

W
THE INFLUENCES OF CHARCOAL PRODUCTION ACTIVITIES AND
ENVIRONMENTAL IMPACT IN ASALS: A CASE OF RUMURUTI AND
NORTHERN APPROACHES IN LAHOPIA DISTRICT

BY

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DEDICATION

To my mother Beatrice and wife Rahab

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This is to register my most sincere gratitude to all those who assistance and co-operation made this work get complete.

I wish to recognise the very strong input made by my supervisor Dr. Samuel Obiero for his valuable guidance during the whole process of producing this work. His criticisms and suggestions were most appreciated.

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Despite all the contributions received from various sources, any mistakes or errors in the work are entirely those of the author.

ABSTRACT

Woodfuel consumption and related energy and ecological problems are important and pressing issues in their own right. Since most Africans, Kenya included, are poor and can afford or have access to little other than firewood, charcoal or even crop and animal residues to meet their basic energy needs, woodfuels dominate the energy economics of virtually all African countries. It's projected that it will take many years of rising incomes and infrastructure development before such countries can make a transition from this massive woodfuel dependence. As these wood resources diminish and recede, for millions of people, the costs of obtaining woodfuels, whether in cash; to time for gathering them, are imposing severe and increasing strains on already marginal households survival and production strategies not to mention the harm posed on the environment.

Commonly, firewood is used in the rural areas and charcoal in the urban areas for cooking and heating. As the rate of urbanization increases, the demand for charcoal will also increase and hence the rate of deforestation.

This study sought to examine the factors which influence the local actors strategies as they engage in charcoal production, and the environmental impacts thereof, in an ASAL area of Kenya. A major objective of Kenya's forest policy has been self-reliance in wood products. Notwithstanding this, woodfuels have been almost totally neglected by foresters, energy specialists and development authorities. In large part this was by design. It has been assumed that as countries develop economically, they must make a transition from traditional fuels to petroleum, natural gas and hydro-electric power — the conventional energy of the industrialized world. But in the mid 1970s, much of the world was gripped by the energy crisis of modern fuels and the shift was again disrupted and as a result, over-use of woodfuels and the ensuing ecological and socio-economic problems have come to be known as the "woodfuel crisis".

The author critically analyses the theoretical formulations in literature which govern local actor's strategies as he interacts with his environment and the complexity of information analysis in the mind of the actor. This formed the conceptual basis of this study. Also well

reviewed are various concepts of energy and ecology which gives a bearing to the field of study.

Primary data was obtained through observation, photography, key informants and interviews with charcoal makers. Due to the legal status of the activity, tracer system was applied in order to reach as many charcoal burners as possible, to conduct the interview. Questionnaires were administered to fifty respondents who formed the sample size. The secondary data was obtained from library research, research findings and government publications. Various descriptive and inferential statistics were performed including percentages, averages, and regression analysis. The data is graphically presented using bar graphs, tables and pie-charts.

Major findings from this study indicate that, most of the charcoal burners are poor and therefore charcoal burning was one of their coping strategies. The socio-cultural orientation of the local actors played a big role in influencing their actions and way of perceiving things. Due to its ease of entry, many children dropped out of school in their early school age to engage in charcoal burning and trading activity which is gaining popularity in the area and this explains the low literacy level. The social and economic status of those involved in the activity has not improved and a cycle of poverty has stalked the charcoal burners and their families. The returns they get from the charcoal sales are so meagre that they only support their subsistence level and many have taken up chang'aa drinking. This has really affected their health a great deal. Due to the more time spent on charcoal burning, little time was dedicated to other development activities like food production, engaging in community group activities, attending chiefs meetings, etc.

It was also established that many people had knowledge on the importance of trees but were ignorant of the consequences that may be brought by complete eradication of trees without replacing them. Their attitude was that of "who cares" and in case trees get cleared up, others will grow up to replace them. Whatever stages or whichever source the trees would come from was not featuring in their myopic minds since they had not initiated any effort to plant trees.

A well thought solution that would treat the problem and not the symptom is the only way to

help the situation. The problem of food, security and poverty were identified as the ones featuring most and requiring immediate attention so that other recommendations can pick off even with self-initiatives. A well fed person provided with food and security will go to school, plant a tree, work for a cleaner and better paying job and educate others.

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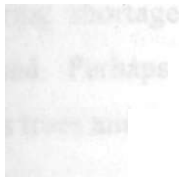
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ABBREVIATIONS

ADC	= Agricultural Development Co-operation
ASAL	= Arid and Semi-Arid Lands
ASP	= Actors Strategies and perceptions in resource use and management
CDA	= Community Development Assistant
CID	= Criminal Investigation Department
DC	= District Commissioner
DDC	= District Development Committee
FAO	= Food and Agriculture Organisation
Ha.	= Hectares
IGAD	= Inter-Governmental Agreement on Desertification
ILO	= International Labour Organization
ITCZ	= Inter-Tropical convergence Zone
KARI	= Kenya Agricultural Research Institute
KEFRI	= Kenya Forestry Research Institute
KENGO	= Kenya Energy Non-Governmental Organization
Kmsg.	= Square Kilometres
KPCU	= Kenya Planters Co-operative Union
LRP	= Laikipia Research Program
m.asl.	= Metres above sea level
MALD&M	= Ministry of Agriculture Livestock Development and Marketing
MENR	= Ministry of Environment and Natural Resources
NGO	= Non-Governmental Organization
UNCHS	= United Nations High Commission for Human Settlements

Environment Program



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CHAPTER ONE: INTRODUCTION

1.1 General Overview

Trees in Kenya are a vital natural resource. They contribute to the renowned beauty of the countryside. They are useful as energy sources; provide shelter for wildlife; protect soil from erosion; and conserve as well as regulate water to mention but a few.

The Kenya Forestry Master Plan (1994) estimates that, about 71 per cent of the energy consumed in Kenya come from wood. Despite all this, the essence of trees is often taken for granted. It is usually in the time of need or hardship such as a draught or a flood or even during shortage of cheap fuel and building materials that the value of trees is appreciated. Perhaps one of the reasons for this is the lack of adequate information on our country's trees and natural resources.

Even though we may claim that we still have sufficient forested lands that the total annual wood production or natural growth considerably exceeds the total woodfuel needs of our people, local shortages can be severe.

Charcoal production has turned out to be one of the main economic activities in Laikipia District. This has the effect of excessive destruction of trees to make charcoal in an already fragile eco-system. Laikipia district is also characterised by a high population growth rate (both natural and immigrants), that puts the natural resource base under great pressure. Bernes(1984) giving an historical explanation on wood energy and household perspectives on rural Kenya said that, people in ASAL areas had complex behavioral responses to regional hazards depending on different set of environmental perceptions. These behavioral responses based on environmental perception enabled local actors (individuals, families, and societies) to survive the rigors of life in the ASAL areas without significantly degrading the ecosystem. The environmental calamities included disease episodes, droughts, famines, civil crisis and the adjustments took the form of selling livestock, brewing beer, collecting honey, consuming insects and engaging in long distant trade to reduce the risks of a complete disaster. For the societies that were predominantly pastoral, adjustments took the

form of grazing cycles that ensured availability of pasture, water and salt and avoidance of disease prone areas.

As population pressure increased, the natural food provision decreased and man suddenly changed his lifestyle. With the changed environmental perception, man adapted new strategies to meet his needs for his continued survival. The achievement of these needs thus form the value system which is the driving force behind the actor decision making process on the utilization or preservation of woody vegetation resources. Due to the increasing human-environment interaction, man has unscrupulously exploited trees and forests without replanting and this increases danger of desertification, and shortage of woodfuel around populated areas has been termed as the second energy crisis. Eroded hillsides and abandoned fields are signs that the problem is real and much greater care of the resource base is urgently required.

Conservationists have been dangerously pre-occupied with areas where the major environmental change is substantially complete. This study aims at finding out ways and means to protect the remaining semi-natural vegetation of arable areas and create new landscape elements in a more functional and visual harmony with the actors practices for a more sustainable resource use. If the conservation of these woody plants is to rest on Laissez fare policies, they will disappear in the near future.

1.2 PROBLEM STATEMENT

Laikipia District, being in an ASAL area and hence having a fragile ecosystem, has a high population growth rate (4.5 per cent)(Kenya Govt., 1996). This has led to a big shift in land use systems that are hardly compatible with the area's ecological requirements. Due to this, low returns that are gotten from these activities have necessitated local actors to find alternatives of earning their living. One and the major of these strategies in the area is charcoal burning and trading. This has led to serious destruction of trees, which leads to negative socio-economic and environmental consequences.

The trees are being removed without replacement and the formerly adored treasure of the area ^{ma}Y soon disappear. This is an indication that, the resource utilization and management

strategies of the local actors will not lead to sustainability of woody-plant resources of the district. What influences the charcoal burners to engage into these conflicting activities is this researcher's bone of contention. Therefore the study set to find out the main reasons of charcoal burning in the study area; whether the charcoal burners were aware of the damage they were posing to themselves and to the environment, and if they are aware, what action have they taken to control the menace. The charcoal burning activity is very rampant in the study area that it deems a research of this nature to be carried out to un-earth pertinent logistics and complexities as to why the activity can not stop despite a government ban of the same.

1.3 STUDY OBJECTIVES

1.3.1 OVERALL OBJECTIVE

To examine the factors influencing local actors activities as they engage in charcoal burning and selling in the study area.

1.3.2 SPECIFIC OBJECTIVES

1. to identify the different types of actors engaged in charcoal burning in the study area.
2. To assess the factors that motivate charcoal making by the local actors
3. To assess the actors' level of knowledge of the long term effects of charcoal burning on the environment
4. To assess the environmental problems associated with charcoal burning; and
5. To recommend policies which would;
 - a. Enhance sustainable woodfuel supply and environmental protection; and
 - b. Manage and reduce wood demand for wood charcoal conversion and increase end use efficiency.

1.4 STUDY ASSUMPTIONS

Actors perceive their environment and value corresponding resources differently, based on their socio-cultural background, and their economic context. They follow different visions and

aims, with respect to their livelihood and dispose of different resources including knowledge. They follow different and basically divergent livelihood and resource utilization strategies that are hence conflicting. It is therefore assumed here that, charcoal burning in Laikipia District will remain a very vibrant activity in the future as long as the status quo pertaining to culture and socio-economic context of the local actors prevails. Any intervention from outside to affect (push or pull) these variables will also influence the behaviour of the charcoal burners.

1.5 SCOPE OF THE STUDY

Resource utilization and management strategies are inter-linked with the perception of the complex and dynamic environmental processes. These strategies are related to the perception of margins of action; of opportunities of action, and of those aspects that facilitate or restrict action.

The study did not discuss the psychological phenomena of the local actors involved in charcoal burning. It concentrated on the broader framework that constitutes perception and causes of action, both on individual and collective levels. This include aspects like cultural norms and values, social political structures and processes like knowledge production and reproduction and social hierarchies, information about resource specifics and other properties of the field of action. The study assumed that, a diverse social-cultural frame work leads to a different perception of opportunities of the margins of action, as far as resource use and management is concerned, rather than a uniform background.

The aim of the research was to point out those factors that propagate charcoal burning activities and to propose strategies that would promote sustainable woody-plant resource use and management; and is part of the current research program being carried out in Laikipia district under the ASP which was established under the auspices of Laikipia Research Programme.

The work was carried out in two divisions; i.e. Central (Northern approaches) and Rumuruti (Rumuruti forest) where charcoal burning was more rampant in the district. The various local actors identified include;

- a). The charcoal burners who consisted of: -

- 1). The small holder land owners and land squatters;
- 2). The pastoral communities;
- 3). Large-scale land owners who contract small-holders for vegetation removal to enhance change of use;

b) The charcoal dealers who consist of: -

- 1). Small-holder bicycle transporters;
- 2). Brokers;
- 3). Large-scale buyers for Nanyuki and other markets;
- 4) Roadside sellers (these could also be burners).

1.6 STUDY HYPOTHESIS

Following the research problem highlighted, the objectives set and the subsequent literature review, the following research hypotheses were formulated to be tested.

- 1). **Ho:** The actions of the charcoal burners are not culturally influenced.
- 2). **Ho:** The actors are not aware of the environmental consequences of their actions regarding charcoal burning.
- 3). **Ho:** Charcoal making does not lead to environmental problems in the study area.

1.7 METHODOLOGY

1.7.1 Introduction

This study sought to examine the factors that affect actors strategies and perceptions on woody plant resource use and management and their implications on the planning of a sustainable ecological environment as vegetation cover becomes an endangered species in the ASAL areas of Kenya. Under this subject, the study discusses the methods of data collection, sampling techniques used, the units of observation and the techniques of data analysis and presentation used. The above methods are considered as central and indispensable to the study with due regard to the research problem, the objectives set, and the hypothesis to be tested, and the theoretical framework the author seeks to explain.

1.7.2 DATA COLLECTION METHODS

Both secondary and primary data was collected from the field to provide useful information regarding the factors that influence the local actors' strategies and perceptions, as they engage in charcoal burning activity in an environmentally fragile environment.

1.7.2.1 Secondary data collection

1. Library research: This was a major source of information particularly for the formulation of the literature review.
2. Other documentation and publications from various offices including government offices.

1.7.2.2 Primary data collection

The following methods were employed: -

- 1). a) Structured interview method: Questionnaires were prepared before hand and the respondents from the two test areas were asked questions so as to compare their perceptions and factors influencing their actions. The questionnaire was divided into several parts; i.e. household characteristics, socio-economic and cultural trends and environmental issues. This sub-division was made with due regard to the objectives of the study and the hypothesis set for testing. This enabled the researcher to unearth the different perceptions and strategies taken by the local actors when faced with certain problems as explained in the conceptual framework.
- b) Unstructured interview method was used where the need arose to get more information especially where the respondents appeared uneasy in their response as in the social and cultural issues. This method was also justifiable owing to the legal status of the activity of charcoal burning. The researcher created a good rapport to the respondents in order for them not to feel ill placed and have confidence without fear of any intimidation. This enabled them to reveal more information. This method required that, the researcher is more observant enough to note when the respondents were tense, unco-operative, untruthful or not genuine. Individuals in the other various category groups in the charcoal production activity were also interviewed using this method. These included the charcoal

dealers.

2). Key informant technique: This method was employed to obtain information from the people employed to protect trees and included; forest officers, agriculture staff, the environment officer and few NGOs. This method helped the researcher to understand the extend of the services offered by these departments and any constraints thereof as concerns the adoption of new technology by the local actors. Some of the prominent charcoal dealers were also identified and their views also sought. These charcoal dealers also formed an important contact group in leading the researcher to the areas of charcoal burning.

3) .Use of scenarios and dilemma situations: Here the study employed several observers and compared their results. Different stories concerning the natural environment were narated to the respondents and the respondents were asked to choose from the stories (scenarios or dilemma situations) the type of scenario that they prefer for the other. The different choices made by the respondents were recorded as observations and ranked in order of merit from the worst environmental scenario to the best environmental scenario that the respondents would wish to live in. This gave an idea of the range of values, error or standard deviation and a better approximation to the average or "true" value of what the respondent perceives the natural environment; its destruction, and the need for its conservation. This gave an indication as to whether the actors were aware of the potential impacts that they were posing to the environment and to themselves. The range of different observations made formed the different range of environmental perceptions by the charcoal burners This was good because the study was dealing directly with subjective values and certain types of obvious braces were reduced simply by asking more than one person to judge the same data. In order for the researcher to understand the thinking and views of the respondents as concerns reasons for charcoal burning and environmental perceptions, he described various environmental phenomenon and contrasting situations and asked the respondent to give his own view of the same. This very clearly portrayed the circumstances of the charcoal burners and the cause of their consequent actions. This enabled the researcher to unearth a lot of hidden information from the local actors which proved to be very useful in policy planning

4) Photograph taking: In order to capture the intensity of the activities of the charcoal burners, the researcher took various photographs to illustrate this.

5. Participant observation and survey method: The researcher involved himself very closely with the charcoal burners, observing their daily activities and monitoring the changes made on the woody-plant vegetation . The major issues arising were recorded in a notebook for further analysis.

1.7.3 SAMPLING TECHNIQUE

1: First phase: Area sampling

1. After a thorough reconnaissance survey conducted in the whole of Laikipia district, two areas were purposively selected where charcoal burning was more rampant. The two areas also differed in their cultural orientation. These two areas were; Rumuruti forest in Rumuruti division and Northern approach area in central division. The charcoal burners in Rumuruti forest were mostly pastoral communities from Turkana land and victims of the Molo tribal clashes. Only a small number of the land owners in the forest's neighborhood was burning charcoal. In the Northern approach, most of the charcoal burners had their places of origin in the pastoral areas surrounding the study area.

2: Second phase: Structure sampling:

Owing to the legal status of the activity, the study adopted a tracer system for the study whereby all focus groups were expected to be studied. The researcher established as many horizontal and vertical contacts as possible in this phase. The information gathered helped to develop hypothetical types of actors(actor categories). These included:- a) The charcoal burners who consisted of; i) The small-holder land owners; ii) The pastoral communities, and iii) Large scale land owners who contract small-holders for vegetation removal to enhance change of use. b) The charcoal dealers who consisted of:- i) Small-holder bicycle transporters; ii) Brokers; iii) Roadside sellers(who could also be charcoal burners), and iv) Large-scale lorry or tractor buyers for Nanyuki and other markets. This stage was thus for pre-categorization of the actors.

Actors within each actor category(structure) identified, were interviewed. Questionnaires were administered only on the charcoal burners actor category. The researcher adopted the tracer system of interview so that he gets information from the real players in the charcoal business activity. Since charcoal burning is illegal, a census of the population involved in the charcoal business was not possible.

1.7.4 VARIABLES MEASURED

1). Biological/physical; ii). Social-economic and cultural; iii). Individual and collective levels of perception and actions.

1.7.5 UNITS OF OBSERVATION

1. The individual

The individual in this study refer to the local actor (resource user) who makes decisions on the use and management of the woody-plant vegetation resource. The environmental perception that is crucial to behaviour varies from individual to individual. An individual samples his environment perceptually and then tests the accuracy of his perception by trying out the environment through his actions (Ittelson et al, 1974). Solutions of environmental problems should focus on behaviour of individuals as they evolve slowly to adopt to the environment according to the way they conceive it, which is bound to change with intellectual development. The individual thus has the power and knowledge, to participate in public debates on vegetation conservation, hence the individual was a very significant unit of observation in this study.

2) The woody plant cover as a resource

This is an artifact of man's use of the environment. How the woody plant vegetation is interpreted (perceived) can reflect the values and attitudes of the individuals concerned. The values attached to woody plant vegetation by man needs to be studied.

³) The household

This refers to social group of people living together, eating from the same kitchen, contributing to and drawing from a common source and with competing needs and aspirations (Omondi C O., 1993). The household is a suitable unit of analysis because it determines what individuals do or what they consume. It is a decision making unit and it is the level at which most management decisions are taken. A diagnosis of the perceptions and strategies at this level would be necessary if reasoned proposal for sustainable woody plant management are to be made. The various subject systems operating within the household are:

a). Cash subsystem

Inadequate cash is a common and serious problem for many households in semi arid areas. A study to establish the major sources of cash income and expenditure patterns will be conducted to reveal the level of income generating activities and cash shortages. This gave an indication of the woody plant level of utilization for economic purposes and hence whether the local actors perceive the vegetative cover in economic terms or otherwise.

b). Energy supply subsystem

Woody plants are an important provider of energy particularly firewood and charcoal. An examination/investigation of the perception of the actors on the future of the trees and tree planting gave an indication of how the actors value the trees.

c). Shelter subsystem

The type of building materials, windbreaks, shade provision, type of structures (modern or traditional) ; whether new, sedentary lifestyle, or otherwise would indicate the permanency of habitation and therefore the willingness to conserve the plant. Other issues e.g. maintenance of infrastructure, drainage and soil conservation measures, planting of trees, grazing intensity etc, were good indicators of the way the actors perceive the environmental benefit of trees.

4). Ecosystem level & community level

a) Trees are ecological modifiers of the environment. Destruction of indigenous trees, including reduction in area and species diversity could be through fuel wood provision, wild fire, clearing for agriculture, invasion of undesirable species, etc.

b) Soils could show declining fertility due to burning during the charcoal making.

The settlement community refers to the social group of people living in the ASAL area which is a problem area of study. People living close together tend to have similar information fields (Hanson 1976) and from this community, they may have different perceptions to new innovations(interventions) so that we have early adopters, late adopters and laggards who succumb to new innovation and the management of vegetation cover. Thus the community was an important unit of observation in this study.

5). The deciding actors

These are charged with the responsibility of managing and controlling access to plant resource e.g. Technical officers and their recognition on woody plant resource use differ significantly from those of the local actors. The experts thus have a say in influencing the action on the vegetation and its conservation strategies. So it is good to have the deciding actors as a unit of observation.

1.7.6 Data analysis and presentation

The researcher picked out and summarised the relevant answers to the questions(structured and evaluated them) in a systematic manner, then he gave a comment(interpretation) to every answer by each respondent. The questions and answers were given codes and entered in the computer for statistical analysis using MS-EXCEL software.

The researcher used descriptive and inferential methods of analysis. Various statistical analyses including percentages, frequency distribution and regression analysis were performed. For graphics presentation, the same computer package was used to produce the graphics to show various findings. The Data interpretation and presentation was organised and compiled separately in two chapters.

1.8 LIMITATIONS OF THE STUDY

Sometimes the interview created unnatural situations and some of the respondents would yield inaccurate data. This was attributed to suspicions that the respondents might have developed at the initial stages of the interviews. In many cases they suspected that the researcher was a

C.I.D ^{sent} by the D.C. to investigate about charcoal burning for further arrests of the culprits. Some respondents also felt coerced into being interviewed and felt the researcher was wasting a lot of their useful time asking questions. They thus showed hostility or un readiness to be interviewed. This problem was solved by being explicit and honest about the researcher's intentions. In a number of cases, the study was unable to obtain accurate information when sensitive questions were asked.

Literature was hard to research on and the researcher really strained to organise the conceptual framework. This was due to scanty research which has been done on this subject. The fact that charcoal burning is illegal explains also why little research has been done in this subject of charcoal burning. Due to this the researcher was looked at with a lot of suspicion by both the charcoal burners and the government officers.

The researcher was risking a lot to go to the forest of Rumuruti where many of the charcoal burners made charcoal. Sometimes they would threaten to harm the researcher if they discover that; his actions could lead to a complete stoppage of earning of living from their 'mother' forest. The researcher had to use very convincing language with the help of the various contacts that he had made.

The journey also of traversing and criss-crossing on foot inside the forest by the researcher was not a simple one especially with the presence of some few wild animals like elephants and buffalos.

Most of the contact charcoal burners demanded that the researcher pays them money for having utilised them in his work. They claimed that the time he used them to reach other charcoal burners was valuable to them and they would have utilised the time to burn more charcoal for themselves as they lacked any other occupation.

1.9 Operational Definitions

Local actors: The ASP conceptual framework refers to local actors as individuals, communities and organisations who directly use natural resources without much influence on

their distribution within Laikipia. The "local actors" are the various charcoal burners in the test areas

Deciding actors: Are actors who play or dispose over, regulate access to or otherwise affect local or regional resource use. They are charged with the responsibility of managing and controlling access to resources e.g. Technical Officers. They have a better understanding of the dynamics of resource use and are able to give appropriate guidance to local actors e.g. water officers who control access to water resources in the basin. Land use planners who guide society in use, planning and development of land, forest officers who manage and develop forests, administrators, private developers, NGOs etc.

Strategies: These refer to deliberately devised courses of action and/or disposition by actors intended to respond to any set of conditions (natural resource issues).

Sustainable development: This refer to the process of development that will care for the needs of the present communities without comprising the interests of future generations.

CHAPTER 2 : LITERATURE REVIEW

2.1 MAN'S INTERACTION WITH VEGETATION COVER

From the earliest history of city civilization, it has been true that man finds a forest and leaves a desert (Crowe, 1956). The fertility of North Africa perished to feed Rome and price of our own industrial wealth has been the dust bowls of the New world and the desolation of the Black country.

It's time to abandon the mentality of the nomadic tribes who take all they can from the land and pass on, and to learn instead to create the landscape in which we have to live (Appleton, 1975). Man is in the position of an animal who has over bred in relation to his environment. By the laws of nature either he or his environment will deteriorate unless he can use his skill and mastery over natural forces to adapt his habitat to the new diversity of his species (Speth, 1988).

This applies also to our vegetation cover. We must decide which parts of our landscape can and should remain fundamentally in their present form and which parts must be recreated to take our new uses and new density. Man can ruin his surroundings and make them unsuitable for future generations just like he can make war and leave unresolved political problems leading to more war. The earth's surface today exhibits many scars, sores and many patches, nearly all due to human activity, but still capable of renewal through human care. The farmer has been traditionally been seen as the effective custodian of the landscape in the country-side, yet most farmers' motives and aspirations center upon commercial success in their operations. The questions of protecting or even enhancing farming land quality; of opening up some farmland for recreational use, and for amenity gain and of adopting farming techniques, which benefit wildlife and contribute to nature conservation objectives are often addressed after the problems of commercial success have been accommodated.

Certain tribal customs operate against the principles of good animal husbandry and grazing management and the preservation of natural assets. Among the herdsmen of some tribes like maasai, cattle are considered to be the storage reservoir of industrial wealth. They are their savings and investment account and numbers are important and not the condition of the animals. Among some tribes, the Bride price is paid in life cattle, sheep, or goats. The result of

such customs is the deterioration of grazing lands to the point at which erosion has become very Serious and scenic pleasantness has disappeared.

According to Douglas(1987), farmers are viewed as vicious exploiters of the land and vegetation; mining the resources in chasing profits. Certainly, farmers have been the agents of resource degradation but more through their over optimistic perceptions of the resource and an ignorance by administrators and scientists of good management principles. He adds that the resource degradation caused by past activities of farmers is continuing at the same rate and will ultimately result in a vast dust bowl. It is more likely that, degeneration has been caused by one or more relatively short periods of over use in the albeit, with many areas in poor condition and all areas subject to further degradation if subjected to future periods of misuse. Many ecosystems are quite robust and have degenerated due to severe misuse rather than inherent fragility. This fact seems to have been recognised by leaders of some developing countries facing massive problems of under development.

The former prime minister of India Mrs. Indra Gandhi, speaking to the plenary of UNCHS at Stockholm stated that, "we do not wish to impoverish the environment any further and yet we cannot for a moment forget the grim poverty of a large number of people. Unless we are in a position to provide employment and purchasing power for the daily necessity of the tribal people and those who live in or around jungles; we cannot prevent them from combing forests for food and livelihood; from poaching and exploiting the vegetation; when themselves feel deprived. How can we urge the preservation of animals? How can we speak to those who live in villages and in slums about keeping the oceans, the rivers and the air clean when their own lives are contaminated at the source?". A similar problem seems to be facing Laikipia's vegetation cover. The existence of this being threatened by excisions, livestock grazing and the activities of charcoal burners whereby many families depend on charcoal-burning industry for their livelihood

As economists put it, it is good to assess the use to which land within a given area is put with respect to factors which influence its productivity e.g. soil type, rainfall, attitude, temperatures etc. Due to these factors, the type of land use practiced may differ from one area to another. With this kind of analysis, irrational decisions about land use will be avoided. There is not much

future for a society which eats up all the resources which led to its development. Only the introduction of ecologically sound technologies would bring degraded land back into productive use. In the tropics, clearing hillsides for agriculture or firewood not only results in massive erosion of fertile soil on the slopes, but causes wells to dry up because of loss of water retention, so that the overall food production is in many cases less than it was before.

2.2 CULTURE AS AN INFLUENCE OF MAN—NATURE RELATIONSHIPS

The underlying causes for human behaviour are the symbolic and material structures which man has himself created. The ensemble of these structures is usually called "culture". Within these theoretical structures, the biological and physical environment is viewed as something, men manipulate to fulfill their needs as defined by their culture (Simmons, 1980).

Man sees the world around him through the spectacles of culture and nature is thus transformed into resources. The elements of behaviour and technology which are found together to make up culture are very varied, and the mix is different for diverse times and places. The sensory perception of the environment and the psychological translation and information of that knowledge into a decision to act, or not to act, upon the environment is a complex issue, since between the perceptive input and the executive output lies a shadowy state of values conditioned by experience; imagination; fantasy, and other assorted intangibles derived from both rational and irrational sources (Ibid, 1980). The ability to act is dependent largely upon the effective technology that a group of individual possesses but behind the motivation, lies the more elusive factors outlined above. There are of course cases where technology is used for its own sake irrespective of the need.

In general terms, the world exists not in absolute dimension but in people's heads. Simmons(1980), further points out that many people act according to the image of the world that they have in their heads rather than in the light of objective 'scientific' information. The role of culture is very strong and while we may establish objectively the results of a particular cultural trait in terms of resource use, it is valuable to be able to penetrate the mind of the individual and see the way in which decisions come to be made (Saarinen, 1969). The study of the environmentally oriented mental process of the

individual 'resource manager' faced with the problem of what to do with his effluent may act as a key to the understanding of many of the irrationalities in resource management and use.

A number of processes are involved. There is first the sensory perception of the environment and this is confined to the organs of the human body. The next stage is where culture plays a leading role for the transformation of the perception of the source of a material into a cognition of a resource (Simmons, 1980). Here; resources 'become' and the 'cultural appraisal' takes place. The values informing the cultural appraisal are many and varied. Knowledge especially of an objective scientific kind like knowing the uses of a particular forest tree is central; but so are various types of prejudice, experience and imagination. Resource managers, according to Kates(1962) thus become "men bounded by inherent computational disabilities; products of their time and place, who seek to wrest from their environment those elements that make a more satisfactory life for them and their fellows."

2.3 THE PROBLEMS OF VEGETATION COVER DESTRUCTION

Vegetation degradation is an ecological phenomenon whose wide ranging consequences have recently began to receive the serious attention of governments, organisations, and individuals the world over and has been a subject of discussion in many United Nations and IGAD's conferences. Most of the earth's arid land has become desert since the dawn of civilization. In 1977, UNEP estimated that on the southern edges of the Sahara alone, as much as 650,000 sq. km of land once suitable for agriculture and grazing had become desert in a period of 50 years. A reputable authority on this subject has also warned that the Sahara is spreading southwards and Nairobi could be swallowed in a few years to come. The desert is said to be spreading 30 miles per year.

The consequences of destroying the country's vegetation cover can be observed in a country such as Ethiopia due to agricultural activities which have been carried out in utter disregard of the need to utilise land resource well. Difficulties of developing arid and semi-arid lands (ASAL) stem from the physical and biological constraints imposed by factors such as inadequate water, shallow soils and sparse vegetation. Speth(1988) suggested that, failure to

initiate and implement projects that work within these constraints is another factor that handicap the development of the arid and semi arid lands. These ecosystems are so fragile that slight changes in their balance can lead to rapid degradation of the land resource. Land degradation can be attributed to the combined effect of inherent ecological features of the arid and semi arid habitats and the socio-economic behaviours which are not compatible with the environmental and developmental requirements of these ecosystems (Obeid, 1980). Existence of human activities presuppose social and ecological influences and interactions with other ecosystem components. If these influences are not well understood and adequately accommodated in resource management plans, the consequences could be disastrous (Darag, 1988).

Walter(1988), argued that in ASAL regions, centres of human and animal concentration expanded rapidly and spread in ever widening circles as people move further and further away in search for cultivation, grazing and fuelwood resources. These practices can easily accelerate the rate of soil erosion and desert encroachment. Lands can degrade less under the same intensity of use if appropriate techniques and appropriate strategies are taken (used) by the actors to minimise the negative effect(Young et al, 1993). It is therefore important for actors to perceive and take strategies that increase the efficiency of land use with minimum possible degree of degradation. Substantial areas of Laikipia which were previously considered as grazing grounds have recently been converted into other activities and overproduction of crops and overgrazing have led jointly to serious depletion of the land resource base thus reducing the per capita cultivable land. Improper farming systems and continuous cultivation of the same plots may contribute to land degradation. This problem can be contained through incorporation of land, water and forest resources in well-defined management systems. The implementing actors therefore should allocate available land according to their production capacity to sustain their productivity for future use.

Obeid(1980), observed that, the breakdown of traditional practices have resulted in intensive crop production which has significantly reduced fallow periods. During the last two decades, overgrazing, wildfire and irrational removal of wood-plants for cultivation and fuelwood have spread into the marginal and economically fragile ASAL areas which receive minimal annual precipitation.

Fuelwood cutting is a human activity that exerts pressure on tree resources of an area causing imminent environmental risks. This phenomenon features more prominently where human population densities are high to cause destruction of standing stocks of trees to supply fuelwood needs. As demand continues to rise from higher number of people, pressure on tree resources is intensified and the quantity that can be trimmed from trees without damage is no longer sufficient.

2.4 THE ECONOMIC IMPORTANCE OF VEGETATION COVER

2.4.1 Benefit to the environment

The earth's vegetation cover as an environmental resource is not infinitely abundant. This brings in the trap into which man has fallen and which has led to differing strategies in which he manages the resources depending on the way he perceives it. If man is to survive more than just a few generations, we must re-examine the man-earth relationship and attempt to understand, manage and control as adequately as possible all our vegetation resources (Robinson, 1977). Calvin et al(1972) argue that, what man can and should do is recognise himself as an important geologic agent and attempt to be aware of the environmental side effects to which each of his decisions leads. To accomplish this, we must educate large masses of our population and make them aware that, their plants are good environmental resource.

Deju et al(1972) put it that, in planning for sustainable resource use, one must weigh the advantages and disadvantages*of depleting a resource rapidly, that it would all be gone before a suitable substitute is found. Exploitation must be geared to maximise the satisfaction of human demands now and in the future. In his summary, Deju adds that vegetation cover is a prime area of concern to environmentalists and one of their objectives is the development of a concept of optimal vegetation cover utilization.

Goldsmith(1974 p219) talking on carrying capacities said that, the canying capacity of land is the maximum intensity of use an area will continue to support under a particular management regime without inducing a permanent change in the biotic environment maintained by that management. These capacities can be physical, ecological, economic and perceptual capacities. Davidson(1974), talking on countryside conservation observed that, landscapes within national parks, as well as outside them, are threatened by developments of many kinds; the expansion of

agriculture and forestry operations; new water conservation schemes; more mineral working; road improvements; pressures for community and second homes and the intensification of outdoor recreation activity.

Gwyn james(1974) puts it that, where the investment in both agriculture and forestry is uneconomic, the national advantages of an area, i.e. Geographical, environmental, topographical, physical- may be exploited through its recreational development or water catchment areas, and protection of fauna and flora. Huxley(1965), adds that, such land should be left as wilderness where he defines wilderness to mean a part of a garden devoted to wild growth. Darling in his 1969 Reith lectures (1970; p57) claims that; for the healthy metabolism of space-ship earth, some parts must not be manipulated by men for any purpose but must be left to the natural cycles of change and decay for the ecological well-being of the whole.

Matter(1966), while discouraging intensive use of land argues that, we can create an artificial wilderness by planting of vegetation . This wilderness management can help by use of deflecting buffer zones. He also adds that, without access to landscape elements like trees and grass, it would be difficult for most people to use leisure time for constructive sport and relaxation and for obtaining inspiration and adventure that really satisfies the so called sportsman, mountain climbers, amateur explorers, picnickers, campers, wilderness travelers, sight seers in scenic localities, the golfer etc...

2.4.2 Aesthetic benefit to thejandscape

Vegetation cover has tangible value only when valued by society according to one of a variety of bases for evaluation. Many values of vegetation cover are related to aesthetic appreciation of fine scenery and so the preferences and perceptions of its use can assume considerable importance in conflict resolution.

Sensitive planning, management and protection of vegetation cover are basic necessities with respect to long-term preservation of the environment. Ashworth(1972), stressed that ironically, planners have rarely been involved in discussions on the long-term allocation of resources nationally or locally but have been rather more involved with short or mid-term allocation.. Vegetation cover as a component of countryside planning and management provides difficulties to the actors involved in that, the countryside is composed of elements from

different periods in time- reflecting a long sequence of change and evolution to which contemporary land use change and structural developments add the final touches. The countryside is a mosaic of landscape elements such as trees, fields, rivers, settlements in close juxtaposition; again highlighting interaction, conflict and dynamics. The countryside in general is a working system where the landscape considerations of change are generally subservient to the needs of agriculture, access, etc. Aesthetic planning should be a dominant focal point of resource planning. There is often a feeling as expressed in William Cowpea's maxim that "God made the country and man made the town- that countryside landscapes should be preserved largely for the enjoyment of urban dwellers" (Ashworth, 1974).

Today all land can and should be regarded as "amenity land" because all land impinges on the visual senses of people for better or worse. Amenity land is valued for one or more of the following purposes:- 1) It delights both the eye and aesthetic senses; 2) It satisfies historic and cultural interests; 3) It contains a range of wildlife habitats features and species; 4) It provides space and facilities for one or more forms of active or passive leisure and recreational pursuits; 5) It contributes to the wealth, employment and health of communities. The functions of the different landscape components are:- Physical; social; aesthetic; recreational; conservational; commercial and economic.

Many problems of countryside planning stem from the ways in which people view the landscape, whether these people are planners, residents, visitors etc.. Perceptions of the opportunities offered by the countryside landscape varies between individuals, and groups but perhaps also, perception is coloured by national variations in population size, pressure on land-use resources, standard of living etc.. In Britain for example, the farmer is often viewed by the urban-based protagonist as the archetypal moaner, feather bedded by the taxpayers money, but for ever pleading poverty while riding around in a new car (Paul Cloke and Chris park, 1985). The extreme environmentalist view, on the other hand tends to brand him as "the destroyer of the nation's heritage, promoting the rape of the natural landscape and poison its flora and fauna in the pursuit of mammon", yet to the farmer, agriculture is both a business and a way of life both of which are to be protected from the meddling of uninformed and potentially dangerous newcomers (Ibid, 1985). The new comers ideas can become transposed as the voice of local people- especially when the newcomers dominate the local politics.

These differences in how landscape is viewed by the actors illustrate some of the many contradictions of image and activity which plague the countryside as far as landscape use and management is concerned. Landscape planning is a question of recognising emergent areas of conflict in values and of taking action to reconcile or otherwise meet that conflict. It is this recognition within planning which perhaps uncovers the most important set of actors attitudes. Planner's images of the landscape resource use, often differ markedly from those of the politicians for example; who they seek to influence and from the images of those sections of the population who are affected by the allocation of resources.

The vegetation and subsequent landscape form of Laikipia have been changed qualitatively and quantitatively by the activities of charcoal makers who do not observe conservation measures. As in many other ASAL regions of the country, Laikipia suffers from periodic draughts which have been more frequent in recent years. These draughts coupled with other human factors have caused a sharp decline in the land productivity and consequently diminished the capability of the landscape to support both human and livestock population. Participation of rural people in trees conservation is very important mainly because some of the human activities are the main causes of natural resource deterioration, hence people have to be involved in combating the same problems (Barnes and Olivares, 1988). Joint efforts to solve common problems of the rural people based on self-help projects should be viewed as essential elements of community development.

Holdcraft (1978) observed that rural communities are usually less motivated to participate in development projects unless they perceive that the benefits arising from these projects will flow directly to them. One of the principles of Stockholm Declaration 1972 was that "man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of quality that permits a life of dignity and well being and he bears a solemn responsibility to protect and improve the landscape for present and future generations and environmental management implies sustainable development".

For any tract of countryside, the values placed upon its landscape may be expected to differ between for example those who visit for some specific activity (Climbing or Sailing); those who come to look at it (in different ways and for a variety of reasons) and those for whom it is their

living or working environment(local actors). Those who do not visit the countryside frequently or who may never have done so, will place other values upon it. All these groups will react differently to landscape change. Moreover, taste in landscape is also subjective; albeit in a less obvious way, than other areas of aesthetic pleasure to the victims of fashion. Current perceptions are most often seen to be sharply divided between those who want to protect the best of traditional scenes (which are now no longer functional) and those who see beauty only in landscapes which are efficient.

In practice only some of those groups with an interest in landscape have been able to influence the way in which particular parts of the country side have developed. Many environmentalists have come up in the recent past as representatives of amenity pressure groups in a most reciferous way, but it is the landowners(local actors) who in practice largely control the appearance of the country side and are substantially free from restrictions upon their operations, almost all of which have some landscape implications. Indeed the clearance of vegetation has accentuated the pleasing land forms of our country hence affecting the forage in ASAL areas thus the landscape is both functional and satisfying.

New perceptions arising from the provisions of Agenda 21 indicated that, land-based life forms be it in human beings, domestic animals, wild animals, insects and birds, depend largely on water and plant biomass. (Kenya Govt., 1996). Experiences from the past indicate that, human activities have tended to over exploit species that are of direct economic use of them thereby leading to the destruction of those that they find little or no direct use to them. In this process, certain species are facing extinction while others have become "endangered". The elimination of species and habitats poses severe dangers to the capability of the earth to sustain life in the future. The preservation of species and their habitats is considered a "global heritage" that is; the responsibility of humanity as a whole.

2.4.3 Forests as protectors of Bio-diversity

The Kenya Forestry Master Plan(1994) estimates that, Kenya's forests, woodlands and bushlands are the habitat of about 6000 species of higher plants (including 1700 trees and shrubs), about 362 species of mammals, 1079 bird species, and 875 butter flies. Although they cover only 2 per cent of the land area, the closed forests contain a very high proportion of the

country's biodiversity(About 35 per cent of the larger mammal species, 30 per cent of the birds and 35 per cent of the butter flies).

The closed forests are even more important as the habitat of the threatened species. They contain twice as many rare woody plant species and three times as many mammals as the other vegetation types together. The forests are thus not only important for the conservation of biodiversity and potentiality for eco-tourism, they are a traditional source of fuelwood, construction wood and other non-wood products. They also provide benefits in soil and water conservation and in sequestration of carbon; used as a fodder. We also get water from forest streams, bush-meat and other animal products, bee products, plant foods, fibres, medicines and minerals. The release of green house gases into the atmosphere has become an important international issue. They include carbon monoxide, methane and oxides of nitrogen but the most important is carbon dioxide. It is responsible for about half of the potential warming that is attributable to human activities which range from burning of industrial fuels to agricultural and forestry practices. Energy production generates about 46 per cent of the extra warming effect attributable to human activities while land-use accounts for about 18 per cent of the human related green houses. Carbon is stored in the forest biomass and forest soil. In forests where the total biomass and soil are not changing, photosynthesis and respiration are in equilibrium and there is not change in the amount of fixed carbon. If there is a reduction in tree cover, carbon is released to the atmosphere. The use of wood for fuel, if it comes from forests under sustained yield management, has little effect on the green house gas balance and it reduces the use of fossil fuels. Burning of trees from cleared areas contributes about a quarter to a third of global emission of carbon dioxide and in Kenya the net annual emission is about 1.5 million tones and efforts towards afforestation can stop this(Ibid, 1994).

2.4.4 Forests use in industry

A major objective of Kenya's forest policy has been self-reliance in wood products. Application of the policy has led to the development of a domestic industry which is protected against imports. These trade restrictions have led to inefficiencies in the wood-based industries resulting in sub-optimal wood allocation, and higher product prices than those that prevail in competitive markets. One challenge for this sub-sector is to increase its market orientation and

improve the stability of the wood supply in the face of an increasing backlog in replanting and **applying** better plantation management techniques

As the population and the economy grow, so will the demand for wood products. The MENR in 1995 estimated the demand for sawnwood to triple from 212000 cubic metres in 1995 to 539000 cubic metres in 2020. The demand for plywood and other wood panels would also increase from 50000 cubic metres to 134000 cubic metres within the same period. Similarly, the demand for paper and paper board is expected to grow from 143000 tonnes to 389000 tonnes corresponding to an increase from 5.4 to 6.7 kg per person. In the last twenty years, annual growth in the saw milling industry has averaged about 2.3 per cent. About 15-20 per cent of the sawn-wood and panel output is used by a large number of small artisan furniture and joinery workshops. The pre-fabricated housing industry also consumes a significant part of both the sawn-wood and the panel output.

More than a million cubic metres of poles are needed annually for construction, posts and electric and telecommunication poles. The supply from forest plantations and farm trees is not enough. More wood products have to be taken from forests and woodlands, legally or illegally.

2.5.1 THE CONCEPT OF A RESOURCE

A Resource is not necessarily a tangible object but it is a culturally defined and abstract concept (Cloke and Park, 1985). In essence, any thing can be regarded as a resource if it offers a means of attaining certain socially valued goals. Attainments of such goals is generally influenced by the prevailing social, political, economic and institution framework of the individual group or unit responsible for the decision-making and so, these elements all become important in any resource management system (Ibid, 1985).

Zimmermann(1951), viewed a resource in terms of a functional relationship between three things; human wants, human abilities and human appraisal of the environment around him. The environment comprises both social/economic and physical/environmental elements and it offers a basic reservoir of " neutral stuff". This neutral stuff can be evaluated in terms of human wants, which are both biological (such as the provision of food and shelter) and social(our sense of value and our aspirations) and human needs at that point in time. On the basis of this evaluation, decisions might be taken to transform this aspect of neutral stuff into some form of

usable resource(Ibid, 1951). Resources are thus created to satisfy human wants. This act of creation depends on many factors e.g. The identification of opportunities, the characteristics of the reservoir of "neutral stuff" and on the deployment of organization and technological abilities.

2.5.2 RESOURCE ACQUISITION

2.5.2.1 Acquisition and maintenance of land ownership

Most people have a strong desire for property land ownership. This desire is fostered by ; 1) Traditional attitudes and sentiments favouring ownership, 2) the cultural approval of society and 3) the promotional efforts of groups that develops and self properties.

2.5.2.2 Methods of land Acquisition

There are ten different ways - 1) Patents or grants from the government; 2) private grants by deed; 3) grants by device; 4) acquisition under the laws of descent; 5) dedication; 6) Eminent domain; 7) Forfeiture; 8) Adverse possession; 9) Accretion; and 10) Escheat.

Deeds are a property drafted, written statement by which an owner conveys the rights he or she has given tract of land to someone else. Land can be **dedicated** by someone for public use. Also land for public purposes can be acquired by the power of eminent domain. Land is acquired by **forfeiture** through mortgage for non-repayment. **Adverse possession** ownership, can be through claiming of unused or abandoned lands. Ownership rights by **accretion** can be through: - when a property bounded by water course has surface land added to it by action of the stream or when a house is added to ones land without one's consent. If a house is built on one's land by mistake, the landowner acquires little or accretion and is under no obligation to its costs of construction(Barlowe, 1986).

Property acquisition by escheat involves the reservation of estates to the state whenever a person dies without known heirs who are eligible to receive the property under the laws of descent.

2.5.2.3 Transfer of ownership

1 Transfers by deed - may involve outright gifts or purchase and sale arrangements.

2. Transfer by inheritance.

3. Alternative inheritance arrangements e.g.

a) Transfer by gift; b) Sales arrangement; c) Contractual arrangements; d) Joint tenancies; e) Use of a will; f) Settlement under the laws of descent; g) Living trusts (trustees); h) Choice of an inheritance arrangement

source: (Barlowe, 1986)

The concept of land acquisition and the method of transfer of ownership have a bearing towards which individuals perceive land and its vegetation cover and the strategies that they take to conserve it, is basically pegged on this.

2.5.3 PERSPECTIVES IN RESOURCE MANAGEMENT

Within any planning situation, three basic aspects of resource, are of central value. The analysis of resource *availability* and *status*(the role of the surveyor); and approaches to the management of *both* given the resource base (resource developer). Inevitably however, the emphasis given to these three aspects of resource use varies under different planning situations, depending on whether one is evaluating the likely resource use through the eyes of a developer, or a planner or whether control (in which case his interest might focus more explicitly on resource survey) on existing problems of land use conflict (where he will be concerned with the more pressing problems of resource management).

Public intervention and social control are necessary to regulate the excess of private action in the public interest and it represents a basic shift of interest within the field of resources in general. Chapman(1969;32) comments that, when a society reaches some threshold of economic development, with its attained scientific and technological capabilities, it can afford to concern itself less with materials and quantity and more with the quality of life. Attaching

utility thus to the quality of environment has the effect of perceiving as resources, some aspects of the environment not previously considered to be resources.

It is proper to take proper account of all view points on what the vegetation of the countryside offers to various groups of individuals or resource users in planning these areas and; to base resource decision making on broadly based images of the countryside vegetation (Ibid, 1969). Social and environmental elements should often be considered alongside economic issues in debates about resource allocations and management (left", 1974). This produces the basis of resource-use decision making and reflects a movement away from economic theory towards a broader rationale, triggered off by growing awareness of the imperfection of market forces. Hines(1973), comments that, the market mechanism cannot at the same time encourage economic growth and the conservation of natural resources; stimulate all kinds of economic activity and maximise social welfare; promote unrestrained economic growth and protect the environment. Economic theory fails in the sense that, it fails to identify and measure (give value) certain elements such as aesthetics and future values of our vegetation.

In resource use planning, it is good to take into account the image of the integrated countryside and diverse ways in which countryside users perceive and value the woody plant as a resource; to recognize the need to take stock of the assemblage of vegetation resource component, which used careful management and development; focus attention in particular, on cases of conflict within this resource using system and consider alternative strategies to allocate and manage the available resources equitably and sensibly between competing demands.

Our concern in the resource management should be at defined 'units' to resource and avoid approaching the limits of resource availability as we recognise that uses are unavoidable. Different groups of actors (resource users or managers) are generally quite different. The significance of a resource use depends in part on the background of the resource user. The resource user will not also have one single goal and these will be reflected in the planning priorities he perceives and in his reaction to given resource management conflicts.

Conflicts occur because of competing demands on resources. Planning allocation-process should resolve these conflicts by replacing the market allocation-process. It should take into account factors such as national and strategic policies; political opinion and pressures;

economic constraints and incentive; the prospects of social impacts and externalities and the likelihood of environmental impacts.

2.5.4 THE CONCEPT OF SUSTAINABLE RESOURCE USE AND MANAGEMENT

Glasbergen(1995), observes that, the challenge to environmental planning revolves around sustainability, which the author sees as a call to co-operative action; but concedes that in practice, the policies they intend to further this goal, often generate conflicts of interests between various actors. He goes further to say that, environmental problems are a result of human interference with nature despite the inevitability of this interference.

The very existence of man depends on his capacity to use the physical environment and its resource but the relationship is problematic since the methods of utilization can jeopardise man's livelihood, if in their use, renewable resources are over-utilised, unbalanced, or depleted(ibid, 1995). He further notes that the concept of sustainability implicitly connotes an aspect of society aspirations, to initiate environmental improvement by minimising ecological damage and instituting repair efforts where an injury has already been caused. The concept entails the prevention of natural resources depletion, protection of biodiversity and conservation of nature's sustainable development. This is thus a concept that engenders a reconciliation of opposing interests but maintains that, it is symbolic in content and is surrounded by dysfunctional vagueness.

Dally(1995), defines resource sustainability as the maximum amount of resources that a person or community could utilise over time and still be as well endowed at the end of the period as at the beginning. Pezzy(1989), defines sustainability as the maintenance of a constant non-declining level of utility.

The brutland commission defines sustainable development as the development that meets the needs of the present without compromising the ability of the future generations to meet their own needs.

2.6 THE CARRYING CAPACITY OF AN ECO-SYSTEM

The Eco-system in which man belongs **consists** of the following:- a) The physical environment; ° g- climate, atmosphere, etc.; b) The soil as a separate entity within that physical environment.

Soil incorporates minerals, moisture, etc.; c) Water; d) The vegetation- Flora(Plant and plant community); e) Fauna; 0 Man and his societies.

Eco-system is regarded as one whole with a continuous interactions between the environment and living organisms including man. This implies that, the growth of any species is directly or indirectly limited by the environment. Only human population have attained a certain degree of freedom on this rule because of their ability to convert the environment for their own use. Nevertheless, there are limits as to the number of people that a particular eco-system can support. This limit is defined as carrying capacity of that particular eco-system.

Carrying capacity has several levels. These range from- optimum density to the maximum subsistence level which a particular eco-system can support. At the optimum density, all individuals have a sufficient supply of all essentials so that their productivity is at a maximum. Only strong limitations on growth can then maintain this optimum density, otherwise, a population will move towards the maximum subsistence level and even beyond with falling productivity until it may reach starvation.

But carrying capacity as a concept itself is not static. It may be modified by human action. Such action tends to disturb the existing equilibrium or balance. When this happens, it may lead to impoverishment of the environment. This will have a negative effect on the stability of the environment. The ability of an eco-system to tolerate human action varies greatly. It is important to note that, any system can be pushed to a point of no return at least within the human time-scale. In this way, plants may require at least a minimum area to regenerate and when this level of minimum area is passed, plant communities degenerate and can not regenerate any more. Similarly soil erosion may expose bedrock and at that stage, soil degradation can no longer be arrested economically after its early stages.

Fortunately, the ecological concept has become fashionable and become part of sub-culture of the western world of the new class.

2.7 LAND USE AND CONSERVATION

Conservation is rooted in the relationship between man and his environment and in particular in "ten's attitude towards his environment. For thousands of years, man has seen his earthly home

as the product of divine creation. He has seen this home as being both useful and beautiful; he has sought to exercise dominion over the earth and to use it for his own purposes, and he has felt a sense of stewardship and responsibility for his use of it. Obviously these concepts or beliefs have not been held with equal firmness by all men in every part of the world. In the West for example, the balance between dominion stewardship has fluctuated and in the orient pantheistic views of god-in-nature prevailed in place of the Western view of God-created nature. But in the east and west alike, man had religious reasons for using land in a responsible manner, whether he always did so is another matter but his religion provided him with basic values from which responsible behaviour ought to have followed. Today the main problem of conservation is in obtaining agreement of basic values, and in translating these values into frameworks for practical action. The technical means of conservation are not without their own patterns, but as in so many other areas of life and society, the tools are better developed than the will to use them(Matther, 1986). Although the roots of conservation lie in philosophy and religion, the first attempts to conserve land and its resources in modern times were decidedly practical in nature and were concerned largely with protecting forests.

The natural resource conservation is defined as "the use of natural resources for the greatest good, for the greatest number, for greatest time", (Burton and Kates, 1960). It was defined by Camp and Daugharty(1988), as "the wise use of natural resources to minimise waste and maintain the resources in as good condition as is practical". Both definitions emphasised sustainable use of the land resources by actors involved for future use by preventing damage and misuse.

The balance between human population and natural (land) resources may be one of the first social equations to be conceived by man. Burton and Kates(1960), remarked that the earliest tribal life, the relationship between productivity of hunting grounds and the welfare of the tribe must have been very clear. In early days, there was a balance between human population and the environment but currently, land degradation has significantly increased as a result of excessive increase in human and livestock population with their greater demand particularly for agricultural lands. The cultivated lands are neither given long fallow to generate fertility, nor fertilizers applied to compensate the large amount of nutrients removed annually. Moreover the

harvested fields are left bare and the erosive forces of the wind and rainfall could become services.

Application of technological solutions to ecological problems has to take into account the actors perceptions and their cultural background in order to persuade the people to utilise the land resources properly (Gupta, 1989). The responsibility of appropriate management of land resources must rest with the farmers (local actors) who are the land users. The local commitment towards sustainable land use plans is best achieved if the people (local actors) are given a chance to decide and identify their needs rather than decisions being imposed upon them by deciding actors (Braatz et al, 1994). Once the farmers are convinced and accept the new ways of natural resource management, these measures become part of their daily life. Programs implemented without consultation of the local community (local actors) will not be appreciated and collapse when the outside assistance (deciding action) is withdrawn.

It is essential to develop strategies for protecting land resources in order to slow down the rapid environmental degradation and encourage rural population (local actors) to participate in management and conservation of land resources in a sustainable manner (Teklu et al, 1991). Some of these strategies such as site requirements and integral planning were discussed by Edington(1979), who argued that rural lands can be rated according to their site requirements, in relation to the natural physical features of the environment, in order to be properly allocated to specific land use activity. He also concluded that appropriate planning for use of water, soils, flora and fauna with the objective of reducing ecological deterioration and assuring sustainability is essential for proper and sustainable management of these resources.

2.8 FORESTS IN KENYA

2.8.1 KENYA'S NATURAL VEGETATION

There are seven broad vegetation types in Kenya. They are; High mountain vegetation, Forest, Woodland, Savannah, Bushland and Thicket, Semi-desert vegetation and Grassland and Swamp.

A. High Mountain Vegetation: This is found on high mountains above 3000 **ma.s.l.** and is dominated by heath and moors. Grasses, giant groundsel and

lobelia(Mw/*e/ie in Kikuyu) characterise the vegetation. Below 3000 m, mountain bamboos are found.

B. Forest: A forest in Kenya is a closed stand of high trees which form a dense canopy inhibiting grass growth. There are few such areas in the country, largely because of systematic exploitation of forests for man's economic benefits. However, the available forest types can be classified according to their occurrence into those of high altitudes above 1800m(Montane forests) and lower altitudes(Intermediate & lowland forests).

i) Montane forests: Examples here are — camphor, podo and *Croton macrostachyus*. In lower rainfall areas, a drier montane forest composed of hard leafed evergreens is present.

ii) Intermediate and lowland forests: These are semi-deciduous rather than completely evergreen. In parts of Mt. Kenya with 1000 - 1500 mm of rain, *Croton megalocarpus* occurs while in lower altitudes with lesser moisture 'mfunda' and 'muhuhu' grow.

C. Woodland: In Kenya, there are two types:

i) Miombo woodland: Found almost only at the coast, e.g. Julbernardie and *Brachystegia*.

ii) Other woodland types: These are *Acacia* varieties well distributed in Kenya. They range from 20 m *Acacia elatior* to the 2 m *Acaciapaolii*.

D. Savannah: This is one with a mixture of trees and shrubs standing in a tall growth of grass. The trees are deciduous and 9-12 m in height. Four types here are:-

i) Combretum Savannah: Frequent species include *Combretum bunderianum* available where it is called 'sheraha' or 'shitao'.

ii) Other broad-leaved types: Example here is *Parianri giratellifolia*. This is a shrub which may grow and become a tree of 12 m.

iii) *Acacia* Savannah: In hotter and drier regions such as eastern and northern Kenya.

jv) Savannah-like vegetation: The country's highlands support a savannah-like vegetation whose plants include *Vernonia auricullifera* and *Albizia Cariria*

E. Bushland and thicket: Semi-arid regions vegetation are of four types:

i) Evergreen and semi-evergreen types: These are found in the drier parts of the highlands of Kenya. Rumuruti forest in Laikipia falls in this category. *Olea africana* and *Acokanthera* spp are the main species.

ii) Deciduous thickets: Example here is *Maerua angolensis* common in Samburu and Turkana areas.

iii) Commiphora thicket and Bushland: Examples here are *Acacia tortilis* and *Croton dichogamus* or 'Kereru' in Kikuyu. These are mostly found in dry localities.

iv) Mixed Acacia Bushland: The dry parts of central and northern Kenya have a mixed Acacia Bushland vegetation. Examples here are — *Acacia millifera* and *Acacia Senegal*. The vegetation of Northern approaches / 01 Pajeta area of Laikipia district fall in this category.

F. Semi-desert vegetation: This is found in the northern parts of the country. It is of woody variety mostly of bushes or dwarf shrubs widely spaced over the ground and remaining bare except for an occasional sparse growth when rain permits. Examples are *Acacia reficiens* sometimes growing to become flat-topped trees of 9 m. The usual height is 3 m. The vegetation of Doldol is of this type.

G. Grassland and Swamp: Montane grassland, for example the Kenya highland type is the major kind of grassland. Among the grasses of the main kinds are *Themeda triandra*, Steer grass (*Permisetum purperum*). River and mangrove swamps of inter-tidal forest are of this category too. Ewaso Narok swamp has got vegetation of this category.

2.8.2 FORESTING DEVELOPMENT AND POLICY IN KENYA

Forestry development in the country dates back to 1891 when the first forestry legislation was passed by the colonial government. It dealt with the protection of the mangrove

swamps in Vanga Bay and it was extended to protect mangroves throughout the Coast in 1890. More legislation and a reservation followed in 1897 with the Ukamba Woods and Forests Regulations which were published and subsequently amended in 1900 and 1901. The Forest Department was first established in 1902. In 1922, the Tree Planting Association of Kenya which later became "Men of Trees" was formed. Promotion of forests was the aim of the organisation. Its task was made easier by the introduction of exotic soft woods to the highlands in 1926. Two considerations were among the factors which facilitated this development. First, the bulk of the indigenous species were found to be widely scattered and this made their maintenance and exploitation cumbersome. Secondly, indigenous woods were slow-growers some requiring as many years as a century to become mature. This was in contrast to most exotic wood which takes 10-20 years to be fully grown. So then exotic trees were introduced.

The inter-war period did not witness great developments but since 1946 there was extensive afforestation. By 1963, 19971 kmsq was registered under forests. Four years later in 1967, the figure was increased to 29,542.2 km sq.

Kenya's first and comprehensive forest policy was contained in the Sessional Paper No. 1 of 1968. Ever since, there has been considerable expansion in forestry. For example in 1969 the World Bank gave Kenya a six-year loan of 2.6 million dollars for the establishing of 1245.97 Ha of saw-wood plantation and 622.93 Ha of pulp-wood plantation between 1970 and 1975. This led to the opening up of paper-mill at Webuye in 1973. The late president Kenyatta also launched the Rural Afforestation Scheme in 1971. The Forest Department maintains the country's forests and also makes available seedlings at subsidised rates to the rural people; although with the current increase of our population and increased demand of forest products, the department has not been able to move with the times and there is a big short-fall of supply.

Forestry in Kenya today is faced with a number of problems. On a wide level, these may be termed human and ecological. Conversion of forested lands to other uses is characteristic of the human problems to forestry. Charcoal production consumes a huge

quantity of trees. More trees are cut than are planted. These problems are a grave danger to Kenya's trees.

Kenya has taken various steps to avoid a looming crisis. In the first place, efforts were made to gazette more land for trees. The Forestry Department was also strengthened to manage these forests. Higher institutions of learning were also set up to train personnel on the required skills and knowledge about their work. There is also the branch of research and silviculture of the Forest Department which deals with establishment, development, reproduction and care of forest trees. KEFRI was set up as an independent research body to carry out research on forests. The government also, through Agricultural shows and tree planting days disseminates knowledge of trees to many Kenyans.

Despite all these efforts, many Kenyans have been ignorant and are instead grabbing forest land, doing illegal logging of trees for commercial timber and charcoal production. This portrays that there is a missing link and calls for an immediate attention to rectify the tragedy before it goes out of hand. The Case for Nairobi for example; by 1973, there were three major forests: Ngong (1310 Ha), Karura (1030 Ha) and Nairobi Arboretum Forest (30 Ha). The future of these forests raises the eyebrows of many Kenyans today.

2.9 SOURCES OF WOOD FOR CHARCOAL

Charcoal is more often found in dry open Savannah type of woodlands than in dense humid forest. The wood found in the dry savannahs is usually hard and dense and has a low moisture content. As a result, it tends to give a high yield of good quality charcoal. The open nature of the Savannah terrain simplifies the task of collecting the wood and transporting the charcoal. The climate is also favourable to charcoal making most part of the year. Moreover the trees used for charcoal making in these open Savannah woodlands are usually unsuitable for timber which means that there is little economic competition over their use.

In the moist forest areas, the more humid conditions and the long rainy season make charcoal-manufacture much more difficult. Although the quality of standing wood is

generally greater than in the Savannah, it tends to be of lower density and with much higher natural moisture content which makes it less suitable for charcoal.

A study done by Foley(1986), revealed that majority of charcoal makers obtain their woodland supplies from common or public lands or from the natural forest reserved to which they are able to gain access. He also reports that in Kenya charcoal making is carried out almost everywhere trees are found.

He also reports that many charcoal makers in Ghana have established themselves besides sawmills where they use waste-cuttings from the saw mills for charcoal and the saw dust for covering the kiln. In Puerto Rico, coffee workers make charcoal from coffee trees. In Guatemala and Lebanon, charcoal makers purchase trees from land owners. In some other countries, charcoal making is also carried out by the forest service.

The tree species used for charcoal vary but those which are hard and slow-growing are preferred because they have a high density. Acacia species are widely used in the drier areas. Mangrove wood is favoured in areas where it is prevalent and the same case applies to coconut shells.

As these preferred species disappear, charcoal makers are forced to cut any tree that is available. Sometimes even they use small twigs and tree roots. This leads to production of poor quality charcoal. This indiscriminate use of whatever biomass is available deteriorates the environment*

2.10 FUTURE WOODFUEL CONSUMPTION

According to a survey done by FAO(197C>), future consumption of woodfuel will depend on:

- 1) Population increase and the rate of urbanization
- 2) Increase in wealth, particularly urban wealth and its distribution
- 3) The price of woodfuel vis-a-vis other fuels. Also for the subsistence sector the physical availability of wood will determine the quantities used.

The per capita consumption of woodfuel decreases with increasing wealth but there

appears to be a much slower switch in rural as opposed to urban area. The world forest inventory indicates that, for the world as a whole the merchantable annual increment may at present just balance the removals but unfortunately supply and demand do not match everywhere and so there are local shortages or the stock is being reduced. Demand is likely to nearly double by the turn of the century and even with the opening up of virgin forests, potential demand will be larger than annual increment; in consequence the forest capital will be reduced. Again more farm land will be required by an expanding population. This land will have to come from the forest reserve so the growing stock will be reduced still further.

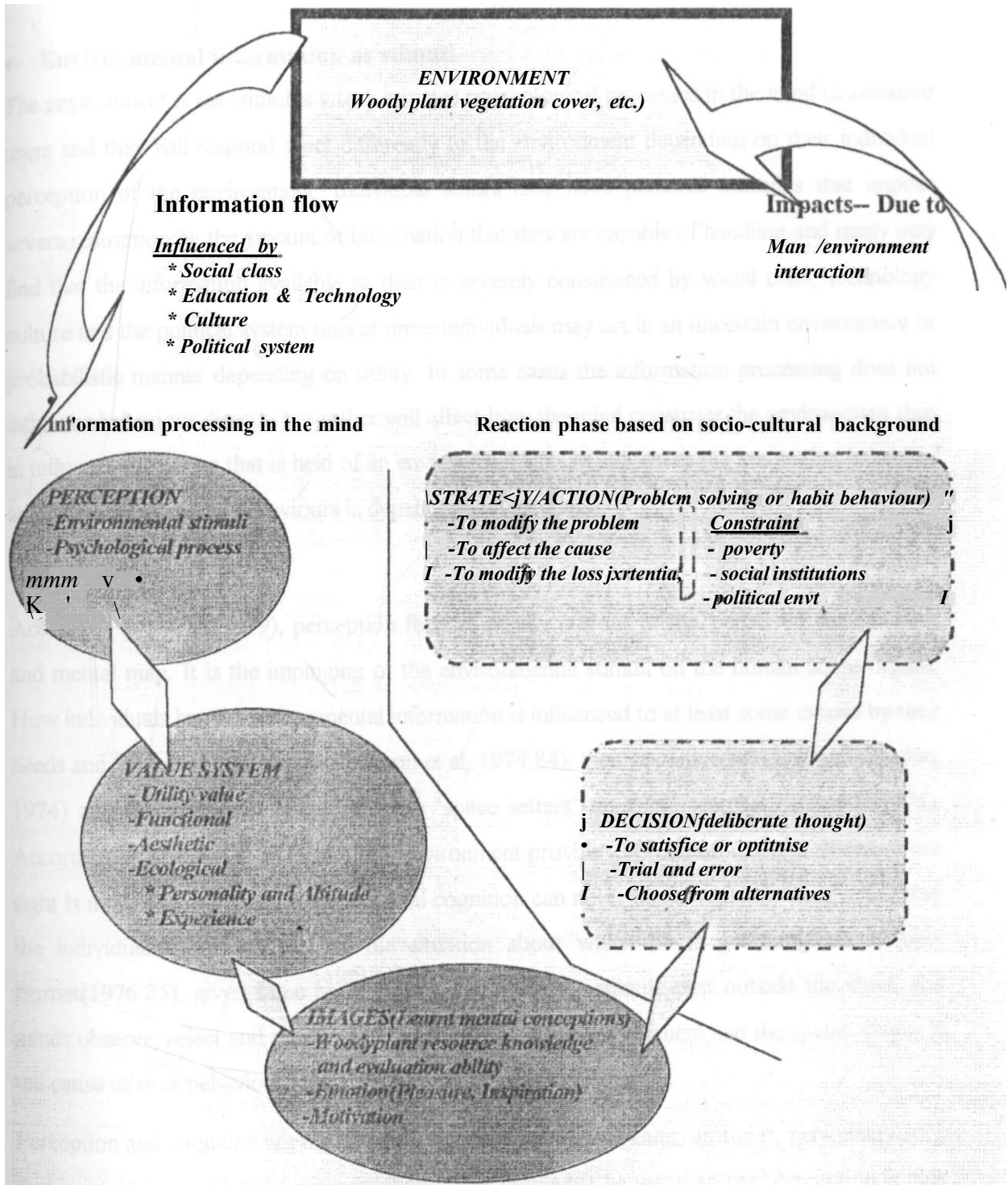
In order to preserve the forest capital, only the increment (in banking terms, the interest) should be removed. But in some areas, the capital is being liquidated and already the warning bells are sounding. There are many areas in developing countries where these shortages of woodfuel are occurring already. Dug, grass, and corn stalks are burned instead of being used as manure and compost; young trees are cut, thus halting succession and ensuring that forests will die on their feet. Priority therefore must be given to solving these shortages first.

2.11 THEORETICAL FRAMEWORK

Overview

Individual actors derive *information* about the environment, through *perception* and evaluates information in terms of a *value system* guided by **social cultural background** of the actors, to arrive at a *cognitive image* in respect of which, *decisions* are made on *overt behavioural strategies* affecting woody-plant vegetation cover.

Figure 2.1: CONCEPTUAL FRAMEWORK



LOCAL ACTORS' FIELD OF ACTION
 (The role of culture here is very strong)

Source: Researcher 1998

- **Environmental information as stimuli**

The environment is the stimulus which initiates psychological processes in the mind of resource users and they will respond react differently to the environment depending on their individual perception of the environment. Individual actors may have personal attitudes that impose severe restriction on the amount of information that they are capable of handling and many may find that the information available to their is severely constrained by social class, technology culture and the political system thus at times individuals may act in an uncertain environment or probabilistic manner depending on utility. In some cases the information processing does not influence behaviour directly but rather will affect how the mind construes the environment thus in influence the image that is held of an environment thus in influences the image that is held of an environment and all behaviours is dependent on an image

Actors perceptions

According to moore(1979), perception focuses on the notions of the 'perceived environment' and mental map. It is the impinging of the environmental stimuli on the human sense organs. How individuals handle environmental information is influenced to at least some extend by their needs and degree of need arousal(Ittelson et al, 1974:84), their cognitive set (Leff and Gordon, 1974) and the extend to which they are 'space setters' or space searchers (Gould, 1975). According to Ittelsson et al(1974:105), environment provide information through all senses but sight is more dominant and environmental cognition can never bee completely passive because the individual is always part of the situation about which he is gathering information. Burnet(1976:25), gives some beliefs about the mind that stimuli exist outside the mind; and minds observe, select and structure information about the environment and the spatial choice is the cause of over behaviour

Perception and cognition are mediated by **experience**, beliefs, values, attitudes, **personality** such that in interacting with his environment man sees only what he wants to see. Perception is thus a purposive acts and the mind is very for **from** being an empty container ready for facts (For example is seen when one meets a stranger unless you have some value attached to the stranger will always appear strange every time you meet just like the negative of a photograph its only

until you develop the negative to positive that a true photograph will be seen.) The end product of the act of perception is a variety of labels-: mental map, cognitive representation, schemata.

Value system

According to matter(1966), the values associated with woody plant can be broadly rationalised into five classes:—i.e.

1. *Utility value*: This is assessed using the economist concept of opportunity cost in terms of what is traded off in order to obtain a particular quality of vegetation.
2. *Functional value*: e.g. protection of forage, water catchment, soil erosion etc.
3. *Aesthetic value*: For attractive scenery.
4. *Recreational value*: Encompassing both functional and aesthetic or amenity value.
5. *Ecological value*: Habitat preservation, ecological **diversity** and **ecosystem** conservation in general. In some African traditional societies, attitudes towards mountains and hills ranged from indifference to dislike because of **possible** danger, **inconvenience** and superstition. The classical ideas of order and reason have the concept that, our vegetation is altogether tamed, trimmed and humanised as to give the impression of a vast ornamental form, as if the whole had been designed for **visual** pleasure (Cloke, 1985). The **Utopian** socialist, the **philosophy** of new town development and the garden **city** concept were based on this belief.

- **Woody plant vegetation Images:**

Woody plant vegetation images can be thought of as learned and stable mental conceptions that summarize an individual's vegetation knowledge, evaluation and preferences. An image is both an individual's phenomenon and a cultural phenomenon to the extent of; similar individuals in similar milieu are likely to have similar images in their minds and hence to exhibit similar forms of behaviour. Tuan(1979), argues that images of woody plant are potentially infinite but that they tend to have a 'family likeness' that results from a common principle of organization. Shared images and shared experiences result from shared social situations, images of vegetation cover and of the environment changes overtime. To kik (1963), the environmental shape, consciousness and meaning added to it by the act of human perception

means that; all men have personal world's but that there also exists conscious views and as **Habnson**(1976), puts it, people living close together tend to have similar information fields.

- **Decision-making:**

This is translation of motives or images into overt action within the context of available information (Lee 1971). Without any motivation an individual may be described as inactive and make up simply of :- i) Services of functional characteristics such as mental and physical abilities and value systems; ii) A series of structural characteristics such as sex, age and occupation and; iii) A series of existence variables such as location and orientation (Haber, 1980).

True problem solving involves; confrontation with a problem which requires deliberate thought in a specified direction; whether it be thought in a specified direction; whether it be searching for trial and error and hence a choice from among a wide range of alternatives. An individual samples his environment perceptually and then tests the accuracy of his perception by trying out the environment through his actions (Ittelson et al 1974). Because sampling is never perfect, vegetation cover knowledge is never perfect. The world is not seen as fact filled, but rather as a place where man constructs and tests alternatives sumptuously as to how things work. One of the principal reasons why many local actors satisfies rather than optimise is that they operate under a number of constraints.

Wolpert(1964), showed that as a result of imperfect knowledge and a degree of aversion to uncertainty, farmers in Sweden achieved only two thirds of their potential output. This suggested that the farmers were satisficers who confronted with a problem sought to have a satisfactory rather than an optimal course of action. Wolpert in his study on decision to migrate suggested that, a full understanding of migration flows would demand consideration of the set of places of which an individual is acting (action space); the desirability and usefulness of each place to the individual (place utility); the motivation and the goals of the decision maker and the stage the decision-maker had reached in his lifestyle.

- **Behaviour(action by actors -i.e their strategies)**

It's assumed that, use of environmental information leads to decision relating to spatial behaviour ranging from problem solving to habitual behaviour activities.

The environment is the stimulus which initiates psychological processes in the mind of man and man will respond differently to adopt to the environment depending on his individual perception of the environment.

Moore(1979), postulates that individuals invent structures in order to enable them to cope with reality and there is a sequence from action-in space, to perception-of-space, to conceptions about space, as a function of increasing differentiation, distancing and re-integration between the organism and its environment. Different people have got different perceptions to new innovations so that we have the early adopters, late adopters and the laggards who succumb to new innovations on the management of woody plant(problem solving can take place in various forms), e.g. The actor may try to affect the cause of the problem (built dams to control floods, plant trees etc.); modify the loss potential by developing a warning system, may spread the losses resulting from the problem or even bear the losses (accept that life is made up of good and bad things).

'Gestaltists' argue that, perception proceeds according to innate abilities, which organise environmental stimuli into coherently structured forms or patterns (Ittelson et al, 1974). Thus each person has a behavioural environment which the environment as perceived. Man evolves slowly to adopt to the environment according to the way he conceives the environment. In this case, survival depends on four types of knowledge and four associated responses, i.e. i) Perception and representation; ii) What is likely to happen(prediction); iii) Whether it will be good or bad(evaluation); iv) What to do about it(action or strategy)(Kaplan, 1973; Pick, 1976; and Stea 1976)).

To make inferences about the mental processes that operate in the mind; it is good to work backwards from observable behaviour. Lewin(1936), thought of human behaviour as a stream of activity that resulted from the interaction of factors within the person (needs, values, feelings, predispositions) with external factors as perceived in a given behavioural setting. Once overt behaviour has taken place, individuals tend to restructure their decision processes in the light of the new and additional information, so as to confirm and

repeat a course of action or lay the foundations for alternative actions (Rushton, 1969b). The range of choices for any one form of behaviour will vary for different individuals; with wealthy, having greater choices than the poor; and the young more mobility than the elderly. Social institutions and policies may constraint individual choices by means of a whole services of entiy rules: (Moore et al, 1976; Fred, 1981).

2.12 ENVIRONMENTAL BELIEF MODEL

Stimulus, response and learning model

Input involving information about the landscapes is transformed into a decision which results in an output in the form of overt behaviour approaches to decision making

- 1) The behaviourist - decision making proposed by wright et al(1970), which involves a simple stimulus response (S-R) relationship in which a particular response can be attributed to a given antecedent conditions; the relationship between a stimulus and a response is viewed as arising from a learning process. With constant repetition, a suitable response is reinforced and learnt so that, whenever the particular stimulus is presented, the resultant behaviour is predictable, i.e. a stimuli must occur to trigger the appropriate environmental behaviour or strategy . This model overlooks the cultural and socioeconomic context of man and forms the basis of this study.

2.13 RATIONALE FOR AN ALTERNATIVE MODEL/OR FRAMEWORK

The gestalt theory argued the need to incorporate the individual mind in any consideration of human decision making. This theory postulates that, perception forms a crucial interviewing variable between stimuli and response and that individuals organise the objects they observe in the environment into patterns or "gestalten"(Koffka, 1935). Koffka also claimed behaviour was based on the environment as perceived rather than the environment as it is. Kirk(1963), argued that the decision-maker is embedded in a world of physical facts and a world of economic, cultural and social facts. Both worlds impinge on decision makers through perception which reflects motives. Preferences and traditions are drawn from an individuals social and cultural background, therefore the same resource may have quite different meanings to individuals from different cultures or at different stages in the history of a given culture.

These ideas form the basis of the notion that; man being a reasoning and purposive being, bases his decisions on the social and physical facts of the phenomenal environment only after they have penetrated a highly selective filter of values . Such conception emphasizes the point that behaviour(action) is guided not by environment (stimulus response) but by a distorted psychological representation of it. The environmental-belief model did not go further to explain what actually goes on in the mind when a decision on action is being made and also overlooks the surrounding circumstances of the actor.

CHAPTER THREE: THE STUDY AREA

3,1 Overview

Humans do not adapt to nature, but rather; human socio-cultural systems via individual agents incorporate or appropriate and selectively use the resources of the environment. A large number of our major purposive acts at best achieve only a portion of their intent. They also generate a great number of unintended consequences. This chapter provides the discussion on the background to the study area and the key issues as they relate to charcoal burning.

Laikipia is characterised by diverse ecological zones(zone 4 to 1)(see Map 3.2), resulting from interaction among different ecological factors such as climate, soils and topography(Hoesli, 1995). The wide range of environmental variations is mainly determined to a large extent by the rainfall which varies greatly. These variations of rainfall coupled with human destruction of vegetation cover are responsible for the diversity of vegetation cover of the place.

The area used to have three land use systems; i.e. European large scale ranches; Nomadic reserves in Mukogodo; and forest area which was government property. The African population was only tolerated as long as they belonged to the workforce of a certain large scale ranch. Today this land use pattern has changed remarkably with the driving force of Africanization and transition to small-scale farming has begun. This land use system which did not occur in Laikipia before, does not augur well with the ecological requirements of the place. Due to the low returns gotten from these activities, small-holder farmers have resulted to find alternatives of earning their living through charcoal burning and trading.

Large-scale ranching still persists in the district (about 56.2 per cent of the district) but accommodates only 13-19 per cent of the local population (Strebel, 1987). The owners are both African and non-African owners but do not represent a key problem group in vegetation-charcoal conversion because of their high social status

The most problem group are the small scale farming community who either own land or squat in the settlement schemes in the western part of the district or occupy land bought through land buying companies or co-operatives and lies in the eastern part of the district. The practice is so

much prevalent in the area despite a government ban of the practice. The main tree species targeted for charcoal burning and hence facing extinction fall under the indigenous category and Acacia genus dominate this category e.g. *Acacia tortilis*, *Acacia xanthophloea*, *Acacia drepanolobium*, *Acacia seyal*, *Acacia mellifera*, *Acacia nubica*, *Acacia nilotica*. In extreme cases, people begin to use twigs, roots and even leaves for fuel.

3.2 Location and size

The study was carried out in Laikipia district which is one of the fourteen districts in the Rift Valley province. It covers an area of 9723 km² and lies east of the Rift Valley. It's bordered by Samburu district to the north, Isiolo district to the north east, Nyeri to the south, Nyandarua to the south west and Baringo and Nakuru district to the east. The district lies between longitude 36°14' and 37°27' south and 0°45' north. The district comprises five divisions namely: Rumuruti, Ng'arua, Mukogodo, Ramuria and Central. Rumuruti is the largest covering 36 per cent of the total area of the district and Central is the second largest covering 23 per cent of the district. Table 3.1 indicates the area covered by each division in square kilometers and the percentage of the district occupied by the division. Map 3.1a shows the location of the District in the National Setting and Map 3.1b shows all the divisions of the district.

Table 3.1: Area of the district by division

Division	Area in sq. km	% of the district occupied
Rumuruti	3498	36
Ng'arua	1070	11
Mukogodo	1166	12
Ramuria	1731	18
Central	2258	23
Total	9723	100

Source: DDP- Laikipia

DISTRICT LOCATION IN THE NATIONAL SETTING



Scale 1: 8,000,000



200

0

Map 3.1b

Laikipia District, Kenya

Administrative Units



location Area (lb)

J North	fj/hururu	16594
	JewaWi	5566
	Mama	4706
	Mum	16696
I North	a Moron	122666
	Kmanba	14761
	Sprh	19211
	Giotamba	3363
	MihoUtu	16594
Central	Daga	119551
	Nanyvk!	9097
	Nturuhma	946
	Segera	69576
	Marwa	4590
	Sown	134543
	Humuruti	17665
	Marmmell	7617
	Mithenger	92175
	Ngobl	25664
South	Spina.	30934
	Amuria	37093
	Dgithl	11612
	IDt&t	11446
	I Owe*	13656
	labor Sgt	10363
	I Mono*	12634
	Mskunan	12634
	AAikogod	4630
	Mumonyd	4659
Stehj	20565	
IJblei	5790	

— Distinct boundary
 - - - Loc'tioM] bound ny
 Sub - Loc ational bow nday

Source: GIS Laboratory
 Laikipia Research Programme Database 1998
 Kyengo I.N., 1998.

3.3 Topography and geology

The district is a primarily volcanic plateau between Mt. Kenya and the Aberdare ranges and both of these do not form part of the district. The average altitude is 1700 m a.s.l. with the main town, Nanyuki, housing the district headquarters, lying at 2000 m. The maximum height of 2600 m is found around Marmanet Forest. Due to its leeward position, this area is comparatively dry and low except for the mountain slopes and forest zones.

The level plateau of the district is drained by the tributaries of Ewaso Nyiro River which have their catchments in the slopes of the Aberdares and Mt. Kenya. The drainage of the entire district is dominated by the Ewaso Nyiro River and its tributaries which flow South to North.

There are two major swamps in the district which are virtually underdeveloped. One is along Moyot Valley in 01 Pajeta Ranch locally known as Marura Swamp. The other is around Rumuruti Town locally called Ewaso Narok swamp. The swamps have some agricultural potentiality if reclamation can be done. Already there is some encroachment by farmers in the Ewaso Narok swamp and there is fear of death when rains are heavy like El Nino.

The south western part of the district has the highest potential for forestry and mixed farming due to its high altitude especially around Marmamet area. This is also the most densely settled area. The eastern part is suitable for grazing while the level plateau between Rift Valley and Mt. Kenya massifs is the ranching region. These kinds of human activities are determined by topography. The rivers also determine human settlement as they are sources of water, both for human and livestock consumption and possible irrigation activities. The flat nature of some areas renders roads impassable during the rainy seasons, hence farmers cannot transport their milk to market on time.

³⁴ Climate

Around 70 per cent of the district is semi-arid or arid (see Agro-ecological map). Laikipia **K one** of the 22 districts lying within Kenya's assigned arid and semi-arid lands (ASAL)

which lie in agro-ecological zone 4 to 7. The area is mainly hot and dry with highly variable rainfall and evaporation rates which are twice the annual rainfall.

The climate of the district can be described as a tropical highland with rainfall ranging between 400 and 750 mm p a. Higher rainfall can be observed on the slopes of Mt. Kenya and Aberdare range. However, the annual rainfall varies from one part of the district to the other. North Marmanet has over 900 mm of rainfall but the drier parts of Mukogodo and Rumuruti Divisions have slightly over 400 mm p.a. The level plateau where most of the ranches are situated has about 500 mm p.a. while Marmanet and Mukogodo forests have an average rainfall of about 706 mm p a.

The seasonal distribution of rainfall in the district is as a result of the influences of north east and south trade winds, the ITZ and the Westerly winds in the middle troposphere in July and August. Thus the long rains occur from March to May and the short rains in October and November. The high mountain areas of Aberdare range and Mt. Kenya form an exception to this pattern, as these areas receive rainfall in other periods because of the influence of the Trade winds.

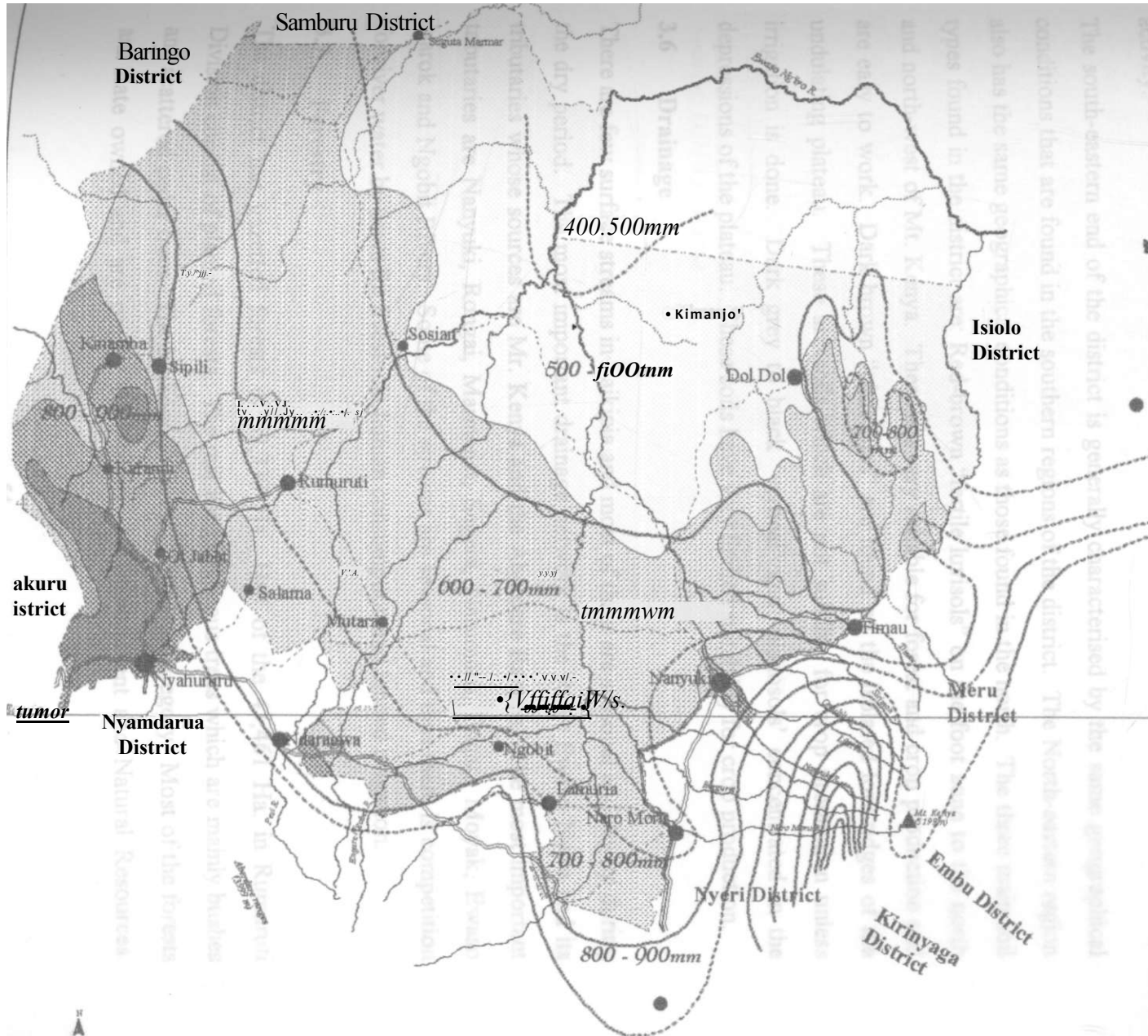
The distribution of rainfall determines the kind of economic activity in the district. On the slopes of Mt. Kenya and Aberdare ranges where rainfall is about 900 mm, there is crop production and forestry. The South-eastern part and the level plateau where rainfall is between 700 mm and 400 mm is more suitable for ranching with less cropping activities. The rainfall level drops as one moves further to the east. This area is where beef ranching and sheep ranching is practiced. The Northern part of the district is dry and has the lowest rainfall. Due to low productivity of the low rainfall areas, the local actors exploit the available natural resources (trees) in order to survive on fuelwood making and selling.

The mean annual temperatures of the district range between 37°C and 20°C. The average hours of sunshine are between six and eight hours daily. The variations in temperatures also tend to dictate the economic activities practiced in the district.

Map 3.2

Laikipia District, Kenya

Mean Annual Precipitation & Generalised Agro - Ecological Zones



Agro Ecological Zones

- S||||S| Zone n (Wheat/Maize - Pyrethram Zone)
- BstffflfS
- Zone m (Wheat/{Maize}-Barley Zone)
- Zone IV (Cattle - Sheep - Barley Zone)
- Zone V (Lower Highland Ranching Zone)
- Zone VI (Upper Midand Ranching Zone)

Mean Annual Precipitation

*** Isobars of rainfall (mm)
broken lines are other
unseen or transitional

- River
- Dirt road
- = Road (flame)
- Road (All Weather)
- i- Railway
- City

Sw w Jaaeald It. (1913) Agro-ecobgtcal Zones
Btrgr P. (1969) holmes
OIS Laboratory
Laikipia Research Programme Database 199S

0 5 10 15 Km

3.5 Soils

Two thirds of the district comprises of moderate soils. The southern part is composed of the less agriculturally productive low lying plateau covered generally with clay soils. It is this expanse of land area where most ranches are found.

The Northern region of the district is generally dry with poor sandy soils although pockets of clay soils are found in some areas. In this area, livestock farming is the most dominant activity.

The south-eastern end of the district is generally characterised by the same geographical conditions that are found in the southern regions of the district. The North-eastern region also has the same geographical conditions as those found in the north. The three main soil types found in the district are: Red-brown "fertile luvisols" on the foot zone to the north and north-west of Mt. Kenya. These are very suitable for forest and crop production and are easy to work. Dark brown "phaezoms" are found on the isolated low ridges of the undulating plateau. These are soils which are not suitable for crop production unless irrigation is done. Dark grey to black 'vertical' and 'planosols' concentrated in the depressions of the plateau. These soils have very limited suitability for crop production.

3.6 Drainage

There are few surface streams in Laikipia and most of them are seasonal and dry up during the dry period. The most important drainage network is the River Ewaso Nyiro and its tributaries whose sources are Mt. Kenya and the Aberdare Ranges. The most important tributaries are Nanyuki, Rongai, Marmanet, Segera, Narumoru, Engare Moyak, Ewaso Narok and Ngobit Rivers. Some of the streams are seasonal and thus there is competition for river water by users for livestock, human consumption and limited irrigation.

3.7 Forestry

The district has gazetted forests of 52,333 Ha.. Half of the 43,461 Ha. in Rumuruti **Division** consist of planted forests. The rest are indigenous trees which are mainly bushes scattered cedar trees. The Mukogodo forest falls in this category. Most of the forests are state owned and are run by the Ministry of Environment and Natural Resources.

Among the most important products are logs sawn for timber and charcoal produced many parts of the district. Forests also provide an important habitat for wildlife and also used for soil conservation, presentation of water catchment areas and for medicinal value

Table 3.2: Gazetted Forests in the District

NHHC of forest	Area in Ha
Rumuruti	6367
Mukogodo	20872
Ol Arabel	7724
North Marmanet	6178
WMM	WMM
Marmanet	5151
Ewaso Narok	2053
n a k	3988
Total	52,333

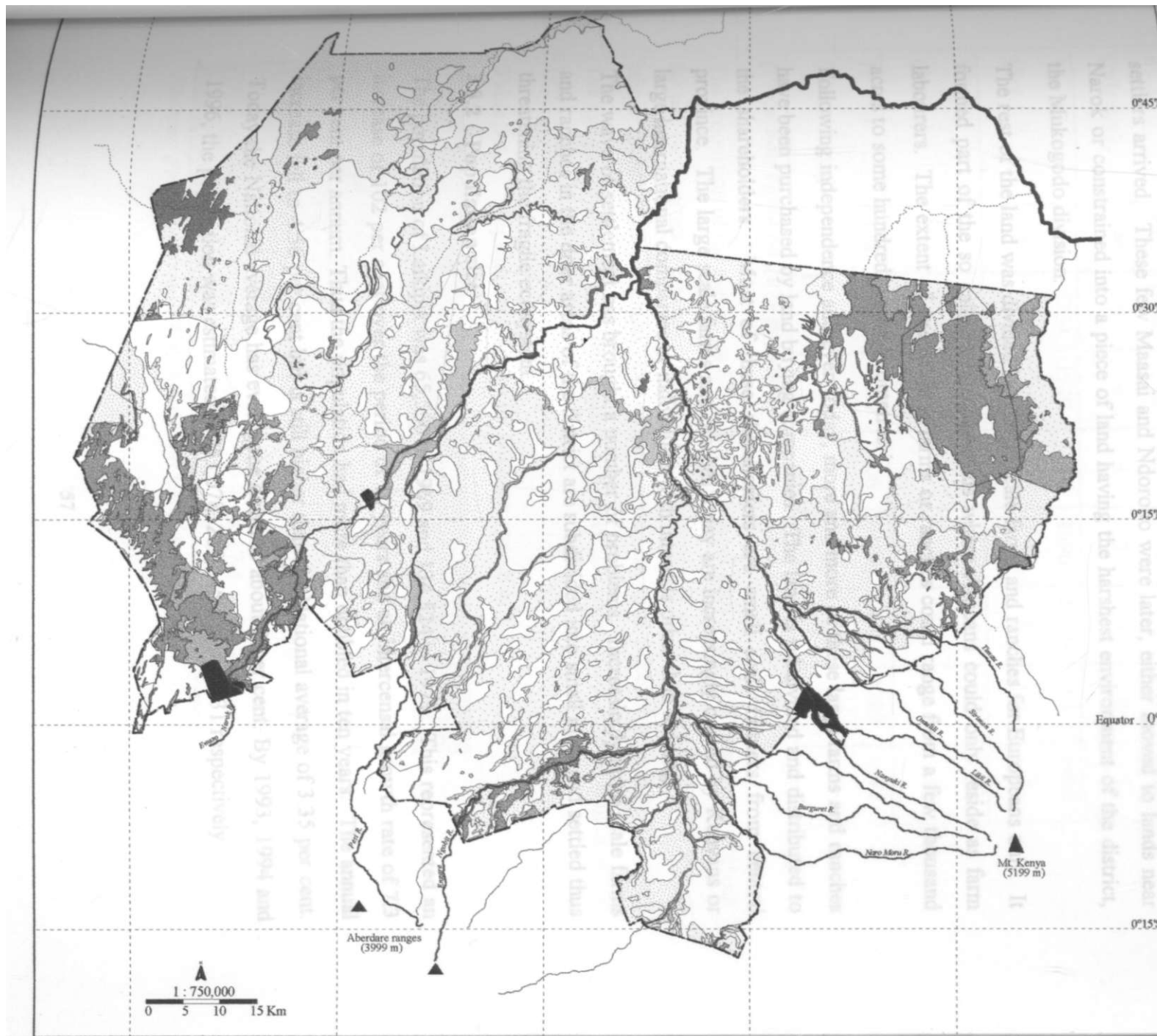
Source: DDP- Laikipia

Map
Laikipia District, Kenya
VEGETATION
COMMUNITIES
1990

Legend

PHYSIOGNOMIC TYPE	FLORISTIC COMPOSITION
1 Urban	Human shelters
Small Scale Cropland Complex	Agriculture
Upland Riverine Forest	Juniperus procera Podocarpus Olea europea Acacia xanthophloea Pinus radiata
Plantation Forest	Cupressus species Juniperus procera Euclea divortorum
Degenerate Dry Upland Forest	Tarchonanthus Rhus natalensis Carissa odulifera Rhus natalensis
Leafy Bushland	Euclea divinorum Acacia drepanolobium Themeda tandra
Leafy Bushland and Thicket	Acacia seyal Themeda tandra
Acacia drerp. bushland	Acacia drepanolobium Pennisetum mezianum Themeda tandra Pennisetum me/ianum
Acacia seyal Bushland	Acacia Brevispica
Dwarf Bush Grassland	Acacia nilotica Acacia mcDifera
Open Acacia brevispica thicket	Croton dichogamus Combretum molle
And Zone Acacia Bushland	Cyperus papyrus Cyperus im mensus
Mpala Scarp late Vegetation	
Swamp	

Sources: Laikipia Research Programme Database. 1998
 Tim S. W. 1990, own field investigations.
 Spot Satellite Imagery 1987/88. aerial photographs.
 Survey of Kenya topographical maps 1:50,000.



3.8 Demographic and settlement patterns

3.8.1 General Overview

By the start of the century, Laikipia was largely inhabited by Maasai pastoralists and hunter gatherer groups(Ndorobo). Due to wars with other Maasai clans and livestock diseases, few people and livestock were living on the Laikipia plateau when the European settlers arrived. These few Maasai and Ndorobo were later, either moved to lands near Narok or constrained into a piece of land having the harshest environment of the district, the Mukogodo division.

The rest of the land was divided into large scale farms and ranches for Europeans only. It formed part of the so called white highlands where Africans could only reside as farm labourers. The extent of one of these farms or ranches could range from a few thousand acres to some hundred square kilometres.

Following independence and even today, more and more of these large farms and ranches have been purchased by land buying companies. The land is subdivided and distributed to the shareholders. Most of these shareholders are small scale farmers from central province. The large scale farms and ranches today are increasingly owned by Kenyans or large international companies or individuals with interests other than farming.

The wave of settlement has brought a number of problems. Increasingly large scale farms and ranches in the drier areas of the district are subdivided into small plots and settled thus threatening the fragile ecosystem.

3.8.2 Population size

The population of Laikipia was 65,506 in 1969 and 134,524 in 1979. This represented an increase of 102 per cent over the period of 10 years and an intercensal growth rate of 7.3 per cent per annum. Thus the population had more than doubled in ten years. The annual increase fell to 4.56 per cent but is still higher than the National average of 3.35 per cent. Today the National average has even gone down to about 2 per cent. By 1993, 1994 and 1996, the population was estimated at 253,678, 265,245 and 286,531 respectively.

Table 3.3 **Population** projections 011 selected age groups

Age group	1979		1993		1994		1996	
	M	F	M	F	M	F	M	F
6-13 (primary)	211 90	1989 9	3342 9	3435 8	3495 3	3592 5	3814 0	3920 1
14-17 (Sec.)	685 2	6704	1539 8	1132 2	1696 5	1283 8	1851 2	1400 8
15-49 (female)		2640 1		5351 4		5595 4		6105 7
15-59 (labour force)	328 73	2896 5	5924 8	5806 6	6194 9	6071 3	6769 8	6625 0

(Projection based on 1979 population census)

The proportion of the age group 6-13 (primary school age) to the total population is about 30 per cent across the years. The largest proportion is in the age group 15-59 that is labour force. This constitute over 45 per cent of the total population across the years. The age group 14—17 (secondary school age) have the lowest proportion averaging about 10.5 per cent

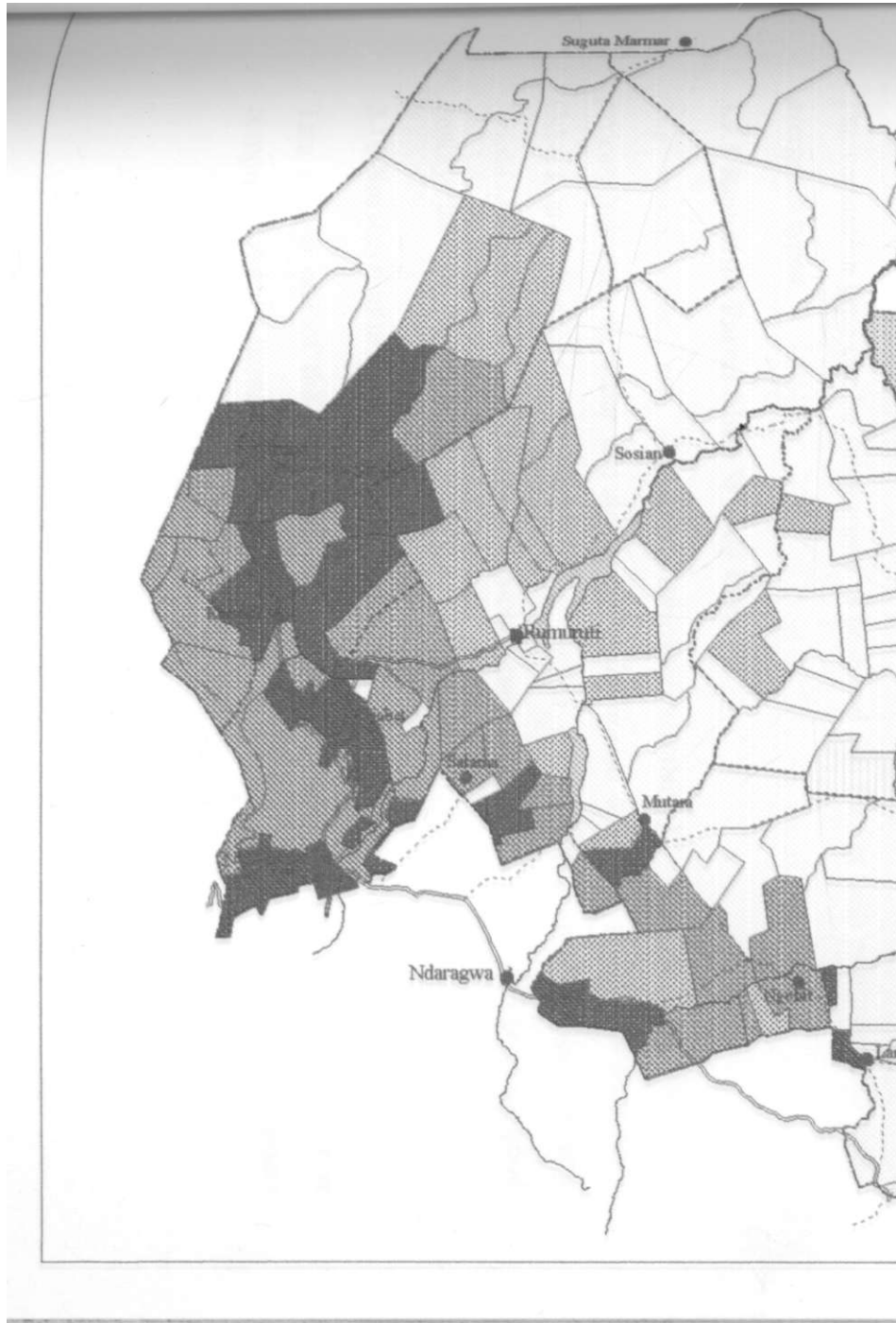
Table 3.4 **Population Density by Division (per Km²)**

Division	Area (km ²)	1979	1993	1994	1996
Rumuruti	3498	13.8	21.1	27.3	29.5
	1070	32.6	61.6	64.5	69.6
Antral and Lamuria	3989	10.0	19.1	19.9	21.5
	1166	9.9	17.4	18.2	19.7

A^J..

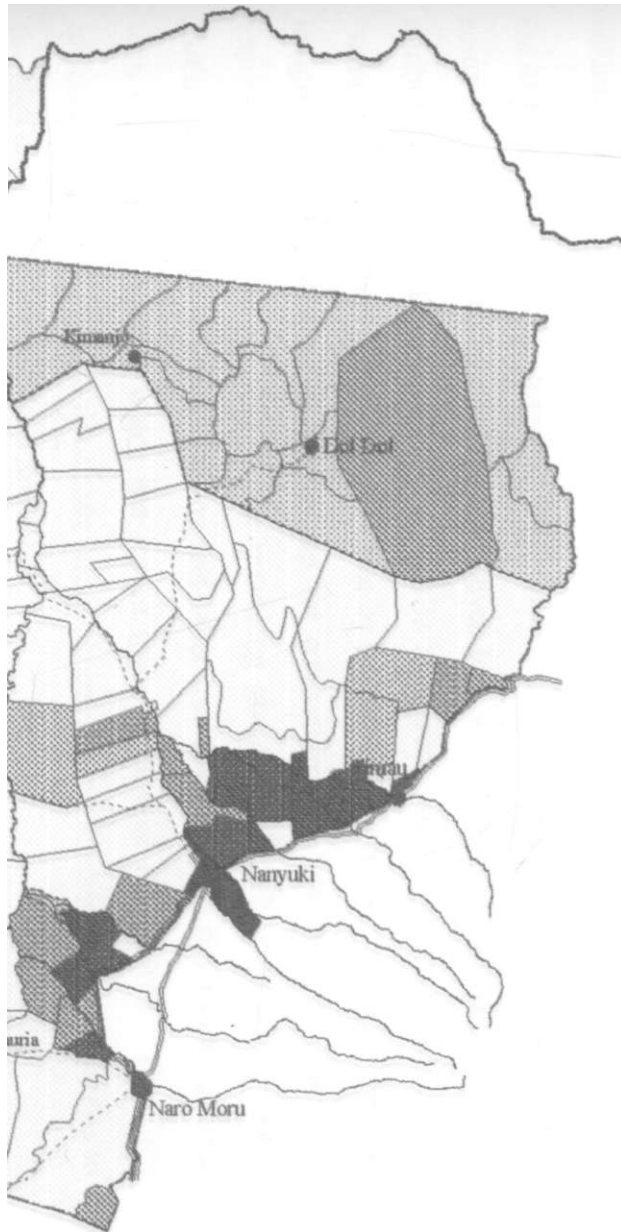
Source: Projected from 1979 Population Census

Ng'arua Division has the highest density. This is attributed to the higher agricultural potentiality of the area. Mukogodo Division has the lowest density due to its unfavourable climate conditions and the presence of large ranches. The few economic activities include pastoralism, sand harvesting, ranching and charcoal burning.



Map J.4

Laikipia District Kenya Land use and Settlement Patterns



Urban center

Small scale farm areas
(1963 - 1972)

Small scale farm areas
(1973-1982)

Small scale farm areas
(1983 -1992)

Small scale farm areas
(1993-1996)

Pastoralist area

I i Large scale ranching

H i l Forest areas

H H I Swamps

District boundary

Divisional boundary

Planning units boundary

— Railway line

= Tarmac road

All weather road

River

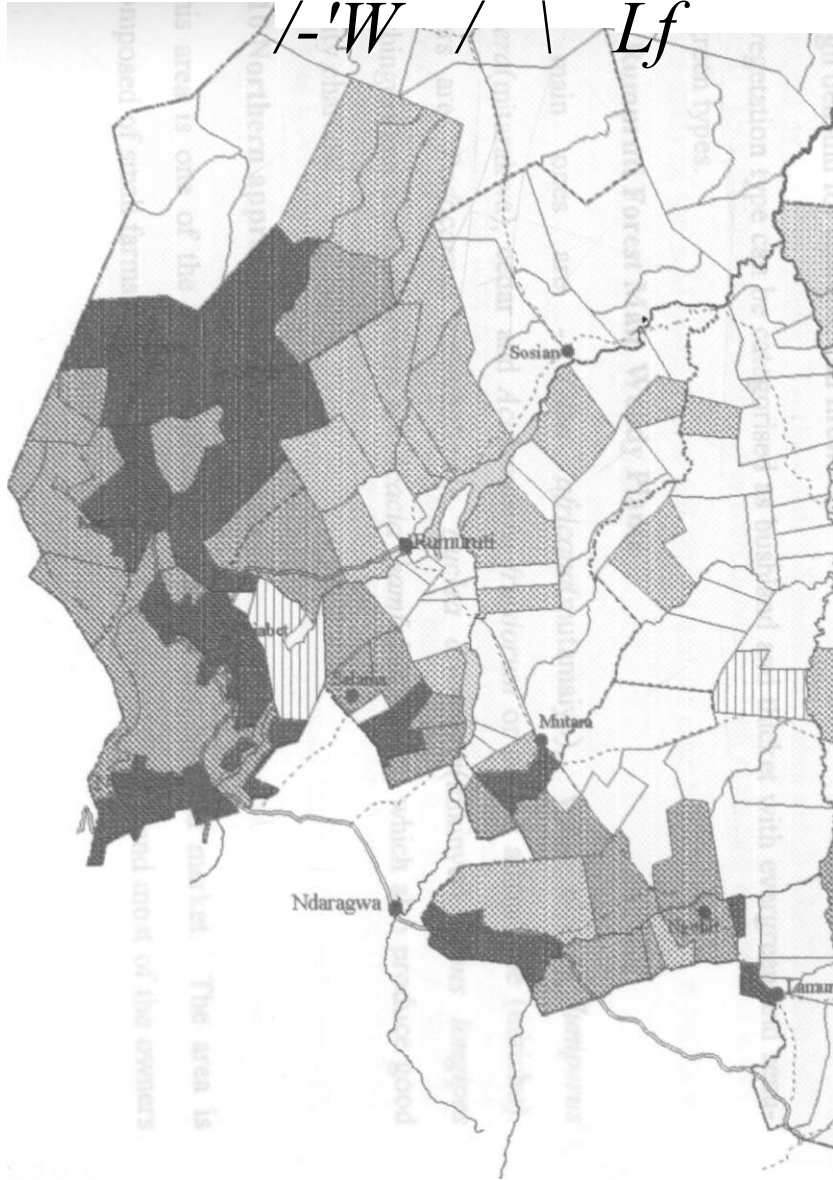
Rural Centres

Source: LRP Database, 1998
Hlesmarut V., 1996

Kyenge I.N., 1998

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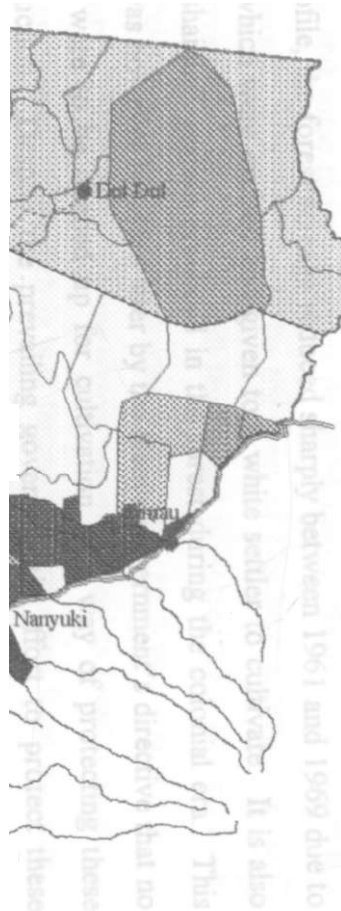


Map 1.5

STUDY AREAS

Laikipia District, Kenya

Landuse and Land Ownership 1996



Urban center

Small scale farm areas
(1963 - 1972)

Small scale farm areas
(1973 -1982)

Small scale farm areas
(1983-1992)

Small scale farm areas
(1993 -1996)

Pastoralist area

I 1 Large scale ranching

Forest areas

Swamps

Study Areas

- Divisional boundary

- District boundary

- Planning units boundary

- Railway line

= Tarmac road

All weather road

- River

Major Centres

Source: LRP Database. 1998

Mesmann V.. 1996

Kyengo I.N., 1998

3.9 Rumuruti Forest — Study area

This forest is found in south-western part of Rumuruti division forest, though with a small section under planted forest¹ eucalyptus and cedar. The indigenous forest contains species podocarpus (along water course), Mbarakira, Mileleshwas, dodone volume of trees in Rumuruti is not known.

On its historical profile, the forest acreage reduced sharply by some 600.1 acres which were excised and given to a white man attributed to the "shamba" system practiced in the forest. The "shamba" system was however reversed later by the Kenya government. Indigenous forests were to be opened up for cultivation and protected from destruction. Despite the prevailing government policy on forests, there is illegal charcoal burning and other tree destruction with illegal honey hunting which has led to many occasions where the *Olea africana* species has reduced drastically and is almost getting to the high demand for charcoal and firewood.

The vegetation type can be categorised as bushland and thicket evergreen types.

3.9.1 Rumuruti Forest Main Woody Plants

The main ones are - *Olea africana* (mutamaiyo), *Procera* (mitarakwa), cedar and *Acakanthera friesiorum* or

have not developed or settled there. This high rate of absentee land ownership has given rise to exploitation of the trees for charcoal burning by non-owners.

The area borders Eland Ranch to the North-west where charcoal burning is done as one of the management practices of the ranch; as trees are cleared along the roads for better vision within the ranch. Many squatter communities who migrated under the guise of staying with their relative workers in the ranch are the main charcoal burners. These people are very poor and some moved from as far as Maralal in Samburu to come and look for means of earning a living there. To the west of Northern approach is ADC mutara which is a government land and is well fenced and protected from any intrusion. To the south is 01 Pejeta ranch which is a private large scale ranch with tourism as the main economic activity. This is where 'sweetwaters tentend camp' is located under the management of Lonhro group. The ranch is well fenced and protected from any human intrusion. Game hunting is practiced here. To the west is several small scale farms purchased almost the same period with those of Northern approach. These farms are N.Tetu, Hohwe, Naromoru and Endana and they border Kariunga-Mutirithia to their west. The farms in Kariunga-Mutirithia are more settled by small-scale farmers and the farms were bought as early as 1960s. To the north is Segera-Mukenya ranch which is also well protected. This area is unique in that it is surrounded by well managed and settled areas, and since many of the land owners have not settled and its near Nanyuki town, it forms a major source of charcoal for Nanyuki town.

3.10.1 Northern approaches main woody-plants:

The type of vegetation here are mixed Acacia Bushland in a grassland. The trees do not grow very tall and in areas where the trees have been cleared for either agriculture or charcoal burning, grass seems to have dominated the other vegetation since these indigenous trees take many years to regenerate. Examples of the wood plants here are; *Acacia seyal*, *Acacia nilotica*, *Acacia Senegal*, *Carisa edulis* and *Acacia thamfolea*.

CHAPTER FOUR: INFLUENCES OF CHARCOAL BURNING AND ITS SOCIO-ECONOMIC IMPACTS

4.1 Overview

This study aimed at assessing the factors which influence charcoal burning activities and its subsequent environmental impact in an ASAL area in Kenya. The objectives that guided this work are:-

- i) To identify the different types of actors in charcoal burning.
- ii) To assess the actors level of knowledge of the long term effects of charcoal burning on the environment.
- iii) To assess the factors which influence the local actors strategies as they engage in charcoal production.
- iv) To find out the environmental problems associated with charcoal burning.
- v) To recommend policies which would;
 - a) Enhance sustainable woodfuel supply and environmental protection.
 - b) Manage and reduce wood demand for wood charcoal conversion and increase end use efficiency.

In this chapter, the first three objectives will be addressed.

It was observed from the field that, originally charcoal making was done by male adults, but now even females and young children engage in this activity. This means therefore that many children drop out of school due to lack of fees and other associated problems to engage in this activity. Mothers are also exposed to hard labour which makes them abscond from other duties like domestic work, agriculture and rearing children. These people depend on charcoal burning for their livelihood and as a result, they have formed different opinions and attitudes which impose severe restrictions on the amount of information that they are capable of handling. Their economic context, social class, culture and political system affects the way they perceive the environment and hence its resource utilization which may not be sustainable.

Charcoal burning is therefore gaining popularity because the actors are only chasing short term economic benefits ignoring the long-term consequences. This is propagated by increased demand, high inflation rate, reduced food production and unemployment. Thus human physio-biological needs take precedence over other needs.

In order to illustrate and compare the charcoal burners' environmental perceptions, the test areas are presented simultaneously and their peculiar characteristics given in detail.

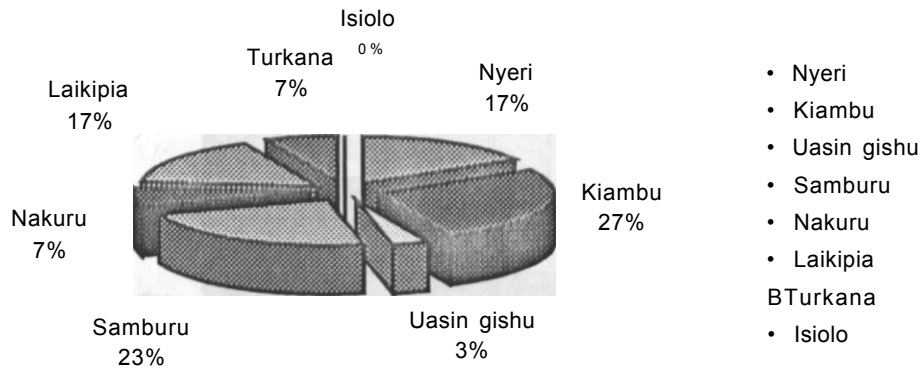
4.2 Historical perspective

In Rumuruti 7.1 per cent of the charcoal burners interviewed settled in Rumuruti before 1960. During 1960's, nobody settled during this period. Only 25 per cent settled during 1970's while 3.6 per cent settled in 1980's. The remaining 64.3 per cent settled after 1990. This means most farms are still undergoing sub-division for people to settle like Muhotetu and Limunga.

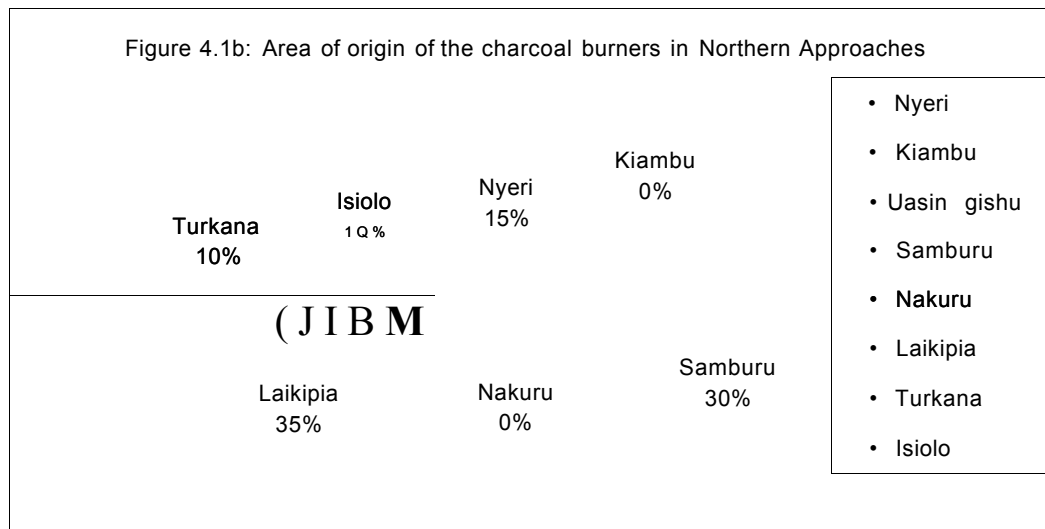
Limunga farm was first acquired by a group of the Munga clan and people from Limuru who bought shares and hence the name Limunga and this is where there were the earlier settlements and most of the people here practised agriculture as the land is more fertile. When the climate is harsh the farmers turn to charcoal burning in Rumuruti forest, which they border. At one time a big section of the forest area neighbouring Limunga was burned and set ablaze to conceal evidence of charcoal burning to senior government officials. This area has since not recovered from that inferno. The neighbouring farm Muhotetu was acquired by buying shares from the original owner (Mzungu) by two groups from Nyeri i.e. Muhoya and Tetu areas hence the name Muhotetu. Settlement period here is more recent and the area constitute the harsh part of this area where many of the charcoal burners live.

Most of the respondents places of origin were Malaral, Baragori and Nyeri. Others were from Burnt forest, Molo, Kiambu/Limuru, and Kerio valley and the neighbouring divisions of Laikipia district. The reasons given for migration ranged from tribal clashes, search for land(landlessness)(population pressure), marriage, search for employment and cattle rustling. According to the respondents in Rumuruti, 40 per cent of them did not have any crop in their land, 10 per cent had less than an acre of crop land, while 26.7 per cent had between 1-2 acres of crop land. This shows that crop farming is not practised allot in the area hence a possible cause of hunger in the area leading to alternative income sources/charcoal burning to buy food.

Figure 4.1a: Area of origin of charcoal burners in Rumuruti forest

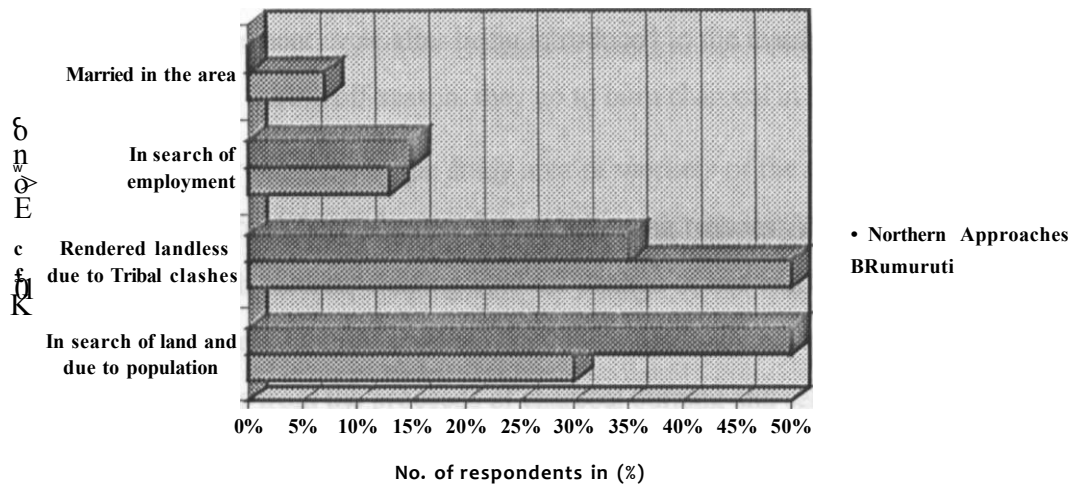


Source: Field survey, 1995



Source: Field survey, 1998

Figure 4.2: Reasons of migration to the study area



So

Source: Field Survey, 1998

Information gotten from the respondents revealed that about 66.7 per cent of them were not satisfied with their housing living conditions as majority of them were either temporary or semi-permanent. About 33.3 per cent of them were grass thatched and 43.3 per cent were mud-walled with 56.7 per cent being timber walled and all of them had an earth floor.

About 40 per cent of the respondents said that they don't like (not satisfied with) the areas living conditions because of its harsh characteristics. Some of the harsh conditions of the area include draught, hunger, landlessness, communication problem, cattle rustling/insecurity, diseases, and lack of employment opportunities.

In addressing some of these problems, the respondents said that they engage in charcoal burning in the forest. Other methods include borrowing, repairing of roads for a pay, storing of water, reporting of theft or raiders cases to police or administration (who are very slow), engaging in casual jobs and small-scale businesses of primary products, keeping watch at night done by the Household head and also pray to God.

In Northern approach about 60 per cent of the respondents came to the area after 1996. 30 per cent came between 1994 and 1995, where as only 10 per cent had gone there between 1990

and 1991. This corresponds also with the years of purchase. This is a newly settled area and most of the land owners are absentees. Those whose place of origin was Baragoi/Malaral were mainly hibernating in the neighbouring Eland Ranch where they burn charcoal during the Ranch's routine management cycle after being introduced to the manager by their relatives who work in the Ranch and during off-season, they go to burn charcoal in the northern approaches.

The others were either residents of the study area or workers of the absentee land owners and their relatives. These ones burn charcoal for the following reasons. As a coping strategy since the area has very harsh climate, clearing land for change of use and also some of the burners are just put as caretakers by their absentee employers who only pay them in kind by allowing them to pay themselves from the proceeds of charcoal burning and selling. The owner benefits in that, when he will plan to settle, he will find a clean land to start developing. This also scares away any wild animals which might cross over from the neighbouring 01 pajeta Ranch.

4.3.1 Household Characteristics of charcoal burners.

From the field findings, 73.3 per cent of those interviewed were males while 26.7 per cent were females. This is due to the cultural element that charcoal burning is a man's work but the trend and believes are changing so that a significant number of females have taken up charcoal burning as a coping strategy. Almost 95 per cent of those interviewed in the northern approaches were males while 5 per cent were females, still showing that the, charcoal burning was a man's job since he is the head of the household and he has responsibility to feed his people. The upcoming trend whereby females are getting involved in charcoal burning could be attributed to female headed households. This is clearly seen in Rumuruti where the percentage of female charcoal burners is slightly lower than half that of males and out of the interviewed charcoal burners, 3.3 per cent were divorced and 3.3 per cent widowed leading to female headed, households. The remaining 73.3 per cent were married and 20 per cent were single. In "Northern approaches" 50 per cent of those interviewed were married while the rest were single, where as the average number of people per household was three. In Rumuruti, the figure for the same was five showing a higher fertility rate.

4.3.2 Education level.

Out of the charcoal burners interviewed in Rumuruti, 26.7 per cent have had no formal education, 23.3 per cent were primary school drop outs, another 23.3 per cent finished primary school education, and 26.6 per cent had secondary school education (including drop outs). In Northern approaches, 30 per cent of the charcoal burners interviewed had no formal education, 45 per cent were school dropouts and a further 25 per cent had finished primary school.

Table 4.1 Education Level of the respondents.

<i>Rumuruti</i>	No schooling	Primary drop out	Primary	Secondary
Frequency	8	7	7	8
Percent	26.7	23.3	23.3	26.6
<i>N. approach</i>	No education	Started primary education didnt finish	Started primary education didnt finish	Started secondary education didnt finish
Frequency	6	9	5	-
Percent	30	45	25	0

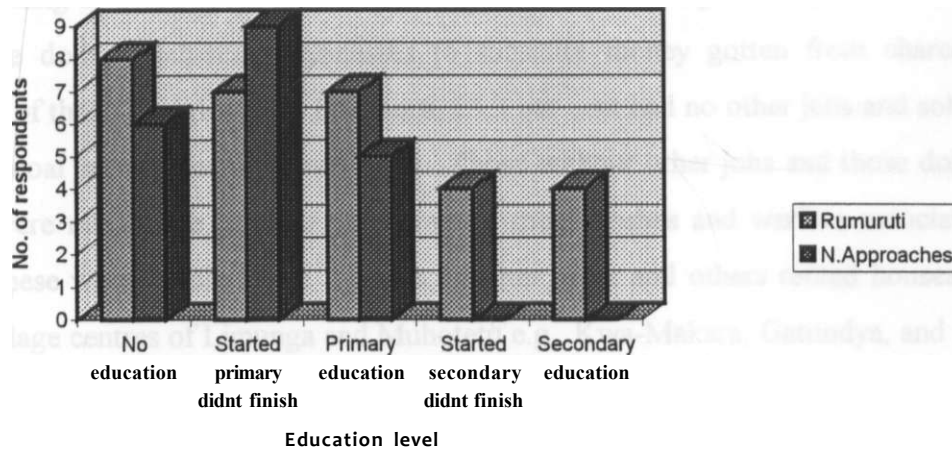
Source: Field survey 1998

The levels of education in the two areas is very low. Charcoal burning creates a trap whereby those who get involved in it, will never get out as explained by some of the respondents. Children born by parents who make charcoal get engaged in charcoal making thus discouraging them from going to school or drop out of school early to earn money. These earnings are so little and even the parents cannot afford to pay fees with it.

Due to the low literacy level, the victim's are so deprived of opportunities to explore alternative income sources thus depending on only charcoal burning(see *Plate 4.1*) and not perceiving this as a cause of environmental degradation since the exercise involves massive felling of trees. This is especially so in the two test areas whereby the actors do not have any ownership of the land so affected so the issue of ownership can also influence their perceptions. The fact that, a few of those who have attained secondary school education also get involved in charcoal burning, discourages young children from going to school and instead opt to stay at home. While at home due to limited income sources (the climate is so harsh), these children thus join their elderly brothers, friends and parents to burn charcoal to earn a living. It was noted that during some days, the children would help Parents in burning charcoal to earn money for the family while on other days, the children

would be let to burn their own charcoal for their own money. They would use this money for their personal spending e.g. buying clothes, shoes and also start drinking beer early.

Figure 4.3: Respondents level of education



Source: Reasearcher, 1998

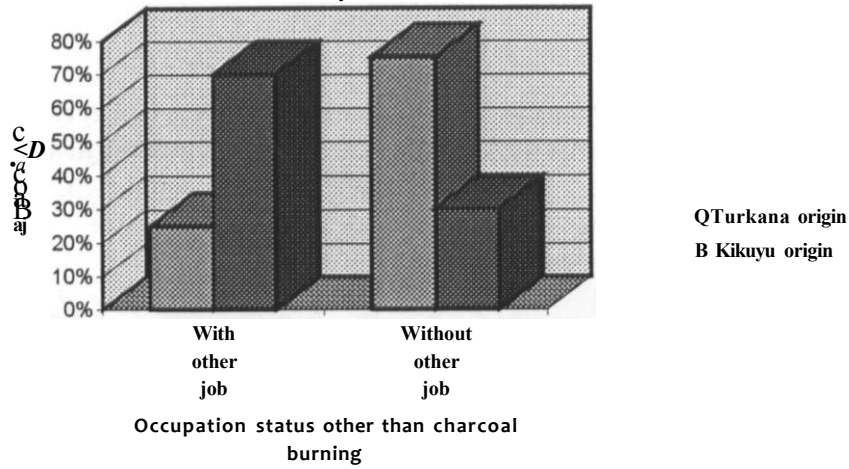
Plate 4.1: *A team of charcoal makers trailing inside Rumuruti forest in search of the preferred trees for charcoal burning. Note the drying up of some of the vegetation because of wild fires.*



4.3.3 Employment characteristics.

Charcoal burning is a coping strategy for most of the burners in Rumuruti forest. From the field findings, 76.7 per cent of the interviewed charcoal burners had other occupations apart from charcoal burning. Out of these with other occupations, 46.7 per cent were practicing farming as a source of income, 33.3 per cent were doing casual jobs while 10 per cent were doing small-scale businesses to subsidise money gotten from charcoal burning. Out of those interviewed in Rumuruti, 23.3 per cent had no other jobs and solely relied on charcoal burning for their livelihood. Those without other jobs and those doing casual jobs were mainly the landless or victims of tribal clashes and warfare associated problems. These were mainly found living in squatter areas and others rented houses in the nearby village centres of Limunga and Muhotetu e.g. Kwa-Makara, Gatundya, and the seven squatter villages where the tribal war victims lived; were identified, and the main residents were the Turkana who were chased away from their original land (mostly Baragois) by Pokots. These villages are:- Gatundya, Kambi ya Simba, Murichu, Ndagara, Crate, Murichu, Kambi ya Nyoka and Monyo. Some of the squatter areas were set aside by a local church (Nyahururu Catholic diocese) to help settle the landless war victims (see *Plates 4.2 and 4.3*). On this land, they are too congested and cannot practice any economic activity hence they resort to going to burn charcoal in the neighbouring Rumuruti forest. Some were reported to be the causes of insecurity in the area especially Gatundya village. It was established that the category of landless in the area constituted a unique class in the society culturally. This was so because, they were culturally, oriented to livestock rearing and not farming. As such they could not see the worth of getting casual jobs with their "native neighbours" who practice farming and that is why, when getting access to the forest got so difficult, they resorted to harassing their neighbours at night. This is a very threat group and a permanent solution must be sought immediately.

Figure 4.4: Occupational characteristics of the respondents



Source: Field survey, 1998

Plate 4.2: Two housing units belonging to two Families seen in the foreground in Murichu squatter village, neighbouring Rumuruti forest (a prominent charcoal burning area). There are six other similar villages in the same neighbourhood.

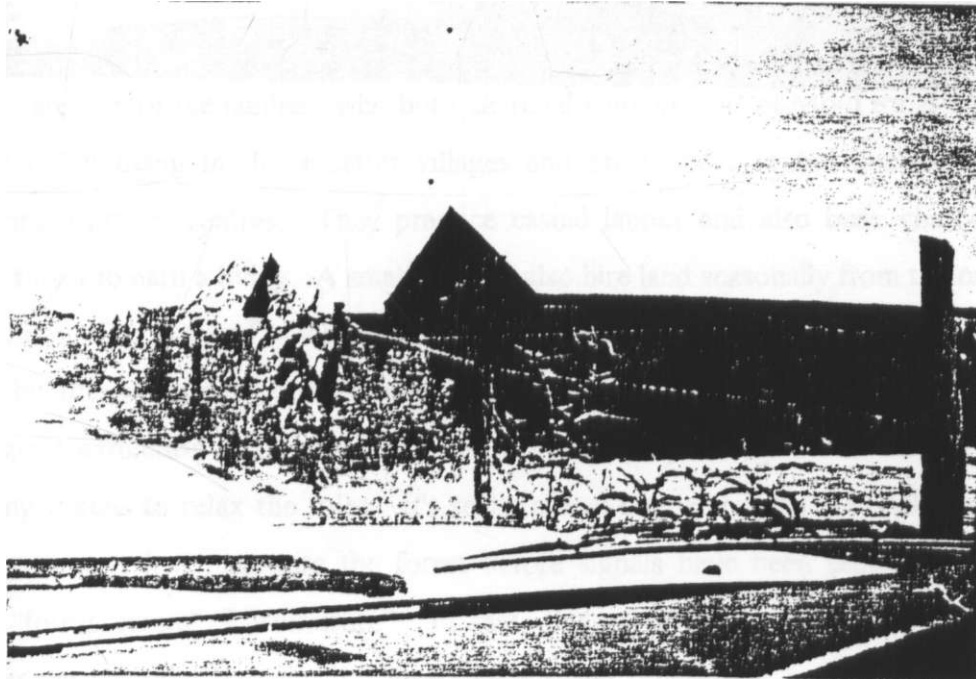
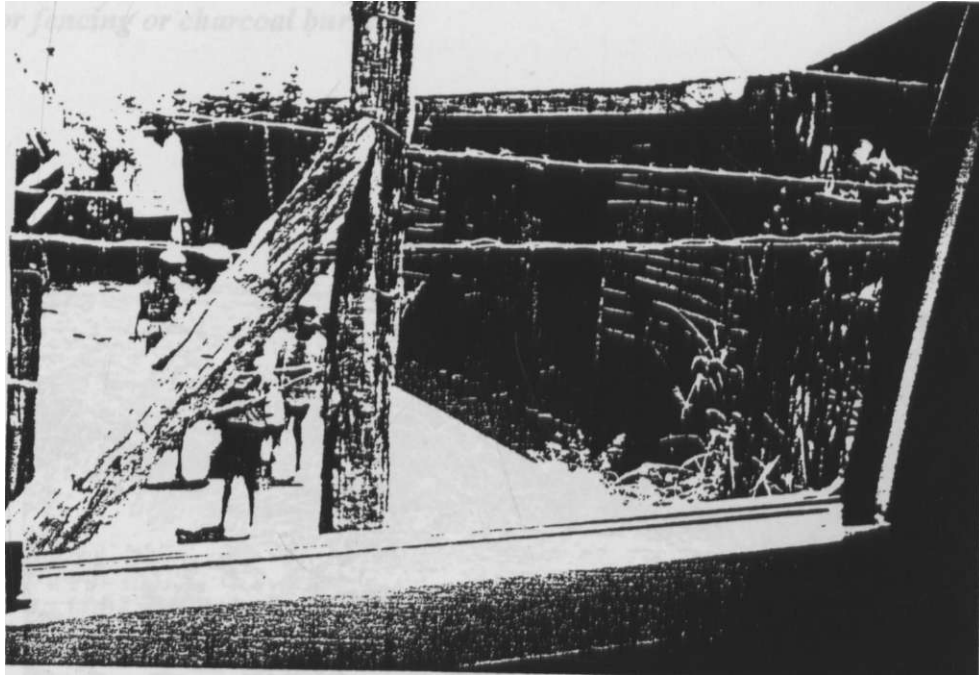


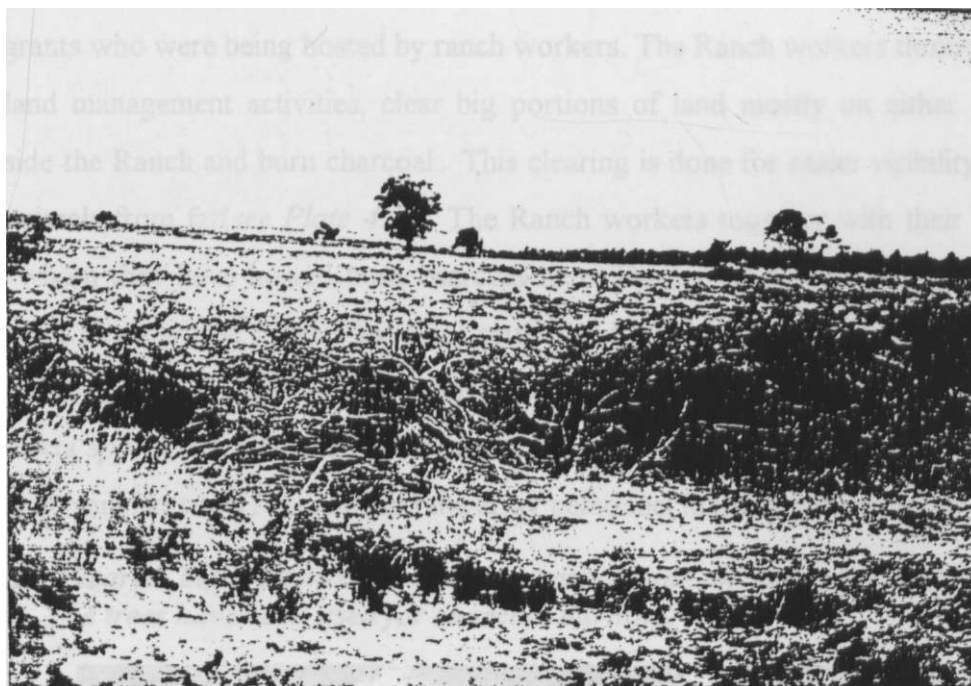
Plate 4.3: *Poverty has stalked the various land-squatters in Rumuruti. This man has no other land to win for his family a good living. Rumuruti Forest is his only saviour.*



The other category of the landless who burn charcoal were victims of Molo tribal clashes. Some are found living in the squatter villages and others have rented housing in the neighbouring squatter centres. They practice casual labour and also burn charcoal in Rumuruti forest to earn a living. A small number also hire land seasonally from the natives to do farming. The issue of landlessness and tribal animosity need to be addressed very seriously by the concerned authorities (the government), because Rumuruti, forest is facing a great extinction considering that the people employed to protect the forest are also getting tokens to relax the rules. It's really a well connected and well schemed job whereby you can't just penetrate the forest before signals have been sent to all those renamed "forest eaters of Rumuruti." In fact, this researcher had great problem in convincing the charcoal burners, the forest guards and others that he was pursuing an academic endeavor and not a C. I. D. sent by D. C. coincidentally immediately after this research work was completed, a whole district curfew was started to crackdown all charcoal burners

The other category of charcoal burners in Rumuruti study area were contract labourers who were burning charcoal as they cleared land for change of use(crop farming)(see *Plate 4.4 below*).

Plate 4.4: *Large-scale land clearing for change of use. The felled trees were either used for fencing or charcoal burning*



Some of those who said they had alternative income sources were honey harvesters who got honey from the forest trees. As they tried to reach the Honey, they would clear down very big trees to get honey from the trunk, only to leave the tree to die. If the tree is of a good species for charcoal making, then they would burn charcoal from it. A mostly treasured tree of charcoal making is the *Olea africana*(mirwai) which makes very good quality charcoal and is now facing extinction in Rumuruti forest.

4.3.4 Income levels

The average income from charcoal burning in Rumuruti forest is Ksh. 3,122/= per month and the average expenditure on food alone is Ksh. 2,417/= per month. Note that this figure excludes other expenses on fees, medicine, water, leisure and others. 93.3% of the charcoal burners expressed concern that they were not satisfied with the income and the

charcoal burning job. Most of them wished that the government or any other body can assist them get out of this predicament. Their first priority was water as the area is very dry and their second priority is job opportunities.

In Northern approach 70 per cent of those interviewed had no other jobs apart from charcoal burning, and 15 per cent were practising farming and another 15 per cent were doing casual jobs outside charcoal burning. A big number of those without other jobs were migrants who were being hosted by ranch workers. The Ranch workers through their routine land management activities, clear big portions of land mostly on either side of roads inside the Ranch and burn charcoal. This clearing is done for easier visibility of the grazing animals from far (*see Plate 4.5*). The Ranch workers together with their several relatives whom they have hosted burn charcoal here. During off-season, they go to the neighbouring farms whose owners have not settled and clear as many trees as one can to maximise their returns from charcoal burning (*see Plate 4.6*). Most of the trees found here are the *acacia spp.* which give very good quality charcoal. This area is a major source of charcoal for Nanyuki town residents and the army personnel in the neighbourhood.

Plate 4.5: *Cleared big portions of land on either side of the road in Northern approach. The trees have been used for charcoal burning.*



Plate 4.6: *The remaining vegetation typology in Northern Approaches.*



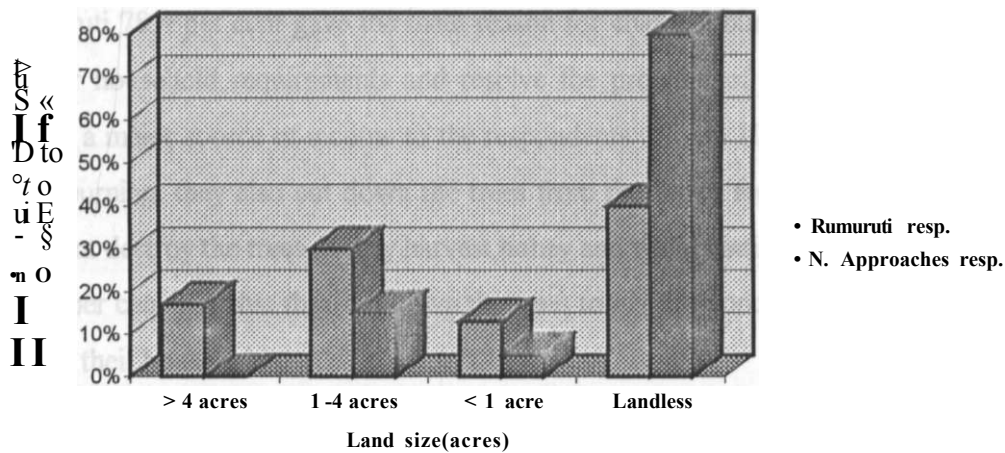
The average income per month by the charcoal burners in Northern Approach was Ksh. 3,458/= while the average expenditure on food alone was Ksh. 1,833/= . This figure excludes expenses on water, medicine, leisure and others, showing that income is not satisfactory. Over 75 per cent of the respondents here expressed dissatisfaction over income from charcoal burning and about 75 per cent were doing charcoal burning permanently. In this area, most of the land has not been settled, the earliest settlement was 1990 showing that the big junks of bush land is left under the mercy of charcoal burners of this area most of whom do not own any land there. This illegal land clearing to burn charcoal is seen by the landowners as a benefit to them because their land is cleared to pave way for their future settlement and development of the land but they don't fore-see that the massive land clearing for charcoal burning very soon will lead to serious environmental problems to the region.

4.3.5 Land ownership and shelter.

About 80 per cent of the respondents said that they did not have any land on crops showing that charcoal burning was a major occupation for them. At least some 5 per cent had between 1-2 acres of cropland while 15 per cent had less than one acre on crop land. Such crop land sizes, considering the arid conditions of the area are not economically viable for any reliable

food crop, thus hunger here could be a cyclic phenomenon, and has made people resort to charcoal burning.

Figure 4.5: Land ownership & size as an influence of socio economic status



Source: Field survey, 1998

These charcoal burners in this area do not mind the extent of vegetation destruction since they do not own any land and they lack proper formal education. About 75 per cent are permanently doing charcoal burning and only 35 per cent are satisfied with the income they get from charcoal selling. Actually the income is so low compared to the strenuous labour involved with all of that.

All the living structures of the respondents are temporary ones with 55 per cent being of mud walled and 45 per cent timber-wall and all have earth floor. The respondents income level is too low to put up a better living structure and also they have no security of land as most of them do not own land there.

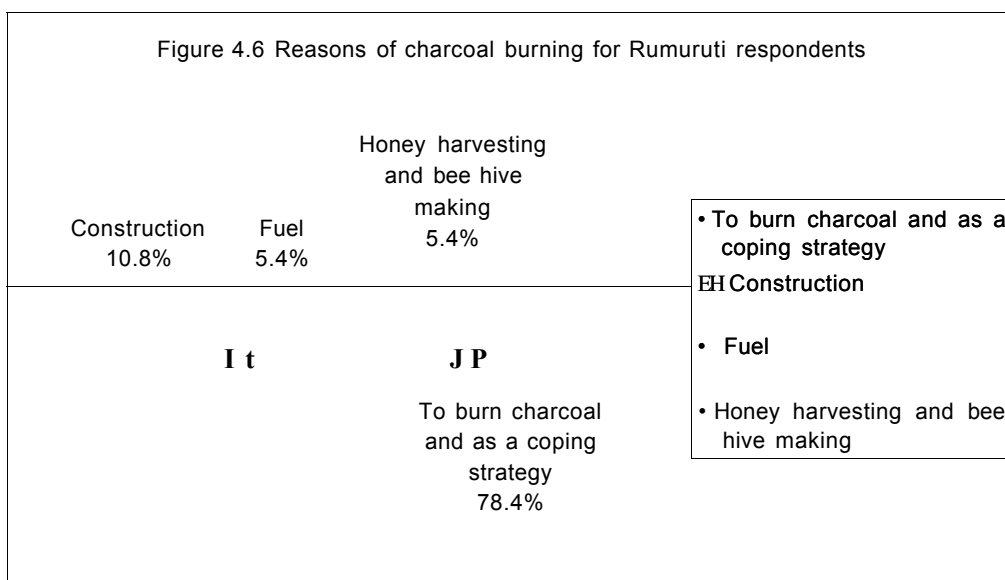
Only 40 per cent said that they are satisfied with the housing living conditions and these were mainly the victims of war who viewed life there to be of better value than their place of origin. Only 30 per cent of the respondents said that they like living in the area because they are used, and life there is better than their area of origin, and there was enough land to burn charcoal.

The rest did not like living there because of draught/water and hunger, insecurity, communication problem and lack of permanent jobs. They respond to these problems by charcoal burning and selling, casual jobs and a few pray to God.

4.4.0 MARKETING AND ECOSYSTEM LEVEL

4.4.1 Reasons for charcoal making

At Rumuruti 78.4 per cent gave the main reason for charcoal burning as a coping strategy to meet their household requirements and resolve the problem of joblessness. Thus charcoal burning is a major source of income to the respondents. Some 10.8 per cent said that besides charcoal burning, they also cut down the trees from the forest for building their houses while 5.4 per cent destroy the trees as they harvest honey and while getting logs for making beehives. Only 5.4 per cent said that they cut down the trees to get firewood. This firewood can be sold or used in their households.



Source: Field survey, 1998

Only 3.3 per cent of the respondents admitted that sometimes, they make charcoal from their own land. The rest 96.7 per cent do not own the land from where they make the charcoal. Out of this 90 per cent make charcoal from the government forest i.e. Rumuruti forest while the 6.7 per cent make charcoal from absentee land owners land. Regarding the way they get the trees, they gave the following reasons;

1. Steal from the forest.
2. Negotiate with forest guards.
3. Cut the trees from unsettled plots.

In Northern approach all the respondents cited that their main reason for cutting down trees was making charcoal to cope up with the difficulties of life-meet their household needs and satisfy their needs. 95 per cent said that they did not own any land from where they were making charcoal and the land belonged to absentee land owners. The remaining 5 per cent said that they owned the land from where they were making charcoal. All the respondents said that it was advantageous to clear the trees as the areas was very bushy and the owners would appreciate so that they settle and develop the place. They explained that the bushy place posed insecurity as wild animals and cattle rustlers would hibernate in the place and make life difficult for the eland owners.

4.4.2 Charcoal making and gender aspects.

In Rumuruti 90 per cent of the respondents said that it is males who go to burn charcoal (both big and small.) This is because of the nature of the job considering that the activity is illegal and involves a hide and seek game inside the forest which women might not succumb. Information about when the forest guards might strike in is normally passed over very fast to those who are inside the forest burning charcoal and this needs the efforts of a man who is regarded as more active. In many traditions, charcoal burning is regarded as a man's job.

Only 10 per cent of the respondents said that the felling down of trees is done by women. This group is constituted by the group of the squatters in the neighbouring small villages, female headed households and cases whereby the couples or whole family goes to the forest to burn charcoal. Some of the women interviewed claimed that either their husbands go to drink beer or Chang'aa and are so reckless that they don't assist the family or the man takes his charcoal sales proceeds to other uses which do not benefit the family. Other reasons are that; for the tribal clashes victims, only the wives fled to stay in the area and their husbands were either left for dead or insisted on remaining behind in order not to loose their land. This category of

women are therefore forced to burn charcoal to be able to support their children and pay rent for some of them. A few of them hire land in the neighbourhood to cultivate crops. This was more prevalent with the Molo tribal war victims, who highly valued land as opposed to the victims from Turkana who have different value system.

4.4.3 Conflicts in charcoal making

When asked if there was anybody they conflict with while burning charcoal in the forest, 80 per cent said that the major source of conflict is that with the authorities i.e. the forest guards or the administration people (chiefs and their askaris). They said that sometimes the guards confiscate all the charcoal and can also prosecute you although sometimes they accept bribes. This really affects their expected outputs after a very tiring job.

The remaining 20 per cent said that conflict resulted from:-

1. Their fellow burners and people grazing in the forest who take what does not belong to them. A charcoal burner once he fells down a tree, he may leave it un-slashed for the next day. He may not also fell down the tree but put a mark on the stem with a panga so that anybody else coming realises that, it has been booked. For the fellow charcoal burners who are not disciplined, they come and start working on these same trees hence causing a conflict between those involved. The cattle grazers also are known to steal charcoal once put in bags and left behind overnight.
2. The other source of conflict is with the owners of the unsettled plots who may not wish their trees to be cut down without their authority.

About 63.3 per cent of the respondents said that dry season is the period when charcoal burning is more dominant and this is because of;

1. This is the season when there isn't much work in their *shambas* and
2. Charcoal burning is easier because of dry weather.

Those who said they bum during wet season were 20 per cent and the reason was that demand for charcoal is high and the prices are more pleasing. The only problem this time is that of

transportation and smoke from the kilns is easily seen/spotted by guards from far. The remaining 16.7 per cent said that they like burning charcoal throughout because they have no other source of income. With disregard to these numbers, charcoal burning in Rumuruti is done throughout the year.

In Northern approaches 80 per cent of the respondents said that charcoal burning is done by males and 5 per cent said it is done by females. The rest said that charcoal burning is done by everybody in the family. The reason why charcoal burning is done mostly by males here is because, this area is not yet settled and its mostly males who have migrated to the area for one reason or another and find themselves engaged in this activity.

The living conditions are also harsh for one to bring with him his family to this area. The females who give birth to children while at their maiden parents or their husbands become Chang'aa drunkards that they are not able to support their families. For cases whereby the whole family go to burn charcoal, they do so to maximise the family's income and the sales proceeds are well managed by the whole family. Sometimes the boys burn charcoal separately to earn their own money to buy their clothing and others engage in Chang'aa drinking at the tender age. There are no schools in this area and this is a big constraint to development in this area.

Asked whether there are any conflicts in charcoal burning, 90 per cent said that the only people they conflict with are the administration officials who crackdown charcoal burners and this is mostly experienced when they try to transport charcoal to Nanyuki town by themselves. They said that if they decide to sell their charcoal in their local area nobody disturbs them as the army people come to buy right from the source and they have no problem. Only 5 per cent said that they had small conflicts with their absentee land owners who might want to sell their trees to any willing charcoal burner. The remaining 5 per cent said they had no problem with anyone.

Concerning the season when charcoal burning is more dominant, 25 per cent said that, its dry season because this is the time when there is no much work in their farms and its easier to burn charcoal. Only 15 per cent said they like burning charcoal throughout as they have no other source of income and the remaining 60 per cent said charcoal burning is more dominant during wet season because this is the time of high demand and prices are good.

Table 4.2: Season when charcoal burning is more dominant

Charcoal burning Season	Rumurud respondents Ko.	KApproaches resp.No
Dry season	63.3%	25%
Wet season	20%	60%
Through out	16.7%	15%
Total	100%	100%

Source: Field survey, 1998

4.4.4 Equipments and Plant Species Preferred for Charcoal Burning.

In Rumuruti, 80 per cent of the respondents said that they use axe to fell down the trees and only 20 per cent use a *panga* to do so. Most of those who use axe to fell down the trees do so in the forest as the trees are so big to be cut by a *panga*. After the tree has been felled down, they now use a combination of both the *panga* and the axe to slash the big tree into smaller logs which are to be arranged in the kiln to burn charcoal. One respondent said that he has used a power-saw in the forest but it was established that due to the illegality of the activity in the forest, the power saw would make noise that would make the guards alert and catch up with the victim. It was also established that, the burners preferred places near the river basin so that smoke from the kilns would be obstructed by the taller trees.

For those who burnt charcoal outside the forest, due to scarcity of the trees, they even used a *Jembe* or mattock to uproot even the tree roots to be used in the charcoal making.

For the tree species preferred for charcoal making, 83.3 per cent of the respondents said *Olea africanum* made best quality charcoal and therefore mostly preferred. The plant is now becoming an endangered species. Only 6.7 per cent said that they burn charcoal from any tree species where as the rest said that due to scarcity of the *Olea africana*, they preferred putting a mix of some selected good species which also gave good quality charcoal. These tree species included;

1. The acacia sp.
2. White witch hazel
3. *Euclea divinorum* (Mikinyui) and

4. *Acokanthera friesiorum* (Murichu.)

As regarding the parts preferred for charcoal making all respondents said that the stem and the branches were more preferred. For those burning outside the forest, they would also include the roots and this means that the tree cannot regenerate again (see Plate 4.7).

Plate 4.7: Both the big tree trunks and the small branches and twigs are used for charcoal making (Grass and soil will be added on top before the kiln is lit up)



In Northern approaches, half of the respondents said that they used the *Panga* while the rest used a combination of the *panga* and the axe to fell down the trees. The high number using a *panga* is because the plants are mostly shrubs which can easily be felled using a *panga*.

The tree species preferred here are mostly the acacia sp. which are more dominant here. The *Euclea divinorum* (Mikinyii) though not many are also used for charcoal making. Here the whole plant except in rare cases the roots, is preferred for charcoal burning.

4.4.5 Amount of Charcoal Produced.

In Rumuruti, on average three trees can be felled and slashed by an average man after working for an average of five hours per day, and on average thirteen bags of charcoal can be made from one mature tree (*Olea africana*). By induction thus, a one days job can convert three trees into 39 bags of charcoal. Thus in a week, about 100 bags of charcoal can be made by one man. This means that the forest is facing excessive destruction if nothing is done to curb this(see *Plate 4.8*).

Plate 4.8: Indiscriminate felling down of trees in Rumuruti Forest.



The charcoal burners invent the forest at the very early morning hours and before mid-day they take off to go and relax in their homes. A few of them may go back in the afternoon hours although its assumed that this is the time when the forest guards could be patrolling the area. They do not carry any food with them except water although some drink water from a within river. One woman exclaimed that "she ties a "lesso" round her stomach when she is felling down the trees so that she is not struck by hunger and only remove it from there, after she has fed other wise if removed before this, she would collapse and die".

Most of the charcoal burners looked very tough and hardy including the women who, though they appeared skinny and looked like hard labour workers, they still had a lot of trees destruction potential. This characteristic was suggestive of the tough job they undertake.

In Northern approaches, the case was a bit different. An average person after working for six hours a day could fell down nine mature trees per day. On average one mature tree (Acacia) could produce about one and half bags of charcoal. This is so because, the trees are much smaller than those of Rumuruti and in many cases, its just a small bush. Thus, a one days job can only produce about twelve or so bags of charcoal. This shows a lack of efficiency in charcoal making thus lower returns than in Rumuruti where returns are so immediate and higher.

4.4.6 Problems associated with Charcoal Burning.

In Rumuruti, only 3.3 per cent did not see any problem with charcoal making activity while the rest cited that there are problems with it. Among the problems identified were:-

1. Charcoal burns and dehydrates their bodies through sweat.
2. The activity is a tedious and tiring exercise.
3. Its a hard job and makes one weak and loose libido (sexual urge.)
4. Charcoal, making was halnpered by rain, making the job difficult.
5. The charcoal burners felt that they were not safe inside the forest as there were wild animal living there.
6. There was a danger in living behind the kiln burning alone without a close monitoring as all the charcoal might turn to ash hence a total loss.
7. Cattle rustlers also hide in the forest and can harass them inside the forest.
8. The forest guards and the chiefs were a big threat to their source of livelihood.
9. The earnings from the activity are so low compared to the difficult job.

10. The charcoal burners trekked a very long distance to the forest, try to identify the suitable trees and sometimes to transport charcoal to a better or appropriate selling point.

11. The charcoal burners cited that, the heat and smoke from the kiln caused respiratory problems and the hard labour of felling down trees both caused a slow and silent death of the victims.

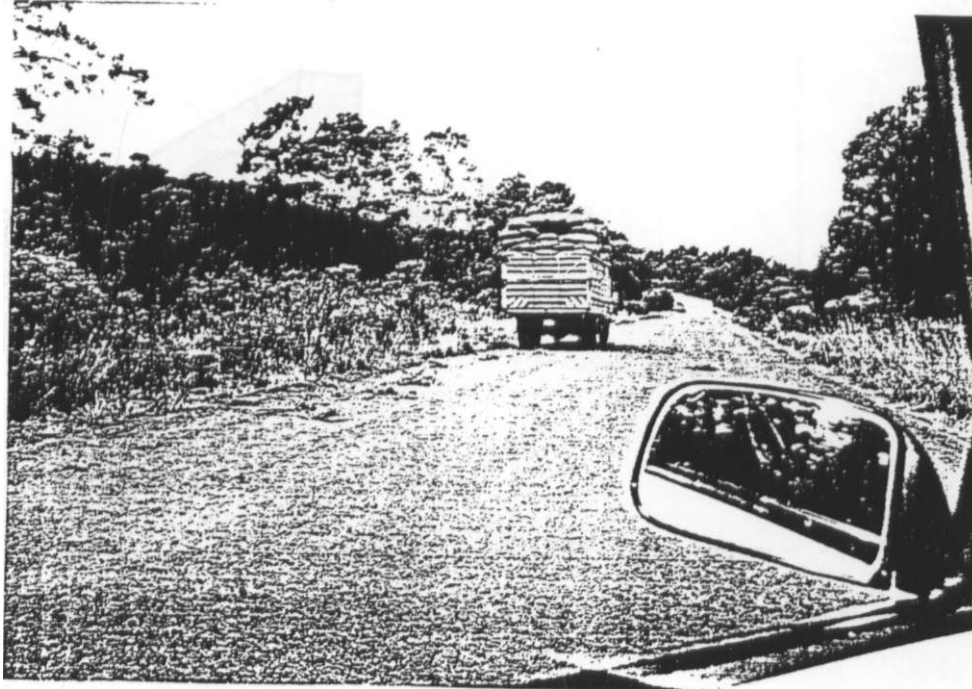
They suggested that, the government should intervene for their case was a survival or death phenomenon as they felt that, they were a forgotten target.

In northern, approaches they did not see as many problems as most of them cited the problem of heat and associated respiratory problems. The other problem was that when it rains, the roads are so poor that marketing their charcoal is difficult as roads become impassable for vehicle.

4.4.7 Charcoal Marketing

In Rumuruti, 78.6 per cent of the respondents said that their main buyers are middle men, 17.9 per cent commuters while 3.5 per cent sell their charcoal to wholesalers. Some of the charcoal burners said that they are not strict on who they sell to since their interest is money. Some of the middle men buy from the forest and transport using bicycles or donkey carts to sell in the neighbouring markets or sell to wholesalers who come with big lorries or tractors. These neighbouring markets include Rumuruti market and Nyahururu. Some are sold on the road side to commuters. The wholesalers buy and take charcoal to far markets like Nyahururu, Nanyuki, Nyeri and even Nairobi(*see Plate 4.9) below.*

Plate 4.9: *Charcoal transportation to far markets by a lorry*

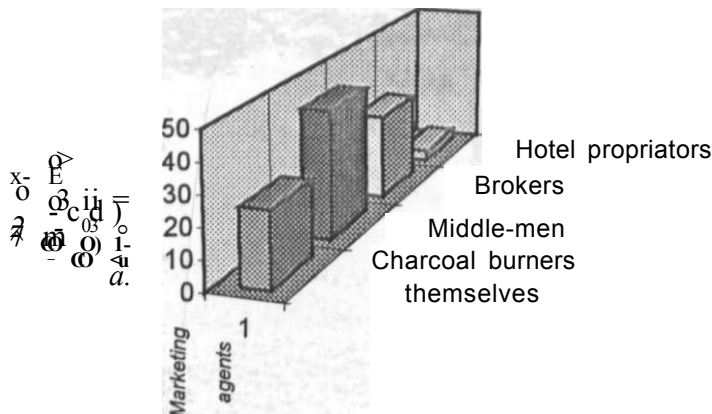


The average retail price per bag of charcoal was 130/= while average wholesale price was 100/=. There is no conventional measurement for a bag but its assumed that a full bag should have the following qualities;

1. The bag should be of a polysac but not the jute type.
2. It should be filled up to the brim and mended well for ease of transportation.

Concerning who looks for the market, 25 per cent of the respondents said that its them who look for the market/buyers, while 42.9 per cent said that its the middlemen or buyers who come looking for charcoal and once identified they buy. Hotel owners also contribute 3.6 per cent of the buyers and the remaining 28.5 per cent said that its brokers who come looking for charcoal and then they go to identify a potential buyer who now comes to buy.

Figure 4.7: Charcoal marketing agents in Rumuruti test area



Source: Field survey 1998

When asked, if they have any problems in marketing their charcoal they cited the following problems:

1. Lack of readily available market.
2. Poor and fluctuating prices.
3. Transportation problems.
4. Theft and
5. The security guards who would confiscate all their charcoal before its sold.

The main mode of transport of charcoal were;

1. Lorries and tractors for long distant markets. This is mostly by wholesalers.
2. *Matatus* and pick-ups for commuters.
3. People's backs, bicycles and monkey carts for middle men and those who sell to commuters along the Rumuruti-Nyahururu road (*see Plate 4.10*) and nearby markets e.g. Rumuruti and Gatundya centre. A neighbouring centre was renamed '*Kwa makarct*' because of its past history of being a collection centre for charcoal from the forest destined for long distant markets^ *Plate 4.11*).

Plate 4.10: *Charcoal trading along the roadside in Rumuruti*

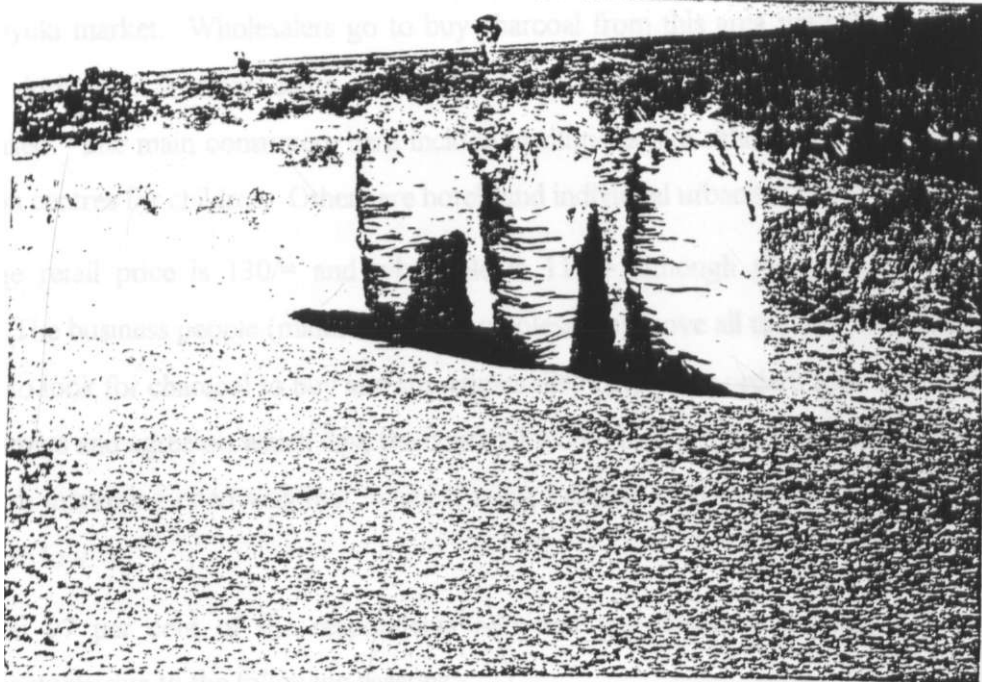


Plate 4.11: *charcoal buying centre (Kwa makara shop), for "briefcase" businessmen at a junction leading to Rumuruti Forest*



In Northern approaches, 80 per cent of the respondents sold their charcoal to middlemen and wholesalers whereas 20 per cent sold their charcoal directly to army guys. Most of the middle

men transport charcoal using bicycles and one bicycle could carry as many as four bags all the way to Nanyuki market. Wholesalers go to buy charcoal from this area with their lorries or pickups but during wet weather, some of the roads become so impassable that tractors are the only ones used. The main consumers here include institutions like schools, hospitals and the rehabilitation centres for children. Others are hotels and individual urbanites of Nanyuki town.

The average retail price is 130/= and wholesale is 115/= although these prices keep on fluctuating. The business people (middle men and wholesalers) move all the way from Nanyuki to this area to look for charcoal to buy and sometimes they only place orders with their contact charcoal burners and agree on which day, the charcoal would be ready for collection. The only problem with marketing cited was that, when it rains, because of the condition of the roads, their sales are low.

In Rumuruti 97 per cent of the respondents admitted that charcoal burning was not a sustainable activity due to the following reasons:-

1. It is just a coping strategy.
2. Its not a stable activity.
3. Its seasonal.
4. Money gotten is not enough.
5. Its only a way of getting initial capital to start other businesses.
6. Trees will get finished.
7. Sometimes authorities become tough.

They were of the feeling that, an alternative should be sought to make them completely move out of the forests and start conserving them instead. This shows that some of these charcoal burners are already aware of the destruction of the forests and the consequences there of. It is only that they have to choose between death and survival whereby their only hope of survival is the neighbouring forest which some believe it was a gift from God.

In Northern approaches 55 per cent cited that they saw charcoal burning as a sustainable activity and able to provide for their daily needs and these were their reasons;

1. They believe that trees are many and people are few and therefore can not be able to finish the trees.
2. Their needs are less and therefore income from charcoal was just enough, no need for excess as more trees are there for their tomorrow needs.
3. They also believe that as long as one is strong enough to fell down a tree, there was no cause for alarm as any need is met anyway by charcoal burning and selling.

4.4.8 Charcoal income spending and importance of Trees.

In Rumuruti, 83.3 per cent of the respondents said that it is the man/husband who is responsible for the income spending from charcoal making. Only 10 per cent said that it is the wife who is responsible for income spending while 6.7 per cent said that income spending was to be decided between, the husband and the wife. This dominant of the male deciding on how, when and for what to spend portrays a male chauvinism whereby the woman is not given a chance to choose from alternatives on what she wants but has to do as the man dictates. As such, since the sales proceeds may not be disclosed to the wife, the man may waste all the money in chang'aa drinking and he gets away with it as he is not bound to be questioned. This way we see charcoal making benefiting only a few and severing many relationships.

Apart from charcoal making, the other benefits of trees cited were:-

- I. Attraction of rain.; 2. Construction.; 3. Fuel. 4. Beauty or good scenery. 5. Water catchment protection; 6. Provide shade.; 7. Fencing; 8. Manure; 9. Wind break; 10. Furniture;
- II. Honey harvesting; 12. Medicinal; 13. Livestock feed; and 14. Control soil erosion.

At least 56.7 per cent admitted that trees attract rain, when asked the nature of place they would want to live, all the respondents said that they would want to live in a place with many trees. Ofcourse this did not mean that they all had a shared perception about trees. About 53.3 per cent of the respondents admitted that they do not plant trees in their homesteads because of the following reasons;

1. Lack of land.
2. Lack of seedlings.

3. The *shambas* they practice farming are rental hence lack of incentive to plant.
4. They do not survive well due to draught.
5. Some are newly settled. In fact those who cited the problem of landlessness were 81.25 per cent, lack of seedlings 12.5 per cent and newly settled 6.25 per cent.

For those who admitted that they plant said that, they do it during rainy season and mostly plant on the fence or on the plot. They said that there is no nearby forestry nursery hence they source the seedlings from as far as Nanyuki.

In Northern approaches 95 per cent of the respondents said that, it is the man who is responsible for income spending from charcoal. The rest said that it is both the man and his wife. Chang'aa drinking in this area is also popular among the charcoal burners and this shows how the activity can retard development. After a days activity, the charcoal burners converge at the chang'aa brewing points to "*refuel their engines*" as they popularly call it in order to disguise the administration people.

Only 36 per cent cited that trees attract rain and 60 per cent said that trees are important for construction on top of providing fuel (firewood and charcoal.) The rest cited beauty, medicinal and livestock feed as the other benefits of trees.

The low number that cited that trees attract rainfall could be explained by the fact that, they see so many trees around them and yet the place has a harsh climate. All the respondents admitted that they would wish to live in a place with many trees as possible. It is because of these other benefits they cited like charcoal burning, firewood and construction. Regarding tree planting, 90 per cent admitted that they don't plant trees because of landlessness; 66.7 per cent cited this reason. The rest 33.3 per cent said that its because of draught. They all said that there is no available source of seedlings in the neighbourhood.

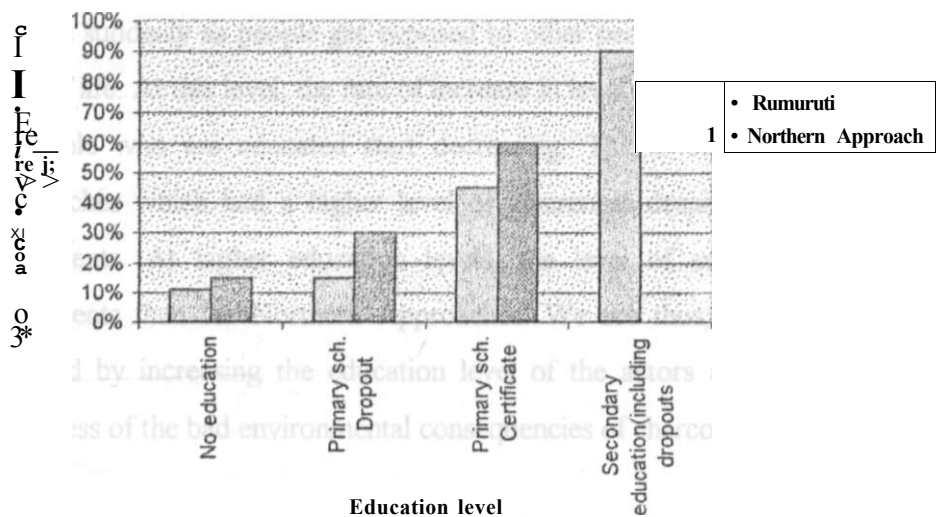
4.4.9 Effects of Charcoal Burning.

In Rumuruti study area, 36.3 per cent admitted that they are aware that charcoal burning can lead to bad environmental consequences and the remaining 63.7 per cent said that it will not lead to any bad effect because trees will continue to grow in the forest as long as one did not uproot the roots. For those who admitted that it leads to bad effects, 63.3 per cent of them

gave problems related to harsh/arid climatic conditions like draught/lack of rain and 6.7 per cent said that it leads to destruction of water catchment. The rest gave problems of fuel and that the area may become too much open and lead to strong winds which destroy property.

In Northern approaches only 15 per cent said that charcoal burning leads to bad environmental effects, ten per cent had no answer while the rest said that charcoal burning does not lead to any bad environmental effects as trees will always grow as long as one does not uproot the roots.

Figure 4.7a: Education level as an influence of awareness of the bad effects of charcoal making



Source: FMJivrey, 1995

The graph shows how education level of the charcoal burners affects their level of awareness of the bad effects of charcoal burning. This was measured by asking the various education level local actor categories how they see the environment being affected by their actions. The various answers given were recorded as observations for further analysis. These observations were then put into two categories of those who were aware and those who were not aware. The percentages of those who were aware in each education level category were then plotted against education level as shown in the graph. At low education level, the level of awareness of bad environmental consequences of charcoal making is very low as culture here plays a very major role in influencing the individual's way of perceiving and hence doing things. At this level

of perception, some of the actors perceive their actions as mere routine activities to keep life going on. At this level of education, the level of awareness for Rumuruti respondents was lower than that for Northern Approaches respondents. This was due to the local actors' orientation to their root cultures and beliefs. Most of these actors used to lead a nomadic kind of life in their pasthood and hence not exposed to the conservation idea as they were used to spending everything they find. The same actors also did not go to school, even their children. The few actors in this Rumuruti test area who seemed at least to show some concern on the trees conservation were the locals whose former place of origin was in central province.

As education level begins to increase, the individual's perception about the way of doing things changes suddenly as people get exposed to other people of different cultures and of different ways of life. At this level, the rate of increase in level of awareness is positive until the number of people who are educated start decreasing. This is seen from the graph for Northern Approaches which had a higher level of awareness despite the lesser number of educated respondents. At higher education levels, the level of awareness is higher for Rumuruti respondents than for Northern Approaches. We see thus, the constraint of culture can be removed by increasing the education level of the actors and hence increasing the level of awareness of the bad environmental consequences of charcoal making.

4.4.10 Suggestions, Alternatives and Comments by the Respondents.

In Rumuruti test area, concerning conservation of our trees, 50 per cent said that after cutting a tree, we should plant more to replace the cut one, 8.8 per cent said that people should only cut the mature trees and with a permit and the authorities should be tough at all levels, 8.8 per cent said that irrigation water should be put for people to cultivate crops and abandon charcoal burning, 11.8 per cent said that the government should either give them alternative jobs or food so that they can abandon charcoal burning while the remaining 20.6 per cent said that prices of farm produce should be high to enable their livelihood. This shows that charcoal burning is done as a coping strategy.

For those who suggested alternative jobs to substitute charcoal burning, the following are their proposals:-

1. Get small loans for small businesses e.g. *Jua Kali*.
2. Incentives to farming.
3. Government can give direct employment.
4. Government to give them land in the forest especially the landless.

Concerning possible alternative sources of fuel they suggested the following:-

- 1, Gas, 2. Electricity, 3. Solar, 4. Sawdust, 5. Firewood (is more efficient), 6. Battery,
7. Paraffin, 8, Biogas. They also lamented that some of these energy sources are expensive and hence not affordable to the poor.

On their final comments, they raised the following issues of concern.

1. If they can get a small loan, they can leave this charcoal burning job. This was cited by 4.5 per cent of the respondents.
2. Only 22.6 per cent said that charcoal burning is done by the poor as they only wanted food and land to settle.
3. About 18.2 per cent said that charcoal burning is not good and should be eradicated.
4. Those who said that cutting down of trees cannot stop and supply seedlings should be improved constituted 4.5 per cent.
5. The Government should provide alternatives to charcoal burning as an income activity and also as a source of fuel before condemning it as illegal. This was cited by 18.2 per cent
6. The Government should provide water for irrigation so that they can stop charcoal burning and even the Turkana can get employment in the irrigation farms. This was cited by 13.6 per cent.
7. Charcoal burning cannot make one succeed in life, its only for survival as there is not other alternative. Only 13.6 per cent cited this.
8. The remaining 4.8 per cent lamented that after burning charcoal they should plant more trees.

In Northern approaches, test area, 38.1 per cent said that its good to plant trees after cutting one in order to conserve our trees, the rest gave no answer.

Concerning alternative jobs to replace charcoal burning 10 per cent suggested that the government should give them loans to start-up small businesses, like *Juakali*, 35 per cent felt that farming if there is water can substitute their charcoal burning activities, 45 per cent suggested that the government should provide enabling environment for jobs creation while the rest did not have an answer.

When asked to give alternative sources of fuel, they gave the same alternatives as those given by Rumuruti forest test case respondents, although they felt that since those alternatives are expensive and yet they had allot of trees, they could continue producing charcoal for a while.

On their concluding remarks, 20 per cent suggested that before the government declares charcoal burning illegal, it should provide them with alternative sources of income and source of fuel which is affordable; 60 per cent said that, charcoal burning has never made anyone of them rich and it is just a survival strategy and causes health problems; 10 per cent said that charcoal burning can not stop and trees will continue to grow whenever it rains where as 10 per cent said that some of them have improved their livelihoods through charcoal burning and are buying and selling cows and goats in the nearby auction markets like that of Doldol.

CHAPTER FIVE: ENVIRONMENTAL IMPACTS OF CHARCOAL PRODUCTION

5.0 Overview:

The previous chapter highlighted the major socio-economic impacts of charcoal burning as they affect the two areas of study in Laikipia district. This chapter will address the environmental effects of charcoal burning in an ASAL area of Kenya.

Man is described as a material using animal. Everything he uses comes from the substances of the planet on which he lives and in gaining these materials, he changes the ecology greatly. The continuing presence of these resources will thus get threatened and the environment can not tolerate this any more. What is clearly coming out of this study is that, the charcoal business has turned out to be a big industry supporting a big number of the population and its being enhanced by high rate of urbanisation, low income levels and poverty and unaffordable alternate fuels. This has led to several environmental effects some of which are highlighted below.

5.1 Soil Erosion:

The indiscriminate tree felling in both study areas has exposed the soil to the dangers of erosion. The eroded soil is then deposited to rivers causing siltation problems and also reducing the depth of the rivers. Due to this many rivers have dried up.

The clearing of trees along the river bank has also exposed the rivers and has led to increased evaporation promoting the drying up of many rivers during the dry season. Trees also act as wind breaks and the* extensive clearing of trees in both study areas will make the areas prone to effects of strong winds.

5.2 Vegetation Depletion:

The most obvious biotic change in both study area was the great shift in species composition both qualitative and quantitative. The original indigenous vegetation, which is preferred for charcoal burning are getting scarce and as a result, some of the charcoal burners i.e. 6.7 per cent in Ruinuruti said that they were burning charcoal from any tree species due to scarcity of *Olea Africana*. These indigenous trees are not very fast in their regeneration and hence they are out competed by other vegetation types like grass and other weeds.

5.5 Sometimes, wild fires have resulted from the charcoal burning activities either by accidents or otherwise.

Other times the charcoal burners deliberately light the fire to conceal the spots of their activities from being discovered by the Forest Officers. Such fires have burned several areas in Rumuruti forest and have caused a lot of vegetation destruction as the vegetation is indiscriminately burned down. This has led to a great reduction of vegetation cover hence affecting the former scenic beauty of the forest.

Honey harvesters in the forest also indiscriminately cut down the whole tree or even several trees as they try to harvest honey from one single tree. They also use fire which also causes accidents inside the forest thus leading to extensive burning up of the forest trees (*see Plate 5.1*).

Plate 5.1: *Honey has just been harvested from this tree. Wild fires due to this activity are very common in Rumuruti Forest*



Other factors which could also have led to an accelerated reduction of trees are:

1. A large number of trees surrounding the kiln for charcoal will have the branches and leaves cut-off to cover the kiln. This has led to retarded growth and even total death of these trees.
2. The smoke coming out of the kiln and the heat affects the nearby vegetation and hence

causing death.

In the northern approaches, the hard or woody plant vegetation is getting depleted and getting replaced by grass. This can have far reaching effects if it continues unabated.

5.6 Disruption of the Ecosystem:

Ecosystem is a set of ecological components together with the relationships between the components and their attributes. If one of these components is altered or reduced, the whole and total system get disrupted. This leads to disorder in the system and this has been compared by Schultz(1967), to the thermodynamic concept of entropy: systems in which disorder is increasing are becoming highly entropic and man's main activities seem to be to remove the homeostatic mechanisms and promote instability sometimes to the point of , outright destruction.

Rumuruti forest has acted as a water catchment and watershed for some rivers. Due to continuous clearing of trees to burn charcoal and especially along the river banks, several of the rivers in the forest have dried up and only one small river (Ewaso Narok) with very little water flowing in it was noticed at the time of this study.

Many of the charcoal burners said that they preferred making charcoal next to the river where the trees are taller than other areas so that smoke emanating from the kiln is not noticed by forest guards from a far. They thus interrupted with the water course causing unnecessary seepage to the surrounding area and reducing the amount of water flow to down-stream and also polluting the water. It was also reported that, unlike in the past, it was very difficult to sink a well or bore-hole in the areas surrounding the forest as the water table had dropped down.

In the lower areas where the river drains into, it was noticed that, a formerly adored Ewaso Narok swamp which covered thousands of acres has already dried up due to less water feed from the river. This swamp is just next to Rumuruti town and several people have now encroached the area and started both residential and agricultural activities. This will have serious implications in the future if the old glory of the swamp is not restored.

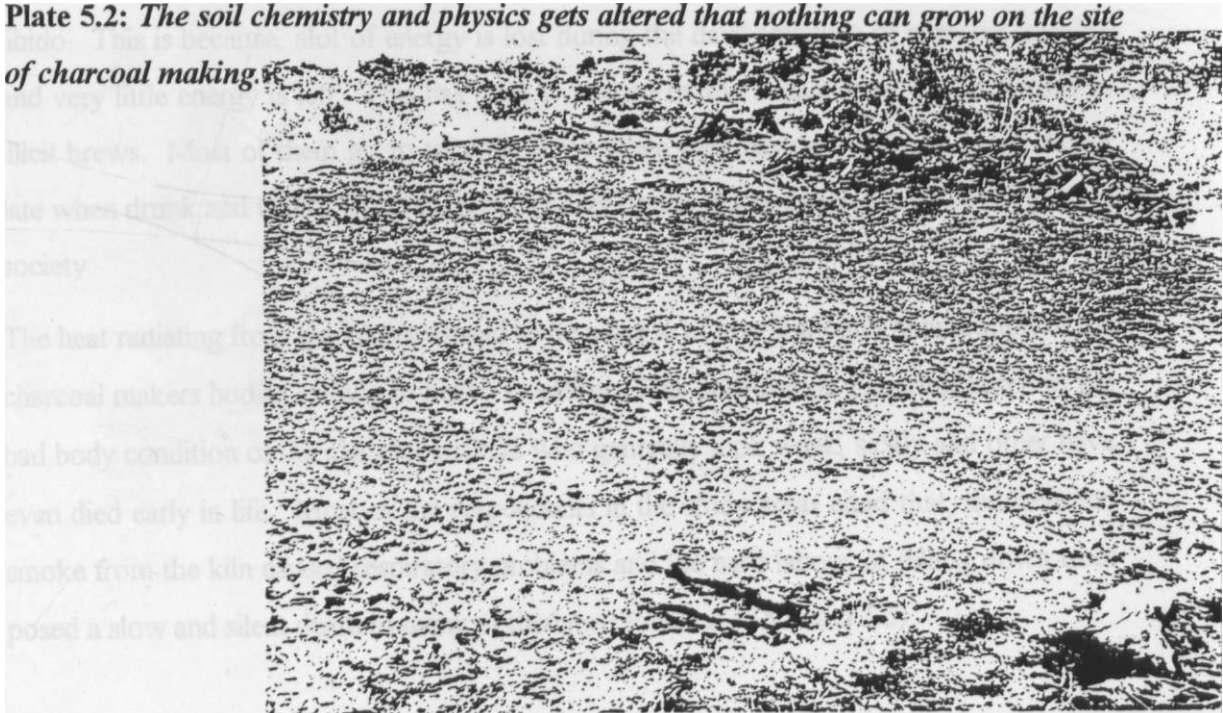
Rumuruti forest also formed a habitat for different animal species (wildlife) but these have now migrated to other areas or have been killed so that the charcoal burners can feel secure while outside the forest. Other facts which might have sent the animals away are frequent fire outbreaks which scare the animals away and also their feed is burned off and a

completely different vegetation develops. The cleared trees also leave behind an open area and some animals like antelopes can not find a place to hide. There used to be many elephants and buffaloes before, but this time when this study was being carried out in the forest, the respondents lamented that these have now migrated to other areas like marmanet forest and many had died. Many birds species have also been affected as their nests together with their eggs and offsprings get burned by the accident fires or destroyed when cutting the tree branches and leaves to cover the kiln.

The bee keeping business has also had a profound impact on the ecology of Rumuruti forest. Since the beehives are normally made from tree trunks, once cut, the rest of the plant is left behind to rot (*see also Plate 5.1*). Some of these charcoal burners are the same people who make the beehives and also harvest honey from tree trunks. It was also noticed that, allot of bees have migrated or they have died from the effect of fire and smoke emanating from the charcoal kilns. This was confirmed by the fact that when charcoal kilns are constructed next to the river banks where the bees go for water, smoke scared away the bees making them to migrate.

Also badly affected was the soil where charcoal kilns were built. The soil is badly burned and nothing grows in that site for a very long time. The organic matter is destroyed, the soil structure also gets affected and the soil loses its original good appearance(*see Plate 5.2 below*).

Plate 5.2: The soil chemistry and physics gets altered that nothing can grow on the site of charcoal making



5.7 Charcoal Burning Effects on Human Health.

It was established from the field survey that many charcoal burners have had their health status reduced by their activities. Many of the respondents in Rumuruti (96.7 per cent) agreed that charcoal making has led to several health related problems. Among these, problems are:- The activity is a tedious and tiring exercise. The charcoal makers normally trek very long distances to go and burn charcoal in the study areas, then they have to walk and identify the suitable trees which are then felled down using axes and slashed using "pangas". The logs have to be stacked together in a well dug place and covered with smaller branches and leaves, then soil is heaped on top so that the kiln "cooks" slowly anaerobically. Several trees will need to be felled down in order to make enough load for a single kiln.

When the charcoal is ready, it has to be uncovered and put into sacks. It is also the charcoal burners duty to transport the charcoal to a better or appropriate selling point. All this process is too involving and wastes away the health of the charcoal makers many of those interviewed looked very emaciated. The activity also takes too much of their days available hours and have little time to prepare food to eat as they are also away from their homes. They are also not able to afford to buy nutritious food from their earnings to replace the lost energy.

The respondents also expressed concern that the activity was making them weak and loose libido. This is because, a lot of energy is lost during the days activities of charcoal burning and very little energy is left. This has been worsened by the engagement of the victims in illicit brews. Most of them go to take the brew when they have not fed and return home late when drunk and weak. This has a lot of effect on the future development of the general society.

The heat radiating from the kilns was said to be a cause of heat burn and dehydration of the charcoal makers bodies leading to heavy sweating. This dehydration has contributed to the bad body condition of the charcoal makers who generally look weak, sickly and other have even died early in life. Most of the respondents in the study areas cited that, the heat and smoke from the kiln caused respiratory problems and the hard labour of felling down trees posed a slow and silent death to many of them (*see Plates 5.3, 5.4 and 5.5*).

Plate 5.3: *This man(T^d right) could not withstand the difficult job and the heat from the charcoal*



Plate 5.4: *When the going gets tough, the tough gets going. For this man(Right), he had to squat in order to make ends meet from charcoal dealings.*



Plate 5.5: *A kiln which is cooking in Rumuruti Forest The smoke has a negative ecological effect*



CHAPTER SIX: SUMMARY, RECOMMENDATIONS, AND CONCLUSIONS

6.1 SUMMARY

6.1.1 Synthesis of Research Findings

The study set out to find the perception of environmental aspects by local actors involved in charcoal production and marketing in Laikipia district. Two study areas Rumuruti and central divisions were selected as case studies.

From the study various key issues came out.

1. That charcoal production has caused various environmental problems - examples are:-
 - a) Woody plants vegetation cover changes whereby the original trees have been removed and some are facing complete extinction.
 - b) That charcoal burning leads to some health problems to the charcoal burners who look weak and develop chest problems.
 - c) The soil structure and chemistry of the charcoal burning sites changes so much that after the charcoal burning exercise, it takes so many years before the vegetation type gets established and the place remains bare,
 - d) The smoke emitted from the 'Jikos' add carbon to the atmosphere increasing the global warming.
 - e) The charcoal burners cut down the trees indiscriminately as they chase the benefits from charcoal and honey harvesting thus interfering with the Habitat of these small organisms since the smoke from charcoal *Jikos* also scares away bees.
- The forests are also Habitats of other small and big animals which get deprived of their natural Habitat. This thus interferes with the ecological balance.
- f) Trees are said to influence rain so this increase in tree felling for charcoal may lead to desert or desert like conditions
 - e) There is encroachment of water resources since the charcoal burners identify the river banks as good sites, where smoke emanating from the 'Jikos' are not easily seen from a far by forest guards. Also from the river there is easy access to drinking water during the taxing exercise of charcoal burning.

2. On socio-economic issues;

a) Charcoal production has given birth to poverty cycle as the respondents showed during interviews with them. Many people who engage themselves in the activity of burning charcoal die poor. Most of their meagre earnings are spent in local brew since the men are the ones in control of family income. Their sons also engage themselves in this activity and the whole cycle repeats itself. There is a link between local beer taking and charcoal burning.

b) There are many repeated famine incidences in the area which are attributed to among others:- less time committed to food production as opposed to charcoal production. The other causes are due to landlessness, draught and insecurity.

c) Some of the charcoal burners (a specific category) was termed as a social misfit as from a unique tribe, they turn into violent criminals at night. Many rape women and theft cases were reported to be a very common phenomenon.

d) The culture of the local actors played a major role in influencing the resource use and management. The culture of the charcoal burners in Rumuruti differed significantly with that of those in Northern approaches and hence the difference in their actions and perceptions.

Also the cheap and easy to get money job of charcoal burning has tempted many children to drop out of school to engage in this business.

On the positive sense, charcoal production and marketing has created a big industry, where the various actor categories identified during the research reap their daily bread. There are two actor typologies - we have; the charcoal burners who fell down trees to convert them into charcoal - we also have the charcoal dealers who buy charcoal from the charcoal burner either from the bush/forest or otherwise to sell to the consumer or a higher level middle men to make profits.

In view of the above, we do not wish to impoverish the environment any further and yet we cannot for a moment forget the great poverty of a large number of people. Unless we are in a position to provide employment and purchasing power for those who live in poverty, we cannot prevent them from combing our forests for food and livelihood when they themselves feel deprived and their own lives are contaminated at the source.

It is important to note that, so many people depend on charcoal - burning industry for their livelihood, that it becomes difficult to condemn them before alternative employment for them is found. It is also worth noting that, the local usage of charcoal as a source of fuel both in urban and rural areas is so extensive that it would be most unrealistic to simply condemn the industry without suggesting suitable alternatives, which should be implemented as guiding policies. This should be coupled with improved/better environmental perspectives by the local actors for whose resource is being guarded against.

6.1.2 Summary of Research findings

Individual actors derive *information* about the environment, through *perception* and evaluates information in terms of a *value system* guided by **social cultural background** of the actors, to arrive at a *cognitive image* in respect of which, *decisions* are made on *overt behavioural strategies* affecting woody-plant vegetation cover.

It was found out that, the charcoal burners in the two study areas(Rumuruti & Northern approach), were heterogeneous in their cultural background and hence their behaviour. Tribalism; area of origin; socio-economic status and level of education had a big contribution towards the cultural behaviour of the local actors(charcoal burners). People who share the same tribe and area of origin will tend to have similar cultural trends. It was also found out that, some people may be of the same tribe, but if their area of origin is different, their cultural trends also differ. The level of education was also seen to influence the level of cultural affiliation of some of the local actors. This was so because, some of the actors who came from the same tribe, and the same area of origin but differed in their level of education, their cultural trends differed significantly. Then above all, the socio-economic status of the actors influenced greatly the cultural behaviour of the local actors and that is why some form four graduates were seriously involved in this activity of charcoal burning although they are learned enough to secure better paying jobs and be of a higher economic status.

Education, both formal and informal and participation in local group income earning activities, came out as the major recommendations for capacity building, change of cultural beliefs and behaviour, and increase the community's resource tapping base and its sustainable utilization and management. Partnerships should also be encouraged between

various interested parties to manage the woody-plants for a better economic and environmental benefits.

6.2 RECOMMENDATIONS.

6.2.1. In planning the development of the forest sector, one must aim to:-

- Increase the forest and tree cover in order to ensure an increasing supply of forest products and services, to meet the basic needs of present and future generations and to enhance the role of forestry in socio-economic development.
- Conserve the remaining natural habitats and their wildlife, rehabilitate them and conserve their biodiversity.
- Contribute to sustainable agriculture by conserving the soil and water resources by tree planting and appropriate forest management.
- Manage the forest resources assigned for productive use on a commercial basis for the maximum sustainable benefit, taking into account all direct and indirect economic and environmental effects, and also review the ways in which forests and trees are valued.
- Support the government policy of alleviating poverty and promoting rural development by increased incomes based on tree resources, by providing employment, by strengthening the individual and national economies and by promoting equity and participation.
- Fulfill the national obligations under international environmental and other forest related agreements.
- Supplies should be increased by improved plantation management and by expansion of farm forestry. Experience especially from the cultivation of wattle for tannin extracts shows clearly that production of non-wood forest products need not depend on collection from the wild. The source plants can be cultivated which will create employment and increase incomes.
- The virtual state monopoly in forest plantation development should be relaxed so that partners who have an interest in forestry are given the chance to contribute to

forest /vegetation management. Each of the development partners must be given an appropriate role, according to their present or potential interest and capability.

- The government must continue to be the highest authority in the forestry sector where it would be responsible for forest policy, law enforcement, the conservation of indigenous forests, issuing of licenses, collecting revenue, and for supporting the other development partners and coordinating their forestry activities.
- Extension work with farmers should be coordinated to decide whose extension agent should make contact with the farmer, both for cost effectiveness and to ensure that farmers are not given conflicting messages. These services can also be privatised.

6.2.2 Recommendation for Forestry Development Partnership.

Five fields in which the partners should be involved.

1. Conservation and management of the indigenous forests.
2. Farm forestry and dry land forestry.
3. Forest plantations.
4. Forest industry.
5. Institutions.

6.2.3 Conservation and management of the indigenous forests.

- a) Excisions - many hectares of gazetted forests endorsed excisions. This contravenes the 1968 forest policy, which states that no more forest land should be lost. The authorities concerned should exercise the full force of the law and refuse all current and future endorsement.
- b) Squatters, forest dwellers, and forest adjacent households. Many Kenyans became squatters when the *shamba* reforestation system was abolished. There are also forest dwellers and other households living at a distance of less or close to 5 Km from indigenous forests. Social justice needs to be exercised to allow people to maintain their traditional way of life but in a managed manner. Outsiders must be prevented from encroaching further into the woody vegetation.

- c) Illegal exploitation: A commitment is needed on the ground to protect the remaining trees from illegal exploitation and to exercise proper control of legal activities.
- d) Forest recovery: There is a need to determine systematically the degree of recovery aimed at and maintained in various types of indigenous forest/trees.

The Kenya special energy programme supports the alleviation of the energy crisis thus;

- a) Promotion of improved stoves,
- b) Substitution of wood fuel by other forms of energy e.g. biogas from animal waste,
- c) Introduction of improved Kiln technologies for charcoal production,
- d) Wood fuel production and afforestation.

In addressing the charcoal burning issues, there is need to consider the culture of the local people, learn from them about how they perceive resources and the environment and to what extent they conserve these resources for the benefit of the environment. The key purpose of this section is to give integrated feasible and sustainable strategies to meet the growing need for forest/tree products, without sacrificing forests/trees or impairing their soil and water conserving functions.

6.2.4 Building of Partnerships and Co-ordination in Forestry Development.

- a) Though most of the government departments have their own specific area of need which they are trying to tackle through tree planting, it is all directed to the same recipient, the farmer e.g. The MALD&M wants trees planted for soil conservation and stabilization, MOW wants trees protected and others planted in catchment areas; Office of the president wants nurseries established in every sub-location to ensure seedling availability to farmers; MENR wants more wood lots and forests, ministry of energy wants sustainable rural wood production for use in homes as fuelwood, NGO's want women groups, schools, etc. raise seedlings besides their activities. All these efforts are meant for the good of the recipient but obviously with each of these agencies approaching the farmer independently, a lot of confusion may arise. This co-ordination will help to present a harmonious and integrated approach to the farmer so that he is not given conflicting information. There is need for co-ordination for the benefit of all, for better effectiveness and to

avoid duplication. Environmental conservation committees (ECC) should be set-up at all administrative levels starting from sub-location to district level to include a representative from the technical ministries involved and also from NGOs in the district.

- b) The committee should co-ordinate all issues concerning, tree seedling raising, tree planting and follow-up whereby technical co-ordination of all tree planting activities lies with the forestry department in co-operation with the MALD&M. With this co-ordination it means therefore that seedlings would be ready in time, at the beginning of the long rains.
- c) Partnership programs should also be encouraged in order to exchange seeds, seedlings, experience etc. among schools, self-help groups and individuals. All staff thus at grassroots level should be involved in fostering tree planting i.e. Technical assistants, CDAs, chiefs, teachers, foresters etc.
- d) KENGO should act as a clearing house for information on tree-planting by collecting accumulated traditional and acquired knowledge on such areas like conditions for germination of seeds, techniques of propagation in semi-arid lands, successful, agro-forestry combinations already in practice etc.
- e) Collaboration with KARI and KEFRI and other relevant research institutions in supply of germ plasm and technical guidelines should be strengthened.
- f) Rural Community Participation.
- g) This should target rural people especially women groups and the private sector. Community based tree nurseries should be propagated and focus should be on the needs and possibilities of the farmers for on-farm nurseries.
- h) These tree nurseries should be assisted until they are self-sustaining. Advice on seed selection, collection, seedling production and protection, assistance with materials and tools to boost efforts of the farmers should be done by relevant department i.e. forest, MALD & M, NGOs etc. The most successful efforts of tree-planting occur when people have a sense of personal ownership in the seedlings, and are therefore motivated to care for them out of self-interests.

6.2.5 Developing and Strengthening the Forestry Institutions which facilitate Extension Services(Capacity building).

- a) There should be good publicity about tree planting activities within the district. General awareness among the population and the leaders should be broadened by various means and methods of approach (on tree planting and environmental protection in general. Technical assistance for tree planting should be availed at sub-locational level by the MALD& M and MENR extension service departments. Farmers should be taken for field trips to promote successful ideas and for general exchange. Field trips should also be done for self-help groups, nursery attendants and teachers involved in tree planting. Also workshops for Nursery attendants and teachers in charge of tree nurseries in schools should be organised on a regular basis and follow-ups made (this can be done quarterly for every location).
- b) Tree planting activities should be included and stressed in the school curriculum to form part of the syllabus even in 4K clubs. Also in order to supplement the National tree planting day, local tree planting days should be organised for every location.
- c) Public *barazas* organized by the local sub-chief or chief should be held to stress the importance of tree-planting and to instruct farmers in practical ways as to the best techniques to use in that area. Forestry and nursery workers should verbally instruct citizens when they come to collect seedlings and distribute simple information sheets on the correct methods of planting and caring for the seedlings. The local administration should play a leading role in trying to eliminate the cultural stigma of some of the local actors who still hold practices which are not sustainable. Education, both formal and informal should be over-emphasised to increase the community's level of awareness and perceive the woody-plants as an important environmental resource. This would enhance the use and management of the vegetation of the area in a more sustainable way.
- d) Also demonstration plots, bulking sites and nurseries should be established in every location by the Departments of forestry, energy and agriculture in order to give farmers step-by-step instruction on how to germinate seeds, establish a nursery, transplant the seedlings and care for them in the field. A more efficient following

system would be needed to determine and evaluate the survival rate of seedlings and the major reasons for seedling death.

6.2.6 Issues on Forest Policy and Legislation.

- a) A national law on conservation of existing forests, bushland and marshland should be promoted by the MENR. Also in order to render possible secure-land tenureship, the process of handing out title deeds should be accelerated by the relevant authorities i.e. DDC and ministry of lands.
- b) Nature Conservation. **A list of sites where water points exist should be compiled in order to enhance proper planning of tree nurseries. The ministry of water development for example stipulates details of riparian reserve. Woodlots should be established on large-scale farms or groups ranches with the co-operation of chiefs and MENR.**

6.2.7 Diversify Agriculture.

It was established that food inadequacy in the study areas made the farmers result to charcoal burning in order to get money to buy food. This was due to very little rain. Establishment of draught resistant and draught escaping crops in the area can help curb the problem of food inadequacy. These are crops like sorghum, finger millet, sweet potatoes, cassava, yams and pumpkins. We also have pigeon peas which mature in one season. The Katumani dryland farming research station in Machakos has produced several other crop varieties which can withstand dry weather and these can be introduced in the area to totally eliminate hunger. These are varieties like Katumani maize, *mwezi mmoja* beans and the more recent millet and sorghum varieties.

With good management and modern irrigation technologies, certain fruit varieties can do well in hot climates. A good example is citrus fruit. The hot climate makes Oranges increase their sweetness and this is well demonstrated by a dry country like Israel where they are the leading exporters of the sweetest Oranges in the world. The Oranges are irrigated using drip method. If such technology can be tapped by the farmers of Laikipia, then, they can be second to Israel.

If the planting of these new crops is to be realised, there is need for education and training of farmers and group by all interested organisations i.e. The administration, agriculture officers, NGOs, community development workers etc.

The farmers should also be introduced to potential markets to sell their surplus of produce.

It has also been learned that, the amount of waste water in an average household is so much that much of it is just thrown away. If farmers can be encouraged to start-up kitchen gardens which can be irrigated using the domestic waste water, crops like Kales (Sukuma Wiki), spinach, cabbage, carrots, ground nuts, sugar cane, tomatoes, potatoes, onions, can be grown for domestic consumption. This will help eliminate food inadequacy and issues of malnutrition will be a gone case and there would be a less need to burn charcoal.

In order to improve on productivity and yields, farmers need to be introduced to new organic farming techniques. There are various moisture conserving farming techniques that need to be practiced in a dry area like Laikipia e.g. mulching with minimum tillage to reduce moisture loss by evaporation. Organic manure usage also improve soil physical properties e.g. water holding capacity and soil temperatures and also add nutrients to the soil.

Soil and water conservation methods need to be employed by the farmers in order to retain sustainable food production. Water harvesting structures for crop and domestic use should be constructed on every farm by every farmer. This will help harness water which would otherwise be lost through runoff when it rains.

The water so harnessed will percolate into the soil and is retained and used by crops a much longer period until the crop matures. Water harvesting structures e.g. earth dams for water which can be used by livestock will help quick multiplication of the animals which can be sold to get money to use in other personal needs. This way, nobody will ever think of going to the forest to cut down trees to burn charcoal and our trees are left intact for a better environment.

6.2.8 Address the Issue of Landlessness.

81.3 per cent of the charcoal burners interviewed in Rumuruti do not plant trees because of the issue of landlessness whereas 50 per cent in northern approaches gave the same reason for why they don't plant trees. In Rumuruti forest. Since they have no land to survive on, and jobs are scarce, their only alternative is to invade the Rumuruti forest and do charcoal burning to support their livelihood.

At times when the government security team is harsh on the charcoal burners, these squatters turn to the neighbouring communities and steal and rape women at night. When the researcher talked to one of the rape victims, she wept in agony and wished that her offenders could be repatriated back to their original land. Currently, there is a bad blood relationship between the natives and the squatters and a permanent solution should be sought to instill enough security in the area and curb further eating up of the forest trees.

There are also other squatters categories who are victims of the Molo tribal clashes and migrated to the area neighbouring Rumuruti forest. Their only source of livelihood is doing charcoal burning in the forest and work as casual labourers in the neighbouring farms. The greatest number of those who were burning charcoal in the forest fell in this category of landless people. If the government could find a permanent solution to this problem of landlessness, this would save Rumuruti forest from an accelerated degradation. It's the Government's responsibility to provide security for all its residents so that these groups go back to their original land and leave Rumuruti forest alone.

6.2.9 Income Generating Activities.

Trainings should be carried out to the charcoal burners and others on how to operate small-scale income generating activities for them to earn a living. This will mean that, with alternative income sources, people will not burn charcoal but engage themselves in these income generating activities. These include:

1. Co-operative businesses. The community can form into groups and be given small loans by the Government or any other agency or negotiate for a loan in a financial institution to start-up an income generating project. The interest charged on such a loan facility should be lower than commercial rates so that the very poor beginners can afford it. This will help to encourage informal sector growth which will in turn create self-employment and not see the need to burn charcoal.

Some of the projects that can be started include poultry keeping projects, goat rearing projects, bee-keeping and birds and rabbits projects.

Also fisheries can be an important income generating project together with camel projects. This will ensure sufficient milk, hides and skins, honey and other products supplies and improve the income base of the local actors.

2. Individual small-scale projects:

The Government can create a revolving fund whereby locals benefit from this fund by getting small loans to start small businesses which will disengage them from any other activity including charcoal burning.

3. Self-help groups: Community development workers should encourage individual initiatives, among the locals to start self-help groups whereby they practice a merry-go-round self-help contributions. The funds so raised can be used to start-up a bigger business which can further be expanded.

6.2.10 Methods to reduce charcoal demand and increase end use efficiency

The effects of fuel access can be seen most clearly in the patterns of household energy use according to settlement size. In remote rural areas, even high-income families typically depend almost entirely on biofuels, with perhaps a little kerosene of lighting or kindling the cooking fire. Supplies of modern fuels are either non-existent or they are insufficient, unreliable or very expensive for the major end uses which biofuels satisfy i.e. cooking and water and space heating.

As one moves towards the larger towns and cities, access to modern fuels increases since these are the centres of demand and economic power and have the best-developed infrastructure of distributing modern energy sources. Generally, many people depend upon notoriously inefficient open fires for cooking and heating.

The following are suggested methods to reduce charcoal demand and increase end use efficiency.

- Fuel saving and fuel switching
- Alternative sources of charcoal
- Alternative sources of energy; High performance pressure; stoves; Electricity; Gas and others.

6.2.10.1 Fuel saving and Fuel Switching

This can be achieved through :

- Use of more efficient firewood and charcoal stoves which are fuel saving.
- Better fire management and cooking practices, e.g. fireless cooker, and tea *cossey*

These have to do with switching off the fuel either

- Immediately the food is cooked or
- Half-cooking the food, then transferring the food in a heat insulated container or bag which allows further cooking of the food with the already acquired heat and also keeps the food warm.

6.2.10.2 Use of more efficient firewood and charcoal stoves

These have got various advantages which include:

- They offer a good match with present cooking patterns (cooking functions, size and space or portability, range of fuels and cooking utensils).
- They save time on fuel collection (if this is a burden) and on cleaning pots, cleaning the kitchen due to smoke, reduced risk of burns, etc.
- They are more fuel-efficient.
- They reduce smoke and eye and lung disease.
- Reduce maintenance and have a longer life time and with rural stoves use available materials for repair and construction.
- Are aesthetically pleasing, providing prestige without creating resentment by neighbours.
- Act in development oriented programs as a vehicle for giving women greater confidence in their ability to improve life for themselves and their children.

Examples of these stoves are:-

- The Ceramic lined bucket stove

- Mud stoves, e.g. *Maendeleo jiko*. These two can be used in combination with Tea cosy and Fireless cooker (cooks half-cooked food)
- Improved kiln technologies for charcoal production also help to increase the wood-charcoal conversion efficiency

When people are encouraged to use these kind of stoves, there would be a reduced charcoal-fuel use and job creation as the local people (actors) would form into community groups or micro-enterprises to produce the stoves. If social and other community workers disseminate this information to the local actors in Laikipia, they would earn more money by making stoves than engage in charcoal burning.

6.2.10.3 Alternative sources of energy

A. Renewable energy options

- **Energy from Biomass:** Energy can be derived from a range of biomass products. Conversion technologies for the fuel production from biomass can be either biological or thermochemical. The biological method involves an anaerobic digestion of human, animal and agricultural wastes to produce biogas. Biogas can also be produced from aquatic plants like the problematic water hyacinth.
- Use of power systems, wind mills and generators, small hydro-unit also hold a good deal of promise.

B. Improved kiln technologies for charcoal production

Traditional charcoal kilns are very crude. The charcoal is simply produced in pits covered with earth. As a result, a good deal of wood is wasted. It may take up to over twelve units of wood to produce a unit of charcoal. With use of improved kilns, this recovery rate can be improved and this would reduce the per capita/family consumption of wood in Laikipia.

Kilns constructed of brick, concrete, and metal allow better control of yields and eliminate contamination of the product with earth and stones.

Jones (1978) gave two types of fabricated kilns: fixed and portable. Some of the typical kilns are: *French Nilmelior system*; *German DRP kilns*; *Beehive kilns*;

Masonry block kilns; Missouri kilns; CUSAB (Charcoal from useless shrubs and bushes) kilns and Mark V kilns

The first four kilns are cheap and easy to construct and are adaptable to mechanized working methods, but they have not proved strong enough to withstand high pyrolysis temperatures. The Missouri kiln incorporates the advantages of the first four systems and overcomes their disadvantages. Its chief advantage is its strength which allows trucks and tractors to enter the kiln for loading and discharging of products. The Mark V is an adaptation of the CUSAB kiln. Both are portable kilns relatively inexpensive and practical to use.

The selection of fixed or portable kilns depends on the location of the available biomass supply and the relative cost of labour.

C. Alternative sources of charcoal

Pyrolysis is a thermo-chemical process in which a material is thermally decomposed into less complex, mainly volatile, organic compounds in an air (oxygen) starved environment. A carbonaceous residue (or char) as well as combustible gas and an oily liquid are normally produced.

Wood can be used extensively to produce "Pyroligneous acid" (methanol, acetone, acetic acid) and other chemicals by destructive distillation. These chemicals are also of much economic importance.

Pyrolysis can also be applied to a wide variety of other cellulosic materials like rice husks, coffee husks, cashewnut and coconut shells, cotton-gin waste, cotton stalks, saw dust and clippings, *bagasse*, etc. KPCU has been in the forefront in this endeavour to make charcoal from coffee parchments and *Mbuni* husks. This project which was started back in 1978 in Dandora should be expanded and the technology be adopted by similar agencies e.g. sugarcane processing companies, the cotton industry, etc. to enable Kenyans to make charcoal from agricultural and all kinds of forest residues or wastes.

If these technologies are adopted and disseminated to many people in Laikipia district, this would help to reduce the strain on forest resources.

6.3 CONCLUSION:

Reliance on woodfuel has contributed to deforestation problems in Laikipia and its consequent overuse and the ensuing ecological and socio-economic problems will soon lead to the "firewood crisis". The rapid rates of population growth, urbanisation and settlement /squattling of tribal-war victims have all worked out to raise the rate of charcoal making in Laikipia district. According to Ndegwa and King'oriah(1996), the human Physio-biological needs often take precedence over other needs. If faced with starvation or threat to survival, an individual is unlikely to give concern to environmental conservation, which is a global objective. It is therefore important that the recognition of a planning process would stand little chance of success without incorporating the knowledge, experience and circumstances of the actor.

People in the area have become openly defiant from the state-owned woodlands. Since the forestry department is usually responsible for the protection of the forest, many people have come to identify the forest rangers/guards as government policemen to be outwitted if possible and to be fought if necessary.

If the current trend of tree felling for charcoal burning continues unabated, it is going to lead to a woodfuel crisis as the trees will completely disappear. If this happens, it would lead to a complex social effect of fuel-wood stress where the poor would use their energy with least utility and devote more of their limited income, time and labour to simply maintaining their present fuel consumption. More children would drop out of school in order to assist their families to meet their fuel needs. This can imply many people having large families for more labour. This would disenfranchise people from the development mainstream and may contribute to their distrust of government authorities. In arid areas as the case for Laikipia, where they can observe the loss of accessible trees and woodlands within just a few years, the impact would be a clear manifestation of their lack of control over their lives and future betterment.

Woodfuel stress in the national scene can also lead to diversion of dung and crop residues as alternative fuel sources, thereby preventing the return of organic matter to agricultural soils. This short-circuiting of the natural soil cycle has serious effect on soil fertility, erosion and water retention.

Generally, charcoal burning has far reaching implications as regards the sustainability of our life support system. This means that man faces a bleak future if the practices highlighted go on unchecked. The government should come out clearly on its stand concerning commercial production of charcoal. The current situation is that, the government is shying off and its not clear to what level trees should be exploited for charcoal production. A partnership must be built up that will allow all sections of society to participate in vegetation resource management, utilisation and conservation.

6.4 Areas for further research

Data on traditional fuels usage are sparse. Detailed studies of a community's particular supply, demand and distribution patterns must be conducted at a projects planning level because usage patterns differ markedly between and within regions. Much of the relevant data — such as the choice of tree species or stove design or the best technique for introducing these technologies in a given community can only be derived from actual project expense.

There is need, however, for governmental capacity to assess the general levels and patterns of woodfuels consumption in order to design overall energy and other public policies. This suggests the need for traditional fuel officers within the government. Ideally, these should be located within the energy Ministry with very close ties to the Ministry of Agriculture, Department of Forest and Physical Planning Department.

As an increasing amount of experience is gained in traditional fuel project, and as information about new stoves and kilns and improved tree varieties accumulates, it will be increasingly important for the government to have a capacity to examine and review this information so that it may be adopted to local needs and situations. This suggests both a need to establish mechanisms of international information exchange and a need of careful review of projects as they are conducted. Donor agencies should actively support such initiatives.

Researchers, project managers and policy makers all need to be kept abreast of the latest developments in community forestry and traditional fuels. Cross-fertilization of research and project ideas between the developing world should be facilitated.

There is need for basic research and development on the following topics:

- Basic sociological, economic, cultural and ecological studies of wood fuel usage
- Thermodynamics of conversion technologies — both basic engineering studies and adaptive work on woodfuel stoves and charcoal kilns.
- Yields of traditional fuel crops. Genetic improvement of fuel crops.

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APPENDIX

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

QUESTIONNAIRE FOR CHARCOAL BURNERS

Questionnaire No:

Area:

Date:

Any information provided will be treated with strict confidence and will be used for academic purposes only. Thankyou.

- 1). Sex
- 2). How old are you?
- 3). Marital status. Tick one; a)Married b)Widow c)Divorced/Separated d) Single
- 4). Household size
- 5). Highest level of education attained+year
- 6). a) When did you settle here?.....b) Which was your place of origin?
c) Reason for migration
- d). Size of land ; i) under crops.....; ii) **Not** under crops
- 7). a) What is your income from this job(monthly).....b) specify whether this job is permanent or temporary.....c) Are you satisfied with the income?
- 8). a) Do you have any other occupation?.....b) If Yes, specify which one

- c) How much do you spend per month on ; a)Food.....b)School fees
c)Water.....d)Medical care.....e)Leisure.....f)Others(specify)

SHELTER.

9). Building materials of the house, a) wall.....b) Roof.....c) Floor.

10). Source of building materials. a)For walls. b)Forroof.

c)For floor

11).Are you satisfied with your house living conditions?.....Give reasons

12).Do you like living here?.....Give reasons for your answer

13).What are the major economic hardships that you get from here?

14).How do you solve them?

MARKETING AND ECOSYSTEM LEVEL

15).Why do you cut down the trees? explain

16). a) Do you own the land?.....i) If no, who is the owner?

17). a) Do you own the trees?.....b) If no, give the conditions under which you acquire the trees

18). Who does the felling down of trees?

19). Which other people do you conflict with in the extraction of the trees?

20). Which tree species and parts are preferred for charcoal burning and why?....

21). Approximately how many bags/sacks are gotten from one mature tree?

- 22).How many trees are felled per day by one man?
- 23).How many hours doe you fell down trees per day?
- 24).What equipment are used to fell down the trees?
- 25). Which seasons/months of the year is felling down of trees most dorminant and why ?
- 26).How many bags of charcoal do you get per each tree felling job?. Give an average
- 27). What problems do you get in this charcoal burning job?
- 28). a). Who is the main buyer and from where ? explain the marketing system(Give the chain of other actors).
- b) For each actor category, give the main mode of transport
- 29). What is the average price per bag?; a) wholesaleKshs.
- b) RetailKshs.
- 30). a) Who looks for the market?
- b) What marketing problems do you experience?
- 31). a).Is charcoal burning activity able to sustain your livelihoods in this area considering the local climatic conditions?.....b) If no , explain why
- c) If yes, explain
- 32). Who is responsible for the incomes spending, and why?

33). Apart from charcoal burning which other ways do you think trees are important to mankind(List in order of priority)?

34). Would you like to live in a place with a) No trees, b) Few trees or c) Many trees
d) Other(specify)...

35). What recommendations would you make to conserve our trees?

36). a) Do you plant any trees to replenish the cut down ones?.....b) If no,
explain

c) If yes, explain i) when and where?

ii) The source of seedlings

37). a) Do you think charcoal burning can eventually lead to bad environmental
consequencies?

b) If yes, which ones

c) If No, why.

38). What alternatives would you propose; a) As alternative jobs to substitute charcoal
burning?

b) As alternative sources of fuel?

39). Is there any other information that you would like to provide to us about charcoal
burning(Comments or criticism)

Thankyou very much.