LAND USE PLANNING FOR FUEL WOOD UTILIZATION BY SMALLHOLDER TOBACCO FARMERS: A CASE STUDY OF KEGONGA DIVISION, KURIA DISTRICT -KENYA

BY

GETANGITA CHACHA PETER
B.A (Geography) Hons BARATON UNIVERSITY.

A Thesis Submitted In Partial Fulfillment Of The Requirements For The Degree Of Masters Of Arts In Planning

DEPARTMENT OF URBAN AND REGIONAL PLANNING

UNIVERSITY OF NAIROBI

SEPTEMBER 2003

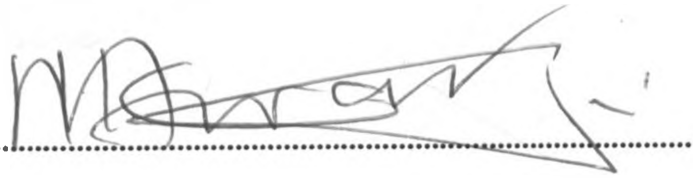
DECLARATION

This thesis is my original work and has not been presented for a degree in any other university

.....

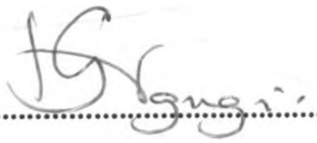
GETANGITA CHACHA PETER

This thesis has been submitted for examination with our approval as the principal University supervisors



.....

DR. ISSAC KARANJA MWANGI



.....

DR. GEORGE NGUGI

DEDICATION

To Hon. Manga, Ann W. Manga, Getangita Mwita, Magaigwa Getangita and , Ghati Chacha, for the love and sacrifice they made for my success, and also to my children and may you grow to do better than this.

ABSTRACT

Tobacco production in Kenya under the aegis of the British America Tobacco (BAT) Company has created a tobacco growing community peasantry that has long been ignored by social scientists and regional planners. Yet, tobacco farming has had profound implication to both the physical and social environment on living conditions of the peasants while wider context a lot of literature on there exists literature on tobacco production and its economic gains for the peasants, a gap exist pertaining on mechanism of production does exist, the relation between people and their physical environment remains a yawning gap in planning in Kenya.

Many scholars argue that agriculture intensification does not always lead to deforestation or even degradation, however, tobacco farming does. Most people overlook the fact that overuse of the land and resources for commercial purposes, leads to the degradation of environment.

The objective of the study was to determine the effect of tobacco on vegetation cover and explored alternative approaches to overcoming the problem of deforestation in Kegonga. A sociological inquiry was carried using Structured questionnaires to solicit information from households. A randomly selected sample of 80 from Kegonga Division was used. Data was analyzed using the Statistical Package for Social Sciences (SPSS). Among the findings it was found that fuelwood shortage for curing tobacco is prevalent in Kegonga. Farmers resort to buying wood from other farmers or harvest the only vegetation along the rivers. It was further established that the widespread of the use of wood fuel in the tobacco has had effects on the environment. It came out from the study that there has been vegetation change whereby the original tree cover has been removed mainly for curing tobacco. In addition, it has encroached onto water courses and has contributed to seasonal drying up of stream. Collecting companies are not involved in any way to ensure fuelwood availability. It is therefore recommended that other sources of curing tobacco be sought like using solar or electricity to sage the environment.

ACKNOWLEDGEMENTS

The successful completion of this work was only possible through the assistance of various institutions and individuals. I am greatly indebted to the Principal of S. R. Manga & Associate for the sponsorship and the staff for the moral supports. Special thanks go to my supervisor Dr. Isaac Karanja Mwangi and Dr. G. Ngugi for the guidance; criticism and help that saw me undertake this work from start to completion. I also, acknowledge the assistance of Mr. Nato and Rose Warungi for proof reading the draft and for there encouragements.

To Hon. Manga, I am very grateful for the encouragement that made me go on even when I thought that I was beaten and would not make it in life I cannot also forget to thank my colleagues, (Sabai, Omondi, Opiyo Mulytah and Ambere), University of Nairobi especially Department of Urban and Regional Planning and also other individuals who assisted in one way all the other. May God bless you and thanks once more.

However, despite all the contribution received from various sources, the errors and misinterpretations that may appear in this thesis are my responsibility.

Getangita Chacha Peter

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

LIST OF FIGURES

LIST OF APPENDICIES

LIST OF ABREVIATIONS

DURP	Department of Urban and Regional Planning
FAO	Food and Agriculture Organization
TOE	Tones Of its Equivalent
B.A.T.	British American Tobacco
M.T.K.	Master Mind Tobacco Kenya
SFC	Specific Fuel Consumption
IFSC	International Forest Science Consultancy
KTDA	Kenya Tea Development Authority
KNA	Kenya National Archive
GOK	Government of Kenya
TCSK	Tobacco Co-operative Society in Kenya
NTC	Nigeria Tobacco Company
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
LH	Lower Highland Zone
UH	Upper Highland Zone
TAZ	Tropical Alphine Zone

CHAPTER ONE: INTRODUCTION

1.0. Background of Tobacco Industry in Kenya.

Tobacco is a cash crop, which has now been produced in Kenya for the last forty years. Since its introduction by the British-America Tobacco (BAT) Transnational, its culture, use, health and economic effects have been issues of great concern. Growing the crop the concern has expressed not only the health hazards associated with tobacco production but also the environmental unsustainability of the crop in terms of excessive use of woodfuel. Today, the crop poses an important dilemma for development since its production has generated a wide range of employment, income, and foreign exchange. However, the damage to forest resources and to the environment in general seems to outweigh the benefits. Kenya's declining economy seems to offer few choices to the exchequer, hence the addiction to the tobacco cash, an affliction that has continued to affect the farmers.

Tobacco production in Kuria was begun under the aegis of the British-American Tobacco (BAT) in 1964 when the group officially toured the area to select pilot farmers. In 1970, it was introduced in Kegonga division. The occupation of the tobacco farmers prior to their adoption of commercial tobacco production showed that a larger proportion were engaged in non-agricultural activities such as trade, brick laying, tailoring, and shoe making, with a few being crop farmers. Tobacco farming in Kegonga drew new settlers from other divisions who were interested in tobacco farming although some scholars attribute the influx to the 1969 "alien quit order" in Kuria.

Before 1964, Kegonga community used to grow tobacco mainly for domestic use. The tobacco, which was grown, was being used for snuffing by old people. After being used by majority of the community, it was introduced in form of barter trade, when the number of the users increased.

Two varieties of tobacco are grown in Kegonga: the flue and the fire-cured variety. The

fire variety is more commonly grown in the district.

PLATE 1: FIRE CURED VARIETY.

Source: Field Survey 2003

Plate 2: Flue Cured Variety.

Source: Field Survey 2003

The flue variety, heat is used whereby it is passed through aluminium pipes inside a barn house. A lot of wood is therefore needed to treat the flue variety. Most of the farmers prefer growing fire cured tobacco partly because it is easy to construct the barn and partly because fuelwood demand associated with flue variety is very high.

1.1 Introduction.

Among agricultural products, tobacco in the developing world's eighth largest export earner. Forty-three developing countries export tobacco. Nine of them account for over 90% of the south's foreign earnings- Argentina, Brazil, Turkey, Thailand, India, China, Indonesia, Malawi, Zimbabwe, and Kenya. Except for Malawi and Zimbabwe, tobacco

accounts for less than 2.2% foreign earnings. In 1992, developing countries exported 15% more tobacco than in 1991, but earned less $2,794million against $2,951milllion, which is equivalent to Ksh. 224,276 million at the current exchange rate of 76 shilling against one Dollar, (Economist Intelligence Unit ,1990).

They imported tobacco products worth $ 1,292 million. The figures do not take into account imports such as fertilizers, needed in the growing of tobacco. As a result of tobacco demand, deforestation occurs because the industry does not grow enough trees to replace those used for curing (drying out) the harvested tobacco. Also, soil erosion does occur and tobacco depletes the soil of nutrients. Growing of tobacco requires use of fertilizers and pesticides, which can affect local water supplies.

Tracing this problem of degradation, one could say that from the very beginning, when commercial tobacco production started in Chesapeake Bay area of Virginia during the early 17^{th} century, it was an enterprise of settlers making use of contract and slave labour to colonize natural environments. In 1980, 70% of world tobacco production was concentrated in North America (Geist,1999). Starting with the American Revolution and the breakdown of colonial rule tobacco production shifted into developing nations of the tropics and subtropics, both having much more fragile ecosystems than the temperate regions, especially when it comes to fuel supply from natural forests.

In 1977, an internal paper was produced by the director's office of the United Nations Environmental Programme, claiming that fuel wood scarcity, land degradation and deforestation in developing nations could be related to tobacco production. This was clarified by Goodman (1995), especially the wood use of tobacco for curing contributed to serious and growing deforestation in tropical dry land areas having seasonal rainfall and poor soils.

Fraser, (1996) and ITGA, (1995) admitted that the production of flue-cured tobacco, used in manufacturing American blend cigarettes, can cause grave ecological problems in such areas where there is a prospective or actual fuelwood supply deficit.

A review 14 of the major causes of deforestation in Central America named cattle ranching and land colonization by slash and burns subsistence agriculturalists as the principal causes Tobacco growing was not named. Brazil appears to be the only Latin American country where tobacco-caused deforestation is acknowledged as a major problem. A 1988 tobacco international report stated that in southern Brazil there were 93,361 curing barns, and despite some recent efforts with reforestation programs the author described "the devastation of the forests" as looking " less deplorable now than it did 10 years ago" (Jungubluth, 1988).

Tobacco use is not only a health issue, but also an environmental one too. Tobacco farming is a process that rapidly depletes soil nutrients and requires use of herbicides, pesticides and other chemicals. It contributes to air pollution, and deforestation. Heavy use of chemicals and fertilizers recommended by the tobacco buying companies makes tobacco farming expensive too.

Fuel uses have been identified as one of the most significant causes of forest decline in many developing countries. Even in the absence of detailed scientific studies of the site level, circumstantial evidence has been cited to illustrate the apparent damaging relationship between the use of wood for fuel, and loss of forests. Recent estimates indicate that wood fuel accounts for over 54% of all global wood harvests per annum (Myers, 1984), suggesting a significant and direct role of wood fuel in forest loss. It is also established that the highest rates of forest decline since the 1960s have occurred in areas with heavy dependence on wood for fuel, namely the developing non-oil exporting countries (Eckholm, 1976; IUCN 1980, FAO, 1981; Allen and Barnes, 1985; Postel and Helse, 1988).

For many developing countries, wood fuel constitutes the cheapest and most accessible source of household fuel for the majority of the population, especially those living in rural areas in countries such as Kenya.

In Kenya, little information is available concerning the effect of tobacco on deforestation, and very little measures have been taken, likewise Kengonga division

Kenya's forests are rapidly declining mainly due to pressure from commercial farming. According to a recent report, tobacco agriculture and other land uses constitutes a greater percentage in forest destruction in Kenya. The production area which forms about 20% of the country's area falls in the medium and high potential agro-ecological zones and is under agriculture, forest and nature reserves. According to Food and Agricuture Organization ,Forest Resource Assessment 1990, Kenya is classified among the countries with lower forest cover less than 2% of the total land area (FAO, 1999).

The World Health Organization termed tobacco control as the quintessential challenge of sustainable development, since it carries implication for trade and taxation, agricultural subsidies, the environment, social polices and health care expenditures, among other sectors. Blunting the epidemic therefore, requires a better understanding of the process and the socio-ecological implications of tobacco production at the farm level. The dwindling forest cover has a saver effect on the climate, wildlife, streams, human population especially forest dwellers as one of the recent report stated:

> "...The slopes on the sides of the Kuria valley, near mount Kenya, are now completely bare. The forest cover has been cut down to meet fuel for curing tobacco. Farmers in Kenya's [in this] valley have stopped growing maize- the country's most important staple food- and are now growing tobacco for a multinational company..."(T.G, parry 1980).

As shown above, tobacco side effects has caused deterioration in the health and nutritional status of households because the crop substitutes and displaces food crop production. This is an indication of tobacco replaces food crop production beside forest vegetation cover. (Sessional paper No. 4 of 1981 on National Food Policy, Republic of Kenya, 1981).

1.2 Land and environmental planning in Kenya.

Land is considered the most valuable resource and therefore the most sought asset and need to protect it and this is why in 20th century Kenya Africans went to the forest to start war for independence against the British in the name of Kenya Land and freedom Army. Sustained demand for land in post-independence years has then lead to conflicts in the use and management of land.

1.3. Statement of the problem.

Tobacco production in Kenya under the aegis of the British-America Tobacco (BAT) Company has created a tobacco peasantry that has long been ignored by social scientists as well as planners. Yet, tobacco farming has had profound implication to both the physical and social environment of the peasants living conditions of the Kegonga community. While in a wider context a lot of literature on social relations and on mechanisms of production does exist, lack of systematic studies on the relationship between tobacco growing and their physical environment and land use planning remains a yawning gap in the settlement in Kegonga.

The tobacco industry has been expanding ever since it was introduced in Kegonga division in the early 1970s. This has had a corresponding increase in fuelwood demand for curing/treatment of the crop before delivery to the tobacco processing companies. The demand for fuelwood has placed a heavy demand on the available tree resources. It is perceived that fuelwood use for tobacco curing is the root cause of environmental degradation and de-vegetation.

Very little information is available on the contribution off deforestation in Kenya and even in Kegonga Division. It is therefore necessary to measure the implication of tobacco farming on the environment (vegetation) and address the same,(Babere 1999).

1.4. Research questions

The main research question is to determine the effects of tobacco growing in Kegonga division, and specific research questions relented to the research are: -

1. What is the extent of tobacco growing in Kegonga Division?
2. What is the level of demand of fuelwood for tobacco curing in Kegonga Division?
3. What land use planning measures has the community and tobacco companies put in place to ensure continued availability of fuelwood?

1.5. Objectives

The broad objective of the study is on land use planning for fuel wood utilization by small holder tobacco farmers in Kegonga division and to explore the alternative approaches of overcoming such problems soil erosion and deforestation all arising from tobacco growing.

The specific objectives of the study are:

1. To establish the extent of tobacco growing in Kegonga division of Kuria district.
2. To examine the effects of tobacco growing on the vegetation cover in Kegonga division.
3. To evaluate the programmes supported by , Mastermind Tobacco K. Ltd and British American Tobacco Kenya Limited to promote Kegonga division.
4. To evaluate appropriate land use planning/practices and utilization strategies of the community.

1.6 Hypotheses

One general hypothesis is considered. Within it, two specific hypotheses are tested. The Acceptance or rejection of these hypotheses would form the basis of acceptance or rejection of the general hypothesis.

a) General hypothesis.

1.Ho: There is significance between tobacco growing and deforestation in Kegonga Division.

2) Specific hypothesis

Ho: There is no preference for tree species used as a source of wood fuel for tobacco use in Kegonga Division.

Ho: There is no self-sufficiency of wood fuel sources for all households in the rural areas of the study area.

Hi: Tobacco growing has no significant effect on forestation in the Division.

1.7 Scope of the Study

The study was carried out in Kegonga division in Kuria district. Although effects of the use of wood fuel in tobacco has been carried out in various part of the world apart from Kegonga division. The study deals with the use of wood fuel by tobacco and its effects to the environment and landuse. Fuel wood is the main cause of depletion of forests and soil degradation.

1.8 Justification

Wood related sources continue to be the major fuel supplies for household domestic uses, especially in Less Developed Countries, Kenya included. This position is strengthened by the fact that they are most convenient, cheap and safest to handle. This type of fuel is extensively used in the tobacco industry.

This role has not been given the attention it deserves both at the national level and local level. Policies have been formulated in the past to delimit parts of the country's forest reserve. There are no policies or programmes to regulate woodfuel availability, distribution and use.

The 1968 Sessional paper on forestry does not cover woodfuel utilization and management. The 1983/1988 District Development Plans do not give woodfuel and environmental issues the attention they deserve. In the Kuria District Development Plan 1999/2003, for instance, it is mentioned in passing that the role of forests are to provide for domestic fuel wood. Neither does it indicate guideline on acquiring fuelwood nor the implementation of forestation programs, (District plan,1999).

Being the most important cash crop, tobacco farming is crucial to the local farmers of Kegonga as a major source of income. It has enabled poor farmers to offer basic education to their children, afford Medicine and meet basic requirements of food and shelter. However, the effect of the Tobacco growing industry on the environment has been overlooked for a long time. Since fuelwood availability is paramount to the tobacco industry, the diminishing tree resource base is detrimental to tobacco farming. This study examined the implication of tobacco growing to the environment and recommended appropriate measures to ensure environmental sustainability and continued availability of fuelwood.

Otieno (1998), in his work, agricultural development and environment change examines the environment impacts on contact tobacco cultivation in Kuria district but the study didn't cover very well in Kegonga Division and it also focused in particular on the social and ecological processes that influence land use practice at the farm level from the colonial period to the present. A major finding of his study is that contrary to the expectation, the Kuria landscape has become wooded over the past 30 year.

His study is a contrast to the premises that the study design is targeting. During the time he carried out his study the community was not wooded even though is trying to urge that bluegurm trees has been planted as it is only few farmers who plant trees due the size of the farm and also the effect of the type of the tree which was being planted. The study does tell the truth what is on the ground and that is there is need for the research to be carried out to show the truth and to show how proper planning can be used to reduce deforestation.

Robert (1998) was concerned with the colliding circumstance under which African men women and children, lived and worked on European owned Tobacco in Zambia. The study demonstrates that workers and their families were not mainly powerless victims of Tobacco farmers, the activity attempted to shape the living conditions they found on the European farm. This study does not mention the production factor of fire usage and environmental assessment. Majority of those who are suffering in Kuria are women

and children as they are the ones who provide most to the labor force on the farm, but the study was not concern with deforestation.

These problems warrant investigation in view of the recent campaigning against deforestation in the district within the study area and the rapidity with which some markets are also affected not only land use patterns within the location but also environment. However, this study has been based partly from the perceptions of Kegonga farmers on the changing soil quality and vegetation and partly from comments on government publications in the district concerning Tobacco and the environment.

1.9 Study limitation.

In the process of carrying out the study the following problems were encountered. The time allocated for the research was very short. The study had to be carried along side other course work and the work load proved to be quite enormous. It was thus not possible to examine certain aspects in great details.

Suspicion was evident among the member of the community in the study. The people viewed the research as an investigator of tobacco buying company for loan recovery and people were reluctant to give information.

The existing public transport was poor and unreliable and this meat walking long distances. This led to time loss in the field.On the whole however, in spite of these limitations the study was able to achieve its objectives.

1.10 Key terms and concepts

1.Wood fuel: This refers to both firewood and charcoal. These are derived from trees or woody parts of smaller plants and used directly or after some processing respectively. They are burnt as fuel to provide heat energy for curing tobacco.

2.Charcoal: This is residue that remains after wood and/ or other plant wastes are heated in absence of air, and broke physically and chemically.

3.Biomass: the term refers to the plant organic matter produced by plants during photosynthesis and available as a source of fuel.

4.Environment: the term is used to imply natural surroundings, conditions and influences that are inherent in geographical regions which have experienced least of man's activities.

5.Environmental impacts: The likely consequences on the environment resulting from activities related to resource utilization in the geographical area or region under consideration.

6.Ecosystem: an integrated set of biological component making up a biotic community and it's a biotic environment.

7.Ethylene: A gas released whenever organic substances are burnt. It's produced during industrial processes, agricultural burning and during the smoking of tobacco. It's toxic to nearby vegetation.

8.Harvesting: The removal of mature ripe leaves from the plant. Plants indicate their beginning to yellow a signal that chlorophyll is beginning to break down. Yellowing leaves a chemical and physical property that enables them to be cured and manufactured in to tobacco.

9.Acid rain: This is rain-containing acid like sulphuric acid and nitric acid formed from pollutants in the atmosphere.

10.Deposition: Deposition can either dry or wet and involves both gases and aerosols. Aerosols can be deposited dry, either by impaction, segmentation or by incorporation into some form of precipitation.

Gaseous deposition in vegetation is by the absorption process that includes surface absorption and absorption through plant stomata. Stomata absorption is by the diffusive process and is dependent on stomata resistance, both the atmospheric and internal concentration of the gas and the duration of the exposure.

11.Fuel wood: Any part of a tree or shrub, green or dry that is obtained from any source, for the purpose of curing Tobacco.

12.Tobacco curing: It is a process of reducing the moisture content (drying) of Tobacco leaves before delivery to Tobacco buying centres.

13.Land preparation: This is a process that involves bush clearing/slashing, burning and ploughing of the land to make it ready for planting Tobacco.

14. Afforestation program: This refers to activities that are aimed at establishing forests where there has been none. The program is aimed at increasing` the forest cover in an area.

15. Agroforestry: This is a kind of farming in which multipurpose trees and shrubs are grown with food crops. The trees can appear as boundaries, hedgerows, and woodlots on the farm.

16. Deforestation: This is a process that leads to the reduction of the forest cover through selective or unselective harvesting of forest trees without replacement.

17. Small scale farmer: this are farmers who are doing farming on a piece of land which is ranging from 0.5 acres to 10 acres and the mean average of the farmers in Kegonga is 1.5 acres.

1.11 Organization of the Thesis

Chapter one has served as an introduction to the study. In it the background to the study, research problem and questions ,objectives, hypothesis, scope of the study and justification have been given. Chapter two, literature relevant to the study is reviewed. In chapter three, gives details of the study area. Chapter four, gives the research methodology, while chapter five gives analysis of the data and research findings. Planning and policy recommendations and conclusions are finally given in chapter six.

CHAPTER TWO: RESEARCH METHODOLOGY

2.0 Introduction

This study aims at analysing the use of wood fuel in tobacco industry in Kegonga division. The study seeks to establish the extent of tobacco growing, examine the effects of tobacco growing on the vegetation cover. The study also seeks to identify steps/ programmes supported by the tobacco buying companies in the study area and also to recommend appropriate land use planning. The methodology adopted to achieve the study objectives is discussed in this chapter.

2.1 Data gathering

A sociological survey has been carried out on selected households in Nyaroha and Nyabikongori locations of Kegonga division. The survey is to seek information on tobacco farming, fuelwood needs and sources and the implication of tobacco farming on the environment.

2.1.

2.2. Sampling procedures

The household will be used as the unit of analysis. The sample size is arrived at using the formula adopted from Nassiuma (2000) as shown in appendix 2.

To perform a simple random sample, each household in the sample frame will be allocated a number. A table of random numbers will then be used to select households.

2.3 Data organization and analysis

2.3.1 Data.

The type of data in research influences both the method of collection and the instruments utilized. The study collected both secondary and primary data. Primary data was achieved by conducting a field survey by use of standard questionnaires, observation and photography. Prior to the field survey, secondary data was sourced from published research findings, journals and government documents.

2.4. Sources of data.

The major two sources of data collection were primary and secondary methods. Primary methods involved the administering questionnaires to a sample of 80, personal (researchers) observations and holding scheduled interviews with selected key informants. This method exposed the researcher to the respondents personal views bout the effects of tobacco growing.

Secondary method involves the study of any written materials that contain information about the study phenomena. Some documents were primary or eye witnesses accounts written by people who experienced in tobacco and degradation area.

2.5 Methods of data collection.

The methods of data collection depends on the type of data to be collected. The method that was employed to collect secondary data involved a review of literature on tobacco. While for acquisition of primary data, field survey through administration of questionnaires and interview schedules, observation and photography were utilized.

2.5.1 Secondary data.

Collection of secondary data involved reviewing relevant literature on tobacco worldwide and in Kenya. This approach lends to qualitative rather than quantitative analysis.

The secondary method of data collection has several advantage; First, it is possible the research to gather information about inaccessible subjects. Most of the farmers grow tobacco for survival as it is the most cash crop in the area and it is through secondary data that the research was able to unveiled some of the past reasons why tobacco was taken to the area. Secondary, this method allows for longitudinal analysis. Like observation and unlike experiments and survey, document study is suited to study over

period of time. Thirdly, through secondary information, unlike experimentation and observation, the research is exposed to a wide range of sample size to choose from a situation that allows him to have access to a lot of information. Lastly, there is advantage in that the method cuts down on the cost of data collection.

2.5.2 Primary data.

This method was applied through administration of questionnaires, observation and carrying out of scheduled interviews and photography.

2.6 Field survey.

The survey consisted of asking questions to a representative population sample of the true population of households. There were a fixed number of standard questionnaires administered to households which were selected based on random systematically classification basis so that quantitative analysis could be made. The design of the questionnaire was deliberate to meet this need of relevant to the study goals and the questions relevant to individual respondents.

One of the advantages is that the interviewer can have control over the environment. This can be achieved by making certain that the interview is conducted in privacy, that there is no noise as contrasted to mailed questionnaires where the interview can be completed by respondents in drastic conditions.

Interview method is its flexibility. Interviewers can prove for more specific answers and can repeat a question when response indicates that the respondent misunderstood. And also even person who are unable to read and write can still answer questions in an interview, and others who are unwilling to expand energy writing out their answers can be glad to talk. The interview also gives an interviewer an opportunity to observe non-verbal behavior and assess the validity of the respondents answer.

2.6 Frequency distribution

This will be used to show the number of cases in various categories of variables, which will be expressed as totals, proportions or percentage of totals. This will be useful for qualitative data measured in discrete rating and ordinal scales. For internal variables such as size of land under tobacco, the data will be grouped and presented in a frequency table.

2.7 Descriptive statistics

Arithmetic mean, range and standard deviation will be produced for interval variables such as quantity of fuelwood used, amount of tobacco produced in a season and average size of land under cultivation. This is useful in finding the most representative value e.g. the average amount of fuelwood used by a household for curing tobacco.

2.8 Correlation

This will be used to establish relationship and provide information on their strength and direction. Bivariate correlation will be employed. For instance in establishing the relationship between amounts of tobacco cured and fuelwood used.

CHAPTER THREE:LITERATURE REVIEW

3.0 Introduction

The environment is constantly changing due to the changes taking places as a result of man's landuse. The interaction between economic activity and the environment has led to scholars unveiling actual and potential conflicts (White, et al, 1987) the concern here mainly calls attention to extension to negative externalities and their social costs as pollution and resource depletion. Currently the emphasis is on the effect of ecological stress-degradation of soil, atmosphere and water regime(WED, 1987) the economic-ecological interaction arise because economic development requires a compromise between material growth and environmental constraints.

When fire was discovered, it constituted significant human invention of the cradle man and great step towards civilization. Wood was the first resource to sustain and amplify heat output. As such, wood remained a free source for along time, as it was readily available.

Firewood collection from source close to where people lived did not conflict human survival concerns in connection with the natural environment, particularly land for farming, water catchments, vital plant, and animal life systems.

Initially tobacco (*Nicotine tabaccum*) originated in South America and was first grown commercially in Central America in the early sixteenth century. From there, it spread to Europe, and by the early seventeenth century, it was introduced in the Middle East, Africa and Indian sub-continent.

When Christopher Columbus landed in the West Indies in 1492, he found that the people there smoked the dried leaves of the tobacco plant rolled up into a small tube. The tobacco plant was unknown in Europe at that time although it had been smoked, probably chewed, and used as snuff in America for about 2,000 years. The explorers took the seed to Spain back with them. Over the next century, the use of tobacco in Europe grew with each voyage of Europeans to the new world.

The first varieties of tobacco found by Spain and Portuguese traders were harsh and strong. In 1892, a new and milder variety was planted in the Jamestown colony, in present day Virginia by John Rolfe. Rolfe probably got his seeds from the Carribean Island of Trinidad, but it is believed that the plant originally came from Brazil.

The new kind of tobacco became one of Jamestowns's most valuable crops in its trade with England. Later tobacco came to be grown in other areas in the Eastern part of North America and in other parts of the world. Smoking tobacco became wide spread pastime. Tobacco plants may grow to about six feet (1.8m) high .the leaves may be more than 3 ft long and half as wide, leaves are covered with tiny hairs that give off a gumming wax.

3.1 Environments and development.

The interaction of man with the environment are enormously complex and can only be understood by considering his perception and behaviour changes to it (White, et, all 1984). The effects of man's activities as inputs to environmental systems is to redistribute matter and energy between the stores of the system and to alter both the magnitude of the pathways by which energy and matter are transferred. Natural systems are open and organized and as energy and mass cascades the consequences of human intervention in the operation of system will almost inevitably have remification beyond the boundaries of that system(Ibid). man's impact on the environment began with his use of tools well before recorded history.

In his drive to find and consume non-renewable resources, man has made his most obvious impact on the renewable ones, (Mbathi, 1992). There is evidence for the deterioration of the natural environment such as barren land, salt water encroachment, lowering of the ground water level, deep holes and gullies caused by tree cutting. Excessive erosion of agricultural land and land subsistence due to over extraction of ground water, waste disposal, overproduction of toxic waste among others is to be seen in rapidly developing countries (Ibid).

Man is faced with the challenge of meeting basic human needs while sustaining the natural resource base upon which the satisfaction of this needs depends. The adverse effects associated with development if avoided or controlled, the area's capacity to sustain itself reduces (UNCRD, 1987). The world's conservation strategy (IUN 1980) pleaded for utilization of biosphere in such a way that life support systems, essential ecological processes and species diversity be maintained and improved.

However political, social and economic factors often limit opportunities to consider or carry out more effective ways of using natural resources. Economic pressure for example in less developing countries may force the state or nation to exploit their natural wealth at the expense of future needs (UNCRD 1987)

United Nation Congerence on Human Settlement (1976) argued that, ' the natural resources of the earth must be safeguarded for the benefit of the present and future generations through careful planning and management as appropriate. The capacity of the earth resources must be maintained and whenever practicable restored or improved and the non-rewable resource of the earth must be employed in such a way as to guard the danger of their future exhaustion...'so that people should not rush to grow crops like tobacco which require natural resource

Geist (1998), on the economic of Tobacco control towards an optimal policy mix highlights that most Tobacco growing areas are located in regions of semi-arid to semi-humid climate such as tree savannah's, dry-land woodlands and fringe rain forests. In Kegonga Division for example, farmers utilize fresh (virgin) soils to avoid fertilizer input expenses. Besides, these wooded lands provide the much needed free wood to cure and store Tobacco.

Mohele (1979) analyzed the process that makes Tanzanians peasant producers of Tobacco for international market. The dynamics of the organization under changing forces, reproduction process and standard of living among the peasant producers. He

observed that continued use of firewood is pushing its sources further and further away from into the forest. However, his study was mainly economic and didn't study Tobacco and how it is related to deforestation. It gives light to the importance of growing Tobacco as most of the farmers do grow Tobacco because of poverty. They grow it so that they can get income.

Alberta (2001) states that cigarette packing alone contributes to deforestation as machines use 4 miles of paper per hour. Over 350,000 tones of paper are used each year to wrap cigarettes. It indicates that even packaging alone contributes to deforestation. International Tobacco Growers (1996) urge for increased efforts of forestation/agro forestation together with lower rates and higher efficiency of wood utilization in curing Tobacco. For example, improvements in barn technology and the use of agriculture wastes as fuel source. However, the technology in Kegonga Division has not been improved or been changed since 1972.

FAO (1997) reported that the share of Tobacco in global production has been on a constant rise from approximately 30% in the 1950s to approximately 63% at present. The annual loss of vegetation cover was assumed to be partly offset by forest increase in developed countries (Australia and New Zealand) resulting in net losses of around 3.1 million hectares. At the same time the amount of natural vegetation removed by Tobacco is estimated to be around 117,300 ha annually. Thus, among the continents, Asia/Oceanic holds the largest share of Tobacco-related forest removal of (3.7%). This study indicates that in most of the Tobacco growing countries deforestation takes place. Fraser (1986) support the idea that most Asian Tobacco growing countries, and selected African countries will have generally fuel wood shortages and are therefore, likely to experience deforestation.

Tobacco only causes deforestation, as the industry does not grow enough trees to fuel the curing barns. The industry claims to be encouraging reforestation and aforestation but in the reality they are not doing so. In Kuria, for example, BAT reports that farmers can only become Tobacco farmers if they agree to plant 1,000 eucalyptus trees a year

on their land. But majority of the farmers have less than one acre on which farming is done and it is very hard to be put on trees as eucalyptus takes a lot of water from the soil. Furthermore, many farmers prefer to use trees such as eucalyptus for building purposes, and so continue to cut native forest for Tobacco curing.

For the last twelve years, BAT Company has been shouting about massive tree planting but there is nothing less than an outrageous attempt to veil the whole problem. Even fast growing trees can take five years to grow. Many farmers do not have time to for planting trees today that can only be harvested five years into the future. They have rather than more pressing problems such as growing enough food to make sure that their families survive today. The claim of designing more efficient curing barns that use less fuel is a fallacy. An alternative to fuelwood should be sought.

Around 60% of the land in Kegonga Division is under tobacco. These percentages rises with the fall of price of maize production as majority of the farmers turn into growing tobacco. Farmers have been persuaded to put a sizeable part of their land under tobacco by BAT and also Master mind Tobacco Company who advertise the crop in the area as the only cash crop which is booming in the community.

In semi-arid areas, where tobacco thrives, the loss of tree can make land more vulnerable to desertification and unfit for agriculture. When trees grow, water table can be lowered, springs dry up and that is why the two springs that are not drying up in the community have become seasonal and the two wells have dried out. Even rivers have been threatened as majority of them are drying up.

Eucalyptus, the tobacco industry's favorite tree, is highly controversial; it grows quickly, even in dry areas, by drawing on underground water. But its fast growth can be at the expense of the water table. If a lower- table results, then ability of land to grow crops can be damaged.

Alberta (2001) states that growing leads to worsening deforestation in Migori. He gives example of the cost of buying wood for curing tobacco. This is pointed out as a major cause of tobacco's diminishing returns as local trees have been exhausted. He dictates that most of the farmers in Migori district are buying firewood from the market for the domestic use and also for curing Tobacco. This did not exist before tobacco was introduced. In Kuria there is an indication of buying firewood and even for domestic use and before it used to be a free commodity. While Oongo, 1997 indicate that there is clear indication that Tobacco growing in Nyanza has resulted into local trees exhaustion.

Heald (1999) offers more variable guideline into the issue of Tobacco production in Kuria district. She provokes questions like, what are the effects of cash intensification? Forest resources, what is the outcome of agricultural intensification especially of Tobacco etc. She reports that the money they male headed household heads get after selling the crop is used to marry second wives.

When fire was first discovered, it constituted significant human invention of the cradle man and a great step towards civilization. Wood was the first resource to sustain and amplify heat output. As such, wood remained a free for a long time, as it was readily available.

3.2 Land use.

Clawson (1995) defines land use as man's activities on land. Huque (1987) takes land use as to signify the use of land, territorial water bodies as well as the buildings and improvements thereon. He then points out that land use refers to how land and its improvements are used and distributed over the locality.

Land use is then a relative term with the meaning dependent on what one takes land to be. Land use is synonymous with resource use, often measured in terms of its economic productivity. Land use could also be defined in terms of area and places that provide opportunities to locate various functions such as agriculture and conservation

Due to increasing human population and changing human needs and aspirations, there is an ever-increasing competition between land uses. This is further compounded by the fact that land resources are finite and the intensity of their use is increasing with population growth leading to conflict between the uses (Bernstein, 1990). There is need to include adequate information in development planning to minimize this conflicts. The study takes land use as a land where agriculture activity is taking place.

3.3 Land clearing for agriculture

Land that is best suited for tree production is also suitable for agriculture practices as food and cash crop production. This means that there is direct competition between these land uses for medium and high potential agricultural land. Traditional agricultural produce have taken priority over tree growing especially tree growing for woodfuel. The trees have often been regarded as a hindrance to expansion and higher agricultural productivity . often trees are cleared to give room for agriculture, (Harris, 1987).

It is evident that tree planting for fuelwood was rarely thought of. Trees were seen as natural, free commodity which occurred in abundance. This made it difficult for trees to be grown on land suitable for agriculture. In many instances trees are not planted at all. And when planted they are planted on unsuitable land and not cared therefore do not do well.

Forested land is often viewed as an enemy to Agricuture development where tobacco can be planted. In many instances, forested land is viewed as fallow land and when need arises it is quickly cleared to pave way for farm land either for planting tobacco or any crop, (B.A.T, 2002)

Land registration is certainly not a "magical specific" which will automatically produce good land use and development. The farmer, who has hitherto managed his land to the best of his ability, will not suddenly change his attributes and practices to use and develop his land more efficiently merely because it has been registered. This attitudes and practices can be changed only by the application of other methods which will vary

and may include e.g training courses for farmers, improved produce marketing arrangements, fostering institutions such as farmers associations or co-operatives, the supply or credit for farm development; or introduction of new crops, varieties of seed and improved farm implements.

Such agricultural measures alone may be insufficient to change farmers' attitudes and practices. It may be necessary to change the tenure of land law reforms or the structure of land holdings of viable size. Land registration is not land reform, though it may conveniently be introduced concurrently with such reform to facilitate its implementation or to stabilize the new pattern of land holding. Land registration is in fact merely "a device part of the machinery of government" (Meek 1946). It can complement the measures or reforms mentioned above thereby contribute towards changing farmers' attitudes and practices, but does not by itself change them. It can, for example provide simple and reliable machinery to enable farmers to offer land as security for credit.

However, that individual and absolute ownership of land registration, which is a form of tenure, automatically results in more productive farming, with the implication that in some mysterious ways, land registration is synonymous with or without t results in individual and absolute lands, (Ibid).

3.4 Land Use Policy

Land use is dynamic, changing with the socio-economic and political set up of a society. So too is the land use planning and management efforts which try to respond to these changes. Various authors argue that planning and coordination of land use operates within politico-economic landscape. They further realize that land use is founded on history and culture.

Kenya does not have a consolidate land use policy. The ownership and use of land are regulated by a large number of Parliamentary Acts. However, the greatest weaknesses in these laws are that most of them were initiated, formulated and enacted as separate or

disjointed instruments, without regard to each other. Consequently, the laws appear to have been based on different philosophies and have therefore addressed different and sometimes contradictory issues and interests. Very little has so far been made to harmonize the different pieces of legislature and the activities of the institutions implementing them. This has resulted in failure to exploit the whole potential of existing instruments and implementing institutions.

The greatest challenge in the use and management of land use in Kenya and other environmental resources is the harmonization and coordination of the different laws, policies and institutions. So far, the dominant policies as regards land ownership and use have been those in support of agricultural production. National policies as spelled out in different development plans, seasonal papers, and other policy pronouncements have focused and emphasized the role of agriculture as the dominant sector in foreign exchange earning and for strategic reasons.

3.5 The evolution of Land use /tenure laws and policies

Many studies have been engaged in the research on the evolution and development of land tenure and land use laws in Kenya. In particular, Okoth-Ogendo's Tenants of the Crown: Evolution of land tenure and land use in the country identified three different eras:

3.5.1 Pre-colonial era

The major form of land holding during this era was based on the principles of rights of occupation of land for functional reasons. Land was owned communally hence a number of people could each hold a right or a bundle of rights expressing a specific range of function.

Therefore many of the African societies who practiced agro-pastoral systems exercised three forms of tenure regimes under communal property management that is, arable lands which were under quasi – privatized status provided permanency of tenure;

grazing land commonly used and regulated by communal sanctions; and unoccupied land used for other purposes such as hunting and gathering.

3.6 Changes in land tenure in Kegonga

The establishment of colonial rule in Kuria had a powerful effect in undermining the existing authorities through which land was acquired, allocated and passed on to the next generation. Although no land alienation took place, during the colonial time as the colonial policy was of major consequence. For example, the appointment of colonial chiefs affected land tenure in that the clan representatives who had previously handled all land related issues were soon deprived of their significance and power. The position of the council of elders, for example, was taken over by the chiefs. As, a result the chiefs could take bribe and allocate the fertile land.

3.7 Wood fuel Measurements

In 1976, Muller claimed that wood fuel for Tobacco curing requires about one tree per 300 cigarettes a claim repeated in a W.H.O publication. The IFSC report assed the much publicized claim and also that one kilograme of trees is felled to cure round two kilogram of tobacco.

A standard way of expressing the quantity of wood used in curing is specific fuel consumption. (SFC). This is the number of kg of wood required to cure 1 kilo of Tobacco. The report suggests that an average cigarette contains 1.3gm of Tobacco and an average mature tree in the African savannah has a volume of 0.12m and weighs about 230kg and 100kg values, (Geist H, 1998).

Remphils report equally fatuous BAT data on registration between 1987 and 1992, BAT Kenya claims that the number of surviving trees resulting from its reforestation rose from 13 million to 31 million. In other words, 18million trees in 5 years. a continuous 365 day a year planting rate of 9,863 trees when the total area under Tobacco cultivation in Kenya is only 8,805ha. Such rates of planting are plainly

preposterous and a testimony to the ineptitude of British American Tobacco Kenya Limited lame attempts at hosting down concern.

Land tenure is so variable and insecure throughout much of the area. This has implications for reforestation projects, for only people with secure titles to land are likely to consider making the long term investments required for tree growing, (Babere,1998).

3.8. Tobacco Growing/Industry

Kenya Forest Master Plan, (1994), state that cash crop growing for export is on increase on the cleared portions of forests, giving an example of Nyayo tea zone's development corporation which was designed for protection as well as alternative source of income and employment to the Nyayo tea areas in Kenya. Tobacco farming in Kegonga was established with similar reasons. Global trade and market forces influence the communities to produce for export and are focusing on fetching good prices in world markets for both Tobacco and tea growing. They have given an example of tea as cash crop, which requires wood, but in their case, the companies are planting trees, which is not the case with the Tobacco buying companies which use farmers to get maximum profit without caring the future of the ecology.

Long before Tobacco seedlings are placed into the field, a lot of work goes into preparing. Preparation begins after a crop has been harvested and continues until the next crop is ready. The type of soil and climate determine the way the land is prepared for the type of Tobacco to be grown,(Kweyu, 1994).

Since the mid 1800s, fertilizers have been used extensively for Tobacco production as Tobacco depletes the soil of naturally occurring nutrients. Prior to planting seedlings, samples are analyzed to learn their lime and nutrient contents. From this, farmers decide what nutrient the soil needs to make it more fertile, (Taylor, 1927).

Preparing the land also involves plowing and deciding to kill old root systems, level off the old crop refuse, break up the soil and incorporate pre-plant pesticides. High, wide beds are for transplanted Tobacco plants. These beds reduce chances of water damage and increase the crop.

Another land preparation technique that some farmers use when growing Tobacco is crop rotation. This is a planned sequence of growing different crops in the same field year after year. It can be used to maintain nutrients in the soil, reduce soil erosion and control pests. Tobacco crop sequences don't follow a set pattern because they make it difficult to control and determine nitrogen in the soil. Nitrogen is the most influential nutrient in the growth of Tobacco. Because Tobacco is a highly profitable crop, some farmers do not rotate their crops. Instead, Tobacco continuously relies on the use of pesticides and other pest and disease practices, (Smith, 1977).

The Tobacco growing industry claims that cultivation of the crop is a major source of rural employment and that it constitutes an important source of foreign exchange for many developing countries. It claims that the global market for Tobacco is continuing to expand, with an annual increase of about 2% in new smokers in developing countries in the past decade, (Otieno, 1998).

Much Tobacco farming is only for limited periods of the year, claims the industry, and uses land, which is often unsuitable for other crops but on the other hand tobacco cannot do well on a land which is not fertile and most of the farmers grow tobacco on the barren land tobacco is more profitable for farmers than other crops, (Babere, 1998).

Under contract with British American Tobacco Kenya Limited, Magaigwa Marwa, a small farmer in Nyabasi west, Division, sold 2000kg of Tobacco in 1990 for 20,000 Kshs-about $128 (exchange rate of 76 kenya shillings per dollar) from 3 acres of land. For this, he and his family worked hard over the nine-month Tobacco preparation and growing season. The earnings he regarded as a pittance "I don't know what to tell my

children and wife who worked so hard to produce the Tobacco". Yet, this level of earnings seems about average in Kenya.

In some developing countries, like in Brazil, most Tobacco is grown on large plantations and farmers sell their products at an annual auction. Although these farmers own large areas, they still have no control over prices. In Kenya, Tobacco is grown by small farmers on plots of about half a hectare. They sell their cured Tobacco to a company for which they have no say over the price

For these small farmers, contractual arrangement with Tobacco companies are common (British American Tobacco Kenya Limited), has a contractual arrangement with about 200 small farmers to buy their Tobacco in Kegonga. The company sells the farmers a package deal (usually on credit) that includes seedlings, fertilizers, pesticides and technical advice. The price that farmers receive for their leaves is dependent on the company's evaluation of it's quality, and ranges from around 20-50 Kshs a kilo. There is no independent assessor, and the farmers are powerless concerning the price, (Heald, 1991).

World Tobacco prices over the last 10 years have stagnated in money terms and fallen in real terms. The average price for the flue-cured Tobacco between 1984 and 1986 was 372 cents a kilo. In 1992, 384 cts; 1994 prices seemed broadly in line. Assuming an annual inflation rate of 4%, Tobacco prices have fallen in real terms by 50% over the last decade, (Heald, 1987).

While returns from Tobacco have become uncertain and low, farmers have the advantage that the companies usually pay quickly, which is not always the case with state purchasing bodies. Other crops like maize now seem to offer farmers a higher return.

Most developing countries are not importers of Tobacco, and are spending scarce foreign exchange on a product with proven of damaging health. The rise in smoking in

their countries means that if current smoking patterns continue, scarcer foreign exchange will have to be devoted to importing Tobacco products, (Heald, 1999).

Tobacco companies also pay taxes. All this is not what it seems, if the 4.3 million hectares in the south now under Tobacco grew other crops, then taxes would be paid and foreign exchanged would be earned on those crops. For some countries where Tobacco is an established foreign earner, a switch to other crops would however, take time and the investment of considerable resources.

3.9. Economic and social importance

The Tobacco sector plays an important social and economic role in Kenya. As far as the economy is concerned, Tobacco accounts for huge amounts of money in taxes. In the social area, Tobacco generates a great number of direct and indirect jobs. In the rural area, Tobacco employs 500 farmers in Kegonga. The processing plants and the cigarette factories employs a work force of 1,000 in Kegonga Division. Considering both direct and indirect jobs generated by Tobacco from seedbed to cigarette sales it's important to stress that a total of 15,000 families derive their livelihood from Tobacco which is their main source of income, (Master Mind Tobacco Kenya Limited).

Perception for future sources of woodfuel in 1989-1993 development plan indicated that wood fuel will remain the main source of energy for domestic use during the period of plan period. Demand was expected to increase from 278 million tones of it equivalent (Tones Of Equivalent) in 1988 to 30.8 million TOE in 1990 and to 35.3 million TOE in 1993. The overall objectives for wood energy is to ensure adequate supplies, through sustained yields while the government was to promote the widespread use of fuel efficient conservation method even though never talked about the Tobacco industry.

In the rural areas 90% of households who grow Tobacco perceive the present and future problems of wood fuel availability in the whole study area. They are ready to take measures by planting trees. Another 20% of the household perceives the problem but are not concerned with serious woodfuel shortages or environmental crisis. Only 30%

of the total households that do not perceive any present or future problems. This percentage indicated that it would be difficult to improve sources of fuelwood or to ameriolate the environment. Although firewood and Tobacco are greatly associated, firewood is used intensively so as to get good grades. Firewood is used mostly in curing Tobacco, as there is no other alternative, (British American Tobacco Kenya Limited, 2002).

3.10. Transplanting Seedlings.

Because Tobacco is grown in different climates, it is transplanted at different times of the year. Well developed, disease free seedlings transplanted after the last frost can produce as many seeds.

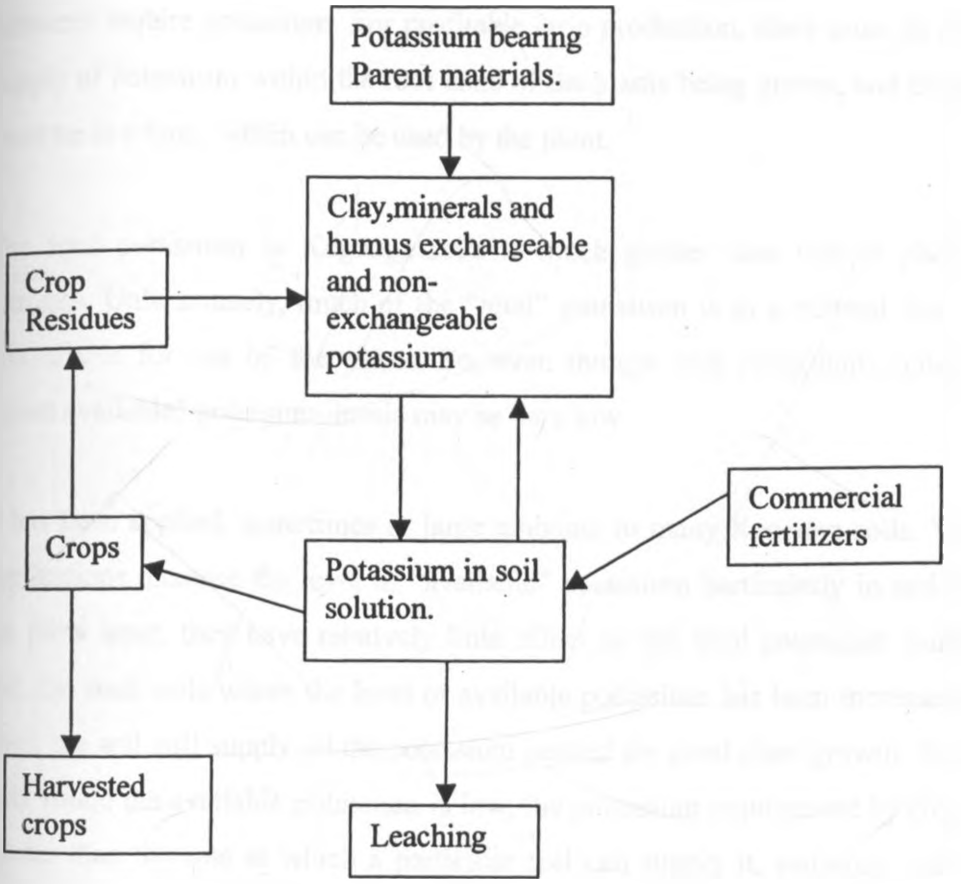
After about 6-12 weeks, the seedlings of large leaf Tobacco plants reach about 15-20 centimeters in height and are ready to be transplanted to farm fields. Spacing between plants varies according to the type of Tobacco and where it is grown. Plants are placed in the field by hand or by a transplanting machine. Machines are used on large farms in the United States. The transplanter is pulled through the field by a tractor. The transplanter clips and automatically place each plant into the soil at a particular depth apart from each other. Fertilizer, water and insecticide are also added to the soil by the transplanter. After transplanting, farmers cultivate the soil to keep it loosen it and eliminate weeds . Tobacco requires approximately 70- 230 days from the date of transplant to reach maturity, (Field Survey, 2003).

Transplanting takes place when the seedlings are five or six inches high and have four to six leaves. The strongest seedlings are selected and planted out in the field- a delicate operation about 20 to 24 inches apart in ridged rows about three to four feet apart. The ground would have been previously heavily ploughed and repeatedly harrowed, as the plants has fine roots which cannot survive in lumpy soil. As soon as the plants have taken roots, hoeing begins. Fertilizer is added before and during cultivation, (Field Survey, 2003).

Flowers buds appear about two months after planting, and these, with the top leaves, are pinched off "topped". This is an important operation, requiring careful attention and experience. The purpose of topping is to improve the quality of the leaves below; usually about 16 to 20 leaves are left.

3.10.1 Potassium cycle in the soil

FIGURE .1. POTASSIUM CYCLE IN THE SOIL.



(Source, Taranganya BAT, 2002)

This schematic drawing shows the sources of soil potassium in Kegonga Division, potassium fixation and how the levels of available potassium are depleted and replenished. There is little or no leaching of potassium except in sandy soils.

Potassium forms reactions in the soil . Note that the reactions are reversible. Most of the non- exchangeable potassium is trapped between the layers of iolite and collapsed vermiculite clay minerals. The exchangeable or available potassium is largely the

cations that are adsorbed on the surface and edges of kaolinite and montmorillonite clay minerals and between the layers of expanded vermiculite. Readily available potassium is the cations that are in the soil solution (soil water) and are not attached to the clay minerals.

Thirteen of the sixteen elements essential for plant growth must come from the soil. And except for nitrogen, plants in much greater amounts than all other soil-supplied nutrients require potassium. For profitable crop production, there must be an adequate supply of potassium within the root zone of the plants being grown, and this potassium must be in a form, which can be used by the plant.

The total potassium in Kegonga soils is much greater than that of phosphorus or nitrogen. Unfortunately, much of the "total" potassium is in a mineral form, which is unavailable for use by the plants. So, even though total potassium content is high, "plant available" potassium levels may be very low.

It has been applied, sometimes in large amounts to many Kegonga soils. While these applications increase the level of "available" potassium particularly in and just below the plow layer, they have relatively little effect on the total potassium content of the soil. On such soils where the level of available potassium has been increased to a high level, the soil will supply all the potassium needed for good plant growth. However, on soils where the available potassium is low, the potassium requirement by crops may be greater than the rate at which a particular soil can supply it, and crop yields will be lowered without the addition of potassium fertilizers, (British, American Tobacco Kenya Limited,2001).

Just as with all other nutrients, potassium must be present in the soil in a form that's available to plants. Even though the total potassium content of most Kegonga soils is far above the amounts required or removed by crops, many of these soils will not release sufficient potassium for highest crop yields during the growing season. This is

because only a very small amount of the total potassium is in the readily available form during a cropping season, (British American Tobacco Kenya Limited, 2001).

3.10.2 Fertilizer and Biology used.

Given Tobacco's potential of mining the soils, the production of Tobacco, fully depends on the commercial fertilizers, while the input of biocides to protect plant growth and mitigate soil exhaustion turns out to be highly different due to the unequal state of land degradation that would have already occurred. The most common fertilizer used by farmers on is sulphate of ammonia (S/A) as top dressing.

Biocides, however, are only used by 3% of the farmers. However, just half of these inputs are artificial (chemical) materials such as novatrion sole, thiodan and aldrin- the latter of which is already phased out and legally prohibited in the developed world- with the other half being organic input (Kweyu, 1994). The main reason behind the low level of biocide (and, comparatively also fertilizer) input is the availability of land for shifting the fields including wooded area to be cleared for new fertile plots.

Clay minerals (the dominant materials in clay or colloidal fraction) in soil are relatively active in fixing and releasing potassium. The different types of clay minerals vary in their capacity to fix and release potassium, (Master Mind Tobacco Kenya Limited, 2002).

Generally there are four dominant clay minerals; Kaolinite, soil mica, vermiculite and montmorillonite. No soil is composed of only one of this and, usually, a soil will contain as many as three or four. Each clay mineral has its own characteristics with respect to potassium fixation and release. In addition, each clay mineral contains different amounts of native potassium, which is bonded between the clay layers, (Ibid).

Growing plants obtain potassium from the soil for their nutrient supply. When the plant residues are returned to the soil, the potassium they contain is readily released and can then be adsorbed to exchange sites in the soil. Highly decomposed organic matter is

called humus and can adsorb potassium cations in much the same way as the clay minerals and hold them in an exchangeable form for rapid release, (Ibid).

Crops require relatively large quantities of potassium. On soils where potassium is not released within the plant root zone at rates sufficient to meet the needs of a particular crop, applications of potassium fertilizers are essential if high crop production is to be maintained. The best guide to follow in planning a potassium fertilization program is the soil test result from a good representative soil sample.

There is no single determining factor as to when Tobacco should be watered. Irrigation will be determined by the amount of rainfall the crop receives, variety of the plant and the soil type. The size, shape of soil particles determines its water holding capacity (the amount of water soil can hold until it reaches saturation point). During transplanting and harvesting time, Tobacco requires higher moisture content. During transplanting, irrigating crops will promote faster growth and earlier maturity. Moisture may be added to improve yield and quality of the leaf if there isn't sufficient moisture in the leaves at the time of harvest. Two main risks of irrigation are getting an extended rain after crops have been watered, over watering them and introducing disease to crops from water sources, (British American Tobacco Kenya Limited, 2002).

Harvesting Tobacco can be done by machine or by hand. Tobacco is harvested by hand, primed or stalk cut. Priming involves leaves as they ripen. Leaves ripen and are harvested from the bottom of the stalk upwards. This requires several harvests because the leaves ripen at different rates. Some growers may use a priming chemical, which causes yellowing of the leaves so that more can be harvested at one time, (M.T.K, 2002, B.A.T, 2002).

Ripening begins about 60 days after the date of transplanting (depending on the climate) when the leafs turn dark green it is the indication of maturity. The stage at which the leaf is ready for harvesting has to be ascertained precisely in order to maintain colour, texture and elasticity in the cured leaf. Personal experience is required

to determine the right time. In general, the higher up the stalk the leaf is, the more definite the signs of ripening should be before picking. But the correct degree of maturity the leaf should reach depends on the type of Tobacco and the way it is to be cured. Fire curing leaves are harvested when fully ripe. The success of the curing depends on the leaf being ripe not to green. Leaves, which turned yellow prematurely, either through severe drought and too much rainfall or through diseases, fail to cure properly, (Ibid).

3.11 Curing

The Tobacco industry commissions a report systematic and detailed country-by-country. Estimates of Tobacco related fuelwood uses are not available from any independent research or monitoring agency. To date, the major source of information on the subject has been a report (the International Forest Sciences Consultancy-IFSC—report) published in 1986, commissioned by the Tobacco industry founded and directed International Tobacco Information Center) INFOTAB. The IFSC report assessed the much-published claims that one tree is burnt to cure 300 cigarettes and that one hectare of trees are felled to cure each half hectare of Tobacco. A standard way of expressing the quantity of wood used in curing specific fuel consumption (SFC) which is the number of kilograms of wood required to cure one kilogram of Tobacco. The IFSC report suggests that an average cigarette contains 1.3gm of Tobacco and an average mature tree in the Africa savannah has a volume of 0.12m3 and weighs about 90kg, thus the IFSC implied by the "one tree for 300 cigarette " claim is 230 kg wood/kg Tobacco (Judith,1994)

The IFSC report cites studies, which show SFCs ranging from 12kg/kg (Uganda), 15-20 kg/kg (Malawi), 2kg (Brazil) and 13-15kg/kg (Philippines). Each of these is radically lower than the 230kg/kg and 100kg/kg (Moyo,1984).

In the IFSC's own study claims that, the average SFC found in 300 barns in the seven countries studied was remarkably low 7.8kg, with a range of 2.5-40kg/kg wood packed into barns, and the varying constructions of barns were suggested as responsible for

these differences. After extrapolating 69 developing countries that grow Tobacco, the IFSC's main conclusions included (Ibid):

- The total annual consumption of fuelwood by Tobacco industry in the 69 countries represents 0.7% of all fuelwood consumed for all purposes in these countries and equate to 6.4 million m3 per annum. Additional wood is required for curing barn structures and for packaging products, raising the total consumption of wood by the Tobacco industry in these countries to about 9.25 million m3 per annum. However, this still falls below 1 % of all wood consumption. However, this is a global picture, the situation in many developing countries is far more alarming.
- The area of all types of forest in most Africa and Asian countries is now below the level at which it is capable of meeting current and future fuelwood demand on a sustainable basis. This means that accelerating deforestation can be expected, with potentially serious ecological consequences.
- Tobacco growers, like other wood users, still tend to regard wood as a 'free good', though in some countries they take steps toward becoming self-sufficient.

One of the fundamental causes of the wood fuel crisis from curing Tobacco seems to be the fact that the cost of wood fuels does not represent its full social, economic and environmental costs of production. If costs would be raised high enough, most of the problems in the community would be resolved. This approach however, overlooks the complexity of the issues. In order for the full costs to be reflected, the prices would have to be raised so much, that it would spell disaster to the community that depends on Tobacco as the main cash crop of the area, (Ibid).

In 1976 Muller claimed that wood fuel curing requires about one tree per 300 cigarettes, a claim repeated in WHO publication, while Madeley suggested that 12% of world deforestation was caused by Tobacco curing.

Forests are not only a quantity of timber to be sold. They play a much larger role in rural and national economics and make a far broader contribution to economic development than is generally realized, (Madeley, 1993).

Flue cured Tobacco currently constitutes 64% of all Tobacco grown worldwide, (Werren, 1995). Flue curing the green leaf must be kept at high temperatures by the circulated heat for about a week. The process can use a variety of fuels including coal, liquid petroleum, gas, oil, and fuels generally available to growers in more affluent countries or to those in nations with abundant natural resources in those fuels. But in most less developed countries, local wood is the main fuel used (Moyo, 1987 and Tietema, 1991).

In the USA , the worlds third largest flue cured Tobacco producer, little if any of the crop is cured by fuelwood; Zimbabwe, the fourth largest producer, cures all its crop by burning wood, as do most of the other third world producing countries.(United States department of agriculture,1993) . China is the worlds largest producer of flue cured Tobacco; in 1993, it produced 61% of the worlds flue cured crop, (Ibid).

The curing process about the rapid destruction of chlorophyll, giving leaves the yellow appearance, converting starch into sugar and removing moisture. Curing brings about the aroma of each variety of Tobacco. Before Tobacco is cured, the leaves contain 80-85% water. Many factors have an effect on the curing schedule position of the leaf on the stalk and weather. Curing involves 3 essential steps. It could be manipulated by controlling heat, humidity and air movement, (BAT,1998).

3.12 Energy Needs

World Bank (1961), talks about the importance of Tobacco and its time of introduction. It concentrates on how Tobacco is cured. The book is classical and there are many changes, which have taken, place since the time when Tobacco was introduced. There are many farmers who have joined in the production of Tobacco as a cash crop and have taken this as a form of occupation. In this study, the farmers were using any source of fuel to dry the Tobacco leaves though this has changed to the using of

firewood to dry the leaves. He left the gap of the usage of wood fuel as the process of curing Tobacco.

Rural people as the Kegonga community who live near forest are provided with valuable sources of forest food- fruits, nuts, honey, mushrooms as well as edible insects and birds and also host of mammalian species. Local people of Nyabasi East have cropped the foods from the forests traditionally for centuries and such cropping is likely to continue to some extent as long as the forest remains. Whether legal or illegal, utilization of wild meat is a valid function of the forest and Nyabasi West location is facing the problem of deforestation due to Tobacco growing (Heald, 1991).

A part from food, the forest is likely to contribute plants with medicinal properties to the local community. Most people get most of the herbal medicine from the mountains such as Chinato. There may be many other plants whose useful properties have not yet been discovered, and for their future contribution to the economy are worthy of conservation. The forest is a major energy source for rural people as most of the people depend on the wood fuel in their daily cooking at home and even all institutions found in the area depend on wood fuel (Ibid).

3.13 Environment Impacts

Forests regulate the climate of the planet, but as is commonly thought, by producing oxygen on huge scale. Most oxygen is produced by oceanic phytoplankton, the myriad of minute plants that float at the surface of the sea. But, by absorbing solar radiation and by retaining water, forest help to stabilize climate. In addition, they serve a vital function by absorbing excessive carbon dioxide, given off when forests or fossil fuel are burnt. A small percentage of carbon dioxide forms an indispensable component of air as pollution (Bradley, 1993).

Trees lock up carbon dioxide in their tissues but the gas will of course be released again when the wood is burned. Thus, conserving and planting trees for carbon dioxide reduction should also be an important consideration and priority.

3.14. Tobacco in Kenya

Tobacco has consumed and/or cultivated in Africa since the end of the 16th century, but it was not until the 19th century that commercial cultivation began. In Kenya there was little production at the beginning of the century and one could not therefore imagine that sixty years later, this plant" profusely covered with clammy hairs" (Murrow,1999)- would produce lands of blasted desolation, causing wretchedness among the people once rich and dignified pastoralists (Muller, 1978).

The history of Tobacco production in Kenya can be traced back from the year 1935, when a native Tobacco industry was started by settlers in Nyanza provice for making cigarettes. In 1954, due to the Swynnerton plan of improved agriculture in Kenya and in 1956, a cigarettes factory was contracted in Nairobi but until the late 1960s, there was little Tobacco production in Kenya. As a result of deteriorating political situation within the East Africa community impetus was given to the expansion of Tobacco production in Kenya especially in the late sixties, (Ibid).

Tobacco production was organized by BAT on the concept of contract farming-a system whereby schemes or companies use small holders farmers to produce cash crops. BAT became the third British company to use the contract system in western Kenya following initiatives in tea and sugar (Mogens, 1982).

The BAT company, considered Kuria District a best alternative area for Tobacco growing after failed initiatives to grow Tobacco in Oyugis, Rangwe and Kisii (Suzzete,1987). These areas were not suitable for Tobacco cultivation and Tobacco crop could suffer severe hail risk (KNA, 1940-1969). Stimulated by speculate expansion of the consumption of blended cigarettes, and the support of the local member of parliament the company intensified it advertising campaigns and established several centers for growing Tobacco and headquartered at Taranganya. By the year 1972 Tobacco growing was often encouraged in public places by the District officers and the local chiefs. Soon the government through the local administration made the

cultivation of Tobacco an obligation so that there were a certain number of growers in each location (KNA,1956-1975).

By 1975, at least one out of three homesteads in the district were growing Tobacco. Soon, Kuria became the second largest Tobacco producer in Kenya (KNA,1976). Tobacco farming in general required substantial amount of wood for a variety of purposes: firewood for curing, others used for constructing curing bans, poles and sticks for the preparation of Tobacco prior to curing. It is estimated that by this time in one crop year at least 60 indigenous trees were cut to facilitate the expansion and curing of the crop. That meant that at least 300 farmers then active in Kuria were cutting down over 180,000 indigenous trees per year so that by the year 1975, over 300,000 indigenous trees in Kuria District had been destroyed, (Babere Chacha, 1999).

During his visit to the area in October, 1975, Aggrey Luseno the marketing director of the BAT company in Kenya projected that through a thorough campaign, the company would work to achieve self-sufficiency in Tobacco production by the year 1985 (Daily nation, 1975). He therefore, launched a campaign to promote the growing of the crop in the district. According to informants in the district, farmers were given incentives like free ploughing, inputs wheel-borrows. Similarly, a few eucalyptus seedlings were distributed to farmers to meet the growing demand for firewood. Nevertheless, the local B.A.T official continued to encourage the use of indigenous trees for the purposes of curing Tobacco on the understanding that:

> "the smoke from these trees determines the aroma of the final cured leaf and it is therefore essential that certain varieties of sources of fuel such as eucalpyptus, cypress ,pine, etc[Exotic trees] which give unwanted smell must never be used, recommended sources of fuel are therefore trees leafs, and local Africa fig trees"(Ministry of Economic planning,P.40,1977)

As a result of the campaign, Tobacco reached its highest peak of production in 1982, it was reported that "Kuria has a Tobacco boom"(the daily nation, September,1982), the mean cash income rose in the ten-years period, from 7,059 to 57,599 Kenya shillings (Suzette,1999). Kjerland wrote:

> ..the AbaKuria in Kenya are successfully growing Tobacco for the BAT and they are earning good money. People are investing in construction and this can be seen semi-permanent houses and development of small centers for the shops and buying of pick-up for matatus other than buying livestock and marrying.".(Kirsland,P.56,1995).

While Suzette observed that 'indeed, the Kuria appeared to be undergoing economic boom',(Suzette,1999) Kuria farmers like those of the Philippines in the late eighteenth century are like gold miner, who always hoping to strike it rich (the Tobacco monopoly in the Philippines,1985), This shows how the Kuria community are hard working as required for tobacco growing. Tobacco also has brought about a number of positive changes to BuKuria. For one, it produced a rich class of people who bought cars and lorries; others installed grain grinding machines and bough grade cattle. The AbaKuria used the money obtained from the sales of Tobacco to purchase ploughs and other farm inputs. In other words, Tobacco production brought about technological and technical innovations in the crop production. However, the BAT credit and paying system was geared toward keeping farmers financially indebted to the company making it difficult for them never to stop growing the crop at any given time.

According to the agricultural reports, intensive Tobacco farming was now a norm, but fallowing practices were abandoned and farms exposed to greater dangers of soil depletion due to over-cultivation (Ministry of Agricultre, 1988). In June 1987, the district suffered food crisis when Kuria district was faced with a serious famine that shattered peoples hopes for a quick recovery. The tragedy proceeded by virulent crop diseases. This was followed by a terrible outbreak of cholera (ikinyamache) believed to have spread from the neighboring Migori district. This swept through the district between 1987-1989.

Tobacco contract farming undoubtedly gave an impetus to this development, as the Kuria were now impelled to produce in order to fulfill their increased consumption needs. The peak of these export in 1992, the company, earned US$ 3.7 million. Kuria district alone was producing 80% of the total Tobacco production in Kenya (African farming,1996). This however, dropped to US$ 1.6 million in 1993, with only about 400

tonnes being exported to the U.S, Europe and Egypt. This was attributed to confusion in the market occasioned by the entry of the new Tobacco company in Kuria, the mastermind Tobacco Kenya (MTK) in 1989, which BAT claimed had led to a total breakdown in law and order within Tobacco growing areas.(Ibid).

Many Kegonga farmers took advantage of the entry of the new company into market to sell their Tobacco while evading to repay the loan advanced to them by BAT, while others went against the established Tobacco growing calendar by growing out-of-season Tobacco. Consequently, most of the Tobacco was wiped out by diseases. A notable disease was the bush root all stems after a Tobacco season and start a fresh crop; As a result of this, the leaf production went down from 10,000 tonnes in 1989 to 5,000 tonnes in 1996.

The farmers complained to the Nyanza Province Provincial Commision and in their memorandum to the P.C they sighted low rates per Kg and rigiging of grades by BAT Company apparent that this instability, resulting from the unorthodox and haphazard operations could lead to the collapse of the Tobacco industry in the area. The government stepped in and introduced a legislation that was known as Tobacco growing and marketing act 1994 which ***inter alia*** decreed that Tobacco sponsors must supply adequate quantities of seed quality to its contracted farmers. Sponsors are expected to provide tree nurseries that shall yield the wood fuel necessary for curing. Flue curing Tobacco farmers are required to plant more trees than the fire curing counterparts.

The key points of the 1994 legislation were also geared toward addressing belated environmental and farmers occupational protection of health issues which had reached a dangerous level. The government outlawed the use of dangerous chemicals like the Diedrine, DDT, Ambush, and Drinox. Though farmers still continued to use the chemicals till the present. Equally, the by-laws were keen on encoring the regulations of tree and forest cover in Tobacco growing land.(Kenya Gazette, Tobacco growing and marketing rules,1994).

In 1996 the TCSK, a Tobacco co-operative society in Kuria sent a memorandum to the BAT management claiming that Tobacco crop was no longer benefiting them. In a separate meeting with the chairman of the BAT company for Kenya, Gechaga,-then held that Kuria district remained the only district in Nyanza province where rural development was not taking place and that since the company's operation in the area it had not employed any single person from the district. The memorandum read:

> " We produce almost 80% of the total Tobacco production in Kenya and the crop we produce is being used to provide employment to other people who do not grow it. This reminds us of colonial days when Kenya was producing cotton and exporting it to England for processing cloths and giving employment to the people of England. In Kenya today we have crop zoning, we build sugar factories where sugarcane is grown, tea industry where tea is grown and milk processing plants where milk is produced etc,.. why should BAT build Tobacco sorting factory in Rongo where Tobacco is not grown?".(Samson Mwita Maroa, Memorandum, TCSK,society,P.8,1996)

They termed this as "daylight robbery and outright injustice" farmers therefore, threatened to boycott Tobacco farming until the company ensured that the crop benefited them. The farmers ***inter alia*** complained of frustration from the BAT staff and use of arrogant and rude language.

Soon, the cooperative society was outlawed by the local government officials claiming that it had become "a hotbed of subversive politics" oral interviews however revealed that this had much to do with the BAT company. Still though the progress for the BAT in Kuria district was not uniformly smooth, individual clergymen attempted at various times to contain if not eliminate the Adventist church, adherents were to abandon their Tobacco farms. Oral interviews reveled however, that those clergy who preached against Tobacco in the area received warning and threatening leaflets from the BAT staff, (Ibid).

3.15. Tobacco and ecological change in Kegonga Division

Tobacco farming is well known to be destructive, not only to the soil, but also to the forest resources. Geist,(1999),contends that Tobacco production can indeed be a "driving force of environmental change, he concludes that Tobacco poses a particularly

difficult dilemma for development since its production generates both range of employment, income, foreign exchange and other cash contributing effects, while the damage to the environment in the long term appears to outweigh the benefits. In his seminal study he found out that deforestation in Tobacco growing and natural covered countries by far exceeds that in Tobacco producing countries of the same dry forests or woodland ecozone, (Ibid). Other negative externalities that has been associated with the natural environments where Tobacco is commonly grown to are., the absorption of high amounts of macro-nutrients from the soil and the usage of large amounts of wood likely to contribute to the accelerated depletion of natural forests and woodlands.

According to Geist,(1986), it emerges that in the course of African Tobacco continental production has shifted from Northern Africa to countries in the central, eastern and predominantly southern part of the continent where the bulk of recent output originates.

In a study that was carried out in Kenya on the use of wood in Tobacco industry, Fraser noted that "the area of all types of forests in Kenya is now below the level at which it is capable of meeting the current and future fuelwood demand on sustainable basis"(A.I.Fraser, 1987). This meant of course that accelerating deforestation can be expected, with potentially serious ecological consequences.

In March 1982, Bazinger reported, "Tobacco production was responsible for the depletion of forest in Kuria district (Bazinger, 1982). He wrote:

> "Farmers in Kenya's Kuria valley have stopped growing maize-the country's most important staple food-and are now growing Tobacco for a multinational company...the slopes on the sides of Kuria valley, near mount Kenya, are now completely bare. Their former covering of trees has been cut down to be used as fuel for curing Tobacco"

With most of the fertile ground given over to Tobacco, some farmers have tried to grow maize on the formerly forested hillsides. But heavy rains wash away soil and plants. The topsoil has been eroded in some places, and rocks and boulders are already washing down toward the fertile fields below, as indicated to the report.

Tobacco growing certainly brings the farmers more profits than maize has done, so that what is happening in the Kuria valley is being repeated in a thousand other places in all of Kenya. Exports are being promoted at the expense of local consumption. In the long run, the ecological basis of all production is being permanently destroyed (Geist, 1999).

Likewise, the burden of external debt has put immense pressure on African countries to maximize export production of remunerative cash crops such as Tobacco at the expense of soil fertility, forest and water resources. Destruction of forests has therefore, become a nationwide problem in Kenya. In recent years the consequences of depletion of Kenya's forest resources has ranged from an increased risk of drought to damage to the economy. Close canopy forests that have had crucial role to play as water catchments has been destroyed on mount Kenya which happens to have three-quarters of the indigenous forests in Kenya. The consequences have been water shortages and inadequate electricity supply in areas surrounding Nairobi (According to the Kenya national Archives staff).

The competing interests of Tobacco agriculture, forests products and area utilization for a growing population on one side, and conservation of catchments on the other have resulted in a complex management issues, that are difficult to resolve. Indeed changing environments in Kuria district seems to be rooted in changing modes of production- from unexploited agro-pastoralism to intensive Tobacco agriculture, (Chapman and Wai Leng, 1990).

Owing to lack of enough information and sources, it is difficult to reconstruct the environmental change in the district or even detail the physical environment of Kegonga Division prelude to the introduction of Tobacco cultivation.

Joy Adamson for example, while visiting Kuria in the late 1950s wrote that ".. living in untouched countryside, they (Kuria) are the most picturesque I have ever come across.. and certainly the least affected by civilization.(Joy Adamson,1960).

Writing in 1970, William Ochieng described Kuria as a "beautiful land with rolling hills". The first Kuria member of parliament, Hon. Samson Mwita Maroa when asked in parliament for the house to vote for the establishment of the farmers training centre in Kuria, the assistant minister for agriculture, Maina Wanjigi rebuked him saying: " how can we put such an institution in a remote area such as Kuria? Just in the bush"(an interview with Samson Mwita Maroa). Indeed such evidence would perhaps seem to suggest primitive precolonial realities, but Kuria maintained a resilience and sound ecological footing until the intensification of Tobacco farming started in the area. Although isolated in many respects, rural Kuria society was far from placid and stagnation.

After the introduction of Tobacco, criticism of land usage in the district became a routine part of the official records (ministry of agriculture 1979-1988). Protection of thinning forests and destruction of catchments areas became a growing concern of agricultural staff. When population increased, and Tobacco agriculture expanded, the landscape gradually became domesticated. From these reports it is clear that forest areas of Kegonga, which had been used exclusively by owners in a pastoral economy were sold off to Tobacco cultivators as the former moved to Musoma, Mugumu and Serengeti areas in Tanzania where they continued with their pastoral life.

According to FAO (1990), Kenya is classified among the countries with the least forest cover of less than 2% of the total land area. There is therefore the need to protect the forest cover for the future generations. Kegonga Division has experienced considerable loss of natural forest although there are no records of the amount of loss. Furthermore, no study has been done to examine the seriousness of the problem.

Perhaps the most pressing energy-environment problem in Africa today is that related to the use of wood fuels and the disappearing biomass base which supplies these wood fuels. According to FAO (1980) about1.3 billion people lived in wood deficit areas, defined as places where people can satisfy their requirements, but only through

unsustainable over cutting of forest resources and over 110 million in acute scarcity areas, where even with over cutting they cannot satisfy all their wood fuel needs. By the year 2000, this total has risen to about 3 billion according to the same study. Akhehurst (1968) and Smith (1977) report that Tobacco curing uses wood as a source of fuel but they do not relate tobacco production with deforestation.

3.16 Theoretical and Conceptual Framework

Based on the above review, the conceptual framework of the study is given below. This starts by recognizing Tobacco farming as a basis of human activity in the community. And tobacco growing to take place there must be land which is a natural resource base, there must be capital to buy input and also labour to work in the farm. In land is where we get fuelwood and direct tobacco growing as a result of tobacco one cuts trees for popurpose of curing the leafs and this leads to deforestation, soil erosion , water pollution due to the spray of chemical to the plants and soil erosion and nutrient leaching and at the end it leads to environmental degradation and leads to the requirements of Agro-forestry and land use management. These relationships is illustrated by figure, 3.16.1. in page 54.

3.16.1. Definition of Operational Terms

Nyabasi West : is the study area which covers Nyabasi west location and Kebaroti

Nyabasi East: Covers Nyaitara location, Nyabasi North and Nyabasi East.

Nyabikongori: Covers Kebaroti and Nguruna.

Environment: refers to man's habitant and those conditions that affect his living of life (White et al 1984). The main components of the environment include the atmosphere, the lithosphere (including soil), the hydrosphere, and biosphere (flora and fauna).

Impact: is the change in an environmental parameter over a specified period of time and within a defined area resulting from a particular human activity compared with the situation which would have occurred had the activity not been initiated. Impact has been measured on the basis of whether it's beneficial or adverse (hazardous).

Landuse: refer to agriculture, residential, transportation, but to the study, it is land under tobacco cultivation.

Tobacco: this is the leafs of tobacco plant which are either dry or wet and when are dry they are to be sorted and sold to make cigarettes.

Land: the study adopts a broad definition of land to include the earth's soil surface and the biophysical environmental. In this way land is taken to be synonymous to land resources.

Demand: the need of wood fuel for curing tobacco, it is being determine by the price and the quantity needed by the farmer.

Scarcity: it is when the fuel wood is less enough than what is needed. It is based on the time needed to search for the fuel wood and the distant.

Supply: it is the amount of wood fuel which the farmer have for the purpose of curing tobacco.

Shortage: this is when wood fuel is not enough for the farmer.

Time: this is the duration which is taken by the farmer to search for wood fuel and the distant to where wood fuel will be found.

Abakuri: this is the farmers who are Kurian and stay in Kuria in the Kenyan side.

Kuria: this is the farmer who stay in Kenya both kurian and the non Kurian but do cultivation in Kuria.

Economic Activity: Tobacco farming is the main economic activity in the Nyabasi location and most of the farmers depend on the crop for earning their income.

Resource level: Tobacco farming to take place there must be some resources, which is required, like vegetation/forest and land/soil. Vegetation/forest is needed because during the curing process there is vegetation/forest, which is required.

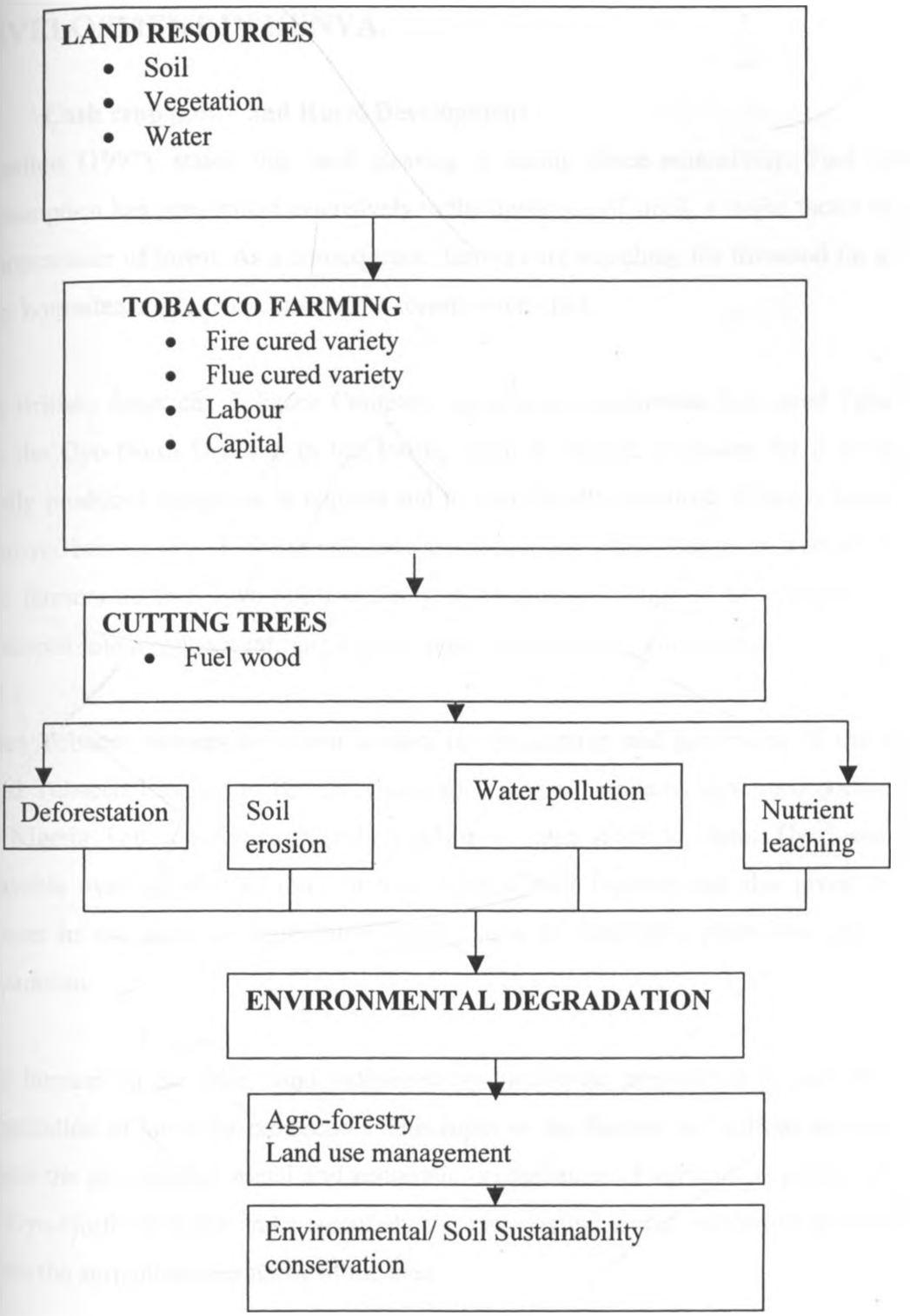
Resource exploitation: fuel wood has been cleared in the area to cure Tobacco and soil nutrients have been exploited due to planting Tobacco direct on the land.

Environmental impact: Tobacco farming that has resulted to cutting of trees has resulted to deforestation, soil erosion, and water pollution due to the use of chemical in spraying of Tobacco to control pests and also nutrient leaching due to soil erosion.

Land use planning: this is taken to comprise the process of guiding land use decisions in such a way that the land resources are put to the most beneficial use while conserving them for future use.
Concern: the main concern is to reduce environmental degradation in the area.

Intervention: to control environmental degradation there must be some intervention to be done like agro-forestry, reforestation, aforestation and proper land use management.
Desirable outcome: after intervention measurers the desirable outcome will be environmental/soil sustainability to the community.

FIGURE .2. THEORETICAL AND CONCEPTUAL FRAMEWORK.



Source: Author,(2003)

CHAPTER FOUR: TOBACCO FARMING AND RURAL DEVELOPMENT IN KENYA.

4.1. Cash crop policy and Rural Development

Hamilton (1997), stated that land clearing is taking place extensively. Fuel wood consumption has contributed extensively to the depletion of stock, a major factor in the disappearance of forest. As a consequence, farmers are searching for firewood far away from homesteads as encroachment into forests intensifies.

The British- American Tobacco Company introduced commercial flue-cured Tobacco into the Oyo-North Division in the 1940s, when it became necessary for it to blend locally produced cigarettes in Nigeria and to cure locally-produced Tobacco leaves to improve their quality. Flue-cured Tobacco production, which began on a small scale with farmers on their own volition freely cultivating the crop for the company, later developed into a contract farming system under the company's auspices.

When Tobacco farmers are about to start the production and processing of the flue-cured Tobacco leaves, the British-American Tobacco company, now incorporated as the Nigeria Tobacco company (NTC), advances cash loans to them. The loans are repayable over a period of three or four years. Credit facilities are also given to the farmers in the form of agricultural inputs, such as fertilizers, pesticides, and land preparation.

The farmers on the other hand independently handle the preparation of land and the organization of labor for production. This input to the farmers to facilitate production affects the pre-existing social and economic organization of agriculture production in the Oyo-North Division and particularly the pre-existing social relation of production within the agricultural economy of the area.

Tobacco was not an immediate panacea for the country's economy. Although the flue cured Tobacco originally grown was profitable, the crops quickly exhausted the soil.

This tendency was especially serious because of the increasing land pressure the southern region was experiencing by the 1910s. As immigrants poured into the area, less acreage was available on either alienated or unlamented land. When planters could not find new acreage as previously cultivated soil became exhausted, they instead had to import chemical fertilizers to revive their fields and thus increase their operation costs.

4.2 Pesticides usage and soil degradation.

Tobacco requires the application of considerably large amount of artificial inputs such as pesticides. Chollat-Traquet (1996) summarizes that the use of pesticides complex compounds carries the possibility of crop contamination of land and water supply with danger for local community and occupational hazards for farmers and their families. It is an important consideration especially in developing countries mostly in Kenya where soil fertility and the extraction of nutrients has to be balanced by suitable inputs of commercial fertilizers and pesticides in order to stabilize plant growth. When Tobacco is cultivated on land with minimal rotation, there is a tendency for soil to become exhausted and for crop pests to become endemic. An alternative fertility in one or two year should be found before to clear near land for shifting cultivation (Goodland, Watson, and Ledec, 1984; World bank, 1984; Chapman, 1994)

4.3. Quantifying the uptake of soil nutrients

It is found that the Tobacco plant depletes major soil nutrients like nitrogen (K), phosphorous (P) and potassium (K) at high rates than any other food crop and at most higher rates than any cash crop grown on average. The mineral uptake by Tobacco amounts to 50 kg/ha for potassium. When compared to the aggregate class of cash crops such as sugarcane and rubber, their mineral uptakes range below that of Tobacco. Only two cash crops i.e. oil palm and coffee have been identified as having a higher nutrients absorption than Tobacco.

4.4. Environmental Policy in Kenya

The government of Kenya, UNDP and UNEP did a project, which was first attempt by UNEP to undertake a comprehensive study of the environment and development relationship in a national planning context.

The objectives of the research was to assist the GoK in identifying and promoting environmentally sound development strategies within the framework of national development planning and to layout practical medium term solutions and to analyze the scope of environmental considerations into development planning and decision making and also to propose policies, actions, and institutional arrangement and implementation of the kind of development planning, (Republic of Kenya, 1989)

At the moment in Kenya the most critical environmental issues that must be faced involve the destruction of the natural resources. The use of woodfuel in tobacco is of interest as a general example as it illustrates a number of complexities of environmental policy. This lead to the requirement of the proper policy to protect the natural resources for the future generations.

4.5. The Wood Fuel Dilemma and the Impending Environmental Crisis

Planting of trees on household land accompanied by a regulated or total ban on use of government forest reserves could be taken as the only "Olive leaf" to self-sufficiency in rural areas and adequate supplies to Kegonga division. This would also be expected to bear progress in environmental management and resource exploitation. Considering these measures as the foundation of socio-economic progress, adoption of agro-forestry is advocated.

However in view of small sizes of land from 1.5-8.0 acres and an average of 3.5 acres, agroforestry should not be considered as the final solution in spite of the high productivity of the land. Charcoal dealers in the district consider that they would travel further to fetch charcoal for sale but would increase prices as a response to persistent shortages associated with demand for fuel. The picture of wood fuel dilemma and

environmental crisis is emphasized by the increasing population of about 3.9% per annum for the whole of the study area.

4.6. Land as resource

Land is basic natural resource and is the foundation for all human activity. Over the span of human history, man has drawn most of his subsistence in term of food, shelter and clothing from land.

Land is defined as the interface between the earth's solid surface and the atmosphere, consisting of all the characteristics of the biological and physical environment that have influence on land use, (Davidson,1980). The elements of land include soils. Landforms, geology, hydrology, climate, vegetation, wildlife and effects of current and past human activities , (FAO, 1976).

Land is diverse in the sense that it may range from well-watered highlands and lowlands to arid and semi-arid regions. The uses to which land may be put are equally diverse; ranging from agriculture, residential, transportation, forestry. It is because of these many uses that land is better regarded as a resource base than a resource in itself (Mather, 1986). The inclusive term land resource is then used as encompassing the soil, ground and surface water, fauna and flora and generally everything that constitutes part of natural resource donation of a place.

4.7. The Environmental Impacts of Tobacco

4.7.1 Desertification

This comes about from Windy climatic conditions that occur frequently on loose soils with limited or no vegetation coverage. Erosion causes severe deflation through loss of topsoil and sand cover on grazing and cultivated land. Soil erosion is mostly widespread in upland areas. Degradation of grazing land and cropping land from inappropriate vegetation and land resource utilization is generally expressed in terms of

lost productivity, rather than direct observation in the field, which leads to over cultivation of Tobacco hence gradual desertification, (I.A.D, 1984) .

Artificial or biological factors include negative influences of human activities on the natural environment i.e cultivation, overgrazing, large-scale irrigation of farmland, over cutting of fuelwood and overuse of water resources. Although, natural factors were originally responsible for desertification, artificial factors now speed up the progress under certain dry and windy climatic conditions. Periodical climate variations from humid to dry and windy as well as seasonal changes cause seasonal desertification. Over cultivation and loss of original irrigation conditions on farmland due to insufficient water supply encouraging land salinitation or desertification in areas with a dry and windy climate, (Leonard, 1988).

Over cutting of fuelwood from natural woodlands has caused serious destruction of vegetation and soil erosion in the upland areas of arid/semiarid regions. Extensive cultivation or fuelwood harvesting from natural woodlands or grasslands has caused soil erosion or desertification of the cultivated areas, (Ibid).

4.7.2 Deforestation

Kweyu (1998), points out that the long-tern economic and environmental impacts, which have resulted to deforestation has not yet been calculated in Kenya. He reports that the cost of buying wood for curing is already a major cause of Tobacco's diminishing returns as local trees have been exhausted, especially in Nyanza province, and that there is need to look for another alternative of curing Tobacco.

Interventional Tobacco Growers (1996), urge for increased efforts of afforestation or agroforestry together with lower rates and higher efficiency of wood used in curing Tobacco. For example, improvements in barn technology, growing use of agriculture wastes as fuel source. However, the technology in Kegonga Division has not been improved or been changed since 1972.

The figures for deforestation (whether global or local) are mostly alarming, yet the wood fuel crisis and deforestation are not the same problems, although certainly related. Although in most areas, the largest use of trees is for energy purposes, the actual reason for deforestation seems to be the need to open up more land for agriculture Tobacco growing included.

FAO (1997) concludes that the share of Tobacco in global production has been on a constant rise from approximately 30% in the 1950s to approximately 63% at present. The annual losses of vegetation cover were assumed to be partly offset by forest increase in developed countries resulting in net losses of around 3.1million hectares. The amount of natural vegetation removed by Tobacco is estimated to be around 117,300 ha annually. Thus, among the continents, Asia/Oceanic holds the largest share of Tobacco growing countries and where deforestation takes place.

4.7.3 Soil degradation

Our rapidly growing urban centers, for example have continued to consume hectares of land, which are still under cultivation. While it is known that part of land degradation results from natural consequences, it is also known over the centuries that man increased the rate of natural degradation and soil erosion by more than two and half times. The depletion and deterioration of some parts of Kegonga soils have been greatly aggravated by abuse-users, some of which are:

TABLE. 4.7.1: CAUSES OF SOIL DEPLETION.

Unguarded of markets and infrastructure development
Deforestation especially of watershed areas
Indiscriminate and unguarded land clearing
Unscrupulous mining of sand for construction
Excessive burning of vegetation
Indiscriminate ploughing, e.g ploughing perpendicular to the slopes.
The terracing of hillsides devoid of vegetation (increasing erosion and resulting in severe mudslides).

The overall of the community objective is to provide knowledge and guidance for the efficient utilization and management of soils so as to ensure their productivity.

Statutory national bodies have to provide for policy guidance on appropriate land use and in territorial co-ordination of issues related to the rational use of the community land resources. The regional or state-based bodies/communities have the mandate to identify, plan, implement, monitor and evaluate regional/state land and development projects and co-ordinate the activities of various agencies involved, (Hose, 1988).

The natural forest and associated resources are under great stress, are fast diminishing, and are in danger of total disappearance in extreme cases. Through watershed effects, forests ensure regular supply of good quality water for domestic use and prevent flood that may damage houses, roads and other public investments. Extensive deforestation and cultivation in Kegonga had in the past resulted in deterioration of the environment as a result of erosion by wind and running water, (Babere, 1998).

4.8. Labour and Tobacco farming

4.8.1. Family work and labour organization

Since land in precolonical Kuria was freely available, as already shown, property and security depended essentially on access to and control over labor. The richest men were therefore those who could command the resource of labour necessary to open new fields for cultivation, watch over lager herds, protect their settlements and engage in trading and raids. Men built their base of wealth first by expanding their families, a fact that was illustrated in a popular aphorism " *ukuibora mboome*", meaning " bearing of children is a sign of wealth as they can work as laborers for source of income, (Heald, 1991)."

A fundamental principle that guided the Division of labour in the Kuria household was that of sex. The allocation of tasks to men and women was not primarily a matter of which tasks men and women were actually able to perform; rather, it was which task they were acknowledged to perform by the society. Women are chiefly responsible for the performance of crop production tasks, while the men are preoccupied with animal husbandry (Baumann, 1928). As to farming work, the Division of labour between men

and women was not rigid; some tasks were assigned to men, and others to women. Men could perform "female" tasks without losing prestige (Tobison, 1980)
In principle, however, men were responsible for the clearing of land before cultivation, including such work as cutting trees and uprooting bushes and grass. Men and women cooperated in cultivation, while women carried out planting, weeding and harvesting tasks, with minor assistance from men.

Kuria co-operation in agriculture work reflected patterns of existing social relationships within the neighborhood community. As work teams were formed from extent social institutions, this meant that co-operation in agriculture was just one activity among a number, which were performed by the members of that group. Since these members were united by more valued forms or relationship, as in the case of circumcision sets. To this extent, production was integrated into the whole network of social relationship (Bryson, 1981).

Looking at the compensation given to these teams for their work, it may be seen that co-operation in agriculture offered an opportunity for the group to express their mutual loyalties

4.9. Tobacco and contract farming

Ayako claims that contract farming existed in Kenya only since independence. It accounts for 50 per cent of Tobacco production. Existing contract farming schemes predominantly use smallholders. Only the barley scheme is based on large-scale contract farming. Approximately 16 per cent of the country's 1.5 million smallholders produce under a contract system. Public and private smallholder schemes are managed privately and enjoy operational and technological autonomy. This limits their relationship with national extension, credit and input distribution programmes. The public and private agro-processing firms in Kenya include KTDA(Tea); the Mumias, Nzoia and South Nyanza Companies (sugarcane); B.A.T(k) Ltd (Tobacco) and Hortiequip Ltd benefit from contract farming.

Kuria is the only district in Nyanza province which is leading in tobacco production in and Kegonga division is the only division in Kuria which is growing fire cured tobacco variety. Figure 4.1. Indicates the areas in Kegonga division growing tobacco, as it is not all the areas which are careable of growing tobacco in the area..

Virtually all the Tobacco farmers engaged hired male and female laborers in the production of flue-cured Tobacco. Generally, family labour is inadequate for the labour required in flue cured Tobacco production. The farmers therefore have to hire labour to complement family labour. The male labourers who were not indigenous to the community were employed for the performance of heavy tasks such as the cutting of cords and curing of Tobacco leaves. Female labourers on the other hand, who were mostly indigenous, were employed for the watering of Tobacco seedlings at the nursery, the furrowing and harvesting Tobacco leaves, as well as the sorting and stringing of Tobacco leaves. While the male laborers were paid immediately after the performance of the tasks assigned to them; female laborers were paid at the end of every Tobacco season, (Heald, 1999)

Wage rates to the hired male labourers depend very much on the type of the work assigned to them and there is some uniformity in the rates of payment to the labourers for the jobs among the farmers. Payments to the hired female laborers are graduated according to their ages, with better wages going to the older female labourers, (Ibid).
After tobacco has been cured and selected it is sold in the tobacco buying centers as indicated in Figure 4..1 below which indicates the number of the tobacco buying centers in the Division.

FIGURE .3. TOBACCO GROWING AREAS

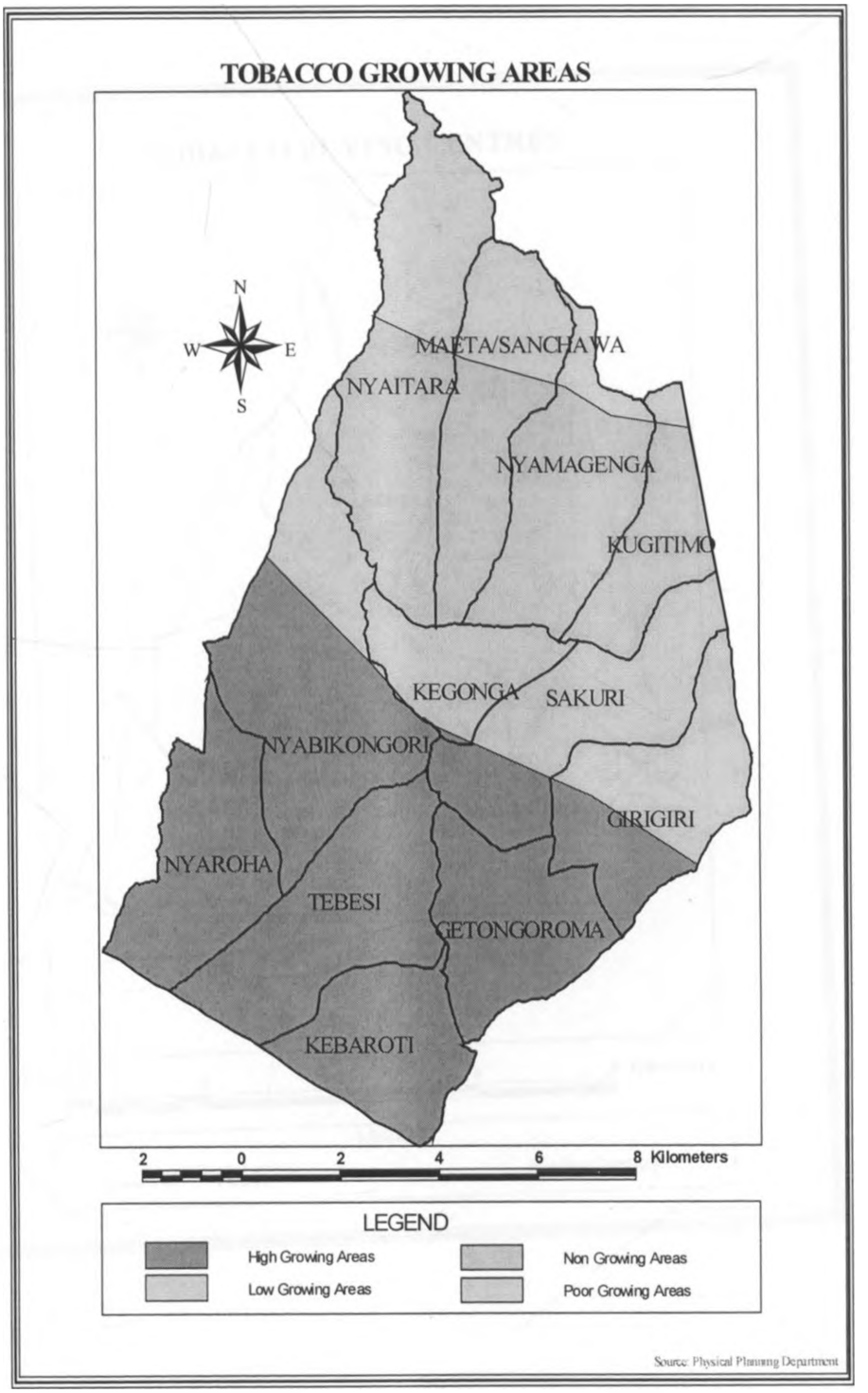
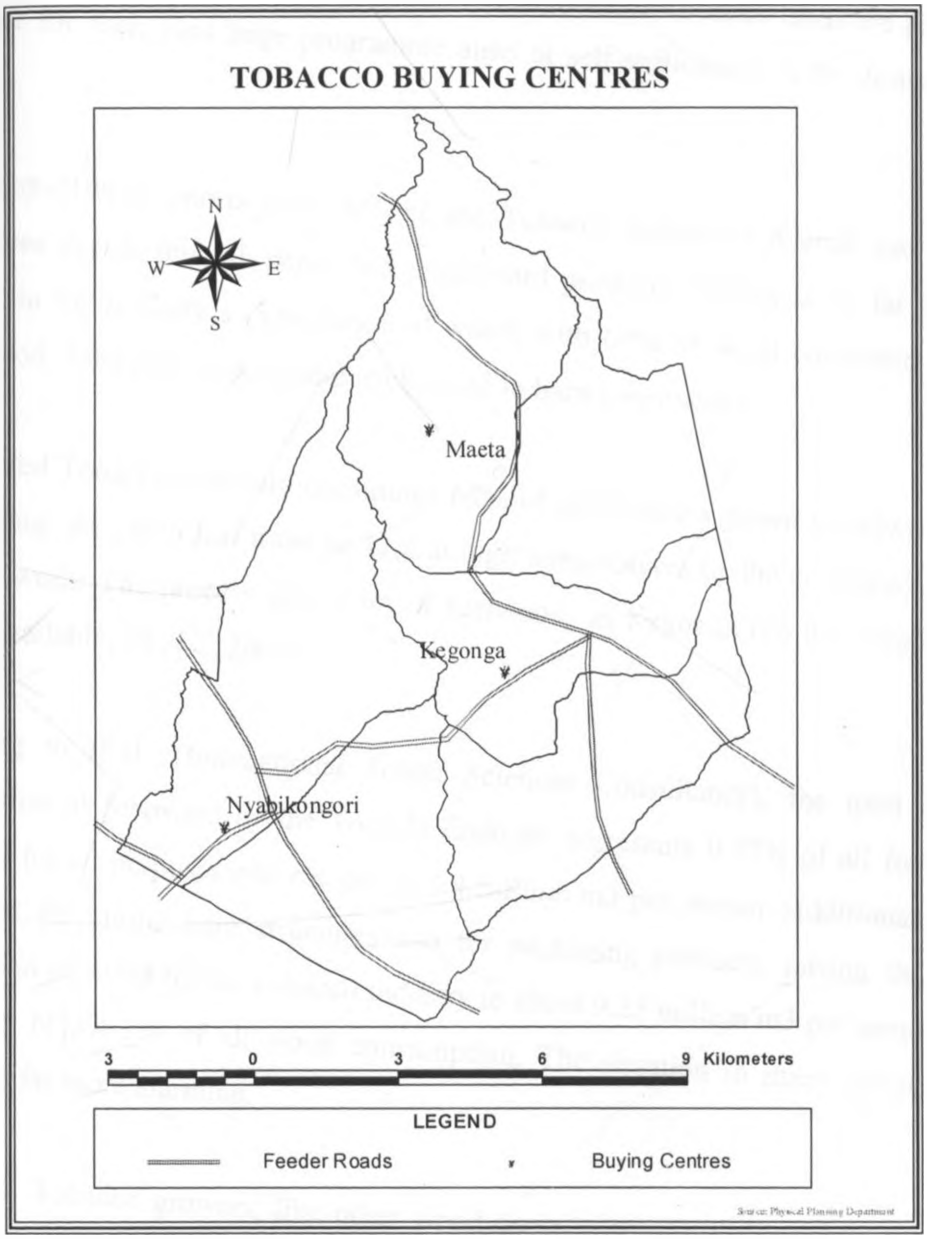


FIGURE 4.2: TOBACCO BUYING CENTERS.



4.10 Wood fuel consumption

Major Tobacco buyers actively promote afforestation throughout the world by negotiating leaf-growing contracts that are conditional upon farmers planting fuel wood. Governments are requiring that 10% or more of Tobacco lands are planted with timber for fuel. This huge programme aims at self-sufficiency in the fastest possible time.

Madeley (1992) reports that 16% of the Tobacco industry's overall use of forest resources occurs through paper and paperboard products. Curing is by far the major culprit in the industry's exploitation of wood, with 69% of wood consumed going to fuel wood. 15% goes to poles and sticks used in barn construction.

Flue cured Tobacco currently constitutes 64% of all Tobacco grown worldwide. With flue curing, the green leaf must be kept at high temperatures by the circulated heat for about a week. The process uses a lot of fuelwood in Kegonga it's the cheapest and locally available, (B.A.T, 2001).

According to IFSC (International Forest Sciences Consultancy), the total annual consumption of fuelwood by the Tobacco industry represents 0.75% of all fuelwood consumed for all purposes and equates to 6.4 million m3 per annum. Additional wood is required for curing barn structures and for packaging products, raising the total consumption of wood by the Tobacco industry to about 9.25 million m3 per annum but still falling below 1% of all wood consumption. The situation in many developing countries is far more alarming.

In Kegonga, Tobacco growers, like other wood users, still tend to regard wood as a 'free good'. Inefficient use of fuel wood at present and only modest or non-existence efforts to establish supplies for the future are contributing towards a generally serious national situation,(Babere, 1998).

Climatic influences have been found to play a significant role in the consumption of wood fuel. Climate creates pre-requisite conditions that necessitate heating of barns besides normal curing. The influence of climate becomes a function of wood fuel consumption depending on factors such as duration of rainfall that constitute a wet season of a locality and altitude.

Unfortunately for Kegonga where climatic factors necessitate high demand for wood fuel, the ability for the ecosystem to sustain the supply has been decreasing because rate of consumption supersedes that of regeneration.

Moreover, no large human social groupings existed as they do today in urban centers and agriculturally productive areas of the world. Human population numbers were under environmental determinism first as any other biological organism (Watt, 1973).

However, due to the inventive nature of man, it became increasingly possible for man to determine his relationship with the natural environment, especially as regards his resource use for survival. Prior to Abraham Dergy's discovery of coal as a replacement for charcoal in iron ore smelting in 1970, woodfuel is still a free good at domestic level. Wood fuel being a free good it meant that no one in the community was supposed to buy it and any member in the community was free to go to any land and collect wood fuel for use.

Foley (1981) and Tillman (1978) have shown that wood has been an inanimate source of energy, which preceded use of wind and water as sources of water. Industrial revolution began in 1750 in Europe and much later elsewhere. Wood remained man's only source of energy until other sources, which accomplished industrial tasks, replaced it.

For more than two centuries since the industrial revolution, wood played a vital role as an energy source at domestic level. Chronologically, coal acted as a fuel of primary industrialization. Fossil oil (petroleum) and natural gas are regarded as fuels for

advanced industrialization. Such replacement is also known to depend upon the nature, level and intensity of industrial activity (Tillman, 1978).

On the household domestic scene, incorporation of electricity, gas and some of oil to meet fuel needs does not play a significant role as wood fuel. Barnes et. Al (1984) emphasizes that millions of rural households in Africa, Asia and Latin America depends on trees and woody vegetation and woodfuel as their main source of energy.

The above dependency does not only apply to less developed communities in the world, but to most advanced ones as well. Efforts to ameriolate these problems are therefore worldwide. In Sweden 9 million metric tones (3.4%) imports were replaced mainly with wood by 1990. In the U.S.A., Tillman (1978) indicated that 2.1% of national energy needs were wood supplies. Projections show that these supplies would constitute 4.2% by the year 2000. This is an increase of 50%.

As for Kenya 71.6% of energy is woodfuel and by 1977 (Kionga-Kamau, 1980), woodfuel contributed about 75% of Kenya's energy needs. Basically, scientists and professional engineers have noted that except for woodfuel, all other sources of energy and industrial power require highly advanced technology and expensive equipment. Moreover, in less developed regions of the world only wood, as fuel, has least social and economic constraints.

A peculiar aspect of wood as a source of wood fuel is its highly localized characteristics. Hence, it has a higher degree of environmental impact especially in rural areas. Unfortunately, such negative influences on the environment are not only experienced in the areas where such effects are directly generated but also influential to areas outside it. These are observed in terms of hydroelectric output, riparian crop and animal husbandry, productivity of marine and fresh water eco-systems, e.t.c. The problem of population –resource ratio in areas where problems of environmental deterioration are prevalent, is a serious one.

Firstly, location of such areas within high productive agro- ecological zones makes them highly attractive for settlement. Secondly, environmental health ensures a low mortality and high fertility rates respectively. Moreover, climatic conditions in Kenya highlands are highly conducive to a large amount and high rates of Wood fuel consumption.
Unfortunately, in this case most social groups living here are incapable of affording any other form of fuel in substantial amounts.

Conventional forms of energy are not envisaged to be of any significant contribution to domestic energy needs at domestic level. Use of biogas for example is hampered by high rates of population growth leading to land use practices for purposes other than keeping animals to provide raw materials for biogas production. These are fundamental considerations that further "pin" wood fuel as the main source of fuel for a long time indeed. Anyesu (1981) has indicated that the critical wood fuel situation is leading to "pouching from forest reserves" and "theft of hedges" to meet household fuel needs.

Moreover, the wood fuel dilemna is related to time and labour diverted to firewood collection. This has been stressed by Haugerud (1984) studies in Embu district. It was noted that a growing wood fuel scarcity increases time required for its collection. This takes away family labour from essential activities such as food and cash crop production.

Through education programmes, developing countries have a clear understanding of the precious nature of their woodstocks. They will continue to use wood as a curing fuel because no cost-effective alternative has emerged. Through the establishment of renewable, energy efficient and regularly harvestable sources in managed tree plantations, they will, however stabilize the impact they make on the deforestation question. In a rural area like Kegonga where there is no electricity, wood fuel is the only way to subsist.

In Kegonga annually one farmer use the average of 2009 kilo of wood fuel for curing tobacco as according to ICS one kilogram of cured tobacco use one kilogram of wood and this indicated that one farmer use the average of two tones of trees to cure tobacco.

CHAPTER FIVE: THE STUDY AREA

5.0 Introduction

This chapter gives an analysis of the study area. It starts by looking at the physical characteristics of Kegonga. The physical aspects covered include location and size, topography, geology and soils, climate and agro-ecological zones, drainage and hydrology. The chapter closes at looking at ecology control.

5.1. DESCRIPTION OF THE STUDY AREA.

Kuria is one of the eleven districts in Nyanza province (FIGURE 5.1). The district is divided into four divisions, namely: - Ntimaru, Kehancha, Mabera and Kegonga. The divisions are further divided into twenty-three locations and fourth-six sub- Locations (Figure 4).

Figure .4. Study Area In Context Of Kenya

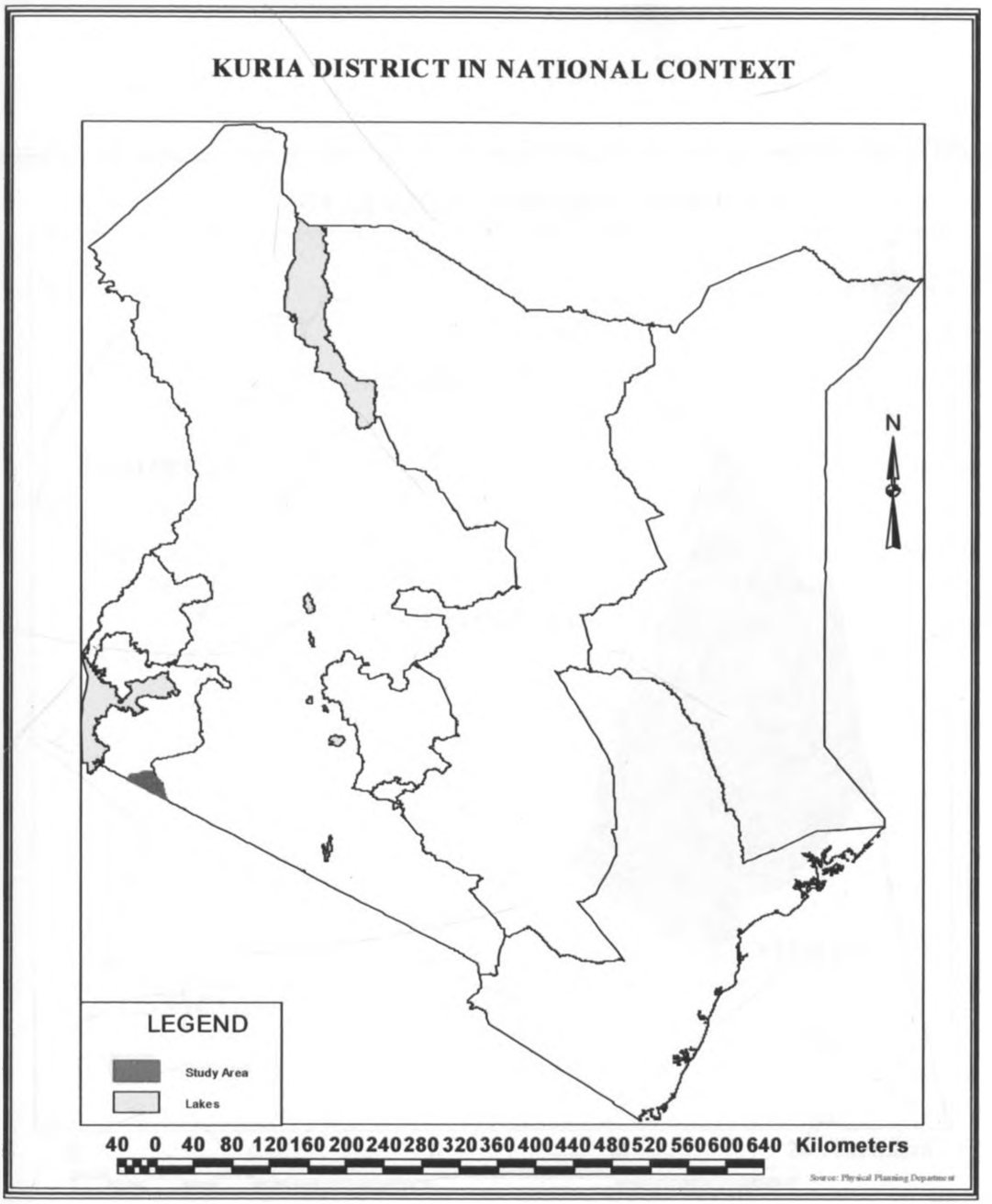
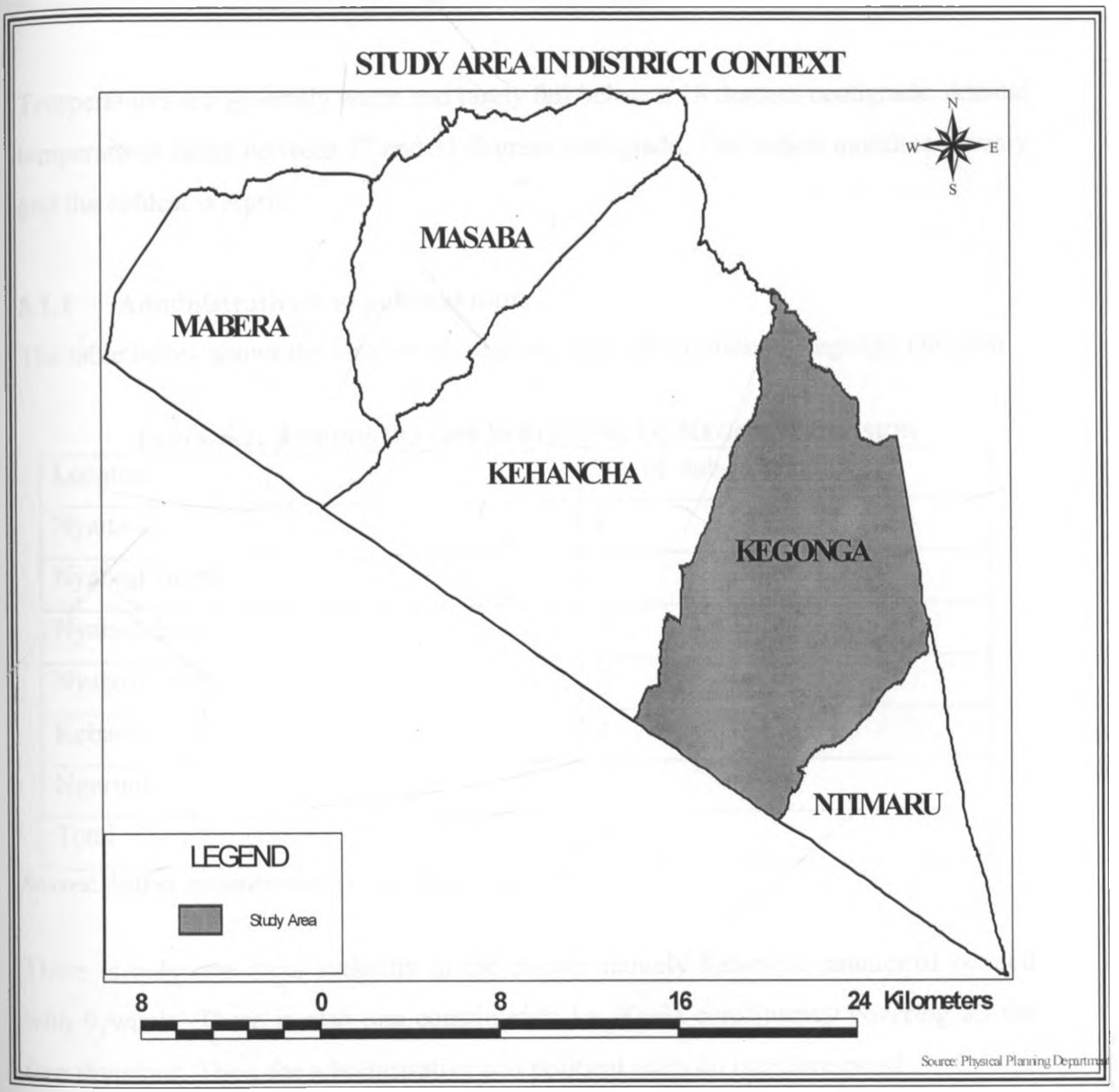


FIGURE 5.3: STUDY AREA (KEGONGA DIVISION)



Kegonga Division has an inland-modified tropical equatorial type of climate. The effects of relief modify it, which is 1350-1800m above sea level coupled with the influence if the lake Victoria. The district receives bimodal rainfall with peaks in April and November. Dry seasons are between December and February, and in September. Annual rainfall averages between 1500mm and 2600mm..

Temperatures are generally warm and rarely fall below h 18 degrees centigrade. Annual temperatures range between 27 and 31 degrees centigrade. The hottest month is January and the coldest is April.

5.1.1 Administrative and political units

The table below shows the number of locations and sub-location in Kegonga Division .

TABLE 5.1: ADMINISTRATIVE STRUCTURE OF KEGONGA DIVISION

Location	No. of sub-locations
Nyaitara	2
Nyabasi North	2
Nyabasi East	2
Nyabasi west	2
Kebaroti	2
Nguruna	2
Total	12

Source: district commissioner's office, Kehancha, 1996

There is only one local authority in the district namely Kehancha municipal council with 9 wards. There is also one constituency i.e. Kuria constituency covering all the four divisions. Thus, the administrative and political units do not correspond.

5.2 Population profiles

The size and demographic features of a population are important variables in the equation of the development process. They determine the pattern of resources utilization. This section presents the population profile of Kegonga division. Among the

demographic features analyzed are population size, structure and distribution in the division.

According to the 1999 national population census, Kegonga division had a total population of 43,087. Majority of the population (51.15 percent) are female. The Division has an average household size of 4.8 with 9,000 households.

5.2.1 Population size

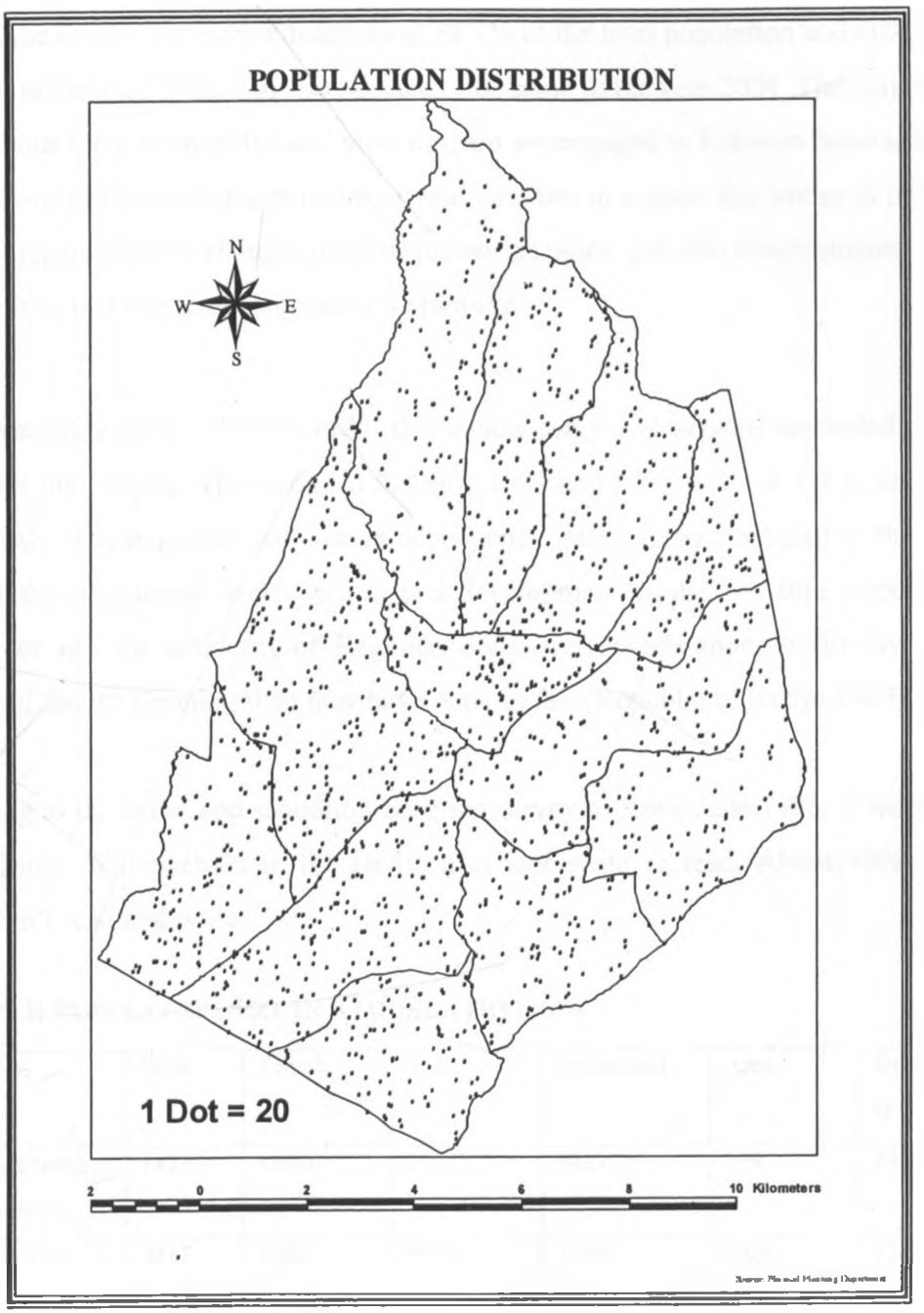
According to the 1989 national population census fingers adjusted to take account of cases of under enumeration, Kuria district had a population of 103,285 in 1989. using an annual growth rate of 2.3%, this figure is projected to increase to 149,691, increasing further to 156,737 and 164,115 in 1999 and 2001 respectively . Table 1.2 shows these projections by age cohorts.

TABLE 5.2: PROJECTIONS OF POPULATION BY AGE COHORTS

Age cohorts	1989	1997	1999	2001
0-1	23164	27843	29154	30526
5-9	19435	23361	24464	25612
10-14	18263	21952	22985	22067
15-19	15279	18365	19230	20135
20-24	7996	9611	10064	10537
25-29	7836	9419	9862	10326
30-34	6565	7891	8263	8651
35-39	5462	6565	6874	7198
40-44	4240	5096	5336	5588
45-49	3937	4731	4955	5188
50-54	3646	4382	4589	5188
55-59	3116	3745	3922	4805
60-69	2358	2830	2965	4106
56-69	1456	1750	1832	3107
70 above	1783	2143	2244	2350
Total	12536	149691	156737	168115

The division's population consists mainly of the youth. The young population aged 0-14 years numbered 60,862 in 1989 and it is expected to increase to 80,205 by the year 2001, which is almost half of the population. This points to an increasing demand for infrastructure facilities especially schools, vocational training and health facilities. The figure below show the population density in Kegonga division in the year 2001.

Figure 5: Population Distribution.



5.3. Labour Force

In 1989, the labour force constituted about 38.7% of the total population and 40% was expected in the year 2002. This is expected to be same in the year 2004. The majority of the labour force is unskilled and most of them are engaged in Tobacco farming and maize farming. This calls for more vocational facilities to expose this labour to training so as to prepare them to changes towards industrialization and also environmental protection so that they can continue to do farming.

The dependency ratio 1:1.24 in 1989 this means every 124 persons depended on 100 people for their living. This declined in 1997, 1999 and 2001 to 1:1.7, 1:1.5, and 1:1.2 respectively. The expected decrease in dependency ratio can be attributed to the likely hood of the population itself declining, a development whose outcome depends on whether or not the residents of Kegonga division responds more positively to the practice of family planning than they have done so far, (Republic of Kenya,1997).

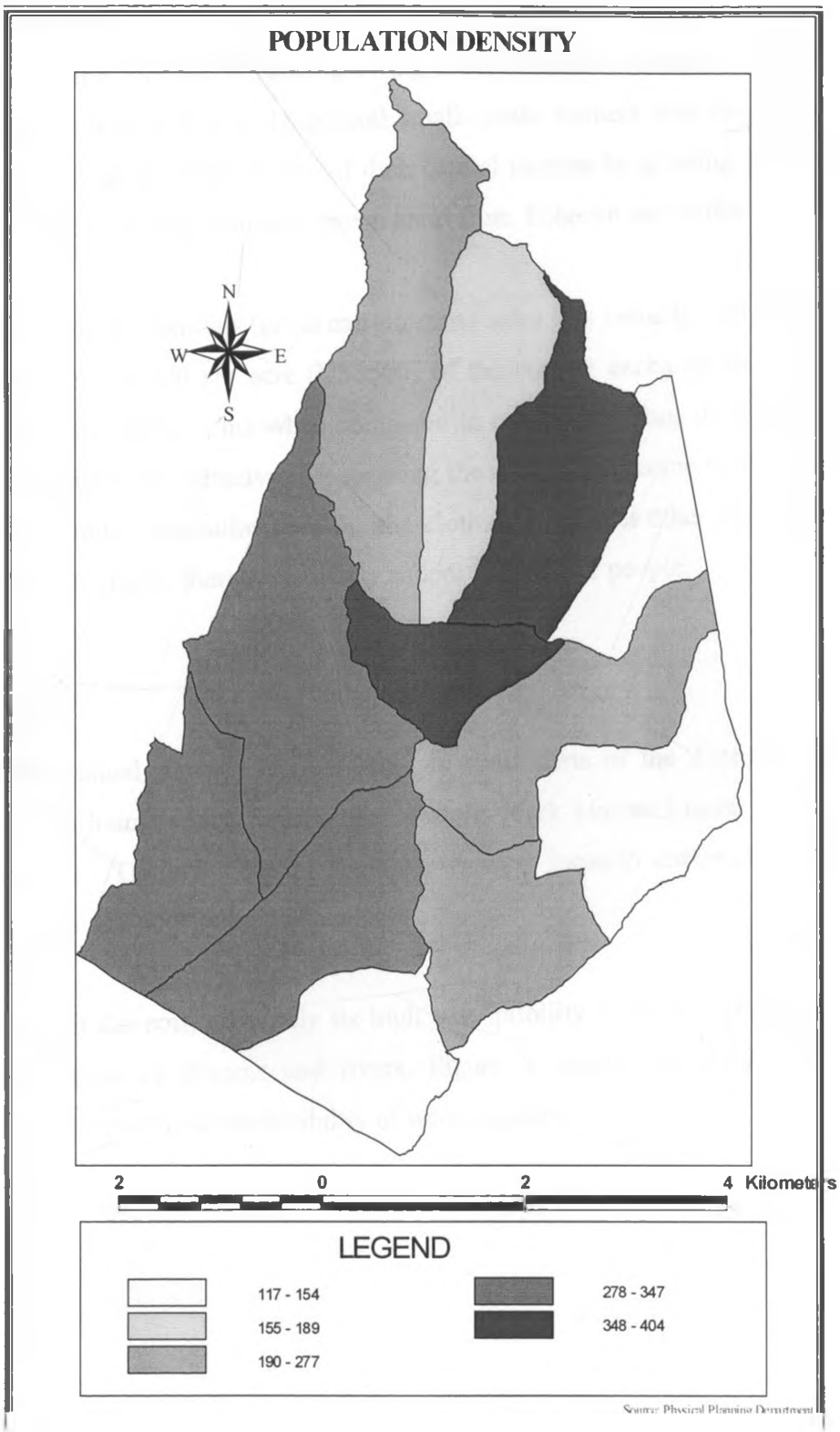
According to the water and sanitation Baseline survey of April-June 1996, it was found that majority of household in the Division cannot write or read. About 40% of the people can't read and write.

TABLE 5.3: POPULATION SIZE IN KEGONGA DIVISION

Locations	Male	Female	Total	Household	Area	Density
Kegonga,North, and Nyaitara	14213	14880	29093	6421	119	244
Nyabasi west.	3417	3580	6997	1290	20.7	338
Nguruna	2207	2339	4546	838	131	347
Kebaroti	1210	1241	2451	452	7.6	324

Source: Kenya National Census 1999.

Kegonga Division receives approximately 1500mm of rainfall, which is well distributed throughout the year. Ground water has a very poor yield and has caused the drying of boreholes (Kuria District Development Plan, 1997-2001).


POPULATION DENSITY
N
W
E
S
2
0
2
4 Kilometers
LEGEND
117 - 154
155 - 189
190 - 277
278 - 347
348 - 404
Source: Physical Planning Department

5.4 Farming

The average farm size for Tobacco growing areas is about 10 acres while the average plot for production is 1 acre. In general small- scale farmers who depend on it as a farming activity as the main source of their capital income by growing Tobacco. There is no any other cash crop, which is grown apart from Tobacco and coffee.

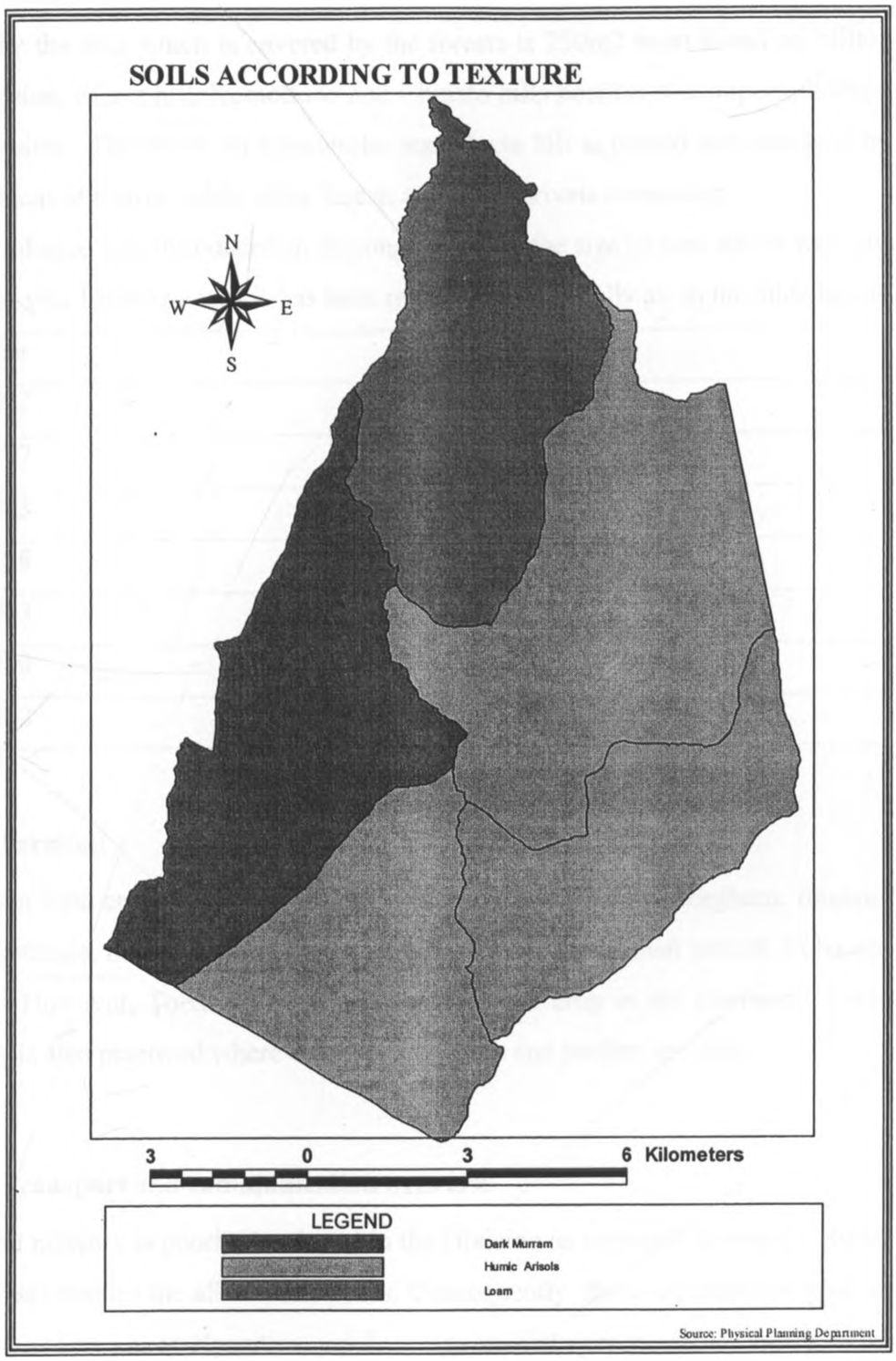
On the average, the earnings (gross margin-gross sales less variable cost) from Tobacco are about Kshs. 38,000 per acre (US$500) of the current exchange rate of 76 Kenya shillings per one dollar. This when compared to other enterprises in the area is higher and thus provides the incentives for growing the crop. The income is used to buy food for the household , education, health, and clothing and meet other necessities. It also provides employment, therefore socially supporting a lot of people.

5.5 Soils

Deep well-drained silt-clay is distributed in most parts of the district. These soils together with loams of the nitochamic forestalls (dark Marram) cover mostly Nyabasi west location. The soil type for Kegonga division location comprises humic arisols with lithosols and poorly drained planosols.

The nature of the soil, especially its high susceptibility to erosion contributes a great deal to siltation of streams and rivers. Figure 5. shows the classification of soil according to texture and susceptibility of water erosion.

Figure 7: Classification of Soils According to Texture.



5.6 Forest Resources

Currently the area which is covered by the forests is 250m2 most found on hilltops in the Division. Maeta hill, Komottobo and Chinato hills host the two important forests in the Division. The forest on Komottobo and Maeta hill is owned and managed by the government of Kenya, while other forests are under private ownership.

Before tobacco was introduced in Kegonga in 1972, the size of area which was covered by forest was 1200m2 and this has been reducing dramatically as in the table below.

Year	Size m2
1972	1200
1977	1000
1983	700
1988	500
1993	450
2000	390
2002	250

Source: Kuria District officer, 2003

5.7 Farming

The main food crops grown in the Division are maize, cassava, sorghum, fingermillet, sweet potatoes, bananas and beans. The major cash crops grown include Tobacco, and coffee. However, Tobacco is the most grown cash crop in the Division. Livestock keeping is also practiced where cattle, goats, sheep and poultry are kept.

5.8 Transport and communication network

The road network is poorly developed in the Division as indicated in map 5. No tarmac road exists besides the all weather roads. Consequently, there are only two post offices in the Division i.e. at Nyamtiro and Kegonga market centers (RoK, 1997). There is some place in Kegonga division where there is network of Safaricom mobile like Mosweto village and the telephone service which they use is the manual one, where one has to go through the operator to be connected.

5.9 Water resources

The division has no major water bodies but there are about four dams in Kegonga division, Among the large dams are Sanawa in Nyabasi west location and Ngirigiri in Nguruna. These provide fish farming mainly for home consumption. Due to poor roads, maximum exploitation of fish farming has not been realized. Potential for fish farming both for local consumption and export to other districts exist.

Kegonga Division receives high amounts of rainfall (about 1500 mm per annum), which is well distributed throughout the year. This makes the Division ideal for roof catchments water harvesting. In fact, most schools and institutions depend on roof catchments for their water needs. Example of these is Komottobo high school, Kegonga secondary and Nyaroha girl's secondary school. Even some private developers have harvested rainwater.

The Division is poor in surface and sub-surface water resources because the compacted murram layer types of soils prevents rain water from percolating into the ground (Figure 5.6 shows the rivers in the district). As a result of this the run-of is high, causing rivers to flood only for a few hours and ebb to their original trickle. Within a few weeks after rains, signs of drying vegetation are visible. By the time, the river flow is low since there is very little from the ground. However, there are many springs, albeit with low discharge, which provide water for domestic use and for watering livestock as indicated in map 6. It is recommended, therefore that many springs are protected and the catchment areas be conserved.

Ground water sources have very poor yields and this has caused the drying up of boreholes. However, with careful hydrological survey, some low yield boreholes can be located. Most individuals have dug wells except in some areas where hard rock is encountered after 30 to 40 feet. Shallow wells are resources, which should be targeted for development to ensure sufficiency in water supply.

Where the run-off water has been harnessed, it is used especially for livestock and fish farming. Currently, the Division has 4 dams. Due to the high overland flow and poor percolation into the ground, it is easy to develop dams as a source of water for livestock and domestic use.

Surface and ground water sources are used in the Division. However, ground water is not very reliable as the existing boreholes do sometimes dry up (Kenya, 1997).

5.10 Resource Utilization

In Kegonga, resource utilization consists of agriculture and livestock production, other natural resources such as fisheries and economic activities in commercial, trade and service sectors.

5.11 Agriculture activities

The main food crops grown in the Division include maize, cassava, sorghum, finger millet, sweet potatoes, bananas and beans while the main cash crops grown are Tobacco, and coffee. The Division's potential for the cultivation of cash crops is well utilized but coffee farming could be expanded as the factories operate below capacity. Other crops include sunflower and cotton. The community is utilizing sunflower more for local oil extraction activities.

Maize play dual role of food crop and cash crops, but most of the production is sold out of the Division and the district as the population mainly depends on cassava.

5.12 Other natural resource exploitation

Fisheries: fish farming (aquaculture) is leading activity in the Division where individual farmers and groups own and manages fishponds with technical assistances of extension services from the department of fisheries personnel. Kegonga has 3 fishponds, which are operating, 1 abandoned and 1 is under construction (Kehancha, 1996). However, if all ponds including the abandoned ones were put into operation, the quantity of fish

harvested could be more than double from 1000 kg too 2000 kg per month and earn the Division some money.

5.13. Forest product Utilization and Human Population in Kegonga

Forests have direct and indirect influence on the population as the most the population in Kegonga depends on the forests directly for woodfuel besides other uses for trees, which include building and fencing, as currently 15% of the total land in Kegonga is under forest cover, (B.A.T,2002).

Indirect influences are as a result of interaction existing between forests, soils and climate. Wood fuel is one of the most important resources from the forests. Aspects of wood fuel utilization are therefore some of the closest relationship between human population and the natural environment. These aspects are integrated into the ecosystem.

Economic and social life in Kegonga is closely related to the forests. The forests form the basis of source of income. Agricultural production is also indirectly related to the presence of forest vegetation. The present trend is for exotic species to replace indigenous forests in both settled and forest reserve areas. Eucalyptus plantation provided firewood sold to other farmers and Tobacco buying Companies to take to the farmers who are in need of the fuelwood.

The rate of urbanization in Kegonga is 1.6% per annum and the population growth rate is approximately 2.0% per annum. Consequently, Kegonga being under both influences, it should be expected that the two would act as a force to accelerate environmental problems through an increased wood fuel demand, (Kenya,1997).

In view of the above prevailing circumstances, indigenous forests play a more useful role in maintaining ecological balance and would be exploited as cheaper fuel with high heat output. These Forests should therefore occupy maximum acreage if wood fuel supply to agricultural productivity especially of tobacco is to be maintained, as it requires a lot of woodfuel for curing purposes.

It has been shown that in exploiting forest vegetation for woodfuel no resource management and conservation were ever made and its consequences have caught people unawares. Inadequate and inaccurate perception of woodfuel problems and environmental impacts has been prevalent. Consequently, the problems were never anticipated in their right perspective until they manifested themselves.

5.16 Drought, Famine and Ecology Control

In the 1890s the AbaKuria, like other Kenyans communities in Kenya, were affected by severe drought. This affected farming and animal production precarious and hazardous occupations. Despite this, the Abakuria changed their general landscape and gradually modified their environment to suit the hard times. They starting staying in one place for some years than keep on moving from one place to another in search of the green pasture for the animals and this lead to permanent settlement. The three main rivers Nyangoto, Tebesi and Nyabasoti played significant roles in the ecosystem to the community. In times of insufficient rainfall, various clans competed and sometimes fought one another in their efforts to occupy the banks of these rivers. Kuria was drastically affected by the patterns of the lake level. Both, rivers and the lake Victoria and land configuration had a critical influence on climate and consequently, on agricultural potential. General climate changes caused drought and hence famine resulting from lack of pasture.

CHAPTER SIX:ANALYSIS OF THE EFFECTS OF WOOD FUEL IN THE EVIRONMENT.

6.0 Introduction

This chapter represents the analysis part of the study. The chapter starts by analysing the extent of tobacco growing in the study area, the level of demand of fuel wood for tobacco curing and the effects of tobacco growing on the environment and also measurers the community, M.T.K and B.A.T companies have put in place to address the issue of fuel wood scarcity.

6.1 Results

The results in this chapter are arranged according to the research questions

6.1.1. Extent of Tobacco growing in Kegonga Division

People in Kegonga Division depend a lot on farming. The kind of farming practiced is either pure Tobacco, Tobacco mixed with other crops, food crops only, livestock or mixed husbandry. A big proportion (87.6%) of the population at least were reported to be involved in Tobacco farming. see Table 6 1

TABLE 6.1: FARMER ACTIVITIES AMONG FARMERS ACROSS THE THREE KEGONGA LOCATIONS

Location	Farm Activities			Total
	Mixed cropping with Tobacco	Crop farming without Tobacco	Livestock husbandry	
Nyabasi West	75.0	20.0	5.0	100.0
Nyabasi East	100.0	0.0	0.0	100.0
Nyabikongori	96.0	4.0	0.0	100.0
Total	**92.0**	**7.0**	**1.0**	**100.0**

$x^2 = 23.5$ df=4 sig= 0.009

On average 1.5 tons of Tobacco are produced by each farmer, as indicated in table 6 2. However there is a big variation in the amount of cured Tobacco. This shows that there is a big gap between the highest and the lowest Tobacco producer.

TABLE 6 2: DESCRIPTIVE STATISTICS FOR QUANTITY OF CURED TOBACCO AND CASH EARNED

	Mean	Standard deviation
Cured Tobacco (gms)	1531.88	2560.05
Cash earned (Kshs.)	95847.00	133863.36

TABLE 6 3: QUANTITY OF CURED TOBACCO AND AVERAGE HOUSEHOLD CASH EARNED IN KEGONGA

	Cured Tobacco mean (Kgs)	Mean Cash earned (Kshs.)
Nyabasi West	2,587.50	148,250.00
Nyabasi East	472.58	36,961.29
Nyabikongori	1,936.21	122,655.20

6.1.2.Level of demand of fuelwood for Tobacco curing

The type of Tobacco planted demand a substantial amount of fuelwood for its curing. On average 1 tractor of wood (approximately 1 ton) is used to cure a ton of Tobacco. A Tobacco farmer uses a mean of 1.2 tons of firewood. See table 6 2 above. However, quantity of fuelwood used is determined by the location. Farmers in Nyabikongori were observed to use more wood (mean=1.98, see table 6.4). Nyabasi East used uses the least amount, mean=0.5.

TABLE 6 4: MEAN QUANTITY IN TONS OF FUELWOOD USED ACROSS THE THREE LOCATIONS

Location	Mean	Standard Deviation
Nyabasi West	1.15	1.39
Nyabasi East	0.53	0.56
Nyabikongori	1.98	2.83

6.1.3.Effects of Tobacco growing on the environment

Nyabasi east and Nyabasi west are observed to depend on indigenous species mostly for the fuel, Table 6 4.

Table 6.5: Proportion of farmers using indigenous or exotic tree species

Location	Category of firewood tree			Total
	Indigenous	Exotic	Both	
Nyabasi	64.0	9.0	27.0	100.0
West	74.0	22.0	4.0	100.0
Nyabasi East	15.0	19.0	66.0	100.0
Nyabikongori				
Total	**46.0**	**18.0**	**36.0**	**100.0**

$x2_{=36.42}$ df=4 sig= 0.000

However, while in Nyabasi East the wood is mostly from own farm, in Nyabasi West a high proportion (10%) of the farmers get the wood along the river or forest, table 6 6. This is a threat to the catchments area in the location.

TABLE 6 6: MAIN SOURCE OF FUELWOOD BY FARMERS IN KEGONGA

Location	Source of wood				Total
	Own farm	Buy	Along river	Own and Buy	
Nyabasi	9.0	9.0	45.0	37.0	100.0
West	61.0	9.0	0.0	30.0	100.0
Nyabasi East	30.0	19.0	4.0	47.0	100.0
Nyabikongori					
Total	**38.0**	**13.0**	**10.0**	**39.0**	**100.0**

$x2_{=31.07}$ df=6 sig= 0.000

Asked if they experience shortage for fuelwood or not, a high proportion of the farmers (57%) said they do. see table 6 7.

TABLE. 6.7: PREVALENCE OF FUEL WOOD SHORTAGE IN KEGONGA

Location	Shortage of fuel wood		Total
	No	Yes	
Nyabasi West	15.0	85.0	100.0
Nyabasi East	61.0	39.0	100.0
Nyabikongori	41.0	59.0	100.0
Total	**43.0**	**57.0**	**100.0**

$x2_{=12.45}$ df=2 sig= 0.014

Nyabikongori has more woodlots than Nyabasi West and Nyabasi East .see Table 5 8. This explains why the former uses mostly exotic. It was observed that woodlots are mostly of exotic eucalypts.

TABLE. 6 8: WOODLOT OWNERSHIP

Location	Woodlot ownership 2 acre and above		Total
	No	Yes	
Nyabasi West	50.0	50.0	100.0
Nyabasi East	68.0	32.0	100.0
Nyabikongori	41.0	59.0	100.0
Total	**53.0**	**47.0**	**100.0**

$x2_{=4.3}$ df=2 sig= 0.351

6.1. Measures the community and Tobacco companies have put in place to address the issue of fuel wood scarcity.

Woodlot establishment has mostly been used to reduce pressure on natural fuelwood sources. This has been more emphasized in Nyabikongori otherwise majority, 53% of the farmers in Kegonga (Table,6.8) have not yet established woodlots. Most farmers resort to buying wood from those who have woodlots, table 6.9, while others go to exploit the remaining resources along the river. The river which is being exploited in Kegonga is river Tebesi and water volume has been reducing and sand harvesting is common in the river, but it is common being affected by the deforestation.. Sand harvesting is because of soil erosion which take place in the divisions.

TABLE 6.9: SOURCE OF EXTRA FUEL WOOD FOR CURING TOBACCO

Location	Source of extra fuel		Total
	Buy	Forest/along river	
Nyabasi west	91.0	9.0	100.0
Nyabasi east	80.0	20.0	100.0
Nyabikongori	100.0	0.0	100.0
Total	**92.0**	**8.0**	**100.0**

$x2_{=10.19}$ df=2 sig= 0.117

In Table 6.10 below, majority 60% of the farmers, have no plans to increase on-farm fuelwood sources to meet the growing demand.

TABLE 6.10: FUTURE PLANS TO INCREASE FUELWOOD

Location	Future plans			Total
	No plans	Plant on-farm trees	Increase budgetary allocation	
Nyabasi	50.0	40.0	10.0	100.0
West	71.0	29.0	0.0	100.0
Nyabasi East	55.0	45.0	0.0	100.0
Nyabikongori				
Total	60.0	37.0	3.0	100.0

6.2. DISCUSSION

6.2.1 Extent of Tobacco Growing in Kegonga Division

Kegonga Division is said to be an agricultural area i.e. both food and cash crop are grown. Of the cash crops grown tobacco takes a lead in terms of size and the proportion of farmers growing it. It was established that 92% of Kegonga farmers grow Tobacco on their farms at least every season (Table 6.1). However, the proportion of farmers growing tobacco varies with the administrative location ($p< 0.05$). All the farmers

interviewed in Nyabasi East grow tobacco while 75% of the Nyabasi West farmers reported growing Tobacco.

The quantity of household cured tobacco also varies with the administrative locations i.e. there exists a significant ($p<0.05$) relationship between amount of tobacco grown and administrative location of the farmer. Nyabasi West location leads with an average production of 2,587 Kilograms per household followed by Nyabikongori location. It is important to note here that while all farmers interviewed in Nyabasi East location grow tobacco their mean output is the lowest. Residents of Nyabasi East could attribute this to smaller land size ownership.

6.2.2 Level of demand of fuelwood and its implication on the environment

As it has been reported earlier, farmers in Kegonga grow the smoke cured tobacco, which demands a lot of fuelwood. It is recommended that the amount of tobacco grown be relative to on-farm fuelwood availability. Sources of wood however vary. Wood can be obtained from community forests (if they exists), government forests (if the policies allow) or from on-farm established woodlots. In the absence of these sources, farmers might resort to harvesting wood in restricted areas such as along rivers and on protected lands.

Large quantities of fuelwood is needed to cure tobacco. On average, it was established that one tractor (approximately one ton) of wood is used to cure one ton of tobacco. On average, each household uses 1.2 tons of fuelwood for curing tobacco every season. The amount of fuelwood used to cure tobacco, varies with administrative locations. Nyabikongori location uses more fuelwood on average (mean= 1.982) than other locations. It is however interesting to note that while Nyabikongori uses more wood than Nyabasi West the later produces more cured tobacco. This can be explained by the species of trees used. Nyabikongori, which owns more woodlots than Nyabasi West, is likely to use mostly exotic species, which are of low calorific content than the indigenous species mostly used in Nyabasi West.

Majority of farmers (57%) in Kegonga reported experiencing fuelwood shortage. They can be attributed by lack of own farm fuelwood sources, and lack of access to gazette forests. It was established that not all farmers growing tobacco own woodlots. In fact only 55% of the farmers own woodlots, which are mostly composed of exotic eucalypts. The highest proportion of woodlot ownership was reported in Nyabikongori location (see table 6.8) while majority (68%) of the farmers in Nyabasi East do not own woodlots. There is likelihood that land size, and ownership affects presence of woodlots in Nyabasi East location.

As a result of the majority farmers lacking woodlots, farmers either buy wood from those who own woodlots or meet their fuelwood needs from the vegetation resources along the major rivers. This has a grave implication to the Kegonga water catchments. The source of wood varies significantly ($p<0.001$) across the administrative locations. A high proportion of Nyabasi West farmers get the fuelwood along the river than any other location. In fact, it was observed that vegetation depletion is higher in Nyabasi West than the other locations.

The future of fuelwood availability in Kegonga division is bleak. Farmers have no plans for establishing and expanding woodlots this has been due to luck of enough land to do farming and the remaining land which could be used to plant woodlot instead it is used in planting other crops other than tobacco. Most of their income is channeled to education. Asked which projects they will invest into for the next five years, a high proportion reported no plans of investing in any project. Lack of proper planning is therefore the major cause of imbalance between Tobacco production levels and fuelwood availability.

It is also worse to note that while majority (46%) of farmers use exclusively indigenous tree species for curing tobacco, all the woodlots observed have only exotic species- *Eucalyptus sp*. Natural vegetation in the Division is therefore on the verge of extinction.

From the field finding it was established that there are several environmental problems in the study area that have been attributed to the use of wood fuel in curing tobacco. Some of these environmental problems include:

1.soil erosion

2. Depletion of tree species

3.vegetation change, there is excision of the indigenous vegetation and opportunistic weeds to replace the excised vegetation

4.encroachment on watercourses

5.ecosystem disruption, which lead to migration of wild animals

Soil erosion

The felling down of tress has been done so that there is no any place in the division which has been left behind, even the river banks has not been left. This has exposed the soil to the dangers of erosion. This is widely spread in the study are. This has left the land to be extremely bare so when it rains, the soil is eroded down toward the streams. This can be attested to by the occurrence of several gullies in the study area.

Other environmental problems cited include strong winds which was attributed to the strong velocity of wind movement after the trees has been cleared and there is nothing to act as wind breaker

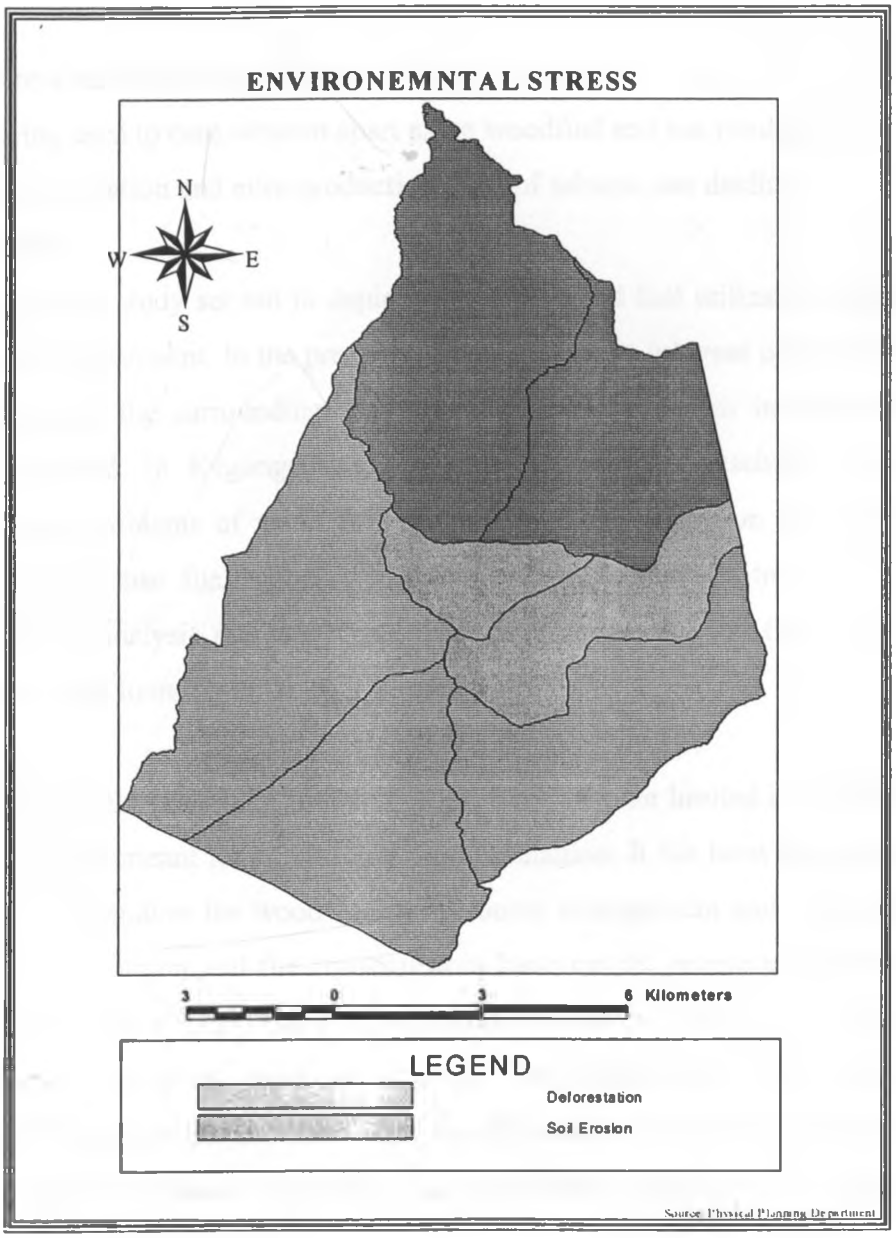
6.2.3 Measures Put in Place to Ensure Continued Availability of Fuelwood

While it has been expected that tobacco companies have afforestation programs within their area of operation to boost fuelwood availability and distribution, none of the companies in Kegonga division reported having such a program. The two companies; Standcom (formerly B.A.T) and Mastermind have no such programs and yet their main source of fuel is wood. Both companies depend on wood fuel provided by farmers from their own farms. No efforts have been made either to start an afforestation programme or educate the public on the need to establish woodlots. Although Standcom gives an excuse on the point of its recent establishment, it should be pointed out that they are taking over a plant (B.A.T) that was established and has been in operation for a very long time. It is therefore expected that B.A.T had such programs.

It is evident that, the two companies are only interested in financial benefits from the area. Asked to give the usefulness of tobacco industry in Kenya, all the companies explain that they are employing a lot of Kenyans. They also point out the huge revenue the government gets from the industry and also for the local communities in their areas of operation.

Figure. 6. summarizes those areas in Kegonga that are environmental stressed.

FIGURE .6.: ENVIRONMENTALLY STRESSED AREAS



CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

7.0 Summary of findings

The study has reveled that there is shortage of woodfuel as there is no any other source of woodfuel being used to cure tobacco apart using woodfuel and has resulted into environmental degradation and even production yield of tobacco has declined.

7.1 Conclusion

The objectives of the study set out to depict aspects of wood fuel utilization and their influence on the environment. In the preceding chapters factors inherent in use of wood fuel in Kegonga and the surroundings have been analyzed and their impacts on the environment assessed. In Kegonga Division, majority of the households perceive present and future problems of wood fuel availability. This proportion indicates that most of the farmers use fuel wood, wet firewood and indigenous trees in curing tobacco. Perception analysis points out that there is an eminent wood fuel crisis and related environmental looming in the near future.

Households who would undertake aforestation on their own are limited by small sizes of land, which is also meant for agricultural crop production. It has been shown that in exploiting forest vegetation for wood fuel no resource management and conservation were ever made. Depletion and the consequences have caught people unawares. The situation is aggravated by exploitation of vegetation resources along the rivers as the farmers face the problem of fuelwood scarcity. The situation has not gotten the attention of the tobacco mining companies as no afforestation programs have been put in place to improve fuelwood availability and distribution among the residents of Kegonga division of Kuria District.

There is a need for the ministries of finance, environment and forestry to reexamine policies on afforestation and deforestation particularly in rural areas where tobacco is a chief cash crop. The need to put a farmer at the centre of decision making regarding

land use and farming seems not to be working especially in light to the profitability of tobacco returns which often compels farmers to ignore conservation measures.

Other sources of energy like the use of electricity or solar should be introduced to cure tobacco instead of using electricity if the crop has to be grown.

7.2 Recommendations

The following are the policy, which might change the implied schemes of Tobacco production in Kegonga:

- Streamlining the production and marketing of some crops like maize and minimize payment delays.
- Introducing production and/ or marketing insurance schemes to protect the other cash crop growers like maize.
- Phasing out recovery of loans made for inputs in coffee farming so that it can develop than growing Tobacco
- Integrating contract-farming schemes into national agriculture programmes to minimize duplication of resources.
- Streamlining and strengthening the legal framework for contract farming by introducing a contract farming act. This will protect those who are growing Tobacco through introducing minimum and compulsory provisions for each contract, institutionalizing negotiations between the buying companies and the farmers and introducing guaranteed minimum returns to the farmers.
- Providing training courses to farmer in basic literacy, accounting and cash management to minimize conflicts between the farmers and the company.
- Efforts should be made to use financial manpower or land resources to initiate and carry out afforestation.
- Immediate measures are required to deal with negative implications of the predominance of small-scale farmlands and their ultimate cutting trees for fuel use. The measures in this case will range from direct land use control to incentives for sustainable land use.

- Most of the small scale farmers were found to depend on tobacco farming as a source of income and they don't have any sources of income. Most of them have low or no formal education at all. The solution then lies in provision of off-farm employment opportunities for the youth.
- Freehold land that is quickly lead to small sub-divisions which are not productive to agricultural, there is need to develop some land use and development control measures. Such measures will include the conversion to leasehold whenever subdivision approval is applied for, the control of the proportions of land being used for specific purposes and even prohibition of certain land uses perceived as being environmentally harmful.
- Other source of energy should be introduced like the use of electricity or the use of solar and if the tobacco buying company cannot introduce this they should stop growing the crop.

REFERENCE

.1.**Anderson D, Fishwick R. (1984)** *fuel wood consumption and deforestation in African countries.* Wolrdbank staff working paper 704. Washington

.2. **Akehurt B.C. (1968)** *Tobacco.* Longmans, Great Britain.

.3. **Arclays Bank D.C.O (1961)** *Tobacco.* Williams, Leo and company Ltd. London

5. **Auman, C. F. H. (1928),** The Division of Work According to Sex in Africa Hoe Culture. In *Africa.*

6. **Auman H. (1928)** the Division of work according to sex in Africa hoe culture

7. **Babere Chacha Kerata, (1999).** The History of Tobacco Growing in Kuria.(unpublished M.A Thesis)

8. **Bryson, J.C. (1981)** "Women and Agriculture in sub-saharan Africa: Implications for Development- An Exploratory Study. *Journal of Development Studies*, Vol.17 No. 3, pp.29-49

9. **British American Tobacco-Kenya (1977),** Annual Report, 1977
10. (1990), Annual Repot
11. (1994) Annual Repot
12. (2000) Annual Repot
13. (2002) Annual Repot

14. **Chandra M. S. (1982),** Commercialization, Peasant Differentiation and Merchant capital in late nineteenth-century. Bombay and Punjab: *Journal of Peasant Studies.* Vol. 10 No.1

15. **Chih-ming, K. (1992)** Agrarian development, family farms and sugar capital in colonial Taiwan, 1895-1945. *Journal of peasant studies. Vol. 18, No.2*

16. **Chapman S., Yach D., Saloojee Y., and Simpson D. (1993)** *conference report; all African conference on Tobacco control.* Harare

17. **Chidumayo, E. D. N. (1987)** *Miombo ecology and management.* IT publications, London.

18. **Eckholme, Foley G., Barnard G., and Timberlake L. (1984)** *Fuelwoood: the energy crisis that wont go away.* London: Earth scan

19. Economist Intelligence Unit (1980) *Leaf Tobacco- its combustion in to the economic and social development of the third world.* An EIU commodity monograph. London: EIU, 1980.

20. Goodland R.J.A, Watson C., and Ledge G. (1987) *Environmental management in tropical agriculture*. Boulder: Westview press.

21. Joseph Oluoch Otieno, 1998, tobacco under contract: agricultural development and environmental change in kuria district, western Kenya, thesis, Urbana Illinois, champaign.

22. FAO (1997) *States of the World's Forests.* FAO Rome

23. Feder, E. (1977), Ditch effort to save undeveloped Agriculture: international Agri-business, the World Bank and the rural poor" *Journal of contemporary Asia,* Vol. 7 no.1

24. Food and Agriculture Organization, FAO, (1998), *Statement on multisectroral collaboration on Tobacco on the Health.* ECOSOC substantive session, FAO, Rome

25. Fleisher, M. (1997) Kuria cattle raiding: case study in the capitalist transformation of an east Africa socio-cultural institution. *Tobacco forum,* Vol. 2 No. 1

26. Fleisher, M. (1986) The use of wood by the Tobacco industry in Argentina and the ecological implications. International Forest Science Consultancy. Edinburgh.

27. Garner Wightman W. (1951) *The Production of Tobacco,* McGraw-Hill Book Company, Insc London.

28. Geist H. (1998) *How Tobacco Farming Contributes to Tropical Deforestation in Abedian.* Cape town.

29. Geist H. (1999), *Transforming the Fringe Tobacco Related Wood Usage and Its Environmental Implications,* UK.

30. Geist, H. (1998) How Tobacco farming contributes to deforestation. In *Economic of Tobacco control: towards an optimal policy mix.* Edited by Wilkins, N. et al. Applied Fiscal Research Center, University of Cape Town.

31. Geist, H. (1999) *Tobacco: a driving force of environmental change in the miombo woodland zone in southern Africa.* A paper presented at St. Antony's conference of African environment, past and present.

32. Geist, H. (1998) Transforming the fringe: Tobacco-Related Wood Usage and its Environmental Implications. In *Consequences of Globalization and Degedation on*

Marginal and Critical Regional Economic Systems. Edited by Fdelgado-Cravidao, H. Jussila and R. Majoral. Ashgate, Aldershot.

33. Goodland, R. J. A. (1983) *Environmental Management in Tropical Agriculture.* Westview Press, Boulder.

34. Gibbon, P. (1992) Failed Agenda? African Agriculture under Structural Adjustment, with Special Reference to Kenya and Ghana. *Journal of Peasant Studies.* No.20, 50-96

35. Glover, d. Ayako A. B, Mukras M.S. (eds)(1989) special issue on contract farming and small Holder outgrower schemes in Eastern and southern Africa. East Africa economic review.

36. Griffins, K. (1979), *The Political Economy of Agrarian Change: an Essay on Green Revolution.* Macmillan, London.

37. Hamilton, A.C. (1997), *Deforestation in Uganda.* Kampala, Uganda

38. Nassiuma, D. (2000) *Survey sampling.* University of Nairobi Press. Nairobi

39. Oongo E. (1997), *Untitled Paper Written for the Tenth World Conference on Tobacco Health in Beijing.* Unpublished.

40. Republic of Kenya (1997) *Kuria District Development Plan 1997-2001.* Government printers. Nairobi

41. Kenya, Republic (1989): Ministry of Environment and Natural resources. Report of the GOK/UNEP/UNDP project on Environment and Development Vol1 and 2. Government printer

42. Taylor H.W. (1927) *Tobacco Culture,* Central News Agency, Limited, South America

43. William O.Y. (1993) *Wood Fuel and Deforestation: Answer for a Sustainable Environment.* Academic press limited, Canada.

44. Roger C. (1988) Representing Reciprocity, Reproducing Domination: Ideology and the labour process in Latin America contact farming. *Journal of Peasant Studies.* Vol.16, No. 1

45. Hayani, Y. and Kikuchi, M. (1981), *Asian Village Economy at the Crossroads: An Economic Approach to Institutional Change.* University of Tokyo Press and the Johns Hopkins University Press. Tokyo and Baltimore.

46. Harris N.P(1987), The Greening of Africa: Breaking through the battle for Land and Food . Paladin Grafton books

47. Heald, S. (1991), Tobacco, Time and the Household Economy in two Kenyan Societies: the Teso and the Kuria. *Comparative Studies in Society and History.* Vol.33 (1), 130-57

48 .Heald S. (1987), *a short Report on Patterns of small Investments in small Holder agriculture: A Kenyan Case Study.* Mimeo.

49 Heald, S. (1999) *Agricultural Intensification of the decline of Pastorolism: A Case Study from Kenya in Africa.* Vol.69.No.2

50. Hill, D. (1986), Growing Tobacco-The Wider Benefits. *Outlook*, No.4

51. Ikiara, G.K, Joma, M.A, and Amadi, J.O. (1993) *Agricultural decline, Politics and Structural Adjustment in Kenya. In Social change and Economic reform in Africa.* Edited by Gibbon, P. Scandinavian Institute of African studies, Uppsala.

52. Judith Mackay, (1994), " the fight against tobacco in developing countries" Longman Group, Uk Ltd, London

53. Kolawole, M. (1975), Economic aspects of flue cured Tobacco production in the savannah zone of western Nigeria. In *savannah*, Vol. 4 No.1, pp 13-23

54. Kjerland, K. A. (1995) *The Belated Incorporation of the AbaKuria into a Modern Kenya.* PhD Dissertation University of Bergen

55. .Kweyu, P.M. (1994), *Tobacco Growing in Kenya –Socio-Ecological Losses.* London.

56. Miller, M. (1978) *Tobacco and the third World: Tomorrows Epidemic?* London.

57. Ministry of Environment and Natural Resources (1994), *Kenya Forestry Master Plan, 1994.* Nairobi, Kenya.

58. Mbathi (1992). The impacat of sand minig on the evironment and land use in masinga division, machakos district.

59 Muray, S. (1959) Report *on Tobacco in central and Eastern Africa.* Rhodes House

60. Mgeni, A, (1988) Woodland going up in Smoke. In *Tobacco and Environment in Tanzania Development and Corporation.*

61. White I. D (1984). Environmental Systems: An introductory text, Allen and Urwin, London

62. Opito, A, (1999) *The crisis of Africa Agriculture, Peasants, Poverty and Environmental Degration in Arua. District, Uganda.* A paper presented at St. Antony, s Conference of Africa n environmental, past and present.

63. Orivis, S, (1993) the Kenyan Agrarian Debate. *African Studies review*, No.36, 23-48

64. Patchett, D. (1988), *Alternative to Tobacco Forum.* Vol.2, No.2

65. Radley, P and Dewees, P. (1993) *Indigenous woodlands, agricultural production and household economy in the communal areas.* Washington

66.Robert C. (1988) *A most Promising weed.* Athens

67. Ruel, M.J. (1964) Kuria Generation Classes. In *Africa*, Vol.32

68.Thompson, E.P. (1968) *The making of the English working class.* New York.

69 Spencier, P. (1984) Pastrolism and the Ghost of Capitalism. In *Production Pastorate.* Et Sociate. Vol.15, 61-76

70. Ingram (1950), *Winington Suvery of Land Utilization in Northern Mara District.* Annual Report. ·

71. Lappe F. and Collins, J. (1980) *Food First, the Myth of Scarcity.* London.

72. Leys, C. (1975) *Undevelopment in Kenya.* Heinemann, London

73. Megher, K. (1990) Institutionalizing the Bio-Revolution: Implication for Nigerian Small Holder, *Journal of peasant studies.* Vol. 10, No.1

74. Meillassoux, C. (1978) Kinship Relations of Production. In *Relation of Production Marxist Approaches to Economic Anthropology.* Edited by Sedder, D. London

75. Missana, S, Mung'ong'o C. And Mukamuri, B. (1996) Miombo Woodlands in the Winder Context. Macro-Economic and Inter-Sectroral Influences. In *The Miombo in Transition: Woodlands and Welfare in Africa.* Edited by Campbell, B. Centre of International Forestry research. Bogor

76. Tobisson, E. (1980), *Women, Work, Food and Nutrition in Nyamwigura Village, Mara Region "Tanganyika" Dar e salaam.* Tanzania Food and Nutrition Committee Report, No.548, 1980:31

77. Maroa S. M. (1989) *nehanchere Ekegambo geito; Amatonio gi IgiKuria*, Nairobi, pp.4-16.

78. Ministry of Economic Planning (1977), *Economic Review of Agriculture.* Vol.2 No.2

79. Ministry of Agriculture (1988), *Kehancha Division, Monthly Report, June 1988.*

80. Muller M. 1978. *Tobacco and the third world- tomorrow epidemic? A war on want investigations in to the production, promotion and use of Tobacco in the developing countries.* London

81.World Bank (1981), *Accelerated Development in Sub-Saharan Africa: an agenda for Action.* Washington D.C.

82. World Bank (1984) *World Bank Tobacco financing-the environmental/ health case: background for policy formulation.* Washington.

83. Moyo, S. O'keefe, P. and Sill, M. (1993) *The southern African environment: profits of the SADC countries.* ETC foundation/Earltscan publishers ltd, London.

84. Tietema, T, Tolsma, D. J, Veenendaal, E. M. and Schroten, J. (1991) *Plant responses to human activities in the tropical savannah ecosystem of Botswana.*

85. Hose C P 1988 Kenya's practical dark- fired plan allows self-sufficient, export. Tobacco international , June 10: 30-1

86. International Agriculture Development. 1984, Kenya's trees go up in smoke-for smokers. International Agriculture Development

87. Werren, M., Lwore, J., Abbot, P., Siddle, B. and Hardcastle, P. (1995) *Management of miombo by local communities.* Forestry research institute of Malawi and university of A berdeen. Lilongwe.

88. Shelton A. (1987) *200 million new trees and growing Tobacco, report.*

89.Smith G.N. (1977). *Tobacco Culture.* AD Guide, spur publications, Hill Brow.

90. United States Department of Agriculture (1993) *World Tobacco situation, foreign agriculture service circular series.* Ft 6-93 June 1993:15.

91. Leonard H. J. (1987) *Natural resources and economic development in Central America.* New Brunswick: Transaction books

92. Jungbluth G. A. (1988) *A survey of devastation and conservation.* Tobacco International

93. Madeley J. (1993) *The environmental impact of Tobacco production in developing countries.* Proceedings of the 5th world conference on smoking and health. Winnipeg, Canada

94. Uchendu V.C. and Anthony, K.R. (1975). *Agricultural Change in Kisii District, Kenya.* Nairobi

Appendix 1: Methodology

$$n = \frac{n'N}{N-1+n'}$$

where n = sample size for simple random sampling without replacement.

N= Population size.

n' = Sample size estimate for simple random sampling with replacement.

But n' is given by the formula

$$n' = \frac{Z_{\alpha/2}}{d^2} p(1-p)$$

where $Z_{\alpha/2}$ = degree of confidence taken as **95% or 1.96**

d = Degree of accuracy taken as **10 % or 0.1**

p = Variability of the characteristics to be measured in the population. A variability of **50% (p=0.5)** is to maximize the expected variance and ensure that the sample size will be large enough to allow the sample mean or proportion to be considered as having a normal distribution

APPENDIX 2 QUESSTIONNERS

University of Nairobi
Faculty of Architecture, Design and Development
Department of Urban and Regional Planning

Declaration: The information obtained will be held in confidentiality and is intended for pure academic purpose only.

HOUSEHOLD QUESTIONNAIRE (To be answered by Household Heads)
Name of interviewer……
Date of Interview……..
Location……..

5.1 A). HOUSEHOLD DETAILS

1. Household Head: Name of Respondent (Optional)----------
a). Male b). Female
2. Marital Status a). Single b). Married c). Separated d) Widowed

3.How many persons live in your household? Total Number ----------

Household member	Age	Sex	Education level	Relationship to H/H head	Marital status

5. Place of birth……..

6. Religion (Specify)……

B). LAND.

5 a. Do you own this land you currently stay on? Yes/No

b. Do you own any other land? 1. Yes 2. No

6. Is yes, what is the nature of ownership?
1. Private 2. Leasehold/rented 3. Trust 4. Others (Specify)…….

7. What is the size of the land in acre?……..

8. How did you acquire this land?
a. Bought b. Inherited c. Granted by government d. Others (Specify)

9. Do you own the title of your land? 1. Yes 2.No

12. What activities do you carry on your farm/land?

a. Tobacco farming b. Mixed Tobacco and other crops c. Crop farming d. Livestock rearing. e. Others (Specify)

13. If you answered a or b in question 12 which fuel do you use to treat the tobacco.

a). Wood b). Cow dung c). Electricity d). Solar (sun)

14. If you answered a in the above question, which tree do you mostly use?

a). Indigenous. Specify.....

b). Exotic. Specify.....

15. What is the source of wood?

a). Own farm b). Buy c). Along the river. d). Other. Specify.....

16 Do you have access to a private or group nursery? a). Yes b) No.

17. Do you own any woodlot?

a). Yes b). No

18. Which agroforestry practice/system is present on your farm?

19. Are you employed? A. Yes b. No

If yes please specify .....

21. How much cured tobacco do you produce per year?.....

22. How much fuelwood do you use to treat tobacco?.....

23. Do you think tobacco farming has had an environmental impact on vegetation cover in this Division?

a). Yes b). No

If yes How.....

25. Do you experience shortage in availability of fuelwood to cure tobacco?

26. How do you make up for the shortage?.....

27. Have you any plans to make up for the shortage in future?

28. What is your main occupation and that of the other family members?

	Occupation		Monthly income in Kshs.				
		Below 5,000	10,000-20,000	20,000-50,000	50,000-100,000	Above 100,000	

29. What are the other sources of income for the family if any?

Source	Approximate amount per month/per year including bonuses

EXPENDITURE

30. What proportion of income do you spend on household consumption?

Activity	Amount spent per month in Kshs
Food	
Clothing and Housing	
Transport	
Medical	
Education	
Others (Specify)	
Total Monthly expenditure Food	
Total monthly expenditure Non-food.	

31.. In which project have you invested surplus family income?

Type of investment	Costs	Source of capital
Farm structure		
Educations		
Machinery		
Business		

32. What are the most important projects you plan to invest in the next five years?

Investment	Estimated costs

CROP PRODUCTION.

33. What crops do you grow on your farm?

Crop type	Area covered in acres	Yield in Kgs/year 2001	Quantity sold in H/H/ day	Quantity sold by the H/H/ day	Price per Kg
Cash crops					
Food crops					

34. Where do you sell your produce? (Give names)

ii. Local market.....

ii. International market

iii. Urban centers within the district

iv. Elsewhere (Specify)

UTILITY SERVICES.

35. Do you have access to water on the land?

36. If so, which type?

a. Piped

b. Borehole

c. Well

d. Spring/river

e. Roof catchments

37. What factors do you put into consideration when allocating land for tobacco farming? (To tick)

a. Size of land

b. Amount of fuelwood present

c. Availability of labour
d. Transportation needs and means
e. Financial need or demand
f. Other specify

University of Nairobi
Faculty of Architecture, Design and Development
Department of Urban and Regional Planning

Declaration: The information obtained will be held in confidentiality and is intended for pure academic purpose only.

Name of interviewer.....
Date of Interview.....
Location.....

TOBACCO BUYING COMPANIES. QUESTIONNAIRE

1. The name of the buying company.....
2. Do you own the land where you buying tobacco?
3. If yes what is the size of the land?
4. What is the average metric tonnes you buy from the farmer of Kegonga per year
5. What is the approximate amount of tobacco you buy from each farmer per year?
6. Do you have any program for agro forestry in the community?
7. If yes in which area?.....
8. Does this company have a forestry/agroforestry department?
    a. Yes
    b. No
9. If yes what are its activities?.....

    .....
10. Does this company run a tree nursery?
    a. Yes
    b. No
11. How many seedlings do you provide per year to farmers?
    A. For free.....
    B. For sell.....
12. Do you give farmers loans?
    a. Yes
    b. No

.....

.....

.....

.....

18. What is your view on the importance of the tobacco industry in future Kenya?

.....

.....

.....

62. Opito, A, (1999) *The crisis of Africa Agriculture, Peasants, Poverty and Environmental Degration in Arua. District, Uganda.* A paper presented at St. Antony, s Conference of Africa n environmental, past and present.

63. Orivis, S, (1993) the Kenyan Agrarian Debate. *African Studies review*, No.36, 23-48

64. Patchett, D. (1988), *Alternative to Tobacco Forum.* Vol.2, No.2

65. Radley, P and Dewees, P. (1993) *Indigenous woodlands, agricultural production and household economy in the communal areas.* Washington

66.Robert C. (1988) *A most Promising weed.* Athens

67. Ruel, M.J. (1964) Kuria Generation Classes. In *Africa*, Vol.32

68.Thompson, E.P. (1968) *The making of the English working class.* New York.

69 Spencier, P. (1984) Pastrolism and the Ghost of Capitalism. In *Production Pastorate.* Et Sociate. Vol.15, 61-76

70. Ingram (1950), *Winington Suvery of Land Utilization in Northern Mara District.* Annual Report.

71. Lappe F. and Collins, J. (1980) *Food First, the Myth of Scarcity.* London.

72. Leys, C. (1975) *Undevelopment in Kenya.* Heinemann, London

73. Megher, K. (1990) Institutionalizing the Bio-Revolution: Implication for Nigerian Small Holder, *Journal of peasant studies.* Vol. 10, No.1

74. Meillassoux, C. (1978) Kinship Relations of Production. In *Relation of Production Marxist Approaches to Economic Anthropology.* Edited by Sedder, D. London

75. Missana, S, Mung'ong'o C. And Mukamuri, B. (1996) Miombo Woodlands in the Winder Context. Macro-Economic and Inter-Sectroral Influences. In *The Miombo in Transition: Woodlands and Welfare in Africa.* Edited by Campbell, B. Centre of International Forestry research. Bogor

76. Tobisson, E. (1980), *Women, Work, Food and Nutrition in Nyamwigura Village, Mara Region "Tanganyika" Dar e salaam.* Tanzania Food and Nutrition Committee Report, No.548, 1980:31

77. Maroa S. M. (1989) *nehanchere Ekegambo geito; Amatonio gi IgiKuria*, Nairobi, pp.4-16.

78. Ministry of Economic Planning (1977), *Economic Review of Agriculture.* Vol.2 No.2

79. Ministry of Agriculture (1988), *Kehancha Division, Monthly Report, June 1988.*

80. Muller M. 1978. *Tobacco and the third world- tomorrow epidemic? A war on want investigations in to the production, promotion and use of Tobacco in the developing countries.* London

81.World Bank (1981), *Accelerated Development in Sub-Saharan Africa: an agenda for Action.* Washington D.C.

82. World Bank (1984) *World Bank Tobacco financing-the environmental/ health case: background for policy formulation.* Washington.

83. Moyo, S. O'keefe, P. and Sill, M. (1993) *The southern African environment: profits of the SADC countries.* ETC foundation/Earltscan publishers ltd, London.

84. Tietema, T, Tolsma, D. J, Veenendaal, E. M. and Schroten, J. (1991) *Plant responses to human activities in the tropical savannah ecosystem of Botswana.*

85. Hose C P 1988 Kenya's practical dark- fired plan allows self-sufficient, export. Tobacco international , June 10: 30-1

86. International Agriculture Development. 1984, Kenya's trees go up in smoke-for smokers. International Agriculture Development

87. Werren, M., Lwore, J., Abbot, P., Siddle, B. and Hardcastle, P. (1995) *Management of miombo by local communities.* Forestry research institute of Malawi and university of A berdeen. Lilongwe.

88. Shelton A. (1987) *200 million new trees and growing Tobacco, report.*

89.Smith G.N. (1977). *Tobacco Culture.* AD Guide, spur publications, Hill Brow.

90. United States Department of Agriculture (1993) *World Tobacco situation, foreign agriculture service circular series.* Ft 6-93 June 1993:15.

91. Leonard H. J. (1987) *Natural resources and economic development in Central America.* New Brunswick: Transaction books

92. Jungbluth G. A. (1988) *A survey of devastation and conservation.* Tobacco International

93. Madeley J. (1993) *The environmental impact of Tobacco production in developing countries.* Proceedings of the 5th world conference on smoking and health. Winnipeg, Canada

94. Uchendu V.C. and Anthony, K.R. (1975). *Agricultural Change in Kisii District, Kenya.* Nairobi

Appendix 1: Methodology

$$n = \frac{n'N}{N-1+n'}$$

where n = sample size for simple random sampling without replacement.

N= Population size.

n' = Sample size estimate for simple random sampling with replacement.

But n' is given by the formula

$$n' = \frac{Z_{\alpha/2}}{d^2} p(1-p)$$

where $Z_{\alpha/2}$ = degree of confidence taken as **95% or 1.96**

d = Degree of accuracy taken as **10 % or 0.1**

p = Variability of the characteristics to be measured in the population. A variability of **50% (p=0.5)** is to maximize the expected variance and ensure that the sample size will be large enough to allow the sample mean or proportion to be considered as having a normal distribution

APPENDIX 2 QUESSTIONNERS

University of Nairobi
Faculty of Architecture, Design and Development
Department of Urban and Regional Planning

Declaration: The information obtained will be held in confidentiality and is intended for pure academic purpose only.

HOUSEHOLD QUESTIONNAIRE (To be answered by Household Heads)
Name of interviewer.....
Date of Interview.....
Location.....

5.1 A). HOUSEHOLD DETAILS

1. Household Head: Name of Respondent (Optional)----------
a). Male b). Female
2. Marital Status a). Single b). Married c). Separated d) Widowed

3.How many persons live in your household? Total Number ----------

Household member	Age	Sex	Education level	Relationship to H/H head	Marital status

5. Place of birth.....

6. Religion (Specify).....

B). LAND.

5 a. Do you own this land you currently stay on? Yes/No

b. Do you own any other land? 1. Yes 2. No

6. Is yes, what is the nature of ownership?
1. Private 2. Leasehold/rented 3. Trust 4. Others (Specify).....

7. What is the size of the land in acre?.....

8. How did you acquire this land?
a. Bought b. Inherited c. Granted by government d. Others (Specify)

9. Do you own the title of your land? 1. Yes 2.No

12. What activities do you carry on your farm/land?

a. Tobacco farming b. Mixed Tobacco and other crops c. Crop farming d. Livestock rearing. e. Others (Specify)

13. If you answered a or b in question 12 which fuel do you use to treat the tobacco.

a). Wood b). Cow dung c). Electricity d). Solar (sun)

14. If you answered a in the above question, which tree do you mostly use?

a). Indigenous. Specify.....

b). Exotic. Specify.....

15. What is the source of wood?

a). Own farm b). Buy c). Along the river. d). Other. Specify.....

16 Do you have access to a private or group nursery? a). Yes b) No.

17. Do you own any woodlot?

a). Yes b). No

18. Which agroforestry practice/system is present on your farm?

19. Are you employed? A. Yes b. No

If yes please specify .....

21. How much cured tobacco do you produce per year?.....

22. How much fuelwood do you use to treat tobacco?.....

23. Do you think tobacco farming has had an environmental impact on vegetation cover in this Division?

a). Yes b). No

If yes How.....

25. Do you experience shortage in availability of fuelwood to cure tobacco?

26. How do you make up for the shortage?.....

27. Have you any plans to make up for the shortage in future?

28. What is your main occupation and that of the other family members?

	Occupation		Monthly income in Kshs.				
		Below 5,000	10,000-20,000	20,000-50,000	50,000-100,000	Above 100,000	

29. What are the other sources of income for the family if any?

Source	Approximate amount per month/per year including bonuses

EXPENDITURE

30. What proportion of income do you spend on household consumption?

Activity	Amount spent per month in Kshs
Food	
Clothing and Housing	
Transport	
Medical	
Education	
Others (Specify)	
Total Monthly expenditure Food	
Total monthly expenditure Non-food.	

31.. In which project have you invested surplus family income?

Type of investment	Costs	Source of capital
Farm structure		
Educations		
Machinery		
Business		

32. What are the most important projects you plan to invest in the next five years?

Investment	Estimated costs

CROP PRODUCTION.

33. What crops do you grow on your farm?

Crop type	Area covered in acres	Yield in Kgs/year 2001	Quantity sold in H/H/ day	Quantity sold by the H/H/ day	Price per Kg
Cash crops					
Food crops					

34. Where do you sell your produce? (Give names)

ii. Local market.....

ii. International market

iii. Urban centers within the district

iv. Elsewhere (Specify)

UTILITY SERVICES.

35. Do you have access to water on the land?

36. If so, which type?

a. Piped

b. Borehole

c. Well

d. Spring/river

e. Roof catchments

37. What factors do you put into consideration when allocating land for tobacco farming? (To tick)

a. Size of land

b. Amount of fuelwood present

c. Availability of labour
d. Transportation needs and means
e. Financial need or demand
f. Other specify

University of Nairobi
Faculty of Architecture, Design and Development
Department of Urban and Regional Planning

Declaration: The information obtained will be held in confidentiality and is intended for pure academic purpose only.

Name of interviewer.....
Date of Interview.....
Location.....

TOBACCO BUYING COMPANIES. QUESTIONNAIRE

1. The name of the buying company.....
2. Do you own the land where you buying tobacco?
3. If yes what is the size of the land?
4. What is the average metric tonnes you buy from the farmer of Kegonga per year
5. What is the approximate amount of tobacco you buy from each farmer per year?
6. Do you have any program for agro forestry in the community?
7. If yes in which area?.....
8. Does this company have a forestry/agroforestry department?
    a. Yes
    b. No
9. If yes what are its activities?.....
    .....
10. Does this company run a tree nursery?
    a. Yes
    b. No
11. How many seedlings do you provide per year to farmers?
    A. For free.....
    B. For sell.....
12. Do you give farmers loans?
    a. Yes
    b. No

11. If yes what is the maximum

Loan?.....

12.What problems do you face currently in regard to tobacco farming?

.....

.....

13.What suggestion can you give as a measure to address deforestation in the community?

.....

.....

.....

.....

.....

14.What is your main source of energy?

.....

a)Name any other complementary energy

sources.....

.....

.....

15. How many tones/ tractors is used to cure one house of tobacco?

16.how kilograms of wood are used to cure one tone of tobacco?

17.Do you have problems related to pollution?

a) In which area;(tick)

Air.....

Water.....

Soil.....

Other.....

b)How do you deal with the above?

.....

.....

.....

.....

.....

.....

18. What is your view on the importance of the tobacco industry in future Kenya?

.....

.....

.....