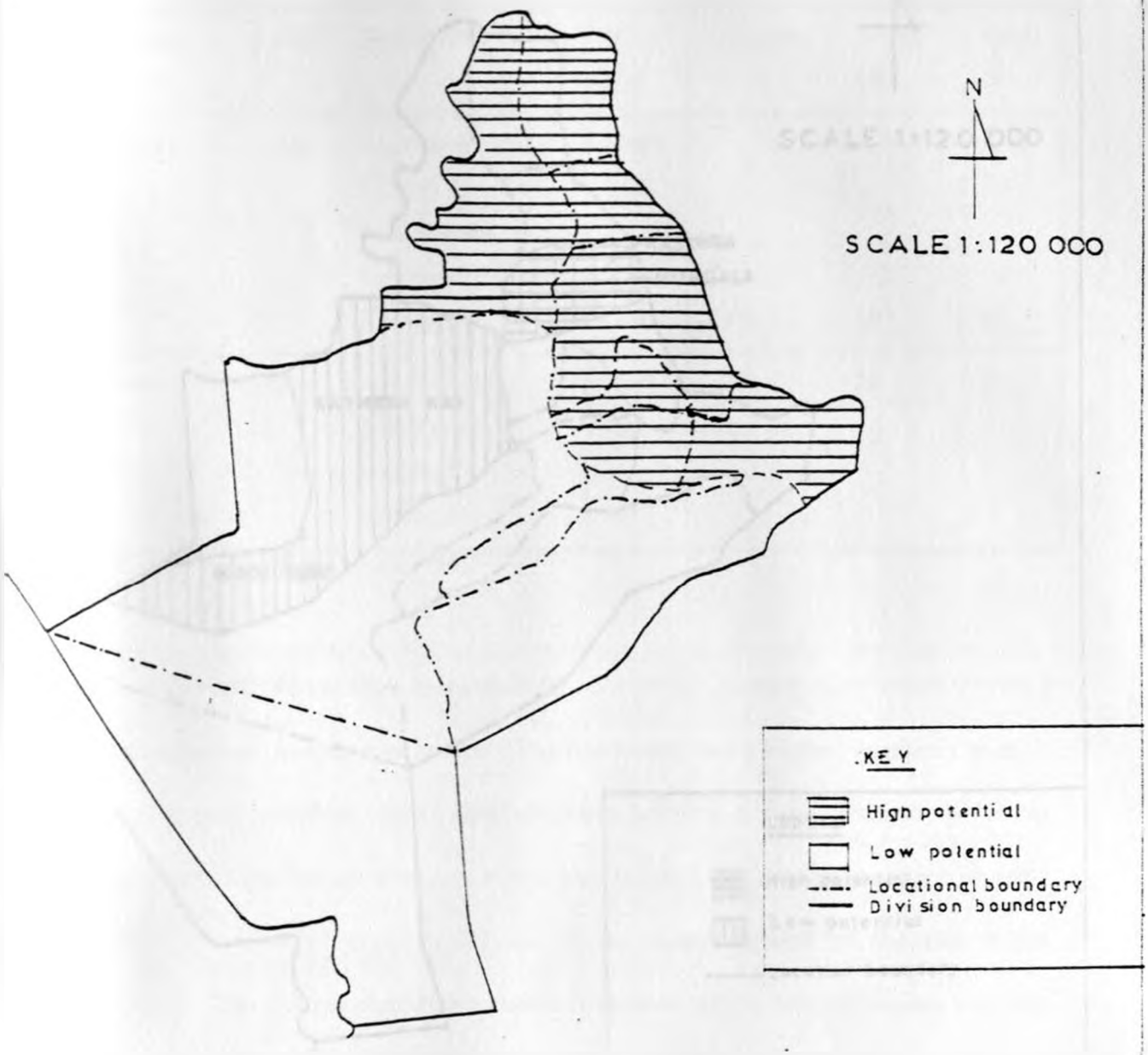
AGRO-ECOLOGICAL ZONES



Source: District Development Plan, 1994

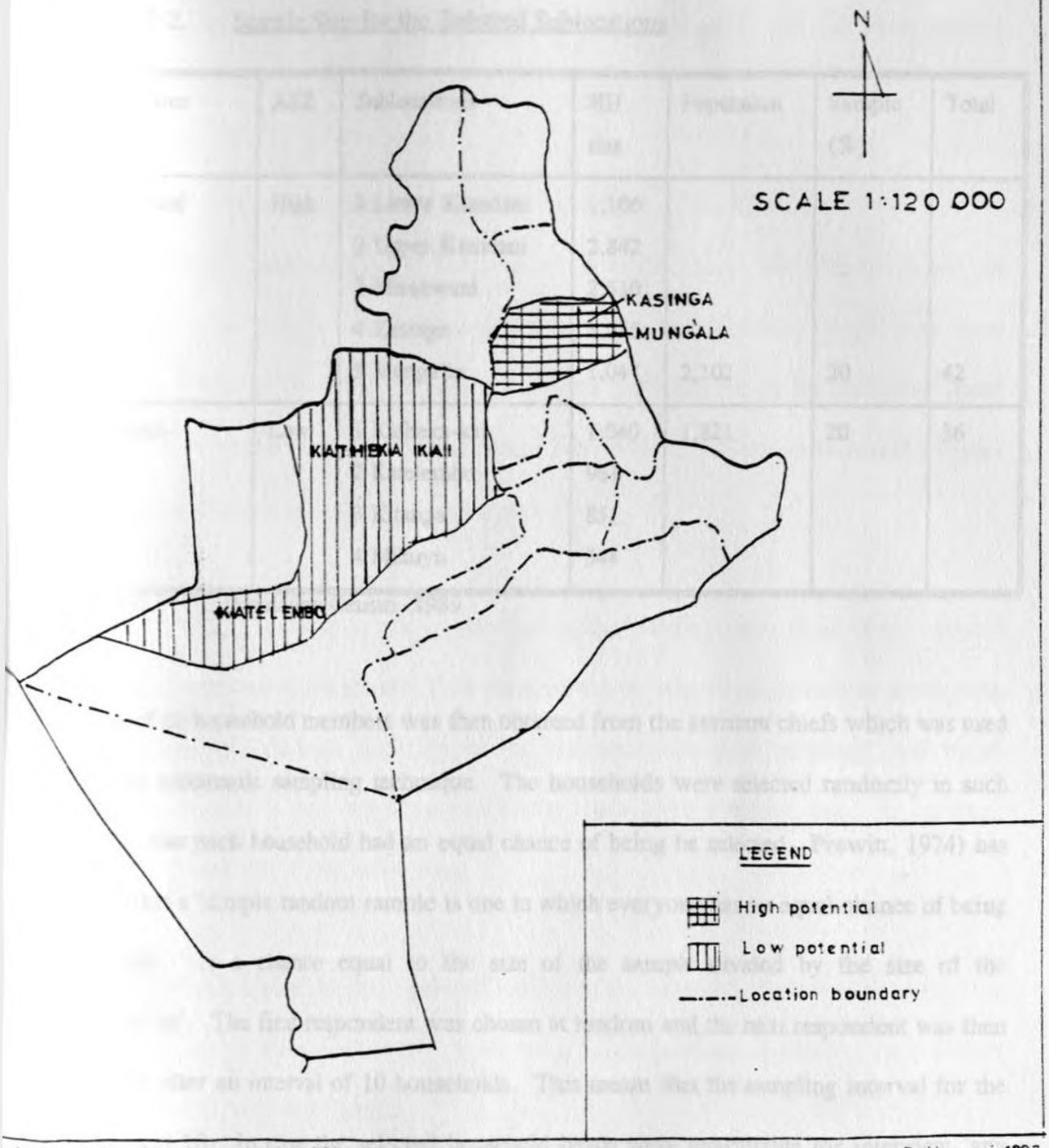
P Mwangi, 1997

2-2 MAIN AGRO ECOLOGICAL ZONES IN CENTRAL DIVISION



Source Farm Management Handbook 1983. P Mwangi 1997

3 SAMPLED AGRO-ECOLOGICAL ZONES



Farm management handbook, 1983.

P Mwangi, 1997

Table 2-2. Sample Size for the Selected Sublocations

Locations	AEZ	Sublocations	HH size	Population	Sample (%)	Total
Mumbuni	High	1 Lower Kiandani	1,106			
		2 Upper Kiandani	2,842			
		3 Misakwani	2,510			
		4 Kasinga	1,055			
		5 Munga'la	1,047	2,102	20	42
Katheka-kai	Low	1 Katheka-kai	1,040	1,821	20	36
		2 Katelembo	961			
		3 Kitanga	851			
		4 Mikuyu	544			

Source: Population Census, 1989

A list of all household members was then obtained from the assistant chiefs which was used for this systematic sampling technique. The households were selected randomly in such as way that each household had an equal chance of being be selected. Prewitt, 1974) has noted that a 'simple random sample is one in which everyone has an equal chance of being sampled. ... a chance equal to the size of the sample divided by the size of the population'. The first respondent was chosen at random and the next respondent was then selected after an interval of 10 households. This meant that the sampling interval for the study was 10. In case the selected household heads were unavailable for interview, any other person within the same household was interviewed as long as the researcher and his assistants found him or her old enough for this exercise. However, if nobody was

available, the next household closest was taken to replace it and the same process continued.

2.8 Problems Related to the Carrying Out of the Research

For an effective understanding of the local actors environment, the research lacked the inputs of other multi-disciplinary researchers whose contribution would have been important. This problem was not anticipated in the beginning but as the researcher found himself in the farmers environment, important questions were raised which required expert handling from other social and biological scientists.

Absenteeism by the would be respondents was another problem since some of the sampled household heads were not home. This occurred mainly when such household heads were engaged in socio-cultural activities of the community such as weddings and burial ceremonies. This meant that during such days, field work activities could not continue since it affected the whole sublocation.

Suspicion was the other problem encountered during the fieldwork since the researcher was not a member of the community. This was a major problem especially when certain answer had to be probed further.

Due to cost and time, it was difficult to carry out a study covering all the agroecological zones represented in the whole of Machakos district. The sampling adopted was however

thought to have presented the true picture of resource management in the district. This study also aimed at using GIS to spatially map land use activities in the division. However, this was not achieved despite the researcher having collected by use of a GPS the actual latitude and longitude of the household interviewed and other important salient features of the division.

As a result of the frequent changes of administrative boundaries, it was difficult to establish the actual boundaries of the study area. This meant that there were difficulties encountered when it came to relate the administrative boundaries with the agroecological zones.

Language was another important problem that faced the researcher. This was mainly felt during the focus group discussions as the researcher's contribution slowed group discussion since the interpreters had to interpret. The researcher understand the language used by the Akamba people but can not speak it fluently.

2.9 Summary

This chapter outlines the research methodology employed in the course of this work and recognises the important role that qualitative and quantitative data analysis techniques play in social science research. Various methods of data analysis and presentation techniques are also discussed. This section also provide a description of how the sample size was arrived at and conclude with the problems that were experienced in the carrying out of the study.

CHAPTER 3. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

3.1.1 Introduction

Literature review is important in any study as it enables the researcher to reflect on a variety of previous researches carried out. It brings into focus different methodologies and how they have been applied in relation to the phenomenon being studied. In this section, literature review focuses on a number of issues related to natural resources conservation in relation to agricultural land, gender and the natural environment.

3.1.2 Theories Related to Resource Use

Natural resources are considered to be a subset of the virtually unlimited components in an ecological system which comprises the sum total of components of nature that have value or can be used by man. Such resources have been used in the past, present and they are expected to be used for the future generation. This brings in the idea of sustainable development in relation to resources use and their management (Wiesmann, 1994).

Literature on natural resource depletion and degradation contains three recurrent and related themes. The first is the concept of *tragedy of the commons* thesis which has been influential over the past quarter century (Hardin, 1968). It signifies the case of land-use by a community where all are competing for resources and no one cares for conservation for the common good. This exposition by Garrett Hardin plays an important role in understanding of the conditions under which the commons are degraded and about the lack

of proper incentives to this. Despite his contribution, he is criticised by Gill (1995) and Anamosa (1995) for having failed to distinguish adequately between open access and common property resources since his argument underestimates the importance of the latter.

The second theme, which tends to be more implicit than stated, is that the processes of environmental degradation are for the most part irreversible (Wiesmann, 1994). However, this has come under increasingly critical scrutiny. Gilmour and Fisher (1991) after a long-term investigation of forestry sector concluded that, when forest resources are plentiful and conveniently located, villagers do little to conserve them. However, once the resource becomes severely degraded and the opportunity cost of collecting forest products becomes prohibitive, new indigenous approaches and institutions start to evolve, including farm forestry and community management of the degraded resource.

Poverty is a factor that contributes to land degradation and is explained by the third theme of natural resource problems (Wachter, 1996). The argument is that poor people under enormous pressure to survive are forced to adopt short term solutions to problems of food and fuel shortage at the cost of longer term environmental damage. It influences decision making and temporal perspective of users of land resources at the local and national level. Studies conducted in Laikipia district indicate that immigrants into environmentally fragile areas of arid and semi-arid areas include those very poor peasants who have been forced out of the high potential area due to population pressure (Flury, 1996; Kunzi, 1996 and Ndegwa, 1996). Such studies have brought forward the fear that continued population

increase will soon lead to depletion of the natural resources in the fragile lands and thereby interfering with the ecosystem. Tiffen et al. (1994:261) however challenged this school of thought by showing that the inhabitants of Machakos district over time did not destroy their environment despite their poverty and the riskiness of their climate.

This study is founded on the second and the third school of thought with the premise that environmental degradation and poverty alleviation in the arid and semi arid lands can be addressed satisfactory only when one understands the socio-cultural, economic and environmental conditions under which these households (communities) live in. As a result, this study focuses on the ' ... family as an indicator of changing social values with respect to natural environments and on changing social behavioral in as far as sustainability of resources is concerned (Pitt,1991).

3.1.3 Role of Natural Resource in Development

In the earliest years of a nation, the availability of plentiful and cheap land provided no incentive for conservation-oriented (Pitt et al., 1991). Recent research on indigenous knowledge in general, and indigenous management of natural resources in particular shows that community based resource management (CBRM) has been gaining popularity as a welcome alternative to solving problems and difficulties arising from the over exploitation and conservation of natural resources (Fellizar, 1994).

In a study carried out in St. Lucia, West Indies on community participation in resource

management. Walters et al. (1992) emphasized the need to involve local people directly in the planning and management of natural resource. It is therefore believed that CBRM is a viable strategy for achieving the goals of sustainable development. There are powerful interlinking dynamics among the fundamental aspects of rural development, for instances, rapid population growth has placed increasing pressure on the rural resources base especially on land, forest, water and even wildlife resources (Schreiber et al., 1994).

According to Shelter Forum (1995), land is one of the factors of production and its proper management and use an important determinant of a country's level of economic growth. A secure land holding increases an individual's willingness to invest in the land thereby improving his or her living conditions. As a fixed and inelastic entity, land is a source of all natural resources and requires proper management in order to achieve a country's major development objectives (Nisula, 1995).

For the majority of the people to benefit from high incomes, food sufficiency, high standard of living, etc., management of natural environments has to be practised, especially in ASALs where according to Pitt et al (1991) the attitudes of 'consume the resource' in the high potential areas and 'move onto conquer new lands' in the fragile ecosystem seems to be the order of the day.

Land is usually considered to hold a very significant position in the Kenyan's view towards his/her economic and social well-being. The predominant attitude is that land provides the

means to fulfilling the basic subsistence needs of the family (Republic of Kenya, 1978). Those who live close to the subsistence level and struggle for their survival are likely to have a short-term planning perspective in their use of land. Several factors contribute to rural poverty, such as population growth and specific laws of succession which often lead to land fragmentation and to inviable, overexploited holdings (Wachter, 1995).

The driving force of any society is it's culture together with the social organisation whose attributes influences resource use strategies by individuals and communities. The UNCHS-HABITAT II (1996) para 29 calls for conservation of biological diversity and the sustainable use of its components, and maintenance of cultural diversity as well as air, water, forest, vegetation and social qualities at standards sufficient to sustain human life and well-being for future generation. According to para 10 and para 43 (b) the creation of an enabling environment for socio-economic development and environmental protection and reinforcing components of sustainable development, are important goals of society in that they generate employment and contribute to eradication of poverty. HABITAT II (1996) recognises the urgent need to eradicate rural poverty and improvement of the quality of living conditions in rural areas.

In order to protect the environment the UNCHS-HABITAT II (1996) has proposed in para 40 (f) the promotion of locally available, appropriate, affordable, safe, efficient and environmentally sound technologies that emphasis optimal use of local human resources and encourage energy saving methods at the local, national, regional and subregional levels.

Since conflict resolution present peculiar difficulties for natural resource management, Gill (1995) recommends 'provision of training ... at the community level, so as to reduce pressures on the environment by substituting knowledge for natural resources'.

The number of impoverished Kenyans is on the increase, with a staggering 12.6 million out of 29 million confirmed to be living below the poverty line with Eastern Province (59.50 per cent) and North Eastern Provinces (56.55 per cent) being the hardest hit (Republic of Kenya, 1997). Para 11 of the UNCHS-HABITAT II (1996) notes that everyone has the right to adequate standards of living for themselves and their families. That right includes adequate food, clothing, water and continuous improvement of living conditions.

3.1.4 Gender and Women Rights to Agricultural Land

In para 40 (b) and para 27, the UNCHS-HABITAT II (1996) has recognised the need to provide legal security of tenure and equal access to land to all people, including women and those living in poverty. Habitat also recognizes the need to undertake legislative and administrative reforms to give women full and equal access to economic resources, including the right to inheritance and to ownership of land and other property, credit, natural resources and appropriate technologies.

According to Wachter (1996:25), women's land rights are usually closely linked with the existing marriage, inheritance practices and with a woman's marital status. Women have significantly fewer rights than men when it comes to land tenure. In most cases, individual

ownership of land for a woman is virtually impossible unless she purchases it. Furthermore, UNCHS-HABITAT II (1996) para 26 has indicated that land tenure is typically more insecure for unmarried, divorced or widowed women than for married women due to socio-cultural, economic and political factors.

Individual and private ownership holdings tend to provide greater security of access and control over land. Farmers without this security may lack incentives to invest and as a result, agricultural development and production is likely to be constrained (Keberry, 1952). Women provide most of the labour for agricultural production and yet they do not have control over land and its resources through they sometimes have access to agricultural land. In some cases it is said that women own only crops while men own the land. This means that women's rights to agricultural land may indicate their position in society and therefore determine their status in the society (Anamosa, 1995).

Pankhurst et al. (1988) points out that land tenure rights are only one aspect of women's rights which influence their social status in relation to men and their society. Changes in land tenure will often not significantly change women's status and access to land, unless they are given absolute and complete land ownership rights. Given the resistance of many indigenous tenure schemes to grant individual ownership rights to anyone and above all to women, women might instead perhaps be given the same rights to land as men.

Changes in land tenure affect the dynamics between men and women, often shifting

additional production burdens on women who perhaps see even less profits from their increased work (Okeyo, 1980). Moreover, traditional life patterns and sexual division of labour has been interfered with due to considerable migration of male members of the community to urban centres in search of jobs. The major implications are that women are left as executive heads of their families leading to increased workload and yet they end up benefiting less from agricultural activities they are involved in (Pankhurst and Jacobs, 1988; Okeyo, 1980; Carney, 1988).

Not all women benefit from the shift toward private property tenure systems. The very process of privatization may tend to exacerbate the difficulties these groups have in accessing and/or controlling land and resources benefitting fully or equitably from their labour (Funk, 1988). In African customary tenure systems, family structure, marriage laws and inheritance practices are most influential (Guyer, 1987). In Kenya, landholding rights and inheritance rights traditionally have not favoured rural female. When a head of family dies, his land and animals are commonly divided among his sons (Foreign Area Studies, 1969). In the Akamba society, women could not be said to have any rights to land or stock, but they were recognised as trustees or guardians of property during the minority of their male children. Should any such children die in infancy the estate reverted to the male relation (Hobley, 1971).

According to Welsh et. al (1987), in most African countries, contemporary constitutional and civil law declare that men and women have equal rights, that women and men have the

right to own property, and that women as daughters and sometimes as wives have the inheritance rights if not always equal inheritance rights. However, where cultural norms and practices are in conflict with these laws, women's legal rights are often ignored. With this in mind, the former UN Secretary-General Boutros Boutros-Ghali in 1993 argued that, "the continent's most vital and least visible economic resource is its women farmers". For this reason, improving the situation of rural women "should be part of the overall development plan" of developing countries (Gellen, 1994:4).

There is evidence that women have been increasingly successful in acquiring direct rights to land, either from their families or by simply purchasing land. Some women have been able to receive permanent rights to land from their fathers, though most of the literature indicates that customary tenure laws do not generally allow for this kind of transfer of rights to women. However, there are indication that women who gain possession of land tend to pass it to their daughters or sisters, thus keeping the land under women's control (Mackenzie, 1995; Bruce, 1994 and Ngaido, 1995). Although the Islamic inheritance laws describe that male children receive equal shares and female children half of males's share, the tendency, however, has been for sons to receive land as inheritance and daughters to receive non-landed, movable property (Feder et al., 1987).

3.2 CONCEPTUAL FRAMEWORK

3.2.1 Introduction

The following conceptual framework helps in the understanding of how resource management can be improved in rural areas. Focus is on the local actors who are a subsect of the wider whole. This means that other actors cannot be ignored in the whole process of management and use of resources.

3.2.2 Legal Framework Subsystem

This subsystem operates at the deciding actors level. It is derived from outside the country and has been imposed on the local actors. The system comprises of the world views in as far as resource use and management at the national and local level is concerned. The principles advocated at are spread into the local actors through legal institutions that have been put in place by the deciding actors.

3.2.3 Research Environment

This is the area in which both the local and deciding actors operate and interact. The actors are all influenced by each others activities. The deciding actors (government ministries. scientists in universities and research institutions, NGOs. etc) try to understand the local actors environment which is a subsystem comprising of the way they relate to natural environment around and which has a direct influence on their day to day lives.

3.2.4 Local Actors Subsystem

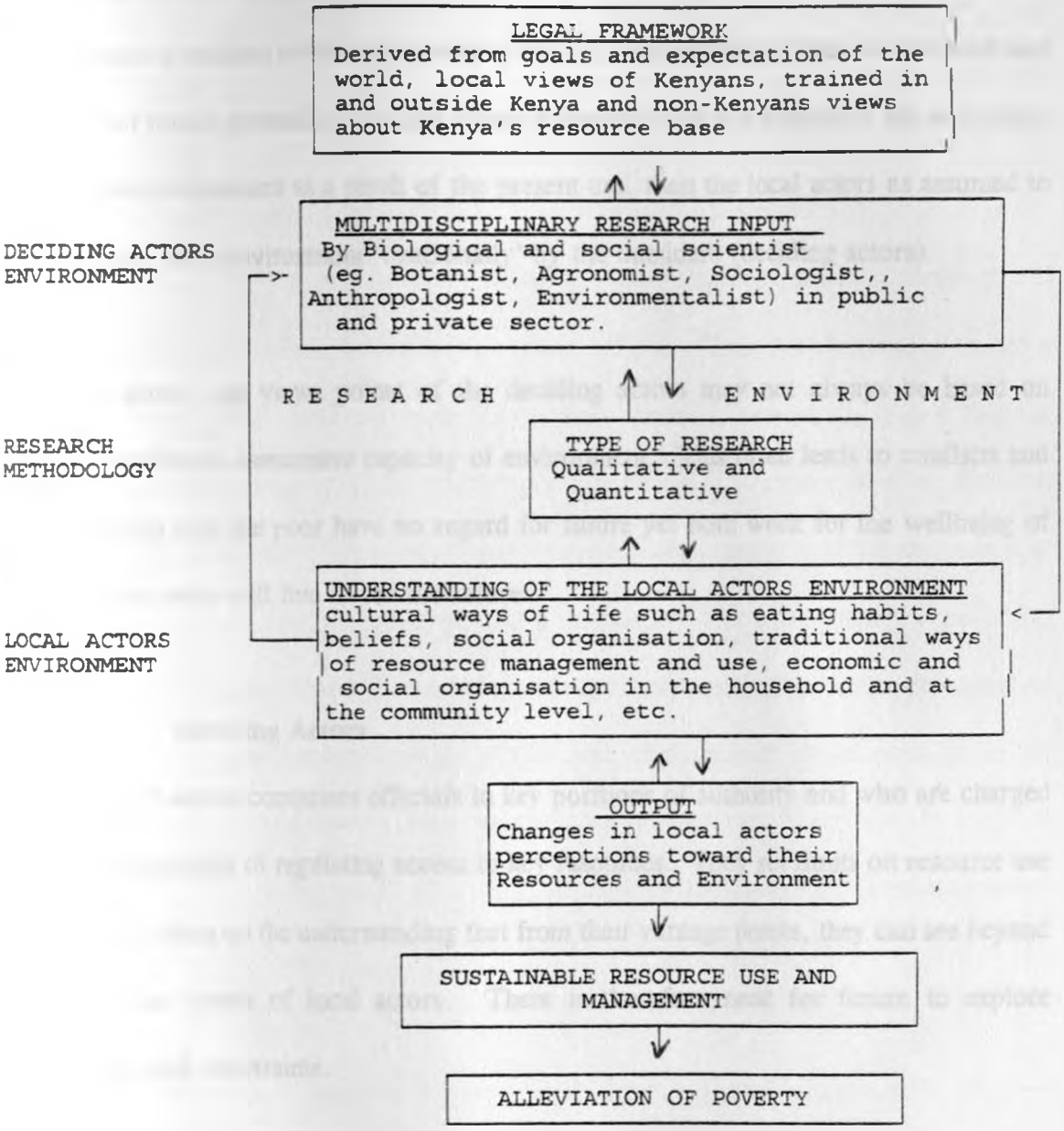
This consist of the social organisation within which the farmers live. It is held together by social and cultural norms that make it survive the test of time. The important thing is to understand this subsystem which is influenced by the socio-cultural, economic, environment and political atmosphere around it. This is the most important subsystem which if understood would pave the way to optimum resource 3-1 conservation in the ASALs. The objective of this study is to understand this subsystem in relation to management and use of agricultural land. Figure 3-1 shows that the problem of poverty alleviation requires concerted efforts from both the deciding actors and the local actors.

3.2.4.1 Culture

This is very important since it regulates the actions of individuals in the society as far as resource use and managements area concerned. It comprises of beliefs, customs, taboos, norms, etc. Resources found in any area are regulated by people's understanding of how such resources are useful in their day today lives. In most cases, people work with the hope of leaving behind a better future for their children. The problem is that, the young are often not consulted about the kind of future they envisage. A good example of how traditionally different Africa generation, including the Akamba, were tied to land in relation to the past, present and the future could be expressed in the words of a Nigerian Chief who said that:

> *"Land belongs to a vast family of which many are dead, few are living and countless members are still unborn". (author unknown)*

Figure 3-1. Poverty Alleviation Through Sustainable Resource Management



Source: Researcher's Own Perception

3.2.4.2 Economic

This is an important indictor of the people's welfare and standards of living. The local

actors usually exploit their environment in order to uplift their standards of living. This rational use of their immediate environment leads to the degradation of their environment when looked in relation to other components such as sustainability of that environment and the needs of future generation. In case future generations are not assured of the enjoyment of the same environment as a result of the present use. then the local actors as assumed to be exploiting their environment 'irrationally' by the outsiders (deciding actors).

As noted above, the views points of the deciding actors may not always be based on scientific verifiable assessment capacity of environment. This often leads to conflicts and an assumption that the poor have no regard for future yet both work for the wellbeing of their children who will live to see the future.

3.2.3 Deciding Actors

This group of actors comprises officials in key positions of authority and who are charged with responsibilities of regulating access to key resources. They set limits on resource use at local level often on the understanding that from their vantage points. they can see beyond the immediate needs of local actors. There is therefore need for forum to explore possibilities and constraints.

3.2.4 Methodological Approach

The methodological approach is a combination of qualitative and quantitative approaches. Qualitative approach is important in the collection of data which involves the socio-cultural

ways of life which is difficult to be used in quantitative analysis. On the other hand quantitative approaches enables the creation of data bases for the community under investigation.

3.2.5 Alleviation of Poverty and Sustainable Development

The values associated with sustainable development are linked by means of complex and dynamic interactions within a man-environment system. This system consist of three subsystems within the household namely; the socio-cultural, economic, and ecological system. In order to understand the local actors environment one has to appreciate the three of them. Changes in one of these subsystem - the economy, society and the environment- will have impacts on other components. As a result, any attempt to modify a particular scale of values in order to promote sustainable development will cause a shift in values on other scales. Sustainable development is therefore characterised by inherent conflicts, because according to Wiesmann (1994) positive changes in some values must be weighed against negative changes in others. As a result sustainable development is always a gradual process.

Various suggestions have been put forward aimed at helping ASAL to develop. Most of these have concerned themselves with the Government's attempt to intervene in the development process of the ASALs. This is seen through various aided government and NGOs projects such as provision of water (boreholes, shallow wells and piped water), building of institutions (such as schools, hospitals etc). In most of these projects, the

community have always tried to fit with the pace established by this development agents without much success. This is because rarely do such project inject in themselves from the inception stages the way of living of the people. In most cases, such technologies have either been rejected or partially adapted. To alleviate rural poverty in ASAIs, it is important therefore to understand the socio-cultural and economic characteristics of the societies found in this area.

3.3 PREMISE

3.3.1 Introduction

Hypotheses(is) are/is very important in any scientific research as they enables one to approve or to disapprove some of the earlier propositions one had before setting out to do research. According to Sottas (1994:4), each researcher has to have at least one hypothesis with a very clear idea what has to be compared to what. This leads to a restricted number of variables one is looking for since time and money are scarce.

3.3.2 Null Hypothesis

This study was guided by the following null hypothesis, that 'there is no significance relationship between the local actor's socio-economic characteristics (incomes, gender, marital status etc) and the use and management of agricultural land (planting, weeding, harvesting, conservation of environment through planting of trees, soil erosion prevention etc) in the two agroecological zones of the division.

3.4 Summary

In their quest to create various consumable resources for their societies, human beings have interacted with the ecological resource base in their areas of habitation. Left to *laissez-faire* operation, man would exploit certain resources for which the economic market and technology of the time have the highest demand (Okidi, 1983). A lot of studies have therefore been undertaken to illustrate how and why natural resources and especially land are important in the development of any country.

The conceptual framework looks at the two types of actors (local and deciding) who are involved in sustainable resource use and management. In order to active this objective, the methodological approach adopted enables the two actors to learn from one another.

The hypothesis set out to examine wether there is any relationship between the socio-cultural and economic characteristics of the households and the they use and related to agricultural land.

CHAPTER 4. BACKGROUND OF THE STUDY AREA

4.1.1 Introduction

Land use in Kenya is controlled by number of factors which include climate, soils (Sombroek et al., 1982 and Jaetzold et al., 1983), labour, technology and markets (Republic of Kenya, 1979). Land cover can be grouped into three broad categories namely, those occurring in the high, medium and low potential agricultural areas. Arid and semi-arid lands in Kenya falls mainly in the last two categories.

The definition of the Arid and Semi-Arid Lands (ASAL) dates back to the 1979 Government of Kenya policy document "*Framework for Arid and Semi-Arid Lands Development in Kenya*". By use of moisture availability, Jaetzold et al (1983) classified 24 districts as belonging to this zone. This classification and that of Sombroek (1982) revealed that approximately 80-88 per cent of the Kenyan land falls within the arid and semi-arid regions. Despite this area being characterised by a limited natural resource base and a low carrying capacity, the land nevertheless support an estimated 20 per cent of the country's population, most of the country's national livestock herds (50 per cent) and a major portion of the country's wildlife resources (World Bank, 1994).

Owing to the low carrying capacity of the ASALs, a relatively small increase in population numbers has a marked effect which include environmental degradation. The increasing numbers of immigrants is threatening sustainable land use in this fragile ecosystem and has

led to increased land degradation and biodiversity disturbances. Most important though is that the ASAL constitute a last frontier for the population spilling from high potential areas (Republic of Kenya, 1994).

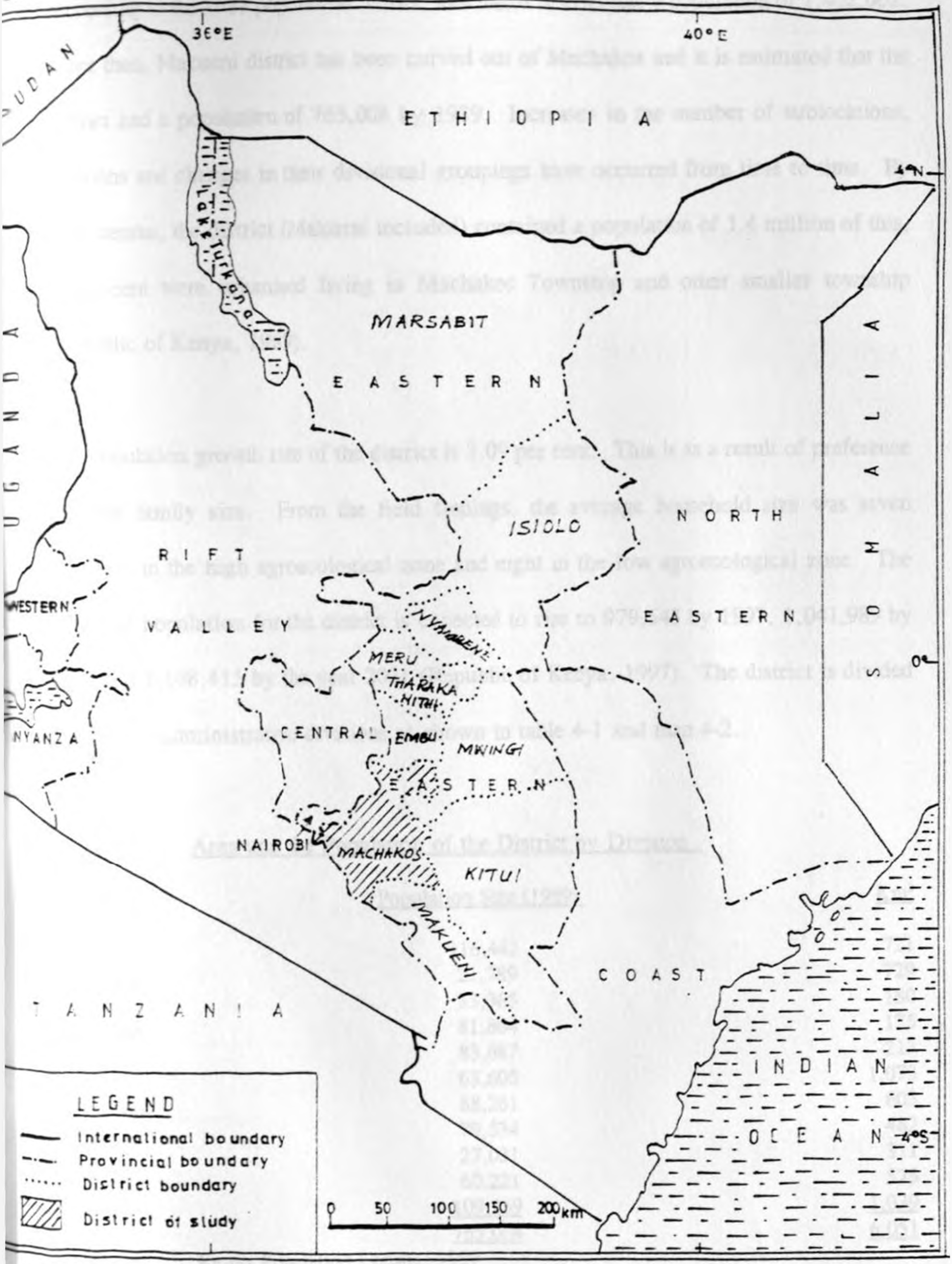
4.1.2 Position and Size

Machakos district is one of the twelve districts that comprise Eastern Province. From North to south, the district stretches from 0^0 45'S to 1^0 31'S while from East to West it is located between 36^0 45'E and 37^0 45'E. The district borders nine other districts which form part of Kenya's Eastern Province. The whole of the Eastern Province falls within the Arid and Semi-Arid Lands (Jaetzold, et al., (1983) and Republic of Kenya (1993). Map 4-1 indicates the location of Machakos district in Eastern province.

4.1.3 Population of Machakos District by Divisions

The district is situated in the transition area between the dry south-eastern lowlands and the wetter high central region bordering Nairobi city and covers a total area of 6,051km^2. About 20 per cent of this area is classified as medium and low agricultural land while 74 per cent is rangelands (Ondiege, 1992). The remaining 6 per cent of the district consists of hill masses. Due to land pressure, ten per cent of the rangelands is cultivated either though irrigation or rainfed systems (Republic of Kenya, 1997).

AP 4-1 MACHAKOS DISTRICT IN KENYA



ce: Survey of Kenya Nairobi. P. Mwangi, 1997.

According to the 1989 population census, Machakos district had a population of 1,402,002. Since then, Makueni district has been curved out of Machakos and it is estimated that the district had a population of 765,008 by 1989. Increases in the number of sublocations, locations and changes in their divisional groupings have occurred from time to time. By 1989 census, the district (Makueni included) contained a population of 1.4 million of this, 8 per cent were urbanised living in Machakos Township and other smaller township (Republic of Kenya, 1989).

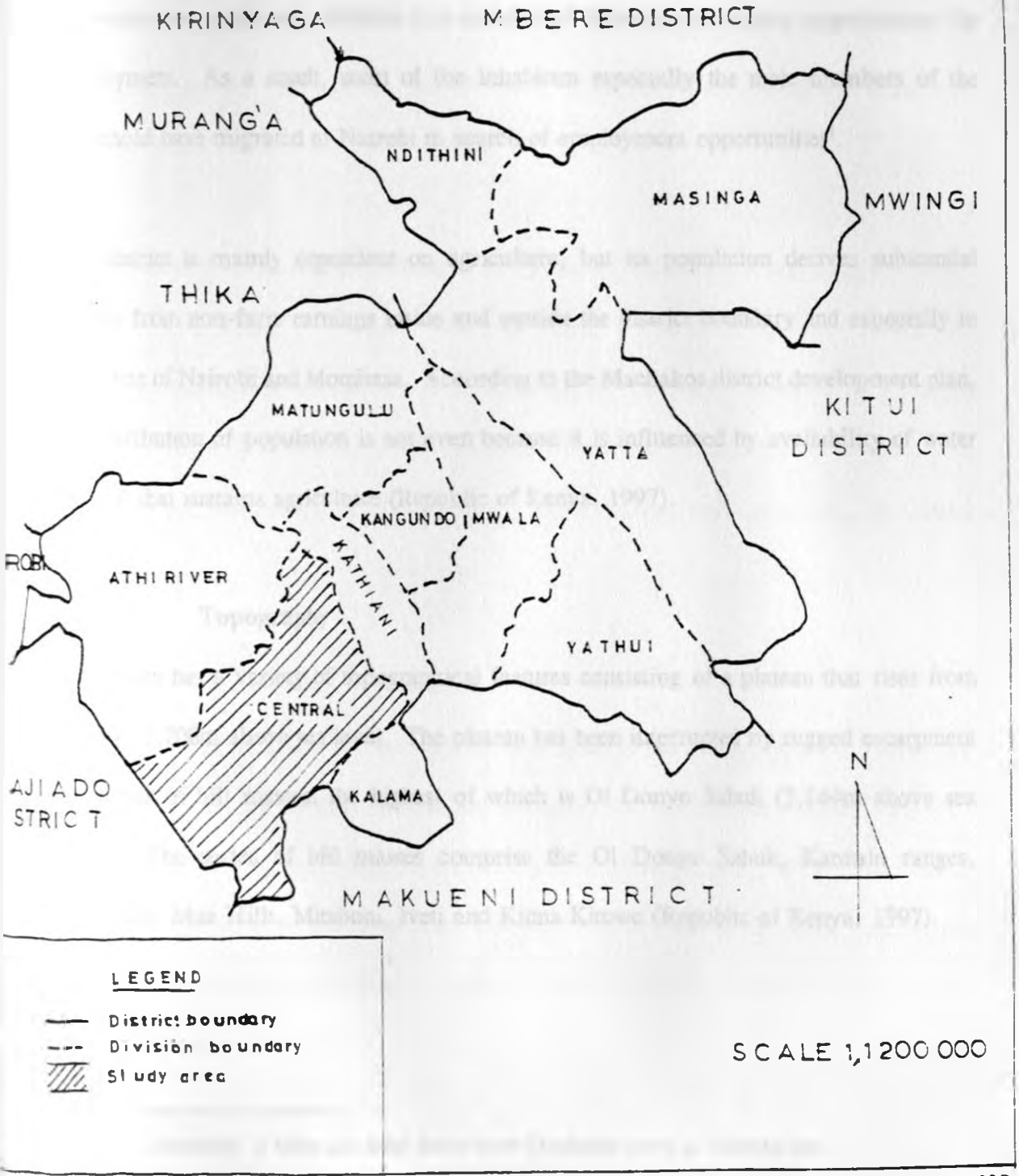
The population growth rate of the district is 3.09 per cent. This is as a result of preference of large family size. From the field findings, the average household size was seven members in the high agroecological zone and eight in the low agroecological zone. The projected population for the district is expected to rise to 979,543 by 1997, 1,041,989 by 1999 and 1,108,415 by the year 2001 (Republic of Kenya, 1997). The district is divided into eleven administrative divisions as shown in table 4-1 and map 4-2.

Table 4-1. Area and the Population of the District by Division

Division	Population Size (1989)	Km^2
Central	116,442	721
Athi River	21,789	729
Kalama	33,365	180
Kangundo	81,804	175
Kathiani	83,687	213
Masinga	63,605	1,073
Matungulu	88,261	603
Mwala	79,534	482
Ndithini	27,031	311
Yathui	60,221	525
Yatta	109,269	1,039
Total	765,008	6,051

Source: Kenya Population Census, 1989

MACHAKOS DISTRICT ADMINISTRATIVE BOUNDARIES



* District Development Plan 1994.

P Mwangi 1997.

Despite Machakos town having been the first capital city of Kenya before the Governor shifted to Nairobi during the colonial period (Republic of Kenya, 1997), there are no major industries in Machakos town save those found in Athi River division. Isolated sand harvesting and quarrying activities in a number of divisions offer some opportunities for employment. As a result, most of the inhabitant especially the male members of the household have migrated to Nairobi in search of employment opportunities[1].

The district is mainly dependent on agriculture, but its population derives substantial income from non-farm earnings inside and outside the district boundary and especially in the towns of Nairobi and Mombasa. According to the Machakos district development plan, the distribution of population is not even because it is influenced by availability of water and soil that sustains agriculture (Republic of Kenya, 1997).

4.1.4 Topography

The region has a variety of topographical features consisting of a plateau that rises from 700m to 1,700m above sea level. The plateau has been interrupted by rugged escarpment and series of hill masses, the highest of which is Ol Donyo Sabuk (2,144m above sea level). The series of hill masses comprise the Ol Donyo Sabuk, Kanzalu ranges, Kangundo, Mua Hills, Mitaboni, Iveti and Kiima Kimwe (Republic of Kenya, 1997).

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[1] Normally, it takes one hour drive from Machakos town to Nairobi city.

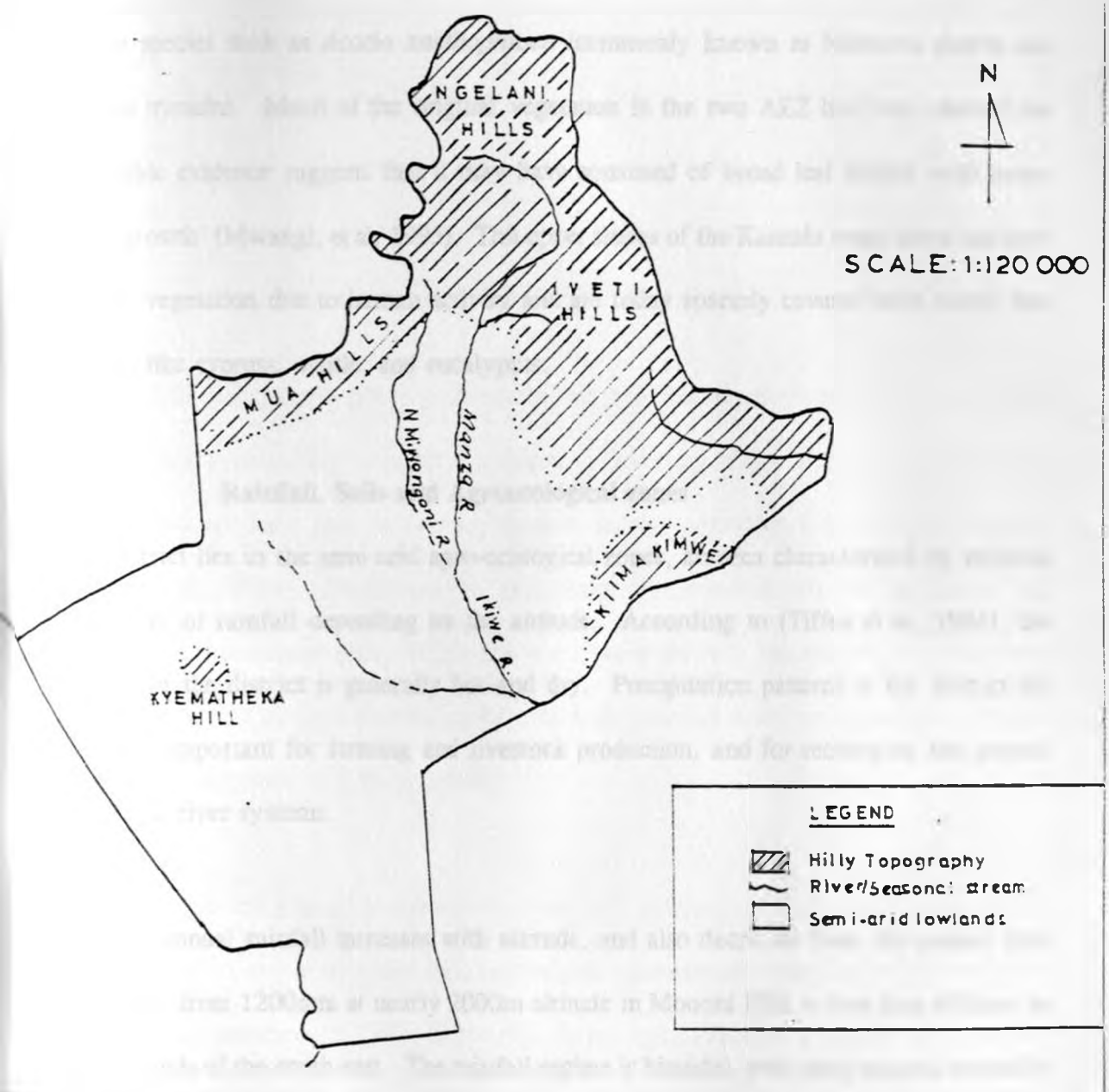
The terrain of Machakos district is mainly hilly. The Kapiti and Athi plains lie on the western part of the district while Athi River, the major water course in the district flow through the northern and eastern parts of the district. The main features of the district is a series of relatively narrow ridges with very steep sides rising to about 600m above the surrounding country side and reaching elevation of between 1800-2100m above sea level (Owako, 1969).

The central part of the district is doted with a series of hill masses rising steeply to 1800-2100m and stretching in a roughly north-south axis. The areas embraces several hill masses surrounded by plateau which in some places are deeply dissected, with slopes gradually dropping from about 1700m in the north-west to 700m in the south-east. Map 4-3 shows the hill masses of Iveti, Ngelani, Kiima Kimwe and Kyematheka in Central division.

4.1.5 Geology and Vegetation

The geological foundation of the district falls under three major types of rocks; the basement system, the tertiary volcanic and sediments, and pleistocene volcanic. Most of the hills in the district are formed of granitoid gneiss (Mwangi, et al; 1995). These rocks have given rise to soils that range from basement system soils on the upper parts of the hills, red volcanic loams and clays on the lower slopes, and black cotton soils on the valley bottoms (Mwangi, et al. 1995).

SALIENT TOPOGRAPHICAL FEATURES IN THE DIVISION



District Development Plan, 1983

P Mwangi, 1997

The soils support natural vegetation of various densities as one would differentiate them based on the AEZ. Katheka-kai and Katelembo sublocation in the lower AEZ support acacia species such as *Acacia xanthophloea* (commonly known as Naivasha thorn) and *Acacia triandra*. Much of the original vegetation in the two AEZ has been cleared but 'available evidence suggests that it may have consisted of broad leaf forests with heavy undergrowth' (Mwangi, et al, 1995). The upper slopes of the Kanzalu range have lost their natural vegetation due to human activity and are today sparsely covered with exotic tree species like cypress, wattle, and eucalyptus.

4.1.6 Rainfall, Soils and Agroecological zones

The district lies in the semi-arid agro-ecological zones, an area characterized by extreme variability of rainfall depending on the altitude. According to (Tiffen et al.,1994), the climate of the district is generally hot and dry. Precipitation patterns in the district are critically important for farming and livestock production, and for recharging the ground water and river systems.

Average annual rainfall increases with altitude, and also decreases from the central hills outwards, from 1200mm at nearly 2000m altitude in Mbooni Hills to less than 600mm in the lowlands of the south-east. The rainfall regime is bimodal, with rainy seasons normally occurring in the months of March-May for the 'long' rains and October-December for the 'short' rains. The limited availability of perennial domestic and livestock water has influenced settlement and agricultural patterns in the district. The five main soil type found in the district by the total percentage of the district area are as follows:-

Table 4-2. The Five Main Types of Soils in the District

Soil Type	% of Total District Area
Vertisol	23
Acrisols/Ferrasols	59
Planosolas	7
Cambisols	6
Andasols	2
Aremosols	3
Total	100

Source: Machakos District Agricultural Office. 1997.

The shallow soils, steep slopes and unstable surface soil structures make soil and water conservation essential for sustainable agriculture (Ondiege. 1992). These types of soils and rainfall patterns have lead to two agricultural seasons occurring both in short duration (Tiffen et al., 1994). Distribution of agricultural and livestock activities depend on the potential of a particular area. While the low lying areas with less rainfall are best suited for livestock and drought resistant crops, the high potential areas are suitable for rainfed agriculture (Republic of Kenya. 1994)

Altitude exerts the greatest influence on temperature in Kenya (Republic of Kenya, 1994). In the district. there is no wide range between the maximum temperatures of 32^0C and the minimum temperatures of 23^0C. Generally, the low lying areas constitute the low potential areas. These are also the hottest areas in the study area. In all the agroecological zones temperature regimes determine the major crop production zones. Historical data indicate that in four out of ten years there is a major drought in the district (Republic of Kenya. 1994)

The district can be divided into five agro-ecological zones (Republic of Kenya, 1997 and Jaetzold, 1983) namely;

1) Zone II which covers the upper slopes of the hill masses of the Iveti, Mua and Kangundo. This zone has an average rainfall of 1,000mm and covers 3 per cent of the district area. Part of this is found in the Central division.

2) Zone III which covers 9 per cent of the total district area occupies lower slopes of the hills of Iveti, Mua, Kangundo and part of Matungulu and Mitaboni divisions. Annual average rainfall for this zone is 850mm.

3) Zone IV which is the largest in the district (40 per cent) and has an average rainfall of between 700 and 750mm. This area include parts of Yatta division, Mwala, Masinga, Matungulu and Ndithini divisions.

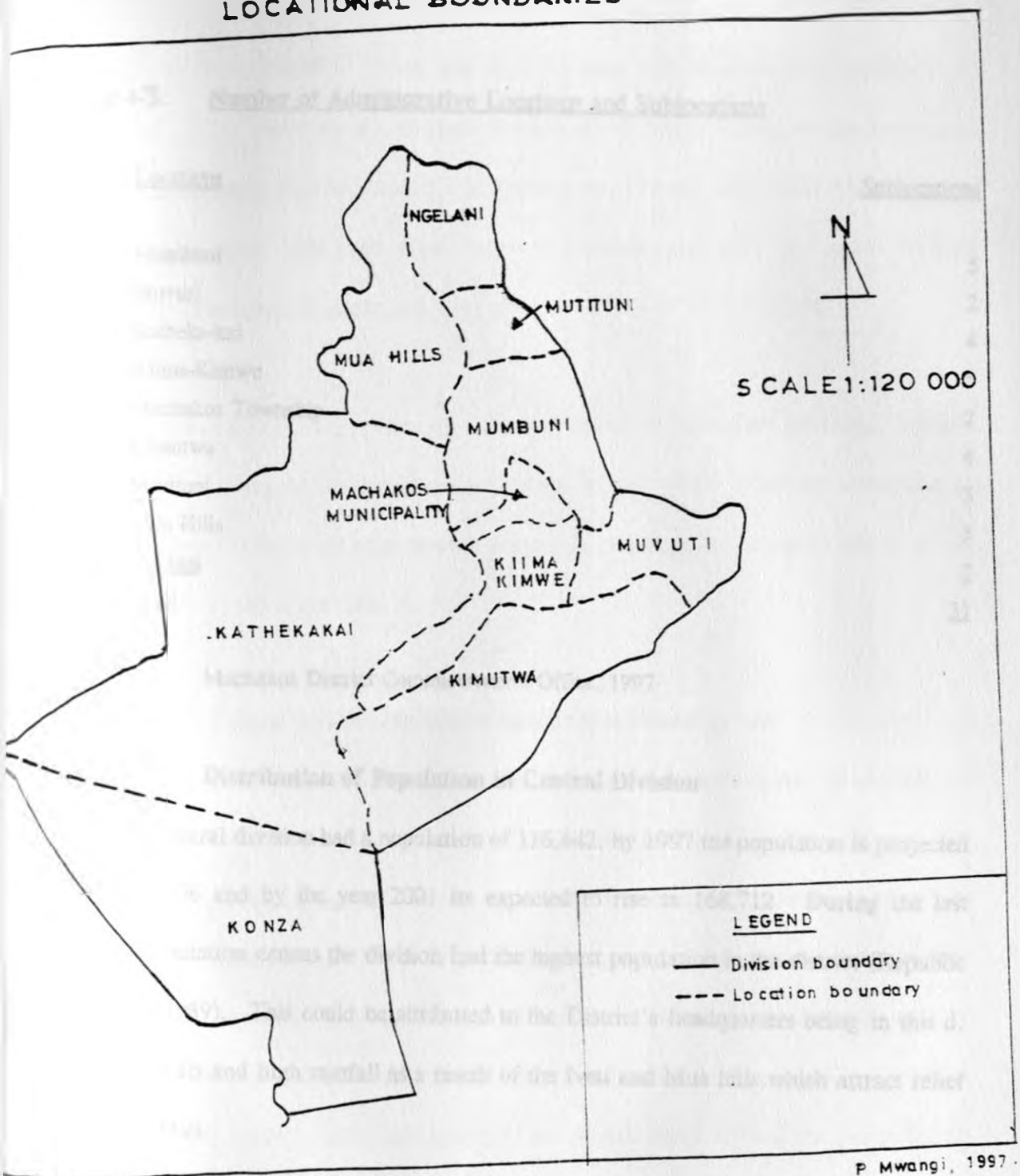
4) Zone V covers most parts of Masinga, Yatta, Yathui, Mwala, and Kathiani divisions. It covers an area of 31 per cent of the district area with an average rainfall about 600-650mm.

5) Zone VI covers 17 per cent of the district and it is found in parts of Central and Athi-River division. The area is exclusively a ranching zone.

4.1.7 Administrative Units of Central Division

There are a total of nine administrative locations constituting of thirty one sub-locations as table 4-3 shows. Map 4-4 shows the administrative boundaries of the division.

LOCATIONAL BOUNDARIES



P Mwangi, 1997.

Machakos District Development Plan, 1994.

Table 4-3. Number of Administrative Locations and Sublocations

	Locations	Sublocations
1	Mumbuni	5
2	Muvuti	2
3	Katheka-kai	4
4	Kiima-Kimwe	5
5	Machakos Township	2
6	Kimutwa	4
7	Mutituni	3
8	Mua Hills	3
9	Ngelani	3
	Total	31

Source: Machakos District Commissioner's Office, 1997

4.2 Distribution of Population in Central Division

By 1989, Central division had a population of 116,442, by 1997 the population is projected to be 149,096 and by the year 2001 its expected to rise to 168,712. During the last national population census the division had the highest population in the district (Republic of Kenya, 1989). This could be attributed to the District's headquarters being in this d, the fertile soils and high rainfall as a result of the Iveti and Mua hills which attract relief type of rainfall.

The unevenly distribution of population in Central division and that of the whole district is greatly influenced by availability of water and good soils for agricultural purposes

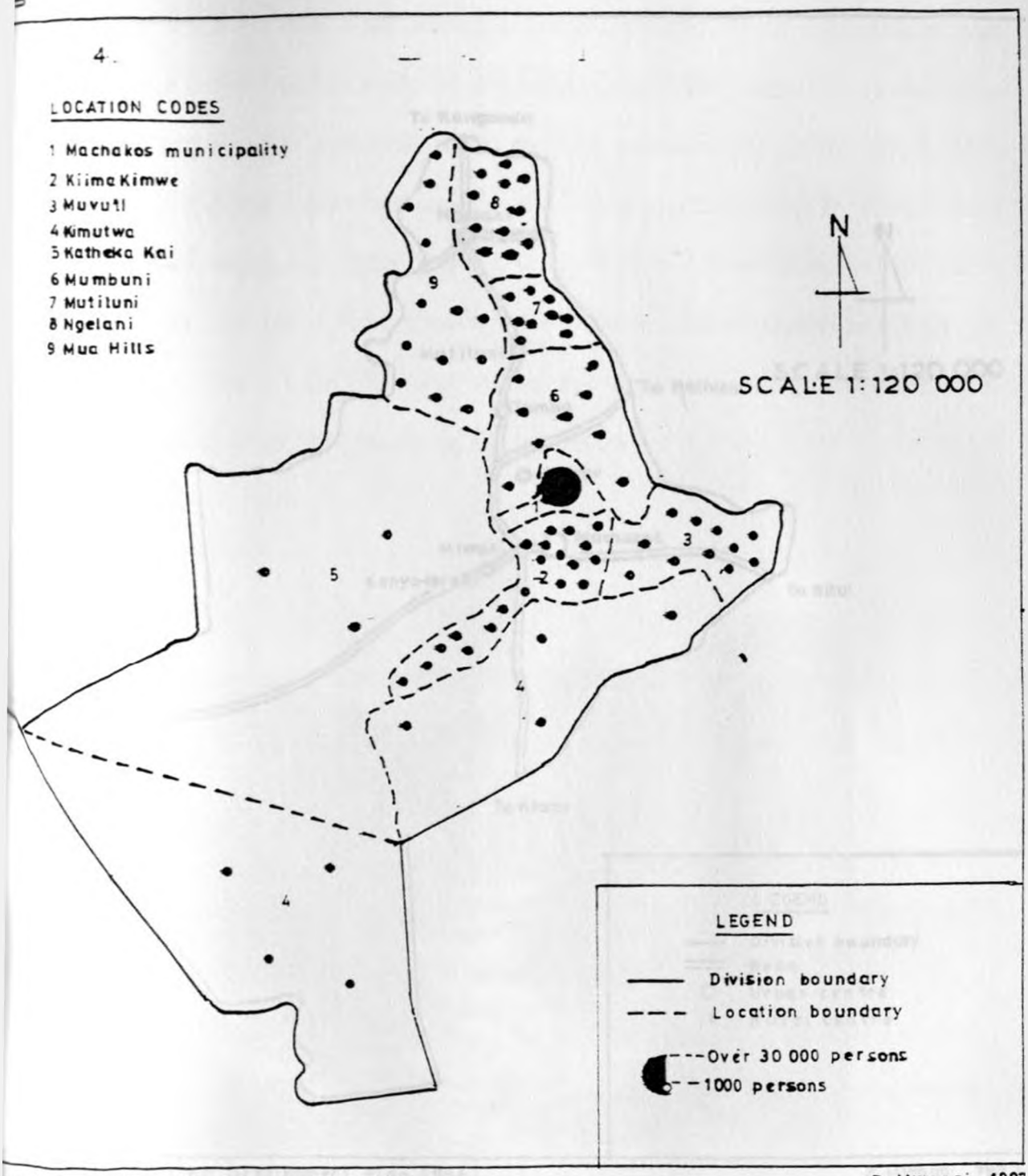
(Republic of Kenya, 1997). There are also big inter and intra division variations in population. As a result of this, Central division which has a variety of agroecological zones with relatively high hill masses and lowland has varying population distribution in various sublocations. The high rainfall areas of North-Eastern parts of Central division have higher population concentration than the low rainfall as shown in map 4-5.

The main urban and market centres of Central division are Machakos township, Tumba, Kenya-Israel, Makutano among others as shown in map 4-6. With the exception of Machakos town, these small rural centres are unable to attract the excessive labour which is not utilized in the agricultural sector.

4.3 Trends and Constraints to Sustainable Resource Use

There are two main types of soil erosion in Kenya: water and wind erosion. Water induced erosion is present in varying degrees in both arable crop land lands and the arid and semi arid lands (Republic of Kenya, 1994). In Machakos district, soil erosion is caused by running water which continues to be a major constrain to agricultural productivity as often top soil is carried away. This has been blamed on nature and human activities in both the relatively high potential areas around the ranges and in the low potential areas where settlements are taking place. According to the World Bank (1994), the main factors determining the magnitude of water erosion in the ASAL are rainfall intensity, slope of the land, and land use.

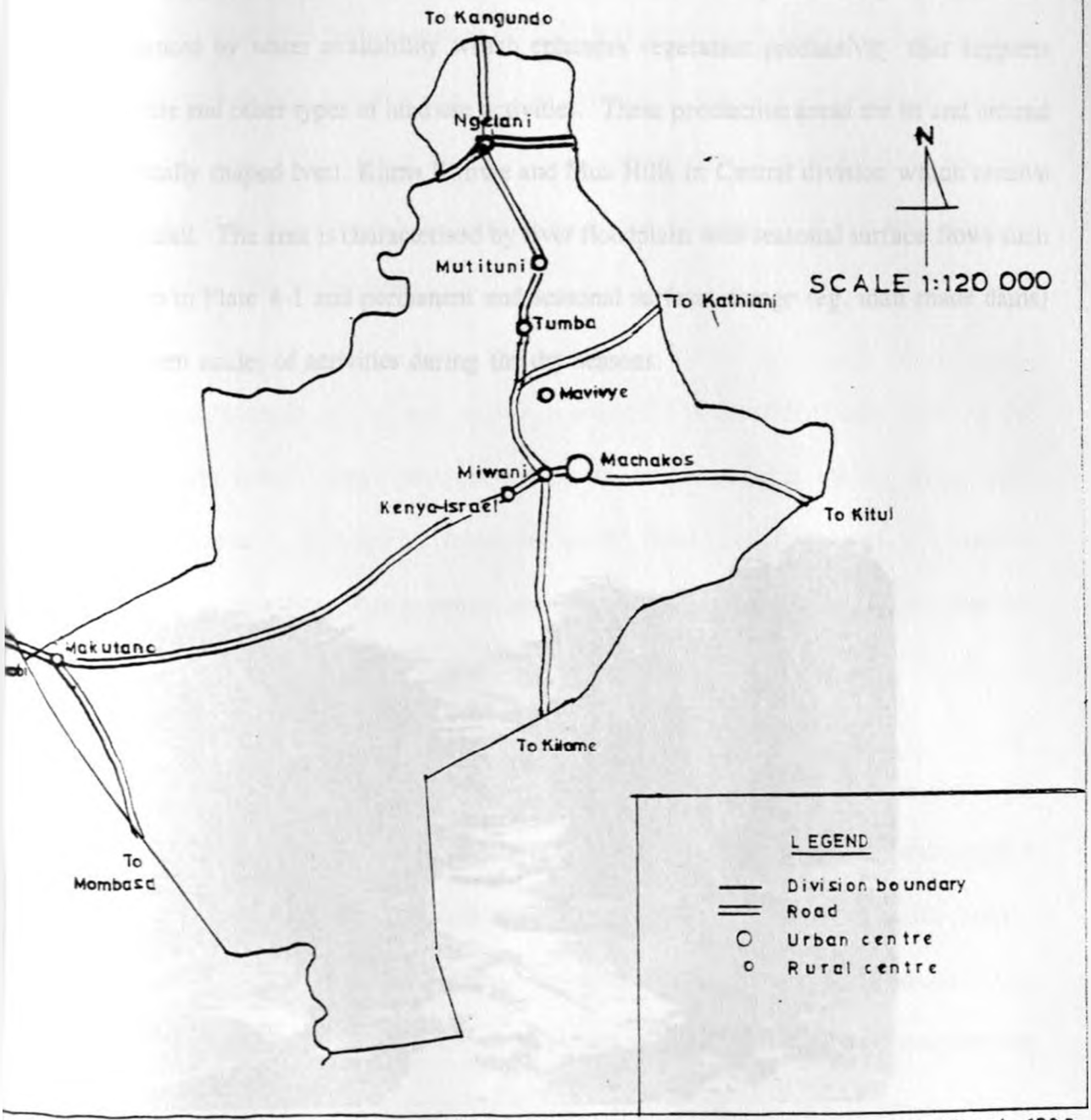
POPULATION DISTRIBUTION



Source: Machakos District Development Plan, 1994.

P. Mwangi, 1997

RURAL AND URBAN CENTRES



Source: Machakos District Development Plan, 1994.

P. M Wangi 1997.

The key production areas in the district are scattered pockets of land with relatively high productive potential set in a matrix of low potential land. The productivity of these areas is influenced by water availability which enhances vegetation productivity that supports agriculture and other types of land use activities. These production areas are in and around the conically shaped Iveti, Kiima Kimwe and Mua Hills in Central division which receive high rainfall. The area is characterised by river floodplain with seasonal surface flows such as shown in Plate 4-1 and permanent and seasonal surface storage (eg. man made dams) which form nuclei of activities during the dry seasons.

Plate 4-1. A Seasonal River in the High Potential Areas.

The rain shadow of the high AEZ consist of extensive low AEZ with scattered settlement and large farms. This is part of the former European settlement area which was used for grazing. The transfer of farming system from the high potential areas as people move from the densely settled high potential areas to low potential continue to influence the farming system of this area. The farming systems which originate often from high AEZ has been incorporated in the exploitation and preservation of natural resources in this area based on the perception of the immigrants.

There is great pressure on soil and vegetation resources in the district as a result of the increasing population. Environmental degradation in this areas is closely linked with population increase, immigration from the upland areas, expansion and concomitant increases in over-cultivation and overgrazing. Data available for several ASAL districts indicate the disappearance of the tree and bush cover (World Bank, 1994).

Efforts to address this problem in Machakos district is noticeable from the works of Ondiege (1994), Tiffen et al (1994) among others. More information is however needed from a multidisciplinary team of researchers in order to adequately highlight the nature, magnitude, causes and impact of soil erosion. Clearing of land for crop production and cutting of poles for building and charcoal production are the important factors contributing to the disappearance of vegetation in the ASALs. Only when farm boundaries lie next to each other and farmers no longer have the option of moving on to virgin land will they willingly invest in soil conservation measures such as tree planting and terracing of their

land. These areas of high population density are now facing critical land shortage and the subdivision of land far below economic limits (World Bank, 1994).

The high and medium potential areas for rain-fed agriculture are limited to the highland which have high and more reliable rainfall. This area covers approximately 26 per cent the total district area. Other areas of the district have less reliable rainfall. In Central division, the main food crops grown are maize and beans while the main cash crops include coffee, french beans and horticultural crops such as citrus fruits, vegetables, flowers among others. The area has seven large farms which occupies a total area of 370.50ha. This gives distortion of the farm area available to farmers since majority of the population have less than 4 acres. The main livestock found in the area include cattle, goats, sheep, poultry and bees.

Land use and environmental situation in Machakos has indicated that with a rising population in the high and medium potential areas of the neighbouring districts outside the ASALs and also in a number of pockets of high and medium potential areas in the ASALs, there has been a rapid expansion of arable farming into what had previously been rangelands. These are environmentally fragile areas.

4.4 Land Tenure and Socio-economic Characteristics

Traditionally in the Akamba community, every man owned his farm or cultivated field. The man used to break up the ground first and then divided it among his wives who would

continue to have access to it but have no control over it. The wives would then plant and each wife harvested crops from her portion and stored the produce thereof in her own hut. If a man did not have enough land for his requirements and could not find unoccupied land, he had to buy a plot of land ie. *shamba* from the neighbour (Hobley, 1971). Traditionally no sale or donation of the land was considered valid unless it received the consent of the chief. Every clan had its grazing lands which where common to all the members, and adjacent clans often grazed their stock on each other's common land.

On the coming of the Europeans and the annexation of the fertile land from the Akamba for European farming, the issue of land began to be critical. After the concentration of the Akamba in the marginal land which was in most cases less fertile, those who could afford to buy land often bought it from their neighbours. When the European left however, the distribution of the land in the former European areas in Machakos to the Akamba people was not equitably done. Those who had the money bought the amount of land they required from the departing European farmers while the majority of the people ended being resettled by the government after paying certain required amounts of money to the government. These purchases were often subsidized. In some cases groups of farmers came together and formed companies which bought land on their behalf.

The Akamba have been keeping livestock and small farming practices from time immemorial (Were,1981). They are generally hospitable to outsiders and occupy two main geographical areas all falling in the ASALs namely those to the North (Kitui) and those to

the south of Tana River ie Machakos and Makueni. This Bantu group has extended families linkages. Although traditionally the Akamba people were polygamist[2], they are currently monogamist following their adoption of christian faith. At the time of marriage, the wives leave their clans composed of father, mother and other members of the close relatives and join the family units of the husbands where they are given a portion of land to work on.

The married wives have access to land in as far as farming practices is concerned. However, they still have to ask for permission from their husbands when it comes to the use to which land may be put and in the disposal of income from sale of crops especially cash crops. Women have to be told by husbands where to plant trees and so forth. Individual title land only applies to land which has descended to the owner as agricultural land and on the death of the owner it passes to his oldest son. According to Hobley (1971), women in the Akamba society cannot be said to have any rights to land or stock, but are recognized as trustees or guardians of property during the minority of their male children. Should any such children die in infancy the estate reverts to the nearest male relation.

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[2] As a result of the present form of marriage system (monogamy), it is frequent to find a number of traditionally married women separated or divorced who have children with the former 'husbands'. Such a break-up of families from traditionally institutionalised type of marriages means that a lot of strain on land is exhibited since it means that women and children who have direct relationship with the head of a household have to farm on the same small farms.

With majority of the people owning small farms, most of which are less than four acres, the small farms have continued to experience pressure from the high population growth rate. As demand for food crops increases, the pressure on natural resources continue to be experienced. The immigrants into the ASALs from high potential areas bring with them the land use practices which they are familiar with. Most of these practices are inappropriate for the ASALs and lead to land degradation. The immigrants also disrupt the indigenous land management systems which are based on appropriate and locally adapted technologies. Clearing land for cultivation, for example increases evaporation from the soil surface which leads to negative impact on environment (Republic of Kenya, 1994) giving way to poverty (Blom, 1985).

Population growth rate in ASALs is heavily influenced by migration. Due to the high population densities in the high potential areas, more and more people are moving into ASALs in search of farming land and employment opportunities (Republic of Kenya, 1994). Poor households place a high priority on livelihood and survival strategies and not development or conservation measures. People are forced to fell trees for fuel, construction, charcoal burning for commercial and domestic purposes and may not have the incentive to conserve the environment (Republic of Kenya, 1994:86). The problem is compounded by degradation of cultural practices that ensured sustainable resource management (Republic of Kenya, 1994:87).

To effectively understand the Akamba society, various scientists and research institutions have undertaken research in this community. They range from planners (Ondiege, 1992);

biological scientists (Lynam,1978); environmentalists (Tiffen et al; 1994 anthropologists (Mwangi, et al. 1995; Mwangi, 1996 etc) and a number of research organisations such as KARI, ICRAF, NGOs, churches and Government ministries. Their findings especially in water projects, have gone a long way in helping the individual households and community based organisations bring about developmental change in the region.

4.5 Summary

Land use in this transitional area is influenced by physical factors such as the hill masses, technology and labour among others. High population increases in the district is exerting a lot of pressure on agricultural land. The division is mainly dependant on agriculture with few people employed in Nairobi, Athi River, Machakos town and other nearby urban centres.

The topography, rainfall patterns and the soils of the division influences vegetation cover and population distribution. In areas where rainfall is high, the farms are small due to the suitability of those areas for settlement and agricultural practices. In the two AEZs, the inhabitants are agropastoralists who keep small herds of cattle and grow both cash crops and food crops. The large farms in the low potential areas has encouraged population drift from the high potential areas of the division and elsewhere in the country. On the other hand due to the inability of the farms to sustain the increasing population, there has been out migration of productive labour in search of jobs in a number of surrounding urban centres.

CHAPTER 5. HOUSEHOLD AND LAND USE CHARACTERISTICS

"Climate sets the broad limits; cultural adaptation determines the actual lifestyles".

Akinoola A. Agboolay (1989) and Taiti (1996).

5.1 Introduction

The analysis in this chapter focuses on the socio-cultural, economic and environmental factors influencing agricultural land use. It is based on the field work that was carried out in the high potential areas of Mumbuni locations and Katheka-kai location in the low potential areas of Central division of Machakos district.

5.2 Household Characteristics

5.2.1 Marital Status and Resource Use

In this study, the highest percentage of the heads of households interviewed were married. These accounted for 71.4 and 88.9 per cent of respondents in the high and low potential areas respectively. The high percentage indicates the need to concentrate land use management efforts at the household level where decision making relating to resource use has an already established family structure. The marital status of heads of households in the two AEZ is shown in Table 5-1. The incidence of polygamous system of marriage which accounted for 2.8 per cent of the respondents in the low potential areas appears to be related to the large average farm sizes of 15 acres. This family system may be related to labour requirement in that the households with large family sizes do not experience labour shortages.

Table 5-1. Marital Status of the Heads of Households

Marital Status	High potential areas	Low potential areas
Unmarried	19.0	2.8
Married	71.4	88.9
Widowed	9.6	5.6
Polygamist	-	2.8

Source: Field Survey, 1996/1997

This type of traditional marriage system shows that some of the older generation of the Akamba community who have large farms sizes still hold to traditional ways of life. However, it's future is not promising as the large land sizes will decline due to subdivision as a result of the increasing population and the system of land inheritance. In the high potential areas, this marriage system was not reported in the sampled households due to probably the already existing pressure on agricultural land.

The unmarried heads of households who constituted 19 per cent and 2.8 per cent in the high and low potential areas respectively indicate that those who do not get married or marry then break up also depend on land for their livelihood. This form of family system was attributed to separation from husband and men and women who had not committed themselves in marriage but where living together. In the high potential areas, it was found out that most of the unmarried had dependants who were living with them. This means that as marriage institution falls short of the expectation of the local people who generally

expect dependants to be raised within marriage system, there is increasing pressure on land resources as the small farms are expected to support this population. This calls for intensification of farming activities so that the increasing population can be supported.

The above household characteristics have particular influence on the use and management of resources at the farm level. The ability of a household to adequately plan for the existing resources such as agricultural land and vegetation cover and use them effectively will positively or negatively determine the extent to which future generation will have access to the same resources for their socio-economic benefits. In the short run however, this will determine their standards of living.

5.2.2 Age, Education and Conservation of Land

The average age of the respondents in the low agroecological zone is 40 years while that of the high agroecological zone is 37 years indicating the exitance of a youthful population. This youthful population tries to adapt differently to various strategies aimed at providing enough food to the households and in turn exerts a lot of pressure on the agricultural land and the resources found on it. This has led to negative effects on the agricultural production as indicated in section 5.7.

This calls for adoptation of both the traditional and modern method of land use management practices so as to ensure environmental recovery. Adaptation of land use practices is needed by three class of people: those who have had no formal education, those with

formal education and the old members in the society who fall in either of the two groups mentioned. Table 5-2 shows household heads education levels.

Table 5-2. Household Members Education Levels

Area	No formal Education	Primary	Secondary	Post Secondary
Low AEZ	19.4	41.7	36.1	2.8
High AEZ	23.8	45.2	23.8	7.1
Both Zones	21.8	43.6	29.5	5.1

Source: Field Survey, 1996/1997

The educated heads of households in the sample area who have had the opportunity of going through secondary and post secondary levels of education account for 38.9 per cent in the low potential areas and 30.9 per cent in the high potential areas respectively. This group of local actors can be expected to plough back their knowledge into the management of agricultural land. Those who have higher levels of education were found to be aware of environmental problems facing small scale farmers in the areas. Their contribution is important since they have been socialised in this area from their youth and have had the opportunity of interacting with a wider community at school and elsewhere in the country. Their status in the society enables them to command respect and a large group of followers in rural area. As a result, they would be anticipated to interact with the other farmers in this environment in order to benefit them with the knowledge they have acquired. This according to the informal discussion conducted with the small scale farmers in the two agroecological zones was not happening.

The household heads who have not undergone any formal education and those who have acquired elementary education have also acquired knowledge about their surrounding through the socialization process within and outside the household environment. This group accounted for 61.1 per cent in the low potential areas and 69.1 per cent in the high potential areas respectively. From the findings, one would therefore assert that most of resource conservation methods are learned and passed on to other members of the household through socialization within and outside the household. Their knowledge in resource management and land utilization need therefore to be harnessed for the benefit of the whole community.

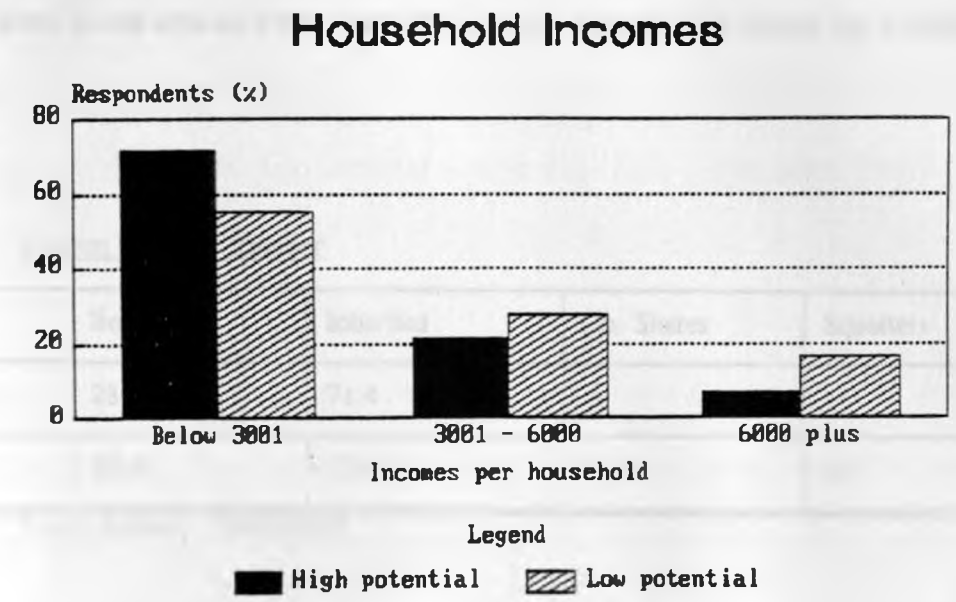
The 16.7 per cent of the respondents in the low and high potential areas who have more than 50 years and are considered old enough in the society can be used as channels of passing information to the younger generation at the household and at the community level. This group of people according to the Akamba tradition are knowledgeable and respected members and could therefore use their position in the society to influence positively the trends of resource management.

5.2.3 Household Occupation and Resource Utilisation

Most households in the two agroecological zones earn less than 4,500 shillings per month. Survey results showed that 80.8 per cent of those interviewed earn less than 4,500 shillings per month. As a result of the low incomes, the land and the environment in general experiences great pressure from the local actors in order to feed and support the average household size. In the low agroecological zone, 27.8 per cent of the respondents indicate

that they receive more than 4,501 shillings per month while in the high agroecological zones 11.9 per cent received 4,501 and above as shown below.

Fig. 5-1.



Source: Field Survey, 1996/1997

According to the household heads interviewed, 76.2 per cent derive their incomes directly from the farm. Incomes received from formal employment accounting for 16.7 per cent was used to supplement farmer's needs from what they received from the land. The study notes that those who are wholly dependant on land for their incomes are likely to adopt good land use management practices than those who are far away from their farms.

5.3 Land Use and Resource Management

5.3.1 Land Tenure

The Akamba land tenure system has undergone tremendous changes. There are two types of land ownership systems in the high agroecological zone, namely inherited land and

purchased land. Survey results showed that 71.4 per cent of those interviewed from the high potential areas had inherited land while only 28.6 per cent of the respondents had purchased land. The highest percentage of those who had inherited land from their parents have always lived in this area as it was formerly a native reserve area during the colonial government.

Table 5-3 System of Land transfer

Area	Bought	Inherited	Co. Shares	Squatters
High AEZ	28.6	71.4	-	-
Low AEZ	38.9	13.9	41.7	5.6

Source: Field Survey, 1996/1997

This indicates that most farmers in the high potential areas have had longer contacts with their land compared to their counterparts in the lower agroecological zone and are therefore willing to conserve resources on their land. It also implies that, as land sizes in this region continue to be further subdivided, the value for the agricultural land continues to increase due to high demand for the land. It is also important to note that in the two agroecological zones, the inhabitants can acquire credit from financial institutions such as AFC and other commercial banks to develop their land.

5.3.2 Sizes of Land

Land sizes are influenced by the natural factors which include climate (rainfall patterns),

soils, temperatures and topography among others and socio-cultural, economic and institutional factors. In the two agroecological zone, land is largely individually owned which means that the issues of resources management is at the hands of the individual land owner. The availability of large farms in the low potential areas has attracted population movement from high potential areas. The systems of land inheritance continue to encourage land subdivision in the high potential areas and the sizes of farm each household has.

Land sizes differ from one agroecological zone to the another with the low potential areas having the largest land holdings. In the high potential areas. it was found out that 90.5 per cent of the households had 5 acres and below while in the low agroecological zone 80.6 per cent had 14 acres and below of land. The average land sizes is 3 acres (1.2 ha) and 11 acres (4.4 ha) per household respectively indicating that land is under enormous pressure to support the mean household size of seven in the low potential areas and eight in the high potential areas. This high population calls for intensification of farming activities and use of appropriate farming technologies.

5.3.3 Problem of the Squatters

The survey established that 5.6 per cent of the respondents are squatters in the low potential areas. These group of landless people have migrated from both the high and the low potential areas and have settled on land owned by absent landlords. The absentee landlords are mainly from the high potential areas of the district. The growing number of landless

people shows that the present land tenure system has not responded to the challenges posed by population increase. This situation has negative implication since the farmers do not effectively identify themselves with the land on which they are squatting.

5.3.4 Migration

As a result of the high population densities and the inability of the farms to meant the family's food requirements, a considerable number of men in the study are migrating into the nearby urban centres in search for jobs. When such migration takes place, women and children are solely left responsible for food procurement. In the low potential areas, the number of men who migrate to urban centres in search for jobs accounted for 10 per cent of the household heads interviewed. The number of female migrant to urban centres and especially Nairobi, Machakos town and Athi river in search of jobs was also on the increase. Most of the female migrants from the areas were said to be working for lowly paid jobs such as housekeeping while their male counterparts were engaged with no particular work in these urban centres. Most of the men who had migrated from these areas to towns were reported as staying with their relatives in the hope that they will find employment.

This phenomenon indicate the urgent need for the intensification of farming activities so that these idle labour could be employed in income generating activities that would support their families. This will only be possible if the basic requirements such as infrastructure services such as water supply and high yielding food varieties can be introduced in the two agroecological zones.

5.3.5 Control of Land

Traditionally, land control was vested in the hands of the chief. Later, the colonial government introduced private ownership of land which led to the present land tenure system in Ukambani where the head of the family who happened to be the male member control land use and land disposal. In the low agroecological zones, 83.3 per cent of the respondents indicated that the control of land was in the hands of men, 13.9 per cent in the hands of women while according to 2.8 per cent of the respondents indicated that it is controlled by both. In the high potential areas, 73.8 per cent the respondents indicated that control of land is under the male, 21.4 per cent women and 4.8 per cent by both.

5.3.6 Perception of the Community on Ownership of Land

In the two agroecological zones, when the respondents were asked why men were the persons exercising control over land, 83.1 per cent of the respondents indicated that men are considered to be the household heads. The effect of men controlling land in the low and high potential areas is that 59.5 and 63.9 per cent respectively of the female respondents in the low and high potential areas encounter problems associated with male control over land. The problems cited by female respondents are as shown table 5-4.

Table 5-4. Problems Related to the Control of Land by Men

Area	Men can sell land	Socially women are marginalised	Men benefit economically
High potential	12.2	51.2	36.6
Low potential	8.3	41.7	50.0
Both	10.4	46.8	42.9

Source: Field Survey, 1996/1997

In the division, the two most common problems that women face associated with the control of land by men are those related to marginalization of women (46.8 per cent). When it comes to decision making concerning how land and resources on it can be used, female respondents indicated that economic benefit such as land transactions mainly benefit men (42.9 per cent). This is despite the important role played by women as users of agricultural land.

There is need for women to have control of land because the present trend is that they have the main responsibility of feeding the family. The study established that men have control over land and also make decisions on resource management and use. If women had a greater share in decision making over the use of land based resources, it would be possible for both to share the economic benefits accruing from it.

The problems facing women's access to and control over land indicates that they cannot make important contracts that involves the use of land. This limitation on women's direct

involvement in land management has important consequences on the standards of living in the area. The farmers do not benefit from loans given by commercial banks and other financial institutions because they are afraid of loosing their pieces of land in case they are not able to repay the money back. It was established that household heads keep title deeds in the house and rarely use them to secure loans for developing their farms.

5.3.7 Land Transfer

Land transfer in the Akamba community is done within and among the family members through inheritance mainly from the men of one generation to the men of the next generation. Inheritance in most cases take place before the ancestor dies. This kind of inheritance is mainly tied to the socio-cultural factors and political factors that directly or indirectly affect a household.

When household heads were asked to give reasons as to this type of inheritance, the following response where given from the two agroecological zones. 41.3 per cent of the respondents indicated that women are married away and therefore will have access to land of their husbands, 16.0 per cent of the respondents said that they would give land to their daughters if not married. Others said that because sons are future households head and parents have to give them land in order to prepare them as future heads of households. According to 28.0 per cent of the respondents. Past and present cultural practices have also a significant contribution in determining who inherits land as was indicated by 14.7 per cent of the respondents. This is because culturally among the Akamba, it is men and not women who inherit land.

This system of land transfer which in most cases guarantees that the male member of the family is in control of land and it's resources has borrowed heavily from the Native Land and Registration Ordinance enacted in 1959 which transformed customary tenure into freehold tenure by registering land parcels in the name of an individual and issuing a title deed. The title deed was mainly issued to the male member who also happened to be the head of the household. When this is combined with the Akamba traditional ways of marriage the land end up being inherited by the male member.

5.4 Gender Activities and Utilization of Land

5.4.1 Introduction

Most of the land related production activities rotates around women and children. While men are involved in what are considered to be traditionally male dominated activities both on the farm and off the farm, women are involved in almost all development activities ranging from household chores such as cooking, looking after children, fetching fuel wood and water, marketing and a number of other farming activities.

The household chores that women engage in take a lot of women's time especially when one has young children. A lot of time which could have been spent on productive activities where the households would have been benefited economically are not performed. Women in the Akamba community according to the focus group discussion held are supposed to be every where from bathing the children, feeding them, attending to children whenever sick, marketing, community social gathering like burials, wedding among others to farming

activities. Usually the more children a household has, the less directly economically productive work they perform. On their part, men are mainly involved in clan issues such as how it is performing, maintaining discipline within the society to farming work where their roles are not as significant as those of women and children.

5.4.2 Fetching of Water

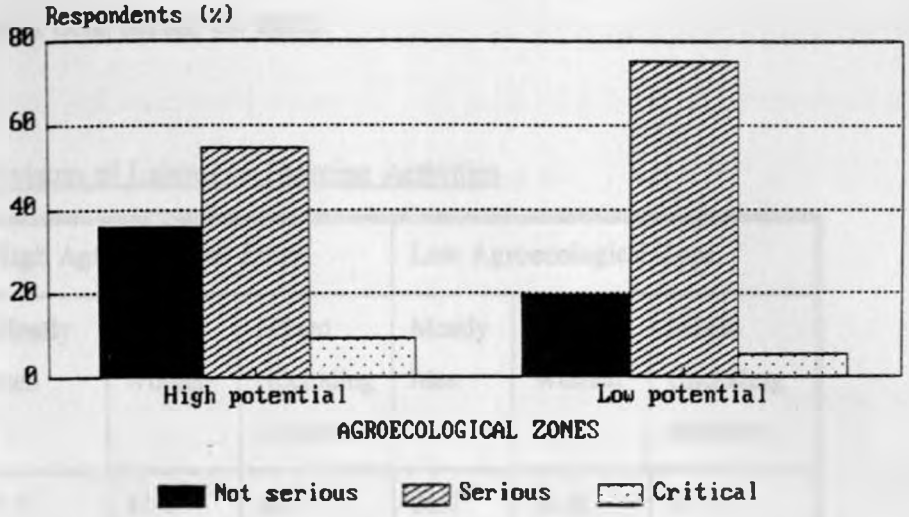
This activity is mainly in the hands of the women and their children who are culturally expected to assist their parents. In the low potential areas where water is fetched at an average distance of 2.2km, a lot of time is spent considering that one jerrican of 20 litres of water cannot be enough for the whole household. In this zone where the average number of cattle is seven, women have to plan their time since they have to travel long distance to fetch water for livestock during the drought periods.

Table 5-5 Fetching of Water

Gender	Low Agroecological Zone	
	Low	High
Mostly Men	5.6	-
Mostly Women	41.7	54.8
Mostly Children	13.9	14.3
Mostly women and children	30.6	23.8
Mostly men and children	2.8	2.4
Mixed	5.6	4.8

Source: Field Survey, 1996/1997

Fig. 5-2. **Rating of Water Problem in the Division**



Source: Field Survey, 1996/1997

Like in the household chores where women dominate, in other land use activities, women also perform a vital role as indicated in table 5-6. The future of land resources in this division will depend on economising of women time in the household so that more of their effort will be devoted to income generating activities which will be able to pay for their labour and reduce incidence of poverty in the area.

5.4.3 Land Preparation for Planting

Preparation of land for planting is usually in the hands of women and children (boy child and girl child). 92.3 per cent of the respondents in the high potential areas and 91.7 in the low potential areas indicated that they prepare their farms for planting during the dry season but just before the start of the short or long rains. The remaining per cent of the respondents in both cases reported that they prepare land during the rains. Those who

prepared their farms before rains indicated that they normally get favourable returns than when preparation is done during the rains.

Table 5-6. Division of Labour in Farming Activities

Activities	High Agroecological Zone			Low Agroecological Zone		
	Mostly men	Mostly Women	Mixed (including Children)	Mostly Men	Mostly Women	Mixed (including children)
Land preparation	9.5	47.6	42.9	36.1	30.6	33.3
Planting	-	66.6	33.4	5.6	55.6	38.9
Weeding	-	58.5	41.5	2.9	34.3	62.9
Harvest	2.4	78.6	19.0	5.6	41.7	52.8

Source: Field Survey, 1996/1997

In all land use activities related to crop production, this is the only activity, that men participate mostly although their input is still insignificant compared to that of the women. In this activity traditional and modern farming methods are normally used. In the high potential areas, 58.6 per cent of the women and 17.4 per cent in the low potential areas use jembe, panga and hoe in the preparation of land which demand a lot of their time while those who use tractors, and oxen plough account for 40.7 per cent of the women in the high potential areas and 68.2 per cent in the low potential areas. Problems identified by farmers during preparation of land for planting included expensive hiring of tractors and

oxen for those who do not have, inadequate farming implements. lack of capital and shortages of labour as was explained by 22.5 per cent. 35.1 per cent. and 5.7 per cent and 18.6 per cent of the respondents respectively. All these influences the amount of land prepared, the food produced and also surplus that may be sold.

5.4.4 Planting

Like in the preparation of land for planting, planting is also in the hands of women both in the high and low agroecological zone. As shown in table 5-6.. 58.3 per cent of the respondents in the low potential areas and 39.0 of the respondents in the high potential areas plant before rains while 30.6 per cent and 46.3 per cent in the low and high potential areas respectively plant during the rains. The remaining percentage plant either before or during the rains.

Problems faced by the farmers include shortages of labour which was expressed by 30.3 per cent in the low potential areas and 37.5 per cent in the high potential areas. Expensive seeds and lack of seeds were identified as problems by 54.5 per cent and 53.8 per cent of the respondents in the low and high potential areas respectively. The two condition have negative influences on agricultural production according to interview schedule in the two areas.

5.4.5 Weeding

In the high and low potential areas. this activity rest in the hands of women and children who experience a number of problems such as deep rooted weeds (coach grass) and inadequate labour in the low potential areas as was explained by 41.2 per cent and 45.2 per cent of the respondents respectively. The other problem in this area was that of water logging due to the nature of soils which was explained by 17.6 per cent of the respondents. This activity needs timely action on the weeds since it influences productivity of the farms. The main problem in both areas associated to this activity is that of inadequate labour and implements. Plate 5-1 and 5-2 shows water logging in the low potential areas and women weeding in the high potential areas.

Plate 5-1. Water Logging in the Low potential Areas During the Rains

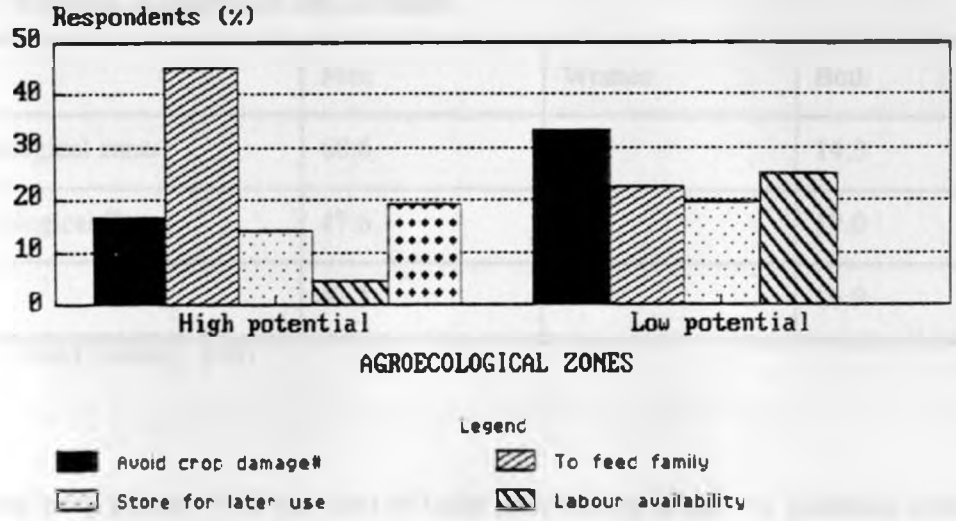
Plate 5-2. Weeding in the High Potential Area.

5.4.6 Harvesting

Like all other farming activities, gender involvement in this activity concentrates in the hands of women especially in the high potential area where 78.6 per cent of the respondents indicated that women are the main actors. Men unlike in the low potential area are rarely involved. In the high potential area, this activity is mainly in the hands of women and children. Harvesting is normally done in the dry periods when crops are ready for harvesting according to 94.4 per cent of the respondents in the low potential areas and 54.8 per cent in the high potential areas.

Due to the small farms and the high population in the high potential areas, the dependency on maize crop when still in the farm is high. From the field findings, 45.2 per cent of the respondents harvest maize when still green and in the farms. In contrast, only 5.6 per cent of the respondents harvest green maize in the low potential areas. A number of responses where given as to why harvesting was undertaken as shown in Figure 5-3.

Fig. 5-3. Why Harvesting is Done in the Division



Source: Field Survey, 1996/1997

In the high potential areas, problems related to harvesting include inadequate labour (25.6 per cent), wildlife (4.9 per cent) while in the low potential areas the problem include inadequate labour (17.1 per cent), little harvest (11.4 per cent) and wildlife like birds among others (16.7 per cent). Harvesting is undertaken in the month of August and February when crops planted during the long rains and short rains are harvested.

5.4.7 Problems Related to Men Keeping Money

Considering that in 68.6 per cent of the households in the low potential areas and 47.6 per cent of the households in the high potential areas men keep money as shown in table 5-7, women are generally disadvantaged in terms of having money that could be used in maintaining and managing land. Table 5-7 shows the household members charged with the responsibility of keeping money in the division

Table 5-7. Keeping of Money in the Division

Area	Men	Women	Both
Low Agroecological zones	68.6	17.1	14.3
High Agroecological Zones	47.6	33.3	19.0
Both	57.1	26.0	16.9

Source: Field Survey, 1997.

Asked why men keep money, 54.3 per cent of those interviewed in the low potential areas indicated that it was because men were household heads and controlled resources on it. It was also noted by 17.1 per cent of the respondents in this zone that men keep money for security purposes for fear that it might be stolen while 28.6 per cent of the respondents reported that it was because men knew what the family needs were. On the other hand, those interviewed in the high potential areas indicated that men kept money because they were household heads as was reported by 46.3 per cent of the respondents. Men keeping money for security purposes was explained by 9.8 per of the respondents while 29.3 per cent in the high potential areas indicated that men understood better the family needs.

From the field findings, it was established that a number of problems are faced by women when men control money as shown in table 5-8.

Table 5-8. Problems When Men Control Money

Area	Interfere with food production	Leads to delayed farm work	Less farm work done	Reduce crop output
Low potential	63.9	57.1	37.1	29.4
High potential	71.4	70.3	37.1	56.6
Both	67.9	63.9	37.1	41.7

Source: Field Survey, 1996/1997

The main problems faced by women when control of money is in the hands of men in the high and low potential areas area mainly two. First, they hinders food production. This mean that since men do not avail money for use in the farm, women have to work long hours in addition to their usual household chores in well-to-do farmer's farms so that they can be paid money to buy seeds for planting. The second problem is one that is associated with delayed farm work as a result of women lacking money to pay labourers. As a result, they have to work longer hours in their farms and in most cases the weeding season ends when they are not through. According to table 5-9, in as far as control and use of money is concerned, the problem is mainly experienced by households that earn less incomes. This implies that as long as women do not have access to resources, they will continue to face problems that will hinder effective utilization of their agricultural land.

Table 5-9. Incomes of the Households and the Percentage of Women Mainly Affected by Control of Money by Men

Households incomes	Percentage of Women in the Agroecological zones	
	High	Low
Below Kshs 3001	42.9	38.9
Kshs 3001 - 6000	11.9	16.7
Above Kshs 6001	4.8	8.3
Total	59.5	63.9

Source: Field Survey, 1996/1997.

5.5 Immigration Trends

5.5.1 Introduction

As has been mentioned in chapter one, three and four the most important natural resource in Kenya is land and any successful development will have to depend on its effective utilization for the benefit of the present and future generation. As a result, the importance of land can not be underestimated in the study area. Due to the high value attached to land, there has resulted to depletion of vegetation cover in the low potential areas.

5.5.2 Immigration into the High Potential Areas

The rate of migration from high to high AEZ are low and accounted for 19.5 per cent of the household interviewed. This can be attributed to the cost of land per acre in the high potential areas which ranged from Kshs 250,000 to Kshs 350,000 per acre as compared to

that of the low potential areas which ranged from Kshs 25,000 to Kshs 80,000 per acre. The willingness of some of the farmers to spend large sum of money in order to purchase land indicates the value attached to land. Such amounts of money is also backed up by other socio-economic and physical factors such as the willingness of the seller to sell and type of climate among other factors.

From the informal interviewed conducted, the high to high potential migrants are generally rich and well to do people in the Akamba community. This group of people have also large tracts of land in the low potential areas where they have not settled and where a number of them keep large herds of cattle in or outside the division. This group accounted for 19.5 per cent of the respondents.

In the low potential areas, 2.5 per cent of those interviewed have bought land in the high potential areas. These group of farmers are relatively rich. They mainly buy land in the high potential areas in order to maintain links with the high potential areas. These links are mainly business related although some wanted to be close to their relatives. 75 per cent of the respondents are those who have always lived in the high potential areas. Conservation of the resources in this area need to target this group of small scale farmers who do not have other linkages with other areas and derive their livelihood direct from their small parcels of land. Due to the duration of their stay in these old settlements, they generally live in a stable ecology compared to those in the new settlements in the low potential areas.

5.5.3 Immigration into the Low Potential Areas

Immigration into the low potential areas is mainly dominated by those from the high potential areas in search of farming land. From the field findings, 69.5 per cent of the respondents where from the high potential areas both outside and inside Machakos district. It was established that this group of local actors often migrate with the same farming system found in the high potential areas. This has implications on agricultural production in the area since the farmers have to work more on their large farms with traditional farming tools as shown in Plate 5-3 which requires more labour. Due to depletion of vegetation, soil erosion is a major environmental problem in the area. Refer also to section 5.7.3.1 and 5.8.

Plate 5-3. A Farmer Using a Hoe in the Low Potential Area

5.6 Performance of Agriculture

5.6.1 Introduction

The problems of agricultural development in the ASAL areas are compounded by the fact that smallholder farms do not produce adequate food for the household. Because of this, the majority of able-bodied (mainly men) are forced to look for off-farm employment in the urban centres in order to supplement farm incomes. This leaves the dependants, the young and the old to take care of the farms. The result is poor farm management which in turn contributes to low productivity. Maize which is the main food crop has not been able to endure drought occurrences in the area. In the low and high potential areas, the farmers have not been able to meet their food requirements.

5.6.1.0 Crop Production

5.6.1.1 Maize Production

Katumani Hybrid maize is grown by all the households in the high and low potential areas. The research institutions have been developing a number of high yielding maize variety in the ASALs. According to the government, the Dryland Hybrid (DH01) maize is to be released in these areas which is considered to have 15 to 20 per cent higher yields than Katumani hybrid maize (East African Standard, 1997). Table 5-10 indicates maize production trends for the last two seasons.

The table indicates that maize production per unit acre fell to negative 0.8 bags per acre in the low potential areas and negative 0.7 bags per acre in the high potential areas. In the whole division there was a negative 0.8 decline in maize production per unit acre.

Table 5-10. Maize Production Per Unit Area

Areas	Average Acreage	1997 (bags)	1996 (bags)	1997 bags/acre	1996 bags/acre
Low AEZ	2.5	1.5	3.6	0.6	1.4
High AEZ	1.4	1.7	2.6	1.2	1.9
Both	1.9	1.6	3	0.8	1.6

Source: Field Survey, 1996/1997

The perception of the farmers in relation to maize production shows that 6.4 per cent of the respondents had better yields, 84.6 per cent had a significant drop in yields while 9.0 per cent had constant yields in the last three years. In the two agroecological zones, the responses were as displayed in table 5-11.

Table 5-11. Perception of Local Actors on Maize Trends

Area	Better yields	Drop in yields	Same
High AEZ	4.8	83.3	11.9
Low AEZ	8.3	86.1	5.6

Source: Field Survey, 1996/1997

Reasons advanced by the 6.4 per cent of the respondents who had better yields indicated that they engaged in better crop management 42.9 per cent, better seeds 28.6 per cent, use of inputs such as fertilizer and manure 14.3 per cent and increase in the area under maize production 14.3 per cent. On the other hand, reasons for drop in yields was explained by

84.6 per cent of the respondents who indicated that crops are affected by bad weather (unreliable rains) 82.9 per cent, bad seeds and small *shamba* 12.9 per cent while 4.3 per cent attribute this on soil erosion. Since the two areas are not able to meet the family food requirements there was need to investigate whether farm sizes explains the poor yields in the two AEZs (refer to chapter six section 6.1.2).

5.6.1.2 Other Types of Crops

Maize production is supplemented by beans and peas which is grown by 98.7 per cent of the respondents. The potential for these two crops especially cowpeas and pigeon peas exist in the division despite its poor performance. The average acreage of these two crop in the division is 1.3 (0.5 ha). In the high potential areas, these two crops are grown at an acreage of 1.1 acres (0.4) by farmers while in the low potential area, they are grown at an average acreage of 1.6 (0.6ha). Sorghum which is an old traditional crop in the area is grown by 14.9 per cent of the respondents in the division. The crop is grown at an average acreage of 1.1 acre (0.4) in the division, 1.2 acre (0.5ha) in the high potential areas and 1 acre (0.4ha) in the low potential areas. Other minor crops grown in the area such as millet, cassava, sweet potatoes, green grams etc are grown by 43.4 per cent of the respondents at an average acreage of 1.1 (0.4) in division, 1.5 (0.6 ha) in the high AEZ and 1.4 (0.6 ha) in the low AEZ.

The low percentages of the respondents who plant traditional type of crops is worrying. These types of foods are important due to their nutritional value, simple storage and their

importance during drought. It is therefore important to undertake more research into the production of these crops in the arid and semi arid so as to come up with high yielding drought resistant varieties. There is also a need for civic education at the community level in order for more farmers to be encouraged to plant more of these drought resistant crops. Different crops require different management practices. Coffee being the main cash crop in the areas is found in both zones. In the high AEZ the crop is grown by small scale farmers along the Iveti hills corridor. This crop require constant attention from the farmers and in most cases due to the immigration of labour to major towns (Machakos. Nairobi. Athi river) for formal employment. the management of this crop has been left in the hands of women and children.

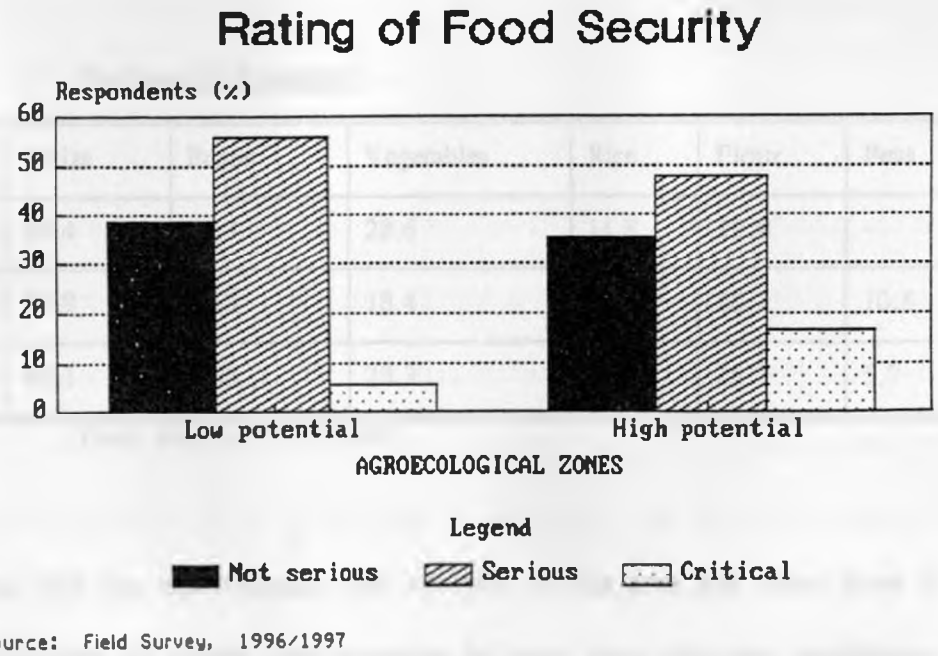
Plate 5-4 Women Picking Coffee in the High Potential Areas

In the low AEZ, coffee is found at the foot of the Mua hills. There are two cooperative societies namely, Katheka-kai and Katelembo. In this cooperatives, all members have equal shares of the coffee estate. There are selected officials to manage this coffee plantation on behalf of the farmers in Katheka-kai and Katelembo. Unlike in Katheka-kai where the officials are members of the farming community, in Katelembo the farmers have engaged the services of outsiders to run the society on their behalf.

5.6.1.3 Food Situation

The problem of food shortage is one that need attention in the whole of the division as most of the households are not able to feed themselves. Figure 5-4 shows the perception of the local actors in as far as food security is concerned.

Fig. 5-4.



Source: Field Survey, 1996/1997

This food problem was attributed to unreliable rainfall by 94.4 per cent of the respondents in the low potential areas and all the households in the high potential areas. Increase in population and subdivision of farms in the low potential areas was identified by 34.3 per cent of the respondents while 6.5 per cent of the respondents in the same zone attributed the problem of food insecurity to infertile soils. One the other hand in the high potential areas, increase in population and subdivision of farms was explained by 78.9 per cent of the respondents while infertile soils was explained by 6.1 per cent of the respondents.

In relation to increase in population above 66.7 per cent and 42.9 per cent of the respondents noted that in the high and low potential areas respectively large families were a cause of less food availability at the household level. This explains the high number of respondents who purchase maize and beans from the local markets as shown in table 5-12.

Table 5-12. Purchase of Foodstuff

AEZ	Maize	Beans	Vegetables	Rice	Flour	Peas
Low	69.4	34.3	28.6	11.8	22.9	-
High	92.9	51.3	18.4	13.2	28.2	10.8
Both	82.1	43.3	23.3	12.5	25.7	5.7

Source: Field Survey, 1996/1997

In order to deal with the unfavourable food situation in this area and other areas of Ukambani, traditionally the people used to engage in barter trade with their neighbours.

Today, the family system is still strong as far as sharing with those who do not have or need assistance. As a result of the inadequate food in the two areas, the local actors have to look into ways of off setting this kind of shortfall between demand and supply.

From the field findings, it was established that the communities in the two AEZ adapted to the practice of give and take. In the low AEZ 16.7 per cent of the households borrow or result to barter trade while 83.3 per cent of the respondents buy from the market. On the other hand in the high AEZ, 17.1 per cent of the respondent are involved in barter trade or borrowing of food while 80.5 per cent of the respondents get their supplies from the market. Coffee farms are also used as security for food in the high agroecological zones by 2.5 per cent of the respondents. Security attached to coffee farms means that after picking of coffee when payments are realised by the cooperatives the farmer pays from what he or she has earned from the coffee produce the amount they had agreed with the person who provided food to the household.

The field findings revealed that traditionally the practice of sharing foodstuffs meant that relatives and friends were expected to help each other in times of hardship. This traditional security system still prevails as indicated in the area of the study. The system also gives small scale farmers access to resources through sharing with well-to-do relatives. On the basis of this, it is therefore concluded that these local actors in the two agroecological zones have not completely abandoned their traditional culture and its ethical rules.

5.6.2.0 Perception of Livestock in Relation to Land Use

5.6.2.1 Livestock Keeping

Livestock keeping is one of the most important undertakings in the arid and semi arid areas of Kenya as was indicated in chapter four. In the division, 71.4 per cent of the households in the low potential areas and 53.8 per cent of those in the high potential areas keep livestock. The main livestock kept include cattle, sheep and goats, rabbits, bees and chicken. Donkeys are used for fetching water and carrying of luggage especially in the low potential areas. The average number of cattle in the low potential area is seven while that of the high potential areas is three cattle. The high numbers of cattle in the low potential areas is attributed to the average farm sizes in the area which is eleven acres as compared to that of the high potential areas which is three acres.

Due to the small land holdings in the high potential area, the type of livestock keeping method is mainly that of zero grazing. The focus group discussions held with the farmers in these agroecological zones established that livestock keeping is mainly influenced by the amount of land available and the level of economic well being of a household. Most households trade off between land for livestock, crop production, settlement or all or a combination of the three land use activities. The farmers sell milk to the nearby market centres and to various households within this agroecological zone who do not have cattle.

In the low potential areas livestock keeping is usually kept on large open fields often set aside for grazing. The open fields are often overgrazed especially during the dry seasons.

Such overgrazing exert great pressure on the ecosystem of the area. On these fields, it is common when it rains for the running water to carry the top soils due to scattered vegetation cover which do not form any kind of canopy.

5.6.2.2 Perception as to the Keeping of livestock

The perception of the Akamba as far as livestock keeping is concerned is that this activity is mainly in the hands of woman. In most cases however, they are assisted by the girl and boy child with little input from older male members of the household. The table below compares the activity of livestock keeping.

Table 5-13. Responsibility of Looking After Cattle

Gender	High AEZ	Low AEZ	Both
Men	15.2	24.1	19.4
Women and Children	45.5	34.5	40.3
Men, Women and children	39.4	24.1	32.3
Servants	-	17.2	8.1

Source: Field Survey, 1996/1997

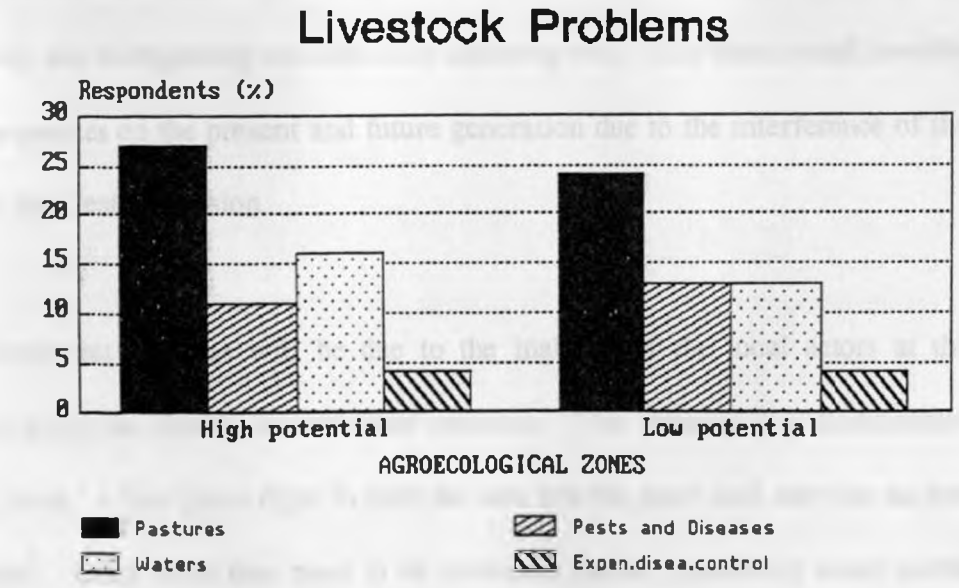
The table shows that responsibility of looking after cattle in the low potential areas is mainly concentrated in the hands of the women. This trend is slowly shifting as men are increasingly being employed to look after livestock. This might be explained by the numerous tasks women have to perform in this area and the distance to and from fetching

water and firewood. However, the study established that employment of these people who look after livestock is mainly undertaken by those farmers who have large tracts of land and also those who are relatively well-off economically. Livestock keeping is a form of security to most of the households in the two agroecological zones during the drought periods.

5.6.2.3 Livestock Problems

There are a number of problems that face livestock keeping. As shown in figure 5-5, these problems include inadequate pasture, inadequate water, expensive methods of pest and disease control.

Fig. 5-5.



Source: Field Survey, 1996/1997

Despite the above problems all forms of livestock and especially cattle, sheep and goats are used in times of unfavourable uncertainty. Selling of livestock in the two areas is mainly done in order to offset food deficits in times of drought or in order to raise money for school fees. As a result of the high value attached to this activity, a lot of pressure is exerted on land due to the high carrying capacities.

5.7 Environmental Conservation

5.7.1 Protection of Water Points

It was established that the small scale farmers at the foot of the Iveti Hills in the High potential areas, those near Mua hills in the low potential areas and Kiima Kimwe Hill areas where concerned about the high rate of depletion of vegetation on the slope of these hills. This situation need more attention because most of the hills are privately owned by the farmers and they are de-vegetating the hills at an alarming rate. This trend could have far reaching consequences on the present and future generation due to the interference of the water cycle in the Central division.

The conflict over this resource will be due to the inability of the local actors at the downstream to enjoy the already scarce water resource. This resource was traditionally been referred to as ' a God given right to both the rich and the poor' and one that no one can monopolise[3]. Other areas that need to be protected include communal water points such as dams which are used for watering livestock during the drought periods.

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[3] In the Water Act, also states that 'the body of all water belongs to the Government'.

Plate 5-5. A Communal Water Point in the Low Potential Area

5.7.2 Community Based Organisations

Mwethya groups in the division like elsewhere in the district have a long history. They are mostly engaged in the provision of water through digging of shallow wells for members and non-members to use. These groups are also engaged in land management activities like prevention of soil erosion and rotational farm work. Such groups help members to ease the problem of inadequate labour during land preparation, planting, weeding and harvesting. These kind of groups have therefore important roles to play in the management and use of land at the household and at the community level. Table 5-14 display the main activities of the community groups in the division.

Table 5-14. Activities and Percentages of Those Involved in Community Based Groups

Potential areas	Tree planting and conservation measures	Social activities	Economic activities
Low	35.3	35.3	29.4
High	6.7	53.3	40.0
Both	21.9	43.8	34.4

Source: Field Survey, 1996/1997

The table indicates that in the high potential areas, less attention is paid to the conservation of the environment compared to the low potential areas. Emphasis in the high potential areas is on social and economic activities as was explained by 53.3 per cent and 40 per cent of the respondent. This is unlike in the low potential areas where there is a balance between the three activities.

There is need to emphases on activities which would conserve resources on agricultural land. Such activities should include planting of trees and information dissemination as to the importance of conserving vegetation cover. This calls for more people to be involved in the planting of exotic types of trees which are of economic benefit to the local actors.

Plate 5-6. Tree Nurseries in the High Potential Areas

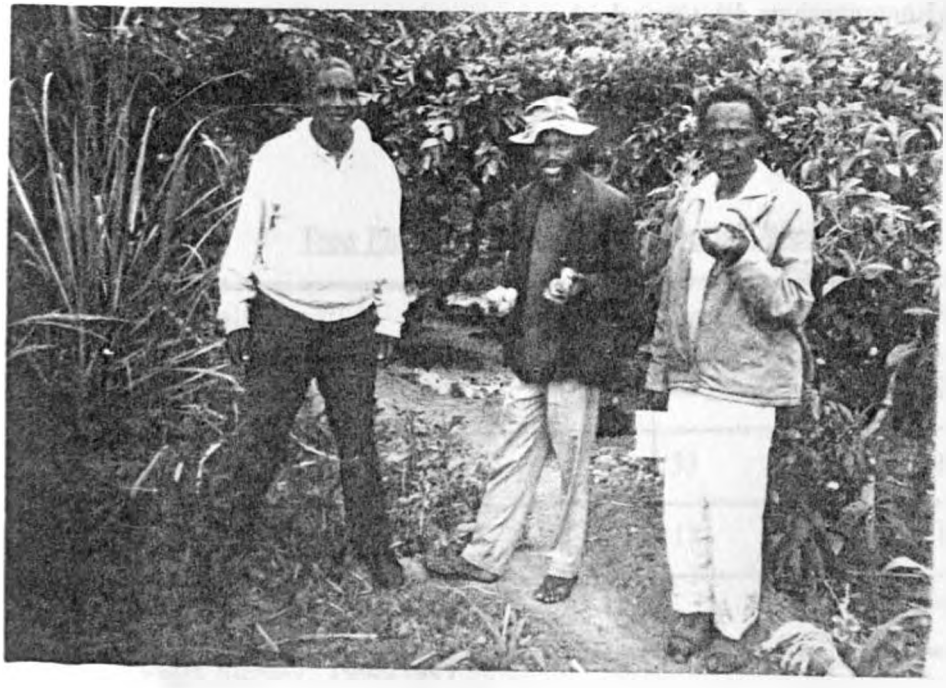


Plate 5-7. There is High Demand for Tree Seedings in the Division

5.7.3.1 Low Potential Areas

From 1961 to 1970, the low potential area of the division attracted 24.2 per cent of the total respondents interviewed, 40 per cent by 1981 and 90.9 per cent by 1991 and between 1981 and 1991, 50.7 per cent of the respondents. This trend has increased pressure on land which has led to clearance of vegetation cover for settlement and agricultural purpose. One farmer from the low potential area indicated that;

> *'the area before the subdivision of land was well vegetated and watered. Today, vegetation cover has been reduced resulting to the present unstable ecological balance. In an attempt to restore part of the former ecosystem, ICRAF and KARI play important roles in rehabilitation of the vegetation cover by supplying seedlings to the organised community groups which deal with environmental protection. These seedlings and information related to management of land is offered free of charge'.*

Table 5-15. Tree Planting in the Low Potential Areas

Origin	Plant Trees	Do not Plant trees	Total (%)
From Low Potential	100	-	100
From High Potential	67	33	100
Outside the district	83	17	100
Had been in the same place	100	-	100

Source: Field Survey, 1996/1997

It was established that those who migrated into the area from the low potential areas of the district and those who where staying in this place during the colonial periods were more conscious of their environment than those who where migrants into the area from outside the district and from high potential areas of the district. While all the respondents in the first category planted trees, those who settled into the area and planted trees from the high potential areas of the district and those coming from outside the district accounted for 68.4 per cent and 83.3 per cent respectively. This indicated that those from the high agroecological zone were aware of major threat to vegetation than those who had lived in this environment. As such, it is important to sensitize those who migrate into the area the importance of conserving their environment.

Data collected from the field indicated that 80 per cent of the respondent planted trees. Of those who planted trees, 67.7 per cent planted exotic types of trees, 21 per cent indigenous trees while 11.3 per cent planted a mixture of the two. Of those who planted exotic trees, mango trees and avocado trees were dominant due to their ability to increase the household purchasing power. These types of fruits supplement food available to the household especially during drought periods.

5.7.3.2 High Potential Areas

All those who had migrated from the low areas and settled in the high potential area planted trees as indicated by Table 5-16. However, unlike their counterparts in the low potential areas, all those who have stayed in this area do not plant trees. Another important

observation is that the percentage of those who do not plant trees from other high potential areas of the district and have settled in the high potential area of the division is high.

Table 5-16. Tree Planting in the High Potential Areas

Origin	Plant Trees	Do not Plant Tree	Total (%)
From Low Potential	100	-	100
From High Potential	75	25	100
Outside the District	50	50	100
Had been in the same place	85	15	100

Source: Field Survey, 1996/1997

In the high AEZ, 80.5 per cent of the household interviewed plant trees while 19.5 do not plant trees. This indicate that the Akamba people are aware that environmental protection goes hand in hand with maintaining of the same environment. As a result, most of them have resulted to planting of exotic types of trees which are also a source of incomes to the farmers. The findings from the this zone indicated that 71.0 per cent of the respondents plant exotic types trees, 12.9 indigenous trees while 16.1 per cent plant both types. cent).

5.7.4.1 Perceptions of Trees

In the two zones decisions as to where trees are to be planted is mainly influenced by men. In the high potential areas, 67.7 per cent of the respondents indicated that men have an important role compared to women in tree planting. Out of those interviewed, 16.1 per cent reported that women have a greater say compared to men in decision related to tree

planting while 16.1 per cent of the respondents noted that both men and women had equal say.

On the other hand, in the low AEZ, 62.9 per cent of the respondents indicated that men are major decision makers in as far as tree planting is concerned, 14.3 per cent of the respondents noted that women had important say than men while 22.9 per cent indicated that both men and women had equal say as far as decision as to who should plant tree is concerned.

Trees play important part in the economic lives of the people in both AEZ. Those in the high potential agroecological zones attach a lot of importance to the preservation of trees since trees are associated with improved incomes. In this zone, 55.6 per cent of the respondents indicated that trees are planted for the purposes of providing fruits, 14.8 per cent in order to prevent strong winds and for fencing purposes, while 14.8 per cent and 11.1 per cent planted in order to prevent soil erosion and for fuel wood. According to 44.4 per cent of those interviewed in the low AEZ trees are planted for fuel wood purposes, fencing and wind breaks, 29.6 per cent while prevention of soil erosion was explained by 14.8 per cent.

As a result of the important role played by trees in the two agroecological zones, the conservation of trees is imperative. However, the greatest threat to trees has been the building industry especially Machakos township and other minor urban centres. Sometimes building materials are transported to as far as Athi River division. Indications were that 61.0 per cent of the households in the high agroecological zone cut trees for building purposes while those who cut trees for the

same purpose in the low AEZ where 67.7 per cent of the respondents. Money obtained from sale of these trees in most cases benefit only the men since they are the ones who are involved in these contracts. As a result of the high rate of vegetation clearance, in the low agroecological zones, 88.2 per cent of the households experience soil erosion problems while 92.5 of the respondents from the high potential area experience the same problem.

To reduce this problem, there is need for more positive altitude toward environmental conservation. For this to work, there is need to incorporate tree planting in the farming systems. The role of ICRAF, KEFRI, KARI and other organisations that focus on environmental recovery in the arid and semi arid areas need to be encouraged as this is the only way toward a sustainable environment. ICRAF has been playing a vital role in encouraging agroforestry practices in the area.

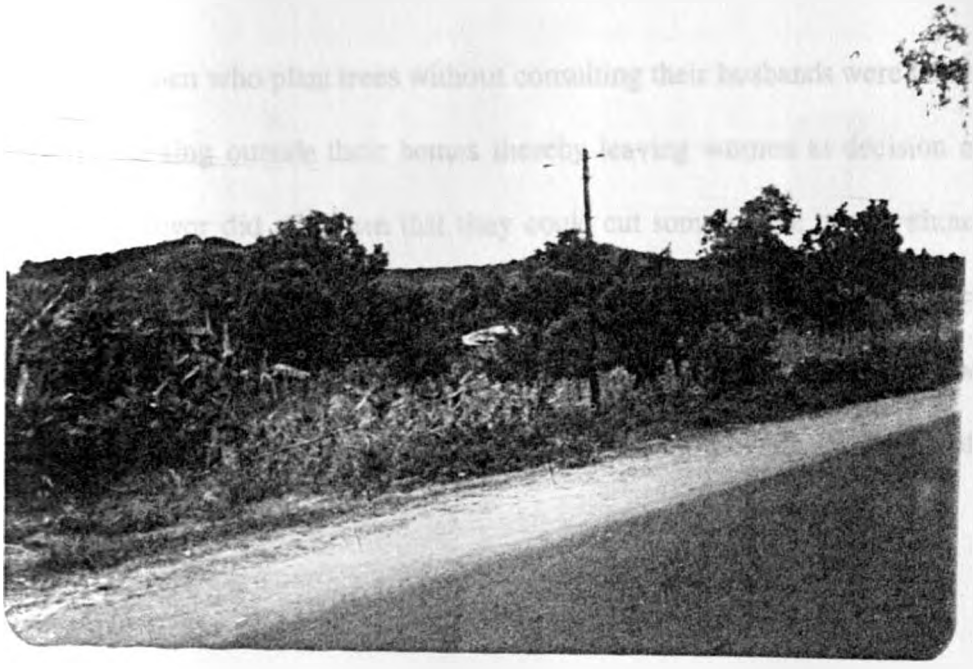


Plate 5-8 There is Need to Encourage Agroforestry Practices

5.7.4.2 Management of Trees

At the household level, gender plays an important role in determining what types of trees should be grown and where they should be grown. Decision making concerning where trees and other vegetation are to be planted rests mainly in the hands of men as indicated in Table 5-17.

Table 5-17. Household Decisions as to Where to Plant Trees

Gender	Percentage
Men	65.2
Women	15.2
Both	19.7

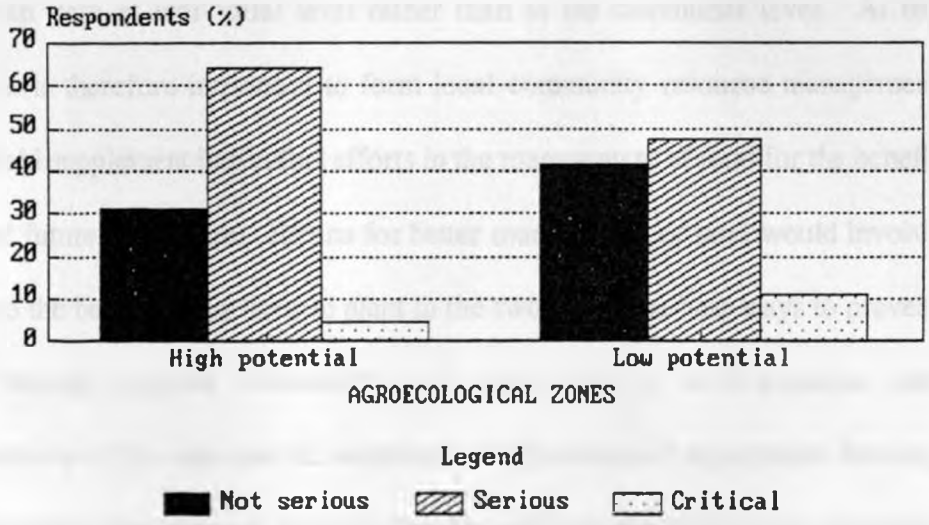
Source: Field Survey, 1996/1997

Most women who plant trees without consulting their husbands were those whose husbands were working outside their homes thereby leaving women as decision makers on farms. This however did not mean that they could cut some of the trees without consulting their husbands. Most of the indigenous trees and exotic trees where the household got incomes could only be cut with the approval of the household head who happened to be man. Management of these trees on the other hand is mainly in the hands of the women and children.

5.8 Soil Erosion

The high rate of clearing of vegetation and unconcern for proper management of land by those who are settling in the area has resulted high rates of soil erosion as was indicated by 88.2 per cent of the respondents in the low potential areas. This problem was experienced by 92.5 per cent of the respondents in the high potential areas. Figure 5-6 shows that when a classification of not serious, serious and critical was used to bring out this problem, it was found out that this problem was serious in the high potential areas but was more critical in the low potential areas.

Fig. 5-6. Rating of Soil Erosion in the Division



Source: Field Survey, 1996/1997

This indicates the importance of concentrating soil remedy measures in the two areas. According to this study, the problems of soil erosion was found to be a function of high demand for agricultural land associated with population increases, demand for fuel wood

and over grazing among others. The end result is soil erosion from running water when it rains due to inadequate vegetation cover. If this problem is not addressed it will lead to continued constrain to agricultural productivity as often top soil is carried away. This calls for positive altitude towards resource conservation in the two areas for future generation to benefit from the same resources.

One way out of this cycle is to incorporate the new comers (those buying land) into the existing *mwethya* groups. Another way out of this problem as was explained by 96.7 per cent of the respondent is through terracing and tree planting. This according to 91.4 per cent and 95.2 per cent of the respondents in the low and high potential areas respectively could be best dealt with at individual level rather than at the communal level. At the communal level it is therefore important to form local community resource management groups which would supplement individual efforts in the management of land for the benefit of the present and future generation. Efforts for better management of land would involve consultations as to the best types of trees to plant in the two areas, the best ways to prevent soil erosion is through constant discussions as to the trends of socio-economic and environmental patterns of the area and the adoption and application of appropriate farming technology and resource management practices that fits well into the local actors economic life.

5.9 Summary

The analysis has established that household characteristics such as marital status, age, education and occupation play a significant role in the use and management of land. These findings further indicates that the small scale farmers have an important role to play in the conservation of resources. The major challenges facing the division include the inability of the small scales farmers to meet their food requirements from their farms, vegetation clearance as a result of the high rate of immigrants and soil erosion.

Gender roles contribute significantly to the management and use of agricultural land. The study found out that although women have access to the use of land and it's resources, they do not control resources and the benefits obtained from it despite their fundamental roles in the household chores, planting, weeding among others. This limitation on women's direct involvement in land management has important consequences on the standards of living of the people in this area. For women to effectively address the problems of poverty and be able to feed their families they therefore need to have not only access to resources but also their control.

Land sizes vary with the high potential areas having average land sizes of 1.2 ha and the low potential areas 4.4 ha. In the two agroecological zones of the study area, the produce from the farms are not able to meet the family food requirements. The two areas have also recorded negative growth rates in the two years that were taken into account. As a result of the continued decline in the food produced, the farmers have intensified the growing of

fruit trees which subsidize produce procured from the farms and incomes obtained from the farms and formal employment.

Immigration into the low potential areas is also very high. This was attributed to the inability of the high potential areas to accommodated the high population and the need for larger farms. Most of the immigrants have carried with them the farming systems from the high potential areas. Resource management in this low potential area need to be addressed urgently in the face of increasing immigrants who are a threat to vegetation over in the area.

Recommendations are therefore needed to address the challenges raised in this chapter. The next chapter focuses on the relationship between socio-economic factors of the household mainly income and gender and resource management in the two agroecological zones.

CHAPTER 6. RELATIONSHIPS BETWEEN HOUSEHOLD CHARACTERISTICS AND AGRICULTURAL LAND

6.1 Introduction

Chapter five has mainly dealt with descriptive statistics with the aim of bringing out important characteristics of the study area. The hypothesis being tested in this section involves the relationship between the local actors household characteristics (socio-cultural and economic) and the management and use of agricultural land (resources such as trees /vegetation, and farming systems etc). In testing this relationship, the researcher set out a 0.05 significance level which allowed for a 5 per cent error. The aim was to safeguard against error of concluding that the management and use of agricultural land and household socio-cultural characteristics are dependent when these variables are actually independent. In this study, large values of x_2 (chi-square) tend to refute H_0 (Null hypothesis); whereas small x_2 values confirm the null hypothesis that *there is no significance relationship between the local actor's socio-economic characteristics and their use and management of agricultural land.*

In looking at the socio-economic characteristics of the small scale farmers that influences the use and management of agricultural land, it is important to note that only a few factors such as gender and incomes have been used. These factors represented the independent variables. On the other hand, the use and management of agricultural land incorporates a number of variables that were taken to be dependent variables. Such variables include

planting of trees, agricultural productivity, livestock keeping among others.

6.1.1 Incomes and Agricultural Land

Land meant for agriculture expansion varies directly with incomes of the local actors in the high potential areas. As incomes increase the land put under agriculture increases. The value of r=0.15504 indicates that there is a positive relationship between incomes and area put under agriculture. Incomes levels explains 2.4 per cent of increased land under agriculture since the r^2 value is 0.02404. As such, this denotes that there is a very weak relationship between the two variables since 97.6 per cent of increased agricultural land is not associated to household incomes.

In the low potential areas, increase in agricultural land varies inversely with the increase in incomes of the local actors as indicated by *r* value of -0.00628. This indicates a very weak positive relationship between incomes and increase in the area under agriculture as explained by only 0.00004. In the two agroecological zones therefore, there is a relationship between socio-economic characteristics of the households and use of agricultural land which discounts the earlier stated null hypothesis at 0.05 significance level.

6.1.2 Farm Sizes and Total Yields

Farm size explains only 0.7 per cent of total yields produced in the high potential areas and 0.4 per cent of the yields produced in the low potential areas. As a result, 99.3 per cent

of the variation in yields in the high potential areas and 99.6 per cent in the low potential areas is not explained by farm sizes. The very weak positive relationship between farm size and total yields which do not influence yields in any way indicate that as the area under farming increases there is an increase in yield. However, there are other factors that influence yields in the two agroecological zones which need to be investigated.

6.1.3 Incomes and the Growing of Traditional Foods

In the low potential area there is a negative correlation between increases in incomes and the growing of traditional foods such as sweet potatoes, cassava, quavas, arrow roots among others by the small scale farmers as exhibited by r which is -0.10695. This in effect means that an increase in incomes leads to a corresponding decrease in the households engaged in this farming activity. There is need to sensitize the inhabitants of the low potential areas the importance of traditional food. These foods are very important to the household especially when there is decline in agricultural produce since most of them are drought resistant.

On the other hand in the high potential areas incomes varies directly with the growing of these crops given by the r value of 0.06242. As incomes increases the growing of this crop is intensified. In both cases however the r^2 values of 0.01144 and 0.00390 representing the low and the high potential areas is less than the expected value of 0.05 representing a very weak relationship between the two variables. This means rejection of the hypothesis earlier stated in as far as management and use of land in relation to traditional foods is

concerned. In the high potential areas, there is need to encourage in more income generating activities so as increase production of traditional foods.

6.1.4 Incomes and the Keeping of Livestock

In the high potential area, as incomes of the local actors increases there is a direct increase (*r* value of 0.17915) in the numbers of livestock in the area and new farmers into this activity. The r^2 value of this relationship was 0.03209 which indicated that incomes of the households alone represented a very weak (only 3.2 per cent) explanation of those keeping livestock such as poultry, rabbits, donkeys, bees, sheep and goats and donkeys in the area.

In the low two agroecological zones, it is important to examine other factors that explain livestock keeping. This is because in the low potential areas 99.6 per cent of livestock keeping is not explained by the farmers incomes. In the high potential areas, as incomes increase there is a direct increase in the keeping of livestock. This could be explained by the new farmers who were not previously.

In the low potential areas there is an inverse relationship between increase in incomes and increase in the number of livestock as indicated by *r* of -0.06202 which indicates that only 0.4 per cent of livestock keeping in this area is explained by incomes. 99.6 per cent of other factors influencing livestock keeping in the area are not related to incomes. In the two agroecological zones, the null hypothesis was therefore rejected and restated to read that the local actor's resource on agricultural land (represented by livestock keeping) is influenced by the farmer's incomes levels.

6.1.5 Incomes and the Number of Cattle

As far as the relationship between incomes (representing the socio-economic characteristics) and the number of cattle (representing the use of agricultural land) was concerned, the observed significance level (x^2) of 0.18480 in the high potential area indicated that the null hypothesis based on the set x^2 of 0.05 significance level could not be rejected since the expected level was less that the observed. This confirmed the hypothesis as set out in this study. In the low potential areas, the r^2 value of 0.00230 (observed) was lower than the expected significance level of 0.05 indicating that the null hypothesis was rejected. As far as the number of livestock and incomes of the local actors were concerned therefore, there was a significance difference between the local actor's socio-economic characteristics and their incomes.

6.1.6 Incomes and Access to Land by Women

In the arid and semi-arid regions of the study area, problems face women in as far as men control land and it's resources. As indicated earlier in chapter five section 5.4.6, men usually control money in the household. In the low potential areas there is a positive relationship between household incomes and problems faced by women when men control land as indicated by *r* value of 0.15732. This denotes that as incomes increases at the households level, women face more problems in as far as access to land and its resources are concerned. The observed r^2 value of 0.02475 indicates that when compared to the expected value of 0.05, only 2.5 per of incomes explained the problems of control of land by men.

In the high potential area, there is an inverse relationship represented by an r value of -0.00568 as far as household incomes and problems experienced by women when men control land. As incomes of the households increases, women face less problems in as far as resource use and control is concerned. This gives a an observed value of 0.00003 which is less than the expected significance value 0.05.

Considering that in the two agroecological zones the observed significance level of 0.02475 and 0.00003 in the low and high potential areas respectively were less than the expected value of 0.05, the hypothesis was therefore rejected in the two zones. In this study therefore, it was replaced with 'there is significance relationship as far as socio-economic characteristics and management of agricultural land is concerned'.

6.1.7 Incomes Levels and the Problem of Soil Erosion

In the two agroecological zone, there is a positive relationship between incomes of the local actor's and the soil erosion problem. In the high potential area $r=$ 0.22333 while that of the low potential areas is 0.21909. This indicates that as incomes increase in the two zones there is a direct increase in soil erosion problems.

When the observed significance levels of 0.04934 and 0.048 in the high and low AEZ respectively are compared with the expected level of 0.05, it was established that socio-economic characteristics of the local actors contribute to soil erosion problems. Other studies by KARI and UNEP have also indicated a positive relationship between poverty and

environmental degradation.

In this study, incomes of the household explained 4.9 per cent of the problem of soil erosion in the high and 4.8 per cent in the low potential areas of the district respectively. This indicates that while 95.1 per cent of the problems of soil erosion was attributed to other factors an almost equivalent percentage of 95.2 was in the low potential areas was blamed on other factors as well. At this level, since the observed significance level was less than the expected significance level, the null hypothesis earlier stated was rejected at 0.05 significance level.

6.2.1 Gender and Planting of Vegetation Cover

As indicated in the earlier sections of this chapter, tree planting is an important undertaking in the arid and semi-arid areas due to fragile ecosystems. To establish whether there was any significant relationship between gender (representing socio-economic characteristics of the households) and planting of vegetation and trees (representing management and use of the agricultural land), the observed significance levels of 0.01849 and 0.10940 in the high and low potential areas respectively were compared at the expected x^2 level.

The observed significance level of 0.01849 in the high potential areas was less than the expected significance level. This meant that the null hypothesis was rejected at 0.05 significance level. It was confirmed therefore that there is a relationship between gender and management of agricultural land by small scale farmers in high potential areas of the

district. In the low potential area where the observed significance level was 0.10940, the null hypothesis was accepted indicating that gender could not be used to establish the relationship between management and use of land in the low potential areas at x^2 0.05 significance level.

6.2.2 Incomes and Planting of Trees

In the high potential areas, it was established that there was a positive relationships between the two variables, incomes and planting of trees. The computed *r* value of 0.20879 indicated that increases in incomes was associated to increases in the planting of trees. On applying the coefficient of determination (r^2) whose value was 0.04359, it was found out that only 4.4 per cent of incomes explained planting of trees in the high potential areas. This indicated that there were other factors which explained the remaining 95.6 per cent of tree planting.

Planting of trees varied directly with increases in incomes of the households in the low potential areas indicated by a positive value of *r* which was 0.15997. This illustrate that there was positive relationship between increases in incomes and planting of trees. The value of r^2 was recorded at 0.02560 denoting that incomes explained only 2.6 per cent of the trees planted in the area. Therefore, 97.4 per cent is explained by other factors. In the two AEZs, the null hypothesis was rejected at 5 per cent significance level since the expected value of 0.05 was higher than the observed. This meant that the relationship between incomes and planting of trees in the area of the study was very weak.

6.2.3 Incomes and Fruit Trees

Fruit trees are very important as a source of incomes for the family in the aid and semi-arid areas. The importance of fruit trees such as avocado, mangoes, quava, passion fruits among others formed the background of establishing the relationship between growing of fruit trees and the level of incomes of the farmers.

The computed value of *r* which was 0.06487 indicated that there was a positive relationship between incomes from trees and the number of fruit trees planted in the high potential area. This indicated that as incomes of the household head increases, the number of fruit trees increases. The r^2 value of 0.00420 which is less than the expected value denotes that there is a very weak positive association between incomes of the household head and the number of fruit trees in these areas since only 0.4 per cent of incomes explained the number of fruit trees planted. Therefore the socio-economic characteristics (represented by incomes) were found to explain the management of agricultural land (represented by fruit trees).

In the two agroecological zones, there was increases in tree planting as a result of increases in incomes indicated that farmers wanted to reap higher incomes obtained from planting of fruit trees. This is because such incomes supplement incomes from farming activities and formal employment. Income generating trees planted in the high and low potential areas included mango trees, Avocado, paw paw and passion fruits. The above analysis has established that other factors that explain planting of trees in the areas also to be investigated.

6.2.4 Areas of Origin and Planting of Trees

Where one was living before explains only 0.5 per cent of those who plant trees. As a result, 99.5 per cent of those who plant trees is not explained by where they were living before settling into this area. A negative relationship between where one was living before and those who plant trees emergence indicating that as people settle in this area there is decrease in the planting of trees in the area leading to decrease in vegetation covers. The negative association of the two variables is significant at 0.16376.

6.3 Summary

This chapter has focused on the hypothesis testing at an expected value of 0.05. In the analysis, whenever the observed value of x^2 was greater than (>) the expected x^2 value of 0.05 the null hypothesis H_O was rejected and the alternative hypothesis H_I was accepted and vice versa.

From the study findings, the relationship between increases in incomes and agricultural land shows that as incomes increases the area under agriculture increases. Unfortunately, this increase is not accompanied by corresponding increases in output per acre as the analysis in chapter five indicated. Moreover, the relationship between increases in land sizes and yields per acre indicated that yields per acre was explained by only 0.7 per cent of increases in land sizes indicating that there are other factors that explains yields produced.

There is a decline in the use of traditionally drought resisting crops such as sweet potatoes, cowpeas and pigeon peas with increases in incomes. These foods are important in times

of drought as they supplement the main foodstuffs produced. This calls for sensitization of the community in as far as these types of food are concerned. For instance, valley bottoms traditionally have been known for the production of these kinds of food.

In the division, there is a decrease in the planting of trees in the high potential areas as incomes increase unlike in the low potential areas where there is an increase in the planting of trees with increases in incomes. This could be explained by the high number of small scale farmers engaged in the planting of exotic type of trees which are in themselves income generating such as coffee, mangoes, oranges, citrus fruits, avocadoes etc.

The analysis of the household head's income explained only 4.9 per cent and 4.8 per of the problem of soil erosion in the high and low potential agroecological zones respectively. These indicates that there are other factors that need to be investigated in the area to establish other factors that explain the problems of soil erosion.

Land use policies especially in the fragile environment should therefore facilitate the maintenance and exploitation of the natural resources. It is important not to generalise land use policies in the whole of the study areas but the most important issue is to be specific in as far as recommendations are concerned related to the management and use of agricultural land in the two zones. From the data analysis, the study has established that there is a relationship between household socio-economic characteristics and the management of agricultural land.

CHAPTER 7. SUMMARY OF FINDINGS, RECOMMENDATION AND CONCLUSIONS

7.1 Introduction

As the available agricultural land continues to be subdivided in the high potential areas to accommodate the growing population and the resulting decline in land productivity, the excessive population is migrating into the low potential areas where they are exerting pressure on the existing vegetation cover. This calls for strategies aimed at preserving the available resources for the benefit of the present and future generations.

7.2. Conclusion of Findings

7.2.1 Objective One

The first objective of the study was to assess the management and use of agricultural land from a socio-cultural, economic and natural environment perspective. The study has established that households characteristics such as age, sex, education, incomes, number of the household members, marital status, land tenure system and occupation influences the use and management of agricultural land. From the findings, agricultural potential can be improved by use of appropriate farming systems techniques that takes into account the existing physical and socioeconomic characteristics.

The study has also indicated that gender involvement in the management and use of agricultural land varies. Inequalities in terms of participation and reaping of benefits related to their participation favours men. At the same time, It was established that

traditional beliefs contribute to the low status of women in the Akamba community despite the fact that they are the main actors in the use and management of agricultural land. The way the girl child is socialized means that benefits related to utilization of land will always favour the boy child unless there are changes in the community that reflects the important roles women play in the use of resources.

The way the Akamba perceive agricultural land influences the way they manage and use it. Inheritance of land favours men and in a way explains his position in the Akamba community. As a result, women are generally disadvantaged despite the important role they play as custodians of agricultural land. The study established that apart from the role women play in households activities such as cooking, fetching water and fire wood and taking care of the young ones, they are left in charge of almost all the agricultural work such as planting, harvesting, weeding, and looking after livestock while men migrate to major and minor urban areas in search of employment. Despite the important role they play in the use and management of agricultural land, they cannot make important decisions on land without consulting men.

In the two agroecological zones, there has been a decline in agricultural productivity. This decline was attributed to physical factors such as unreliable rainfall, topography, and the nature of soils, and the socio-economic factors such as subdivision of land as a result of the increasing population and cultural practices, changes in tastes and preference of food, the ability to hire labour and to purchase farm inputs. Shortages of labour in the area is

a major problem experienced during preparation of land for planting, planting, weeding and harvesting. Other problems that affect small farmers include expensive farming inputs such as fertilizer, pests and diseases.

Livestock keeping is an important undertaking which supplement crop production in the two zones. The activity is mainly management by women and children as dictated by cultural practice. A few men and hired labour are also involved in this activity especially in the low potential areas in the households with high number of livestock. Problems facing this sector include inadequate pasture, water, diseases and pest and expensive pesticides.

The 16.7 per cent of the respondents who have more than 50 years and are considered old enough need to play important roles in the use and management of agricultural land in the areas by acting as channels of passing information to the younger generation at the community and at the household level since they are knowledgeable and respected members and could therefore use their position in the society to influence positively the trends of resource management together with those who have undergone training.

It was established that there is high immigration of population into the low potential areas which was attributed to the inability of the high potential areas to sustain the high population economically in the face of increasing subdivision of land and declining agricultural production per unit area. The immigrants who often migrate with their farming systems exerts a lot of pressure on the ecosystem of these areas.

Trees and other types of vegetation cover were found to be important for prevention of soil erosion, wind breaks, sources of fuel wood, building poles as well as provision of fruits. Due to depletion of vegetation cover for settlement and farming activities without any effort of their replacement, the demand for water especially in the low potential areas and in some high potential areas has increased which has subsequently affected the quality and quantity of water in the area.

Environmental conservation is mainly in the hands of individual farmers (mainly women) who voluntarily join community initiated *mwethya* groups where they play important roles in economic and social activities as well as in the conservation of soil efforts. The study established that most of the farmers settling in the low potential areas are not involved in the activities of the *mwethya* groups.

According to this study, the following factors influences resource use and management;

(i) continuing subdivision of agricultural land to accommodate increasing population in the high potential areas has accelerated out migration of the population into the low potential areas,

(ii) depletion of vegetation cover for settlement and agricultural activities due to increasing immigrants from the high potential areas which is not accompanied by replacement. This has negative implications to the water cycle,

(iii) declining land productivity as a result of both physical and socio-economic factors have led to low production and hence low income per household, and

(iv) the socio-cultural and economic characteristics of community

The study has therefore established that there is a relationship between socio-cultural and economic attributes of the community living in this area and management and use of agricultural land. This confirms the assumption that the perception and strategies of the small scale farmers in the use of agricultural land need to be understood in order to formulate resource management policies for the ASALs which will among other things lead to alleviation of poverty.

7.3 Recommendation

The second objective suggests recommendations that would contribute to improvement in the use of agricultural land in the arid and semi-arid areas of the division.

7.3.1 Intensification of Farming Activities.

Land subdivision continue to take place in both the low and high potential areas. In the high potential areas, it was found out that 90.5 per cent of the households had 5 acres and below. This calls for policies that would directly encourage farmers to intensify their farming activities. Practices such as mulching and crop rotation can be practised with the aim retaining moisture in the soil and stepping up soil fertility. There is need for diversification of dry weather resistant crops such as bananas, cassava and sweet potatoes among others. With availability of water, there exists enormous potential for intensification of dairy farming and production of horticultural crops especially vegetables and fruits.

Intensive dairy production need proper government support through appropriate policy in areas such as breeding, marketing of milk, acaricide, and treatment.

The success of this intervention will depend on how various actors involved in the rural areas involve the farmers in the identification of research packages which takes into account the purchasing power of the farmers. This will ensure that the research packages are adapted by the farmers. The study recommends more on-station and off-farm research to establish the true extent of various production gaps related to crop production and more attempts at solving the problems of soil erosion which was found to be related to declining food production. The stakeholder in this exercise need to include the Ministry of Natural resources, Ministry of Agriculture, KARI among others with the assistance of NGOs and donors agencies.

7.3.2 Agroforestry Practices

Immediate concern of the people in this area should be the incorporation of agroforestry practices in their farming systems. There is need to focus on high yielding fruit trees that can act as a source of income for the family and at the same time supplement what is available from the agricultural land. These types of trees will also contribute to the environmental recovery of the fragile ecosystem.

7.3.3 Environmental Conservation

To avoid future conflict as a result of the increasing water demand, there is need to

sensitize the communities living on the upper parts of the Iveti and other hills the need to conserve and protect natural vegetation since removal of vegetation adversely affect the capacity of the soil to retain water and has negative effects on rainfall patterns and water regimes. Community participation in the reafforestation of these hills and farmers farm is recommended.

The churches and *mwethya* groups could facilitate the undertaking of this activity as it requires mobilization of the community members at wider scale. At the national level, there is need to re-enforce a number of legislation acts that have stressed the importance of environmental conservation such as;

(i) the *Agriculture Act (Cap. 318)* which contains provisions for soil conservation, protection of catchment areas and control of land subdivision,

(ii) the *Forest Act (Cap. 358)* which is a conservation instrument,

(iii) the *Water Act (Cap. 372)* which contains provisions for the protection of the water catchment areas,

(iv) the *Chief's Authority Act* which empowers the chiefs to make orders for conservation purposes.

While enforcing these acts, it is important to evaluate them first and find out wether they are in tune with the aspirations of the farmers in this fragile area. Statements such as the one that was issued by the former President of Zaire, Mobutu Sese Seko to the IUCN General Assembly in 1975 that "Only political leaders have the power to make major

decisions on land-use" (Taiti: 1996:66) should be avoided since they indicate legal and practical shortcomings to rural development.

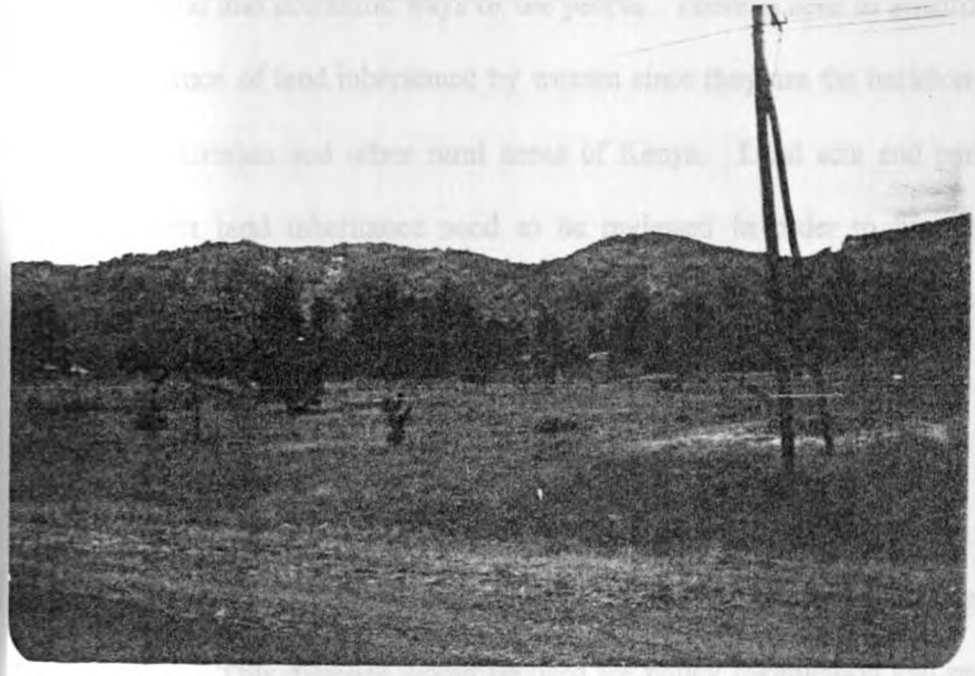


Plate 7-1: Mua Hills Where Reafforestation Exercise is Required

7.3.4 Gender Sensitization

Since gender involvement in land use activities varies, there is need for civic education and gender sensitization to enable women to participate more effectively in rural development since women issues have been seen as societal issues. This civic education should be undertaken by both men and women who are willing and ready to appreciate the already existing local people's situation. The programm should concentrate at training of trainers who already know the environment of the farmers. The participants of the course should

focus on the grassroots areas targeting both men and women.

In this community, since land inheritance is viewed as a cultural practice embedded in the socio-cultural and economic ways of the people. There is need to sensitize the community the importance of land inheritance by women since they are the backbone of the economy in central division and other rural areas of Kenya. Land acts and particularly sections dealing with land inheritance need to be reviewed in order to be gender sensitive by incorporate sections that enables women and men to have equal control of land.

7.3.5 Management of Information in the ASAL

7.3.5.1 Database

There is need for socio-economic database related to the use and management of land in the division. This database would be used for policy formulation and recommendation in guiding proper use of land for the benefit of the people at the grassroots. At the national level, the database need to be collected from communities living in the arid and semi-arid area. This can well be coordinated only if the private and public institution could come up with codes for guiding the exercise. Although each organisation could keep its data, it should be made available to other organisation on request in order to avoid duplication of resources while assisting the beneficiaries. The development of this area in future will therefore depend on how best the policy makers (deciding actors) are able to interpret the local actors aspirations.

5.7.3.1 Low Potential Areas

From 1961 to 1970, the low potential area of the division attracted 24.2 per cent of the total respondents interviewed, 40 per cent by 1981 and 90.9 per cent by 1991 and between 1981 and 1991, 50.7 per cent of the respondents. This trend has increased pressure on land which has led to clearance of vegetation cover for settlement and agricultural purpose. One farmer from the low potential area indicated that;

> *'the area before the subdivision of land was well vegetated and watered. Today, vegetation cover has been reduced resulting to the present unstable ecological balance. In an attempt to restore part of the former ecosystem, ICRAF and KARI play important roles in rehabilitation of the vegetation cover by supplying seedlings to the organised community groups which deal with environmental protection. These seedlings and information related to management of land is offered free of charge'.*

Table 5-15. Tree Planting in the Low Potential Areas

Origin	Plant Trees	Do not Plant trees	Total (%)
From Low Potential	100	-	100
From High Potential	67	33	100
Outside the district	83	17	100
Had been in the same place	100	-	100

Source: Field Survey, 1996/1997

7.3.7 Community Participation in Resources Management Efforts

Community attachment to individual natural resources should also be encouraged but with more emphasis to the 'we filling' than 'I felling'. Indeed, protection of resources in one parcel of land by a particular farmer should be seen as an attempt to call upon the rest of the members of the community in which he/she is a member to participate. To this end, with the rich African tradition that called for working together for the benefit of the whole community, the immigrants into the low potential area should be encouraged to join the existing *mwethya* groups.

Through community participation, the environment need to be guaranteed through promotion of alternative means of livelihood to reduce the impact of cultivation and livestock activities in the ASAL. There is also need to promote awareness of human impact on the environment, and technologies available to mitigate that impact. At the sometime, incentives for individuals and groups for conserving biodiversity and other resources need to be provided for by the government through creation of an enabling environment in order to prevent land degradation.

7.3.8 Market Survey and Employment Opportunities

Since 65.86 per cent of the population in Machakos live below poverty line (Republic of Kenya, 1997), a market survey need to be conducted to establish the most rewarding crops and dairy products in terms of increasing household incomes in order to address the problem of rural poverty. These survey would give insight as to the best types of

agrobased industries that should be encouraged by the government in the area thereby increasing the farmers incomes. The division could support industries based on dairy farming, cereals (maize and millet) and legumes such as beans and cowpeas produced from the farms as the study indicated although this need more research input. From the industries proposed, the residents will be engaged in the resulting services from the farm to the factory thereby uplifting their standards of living.

Policies have been put in place by the 1997-2001 National Development plan for the location of light agrobased industries in rural areas and small towns because such industries rely on agriculture for their inputs (Republic of Kenya, 1997). In this development plan, rural population are suggested as providers of raw materials. This can only be achieved if more intensification of farming activities could take place in the rural areas and the subsequent growth of non-farm activities to provide the demand need for the commodities produced at the farm in the face of decreasing farm sizes.

7.4 Areas of Future Research

7.4.1 Role of Institutional Establishments in Resource Management and Use

There is need to investigate the relationship between institutional establishment and declining agricultural productivity in the low and high potential areas so as to come up with policies that would lead to increased agricultural productivity in the ASALs. Such studies would bring out important findings that need to be taken into account when planning for natural resources in the fragile ecosystems. Important too is to reduce the gap between the

resource users (managers) and those who are charged with governing or controlling these resources in the ASAL. This type of research need to to focus on the gap between policy makers and policy users in as far as control and access to resources in the ASALs is concerned.

Figure 7-1. There is Need to Address the Gap Between Policy Makers and Policy Users

Source: Researcher's Own Perception

7.4.2 Programme of Resource Management in the ASAL

There is need to develop a regional programme of research on the management of natural resources, particularly soil, that will contribute to the sustainability of agriculture and livestock production through improved technologies based on the understanding of the natural and socioeconomic environment, and in collaboration with the local communities. Such a programme will encourage cooperation between various stakeholders involved the management and use natural resources.

7.4.3 Dissemination of Research Findings

A number of research have been undertaking in the ASALs without those who were intend

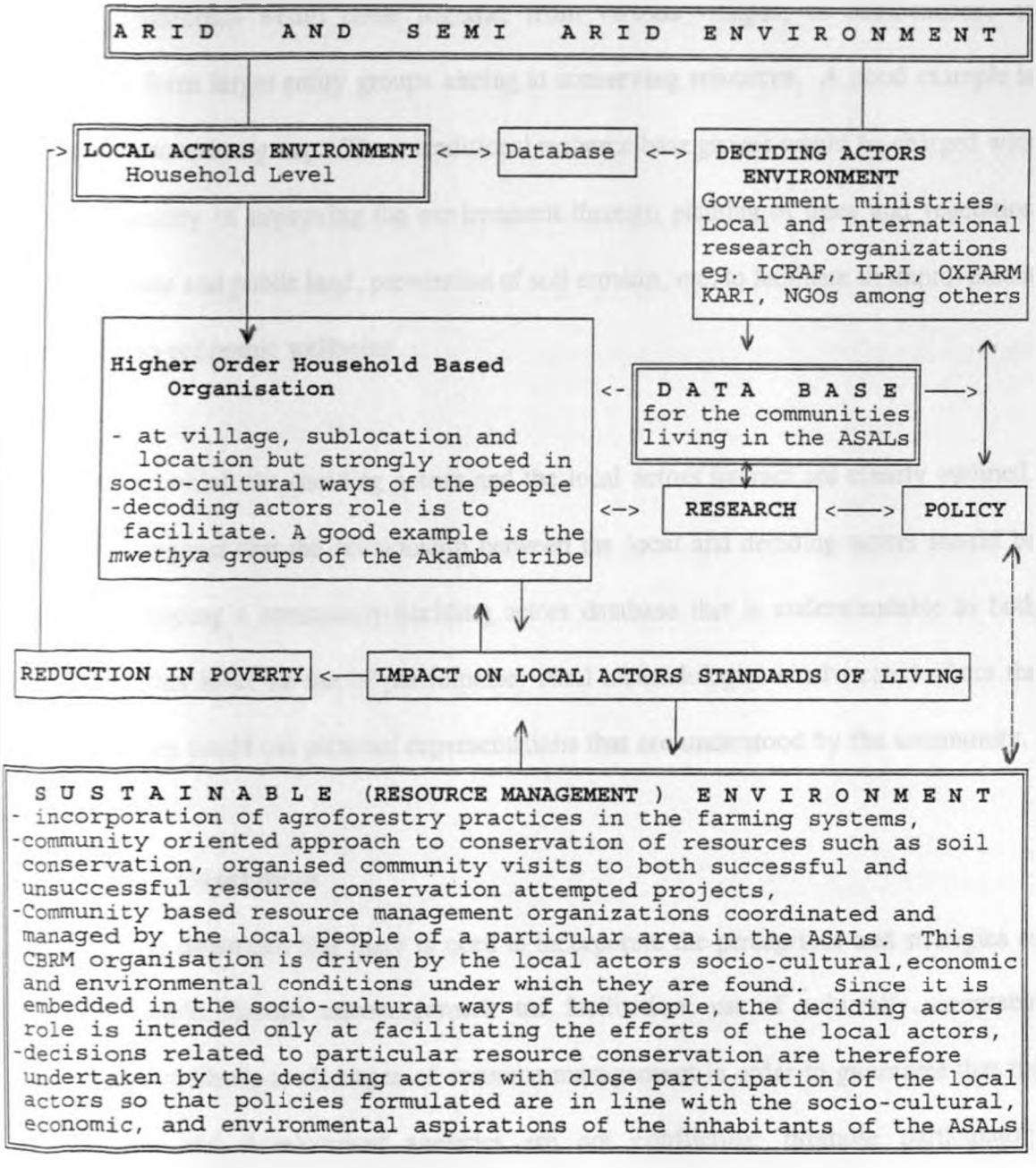
to benefit from the findings knowing their outcome. It is important that such research findings find their way into the people they were expected to benefit. This is because such findings on reaching the farmers would possibly have a positive effects on their standards of living. This form of information dissemination programme should draw from the government, policy experts, private individual researchers, NGOs, community development workers, community leaders, and local farmers to scrutinize past research and to find out how some of the important findings could reach the end user of resources at the local level. Through such a programme the recommendations and the research findings from this work would reach the community.

7.5 Model for Development of Arid and Semi-Arid Area

According to 95.2 per cent of the respondents land use management is advocated for at the farmer's farm in the two agroecological zones. This indicates that future policies related to management of resources in the arid areas should be derived from the perception and strategies of the household members. The following model is suggested for resource management in the arid and semi-arid areas.

The model notes that there is need to establish community based resource management organisation in the ASALs. This will facilitate dissemination of research to the community. The first step toward the realisation of this is the establishment of small community groupings which are rooted in the socio-cultural and economic ways of the communities living in this environment.

Figure 7-2. Model for Resource Management in the ASAL of Kenya



Source: Researcher's Own Perception

This model proposes that the household members consisting of men, women and children would work together as a small magnet with common interest in the use and management of resources. From this initial identification of the common interest of sustainable resource use, the households would come together from various villages, or sublocations, or locations to form larger entity groups aiming at conserving resources. A good example is the Akamba *mwethya* group. These traditional resource base groups would be charged with the responsibility of improving the environment through planting of trees and vegetation on both private and public land, prevention of soil erosion, etc; to facilitate in improvement of their socio-economic wellbeing.

The levels at which the deciding actors and the local actors interact are clearly outlined. The model suggest that the relationship between the local and deciding actors should be toward developing a community-deciding actors database that is understandable to both parties. At this level the use of participatory rural methodologies is advocated where the deciding actors could use pictorial representations that are understood by the community.

7.6 Conclusions

The study has illustrated that there is need to incorporate the perceptions and strategies of the local people through encouragement and facilitation; use of culturally acceptable participatory methods at all stages of resource management in order to guarantee that the local people and development agencies are not conflicting; promote participatory management of natural resources, their innovativeness, indigenous knowledge and technologies; and intensification of public education and awareness programmes related to

land use in rural areas.

While recognising the existence of a number of laws and /or systems of land tenure, the Government should strive to remove all possible obstacles that may hamper equitable access to land and ensure that equal rights of women and men related to land and property are protected under the law. Failure to adopt at all levels appropriate rural land policies and land management practices that have positive contribution to increasing rural incomes will mean that the problem of inequality in terms of access and control for the resources by the primary users will not have been solved and wide spread poverty will continue to frustrate initiated policies in the ASALs.

Therefore the deciding actors need to provide important checks and balances in form of infrastructure to regulate and control the activities of the local actors. Such types of land use policies need to take into account the changing socioeconomic lifestyles of the people in the ASALs.

In conclusion, the study indicates that households socio-cultural and economic factors are important when it comes to management and use of resources in the arid and semi-arid areas and they cannot therefore be underestimated. The balancing between these factors and sustainable resource utilization for the development of rural areas is a major concern of any government. Future development of this area will therefore depend on how best stakeholders involved in the development of ASALs incorporated the local actors in the management process of natural resources.

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APPENDIX 1

HOUSEHOLD QUESTIONNAIRE

Questionnaire Number
Latitude
Longitude Sublocation
Location Date of Interview

A) Socio-economic Characteristics

1. Respondent sex: 1) Male
   2) Female
2. Respondent Age
3. Respondent marital status
   1) Unmarried
   2) Married
   3) Divorced
   4) Separated
   5) Windowed
4. Respondent level of formal Education
   1) No formal education
   2) Primary
   3) Secondary
   4) Post Secondary
   5) Post Secondary
5. Occupation (Specify the main one)
6. Size of Household Members
7. Household Income per month
   1) below 3000
   2) 3001 - 6000
   3 Above 6001
8. Who performs the following activities
   For each use either 1, 2, 3, etc where applicable representing
   1 Mostly men
   2 Mostly women
   3 Mostly children
   4 Mostly women and children
   5 Mostly men and children
   5 Mixed
9. Who looks after the children
10. Who Cooks?
11. Who Fetches water? b) why? c) when? d) Distance d) problems
12. who Prepares land for agricultural purposes? b) when c) why
    d) what implements do you use e) what problems do you face
13. Who plants b) when c) why d) what problems do you face
14. Who weeds b) when c) why d) what problems do you face
15. Who harvests b) when c) why d) what problems do you face
16. Who decides what to sell in the household b) why
17. Who within the household looks after livestock? b) why c) what problems do you encounter
18. Who within the household keeps money? b) why
19. Who within the household decides on how money is to be used? b) why?
20. If it is men who control money, are there problems experienced by women?
21. Who works on land more? b) Why

22. Does the performance of the household chores interfere with food production 1)Yes 2) No
23. If yes, how
24. Who within the household has control over how family land may /can be used?
    b) Why?
25. Are there any problems faced by women when men control land? 1) Yes 2) No
26. If the answer to question 25 is yes, outline them in order of the most acute

B Land and Other Resources

1. Do you own this land 1) Yes 2) No
2. Explain how you acquired it
3. Farm size..... acres
4. Do you have parcels of land (1) Yes (2) No
5. If yes, total size ..... acre
6. Where 1) in the high rainfall areas of the division
   2) in the low rainfall areas of the division
   3) in the district in the high rainfall areas
   4) inside the district in the low rainfall area
   4) outside the district
7. Have you always lived in this area? 1) Yes 2) No
8. If the answer is no where were you living before
9. What made you move to this area?
10. What crops do you grow and on what proportion of the land?

Crop	area

11. Land under maize for the last two seasons

Year	area	bags/acre
1996		
1997		

12. What is your view about the general performance of maize production in the area?
13. When you compare the present maize yields per acre of maize with what you were getting in the past, would you say that
    1 Yields are better
    2 Worse
    3 Same
14 Give reason
15. What problems do you face in the production of these crops?
16. What types of foodstuff do you purchase from the market?
17. Do you keep livestock? 1) Yes 2) No
18. If answer is yes, what type of livestock do you keep?
19. If cattle are kept, what number?
20. What problems do you face in the keeping of livestock
21. Who would inherit land?
22. Do you receive any foods as gifts from relatives?
23. Do you give food as gifts to your relatives?

24. If there is a shortfall between demand and supply what do you do to meet your family's food requirements?

24. Do you plant your crops with fertilizer?

25. If yes, which fertilizer do you use
    1 Animal manure
    2 Chemical fertilizer
    3 Both

C) Natural Vegetation

1. Do you plant trees 1) yes 2) no
2. If yes, what types? 1) exotic 2) indigenous 3) mixed
3. What types of exotic trees do you plant?
4. Who makes the decision as to where to plant trees? b) why?
5. What use are trees put into within the household?
6. Do you face soil erosion problem?
7. What are the main causes of this problem?
8. How do you rate the following in your household
   Use 1 for Not serious
   2 " " serious
   3 " " critical

a. Food problems
b. Water problems
c. Soil erosion

9. What are the causes of each?

a. Food problems
b. Water problems
c. Soil erosion

10. Who within the household undertakes soil conservation measures
11. Where would you concentrate resource management efforts
    1 Individual land
    2 Communal land
    3 Equally on both
12. Explain why for the option taken

D) Community Participation

1. Are you a member of any community group? 1) Yes 2) No
2. What activities are you involved with?
3 Are there organisations which work with you in the activities mentioned above?

E) General

1. What is your belief about land (or what is land to you)
2. Any other comments about resource use and agricultural land in
   a) Your farm?
   b) At the village level?

Thank You

APPENDIX 2

Focus Group Discussion with Community Groups

Community Group Name
Location
Sublocation
Village

1. Members in the group 1) men 2) women
2. When was the group formed
3. What issues led to its formation?
4. What are your views concerning
   a. vegetation clearance in the area
   b. soil erosion problem
   c. migration of the people to the high or low potential areas of the division
   d. performance of agriculture
      - Crops
      - livestock
5. What are the major causes of vegetation clearing in the area?
6. What is the effects of vegetation clearance in the area
7. How can this problem be solved?
8. Which organisations are involved in management of vegetation, agricultural activities and conservation of soils in the area?
9. How have they performed?
10. What are your successes in the conservation of land resources in the area?
11. What are your failures in terms of resource conservation?
12. What do you see to be the future of this area in the face of increasing clearance of vegetation?
14. Any other comments

Thank You

APPENDIX 3

Scheduled Interview with the District Environmental Officer

1. What is the your role in resource use and management in Central division?
2. What problems do you face?
3. Could you please give an outline of the environmental problems facing the division?
4. What are their causes?
5. Due to the high immigration taking place in the low potential areas of the division especially Katheka-Kai location, what are the resulting environmental problems this area?
6. How can they be addressed?
7. What are the environmental problem facing the high potential areas of the division?
8. How can they be addressed?
9. Which are the organisations involved in the management of soil and vegetation resources in the area
10. How successful area they?
11. What role is the community playing in the management of soil and vegetation resources?
    a) In the Low potential areas
    b) In the high potential areas
12. What problems do they face?
13. Could you comment on the community based resource management groups ie *mwethya*, in the area.
14 What future do they have?
15 What is the relationship between poverty and resource use and management in this area?
16. What is the future of resources in this area?
    a) Low potential
    b) High potential
17. What effects will this have on the people of the two areas?
    a) Low potential
    b) High potential
18 Any other comments

Thank You

APPENDIX 4

Scheduled Interview with Research Institutions

1. What is the your role in resource use and management in Central division?
2. What problems do you face?
3. What are your successes?
4. Could you please give an outline of the environmental problems facing the division?
4. What are their causes?
5. What role is the community playing in the management of soil and vegetation resources?
   a) In the Low potential areas
   b) In the high potential areas
6. What problems do they face?
7. Could you comment on the community based resource management groups ie *mwethya*, in the area.
8 What future do they have?
9. How do you relate with these CBOs?
10. What is the relationship between poverty and resource use and management in this area?
11. What is the place of research in solving the problems of natural resource problems in the area
12. What is the future of resources in this area?
    a) Low potential
    b) High potential
13. What effects will this have on the people of the two areas?
    a) Low potential
    b) High potential
14 Any other comments

Thank You