

**DEFORESTATION AND ENVIRONMENTAL DEGRADATION:
ACASE STUDY OF ABERDARE FOREST CENTRAL PROVINCE,
KENYA**

BY

**DORINA CELLAR WASWA
BEM/3790/32/DF**

**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF A BACHELOR OF -SCIENCE
DEGREE IN ENVIRONMENTAL MANAGEMENT OF
KAMPALA INTERNATIONAL UNIVERSITY**

NOVEMBER, 2007

DECLARATION

I, DORINA CELLAR WASWA (BEM/3790/32/DF) declare that to the best of my knowledge the work presented in this dissertation is original and has never been submitted for award of any academic qualification in any institution.

NAME OF STUDENT DORINA CELLAR WASWA
REG. NO BEM/3790/32/DF
SIGNATURE Dorina
DATE 22/10/2007

NAME OF SUPERVISOR Dr. Steen Thiele
SIGNATURE [Signature]
DATE 22/10/2007

DEDICATION

This project is dedicated to my dearest lovely son Darryl Joe Mugabi

ACKNOWLEDGEMENT

Completion of this project would not have been possible without guidance, cooperation, help and encouragement received from a number of people and institutions.

Firstly, I am thankful to my loving parents Colonel and Mrs Joseph Waswa for their struggle to put me through my undergraduate degree and being parents to my son when he needed me most.

Secondly, I am thankful to my supervisor Dr. Ali Twaha Ateenyi who tirelessly read my work and similarly offered constructive criticism and guidance that has made it successful for the completion of this work.

Thirdly, I would like to thank my brother Mike and my sister Nancy for being more than an uncle and an aunty to my son Darryl. They made sure I never got any destruction from Darryl in order to complete my research successfully.

Lastly, I wish to thank all the experts in the institutions that I visited for their assistance, which they offered in one way or another.

DEFINITIONS OF TERMS

Atmosphere – The outer layer of gases that surround a planet.

Biodiversity – The variation in life forms that exists on the planet.

Developing/3rd World Nations – Countries that do not have the economic resources that other, more economically powerful nations possess.

Ecosystems – Collection of life forms, the way they live and interact with each other.

Erosion – Land that becomes barren of nutrients and the soil literally "erodes" and is swept away by the elements.

Evapo transpiration – Water is removed from the environment by transpiration and evaporation, transpiration being the taking in of water by leaves on trees.

Global Warming – The temperature increase in the earth's climate that is caused by an increased number of gases such as methane, carbon dioxide, and nitrous oxide that retain heat in the earth's atmosphere.

Greenhouse Gasses – Gasses that trap heat and hold it in the Earth's atmosphere, helping to contribute to global warming.

Industrialized Countries – Powerful countries that have economic and technological resources other countries do not have.

Shifting Cultivators – People forced off their land; who resort to making homes and farms in the tropical forests.

Deforestation - The permanent loss of forests to other land uses such as agriculture, grazing, new settlements, infrastructure, and dam reservoirs.

TABLE OF CONTENTS

DECLARATION	i
DEDICATION.....	ii
ACKNOWLEDGEMENT.....	iii
DEFINITIONS OF TERMS.....	iv
TABLE OF CONTENTS	v
ABSTRACT	viii
 CHAPTER ONE	 1
INTRODUCTION	1
1.0 Background.....	1
1.1 Statement of the Problem	2
1.2 Objectives of the Study	3
1.2.1 General objective	3
1.2.2 Specific objective	3
1.3 Research Questions	3
1.4 Significance of the Study.....	3
 CHAPTER TWO	 5
LITERATURE REVIEW.....	5
2.2 Population Growth and Deforestation.....	5
2.3 Logging and Deforestation	6
2.4 Economic Restructuring	7
2.5 Cattle Grazing and Deforestation.....	7
2.6 Ranching.....	7
2.7 Consumption Rates	9
2.8 Poverty.....	9
2.9 Mining and Petroleum Exploration.....	10
2.10 Poor Government Policies	11
2.11 Other Causes	11
2.11.1 The Consequences.....	12
2.11.2 Erosion.....	12
2.11.3 Flooding	13
2.11.4 Climate Change.....	13
2.11.5 Measures being undertaken to Deforestation.....	14
 CHAPTER THREE	 15
METHODOLOGY	15
3.0 Research Design.....	15
3.1 Sample Size	15
3.2 Data Collection Methods	15
3.2.1 Questionnaire	15
3.2.2 Observation.....	16
3.2.3 Interviews	16
3.2.4 Literature Review	16
 CHAPTER FOUR.....	 17
4.0 PRESENTATION AND DISCUSSION OF RESEARCH FINDINGS	17

4.1 Background Information of Respondents.....	17
4.2 Causes of Deforestation in Aberdare Forest.....	19
4.2.1 Logging.....	20
4.2.2 Market Pressures.....	20
4.2.3 Population and Poverty.....	20
4.2.4 Land Access and Land Tenure.....	21
4.2.5 Government Policies.....	21
4.2.6 Weak Government Institutions.....	21
4.2.7 Consequences of Deforestation.....	22
4.3 Logging May Hinder Forest Regeneration.....	23
4.3.1 Water Shed Management and Erosion.....	23
4.3.2 Social consequences.....	24
4.3.3 Industrialization.....	24
4.3.4 Forest Management Options.....	25
4.4.1 Partnership.....	26
4.4.2 Reduced Impact Logging.....	26
4.4.3 “Close-To-Nature” Forestry.....	26
4.4.4 Agro-forestry.....	27
4.4.5 Community Outreach.....	27
4.4.6 Corruption Eradication.....	27
4.4.7 Legislation and Institutions.....	28
4.4.7.1 Policy Framework:.....	28
4.5 Current Management Practices.....	28
CHAPTER FIVE.....	30
CONCLUSIONS AND RECOMMENDATIONS.....	30
Conclusions.....	30
Recommendations.....	30
REFERENCES.....	32
APPENDICES.....	35
Appendix I: Questionnaire.....	35

LIST OF TABLES

Table 1: Gender of respondents.....	17
Table 2: Age of respondents.....	17
Table 3: Education Status of Respondents.....	18
Table 4: Profession of the Respondents.....	18
Table 5: Area of Residence	18
Table 6: Causes of Deforestation in Aberdare.....	19
Table 7: Consequences of Deforestation.....	23
Table 8: Forest Management Option	25

ABSTRACT

A study of deforestation and environmental degradation ^{was} will be carried out in Aberdare forest, Kenya's Central Province.

Deforestation in Africa has been a consequence of a combination of factors including agricultural expansion, commercial harvesting, increased firewood collection, inappropriate land and tree tenure regimes and industrialization. Drought, civil wars and bush fires also contribute significantly to deforestation. (F.A.O 1997, 1998).

The main variables ~~to be~~ considered included the factors leading to deforestation (cases), the consequences of this vice on the environment, what has been done to mitigate these consequences and the way forward through the suggested recommendations. A general survey research design was used in carrying out the study. Methods of data collection include questionnaire and interviews, direct observation, photography and literature review.

The deterioration of natural resources in this forest has not only destroyed the environment, but also undermined the very foundation on which economic growth and long-term prosperity depend.

Weak abstract

All for the
work done
(in your
Honor)

Abstract covers
- introduction
- methodology
- on results
- conclusion
- references

CHAPTER ONE

INTRODUCTION

1.0 Background

A forest is an ecological system dominated by trees and other woody vegetation. Forest communities are characterized by complex interactions between wood and herbaceous flora and fauna, soils and other physical factors, (Barnes et al 1980) International Union for the Conservation of Nature (IUCN) defines a forest as tree dominated landscape.

Deforestation at a major scale has been occurring in both developed and developing countries since about 1700 where it is estimated that forests covered as much as 4.5 billion hectares (11 billion acres) of the planet. If these estimates are correct, total forest cover has declined by about 1.0 billion hectares, which is equal to 2.5 billion acres or 23 % during the last 30 years, which is equal to 0.8 per cent per year.

More recent rates of deforestation are even higher. Available data shows that between 1990 and 1995, forest cover declined by 56.3 million hectares (139 million acres). This represents an average worldwide rate of decline of 11.3 million hectares (27.9 million acres) or 0.32 per cent per year, four times greater than earlier rates). However, estimates indicate that 52 per cent to 64 per cent of tropical deforestation occurs outside Brazil. In 1999, more than 31,000 fires were spotted in a single month. Assuming that 4 per cent of these fires occurred on recently cleared forests, remote-sensing experts calculated that 8 million hectares (about 20 million acres) per year were being cut. (FAO, 1996).

Furthermore between 1990 and 1995, forest cover declined by 5.33 million hectares (139 million hectares). This represents an average worldwide rate of decline of 11.3 hectares equal to 27.9 million acres or 0.032 per cent, four times greater than earlier rates.

However, by all odds, the greatest rates of deforestation are occurring in tropical forests, where approximately one per cent of existing cover is lost annually (Nicholson et al., 1990)

Deforestation in Africa has been a consequence of a combination of factors including agricultural expansion, commercial harvesting, increased firewood collection, inappropriate land and tree tenure regimes and industrialization. Drought, civil wars and bush fires also contribute significantly to deforestation. (F.A.O, 1997, 1998).

Throughout Africa and especially East Africa- Kenya, at a large scale there has been an increasing demand for wood products especially firewood and charcoal. As a result the consumption of forest products nearly doubled between 1970 and 1994. The production and consumption of firewood and charcoal rose from 250 to 502 million m³ during the same period. (The State of the Environment for Kenya, 1998)

Other factors that have led to deforestation in most developing countries with widespread poverty, is search for land to farm and settle. People with little experience and understanding of the complex forest ecosystem have tried to turn it into settlement areas. The studied results have been an ecological disaster because forests help maintain a delicate balance between all of nature's elements. (Strategic Resource Planning for Kenya, UNEP volume 111). By destroying forests through ranching, logging, farming, settlements, industrial practices amongst others this delicate balance is put in jeopardy.

1.1 Statement of the Problem

Deforestation in Aberdare started way back long in 1960s after the independence with the change of hands in land ownership. It is noticed that with the rapid growth in population and development, the demand of forest and forestland has increased, not leaving Aberdare. Economic activities of agricultural land, commercial timber harvesting, increased firewood collection, charcoal burning, pit sawing and inappropriate land and tree management are being held responsible for the alarming deforestation.

This has led to serious consequences of soil erosion, lose of plant and animal species (biodiversity), loss of soil fertility, reduction in plant cover as well as degradation of water resources and to some extent air pollution. This has not only affected the physical, but also the human environment in and around the Aberdare forest.

However, the immediate effects of deforestation have not yet been fully investigated and thus the purpose of this research is to provide an insight with the problem, establish its possible causes since the available knowledge is insufficient, with an ultimate goal of establishing long standing solutions if Sustainable Development is to be achieved.

1.2 Objectives of the Study

1.2.1 General objective

To describe the deforestation status in Aberdare forest in Central Province, Kenya.

1.2.2 Specific objective

1. To find out the factors responsible for causing deforestation in Aberdare forest.
2. To include the consequences of deforestation on the environment.
3. To identify measures being put in place to control or check deforestation

1.3 Research Questions

1. What are the factors responsible for deforestation in Aberdare forest?
2. What are the consequences of deforestation on the environment?
3. What measures have been put in place to control the problem?

1.4 Significance of the Study

The study findings are vital in providing information of the associated causes of deforestation at the Aberdare forest. This is because less had been researched on about the causes and consequences of deforestation of the forest on the surrounding environment.

The research further provides data to help the decision and policy makers like the environmentalists, politicians and academicians on the importance of the Aberdare forest to its entire environment. The information is useful in formulating new strategies and measures to curb the growing problem of deforestation. This information may not only be useful in Kenya but also in other countries facing a

similar problem. This is because environmental degradation caused by deforestation is of both regional and global concern that threatens Sustainable Economic Development through irreversible loss of biodiversity. At the same time the study also arouse the public's awareness on the importance of this forest as well as provide a foundation of information for future researchers on the same problem.

CHAPTER TWO

LITERATURE REVIEW

2.1 General

The forests of Africa cover 520 million hectares and constitute more than 17 per cent of the world's forests. They are largely concentrated in the tropical zones of Western and Central, Eastern and Southern Africa, with more than 109 million hectares of forests; Democratic Republic of Congo alone has more than 2 percent of the Western Mediterranean's forests, (according to Food and Agriculture Organization).

Over the last 20 years, about 300 million hectares (six times the size of France) of mainly tropical forests have been converted to other land uses on a world basis, such as farms and pasture for large scale plantations of oil palm, rubber and other cash crops. Increasingly fragmented forests have become much more susceptible to fire than was ever thought possible- 10 million hectares of normally fire resistant forests have been destroyed by catastrophic infernos in the Amazon, Central America, Indonesia, West Africa and Madagascar.

2.2 Population Growth and Deforestation

The World Wide Forest Report found that when the Roman Empire was in control of Europe 90% of the continent was forested. Today 500,000 hectares vanish in a single week yet there is no one easy answer as there are many causes at the root of deforestation. One is overpopulation in cities and developing countries. Population is continually growing in the third world. Some had land until increases in population forced them off it and they became landless peasants that are forced to look for land in the untouched forests. According to Norman Meyers (1989), bad land tenure, a shortage of modern agricultural tools, and government neglect of subsistence farmers has put an influx of human interference in the forests. The poor are pushed in further and further and destroyed more forestland every time they must move on.

What the poor do in the forests is the most devastating. In attempts to settle farmland, the poor become "shifted cultivators" and resort to using slash and burn methods of tree removal. Slashing and burning involves what its name implies, trees are cut down and the remains are burned. (Anon., 1996). The ash is used as a fertilizer and the land

is then used for farming or for cattle grazing, however, the soil that is cleared in slash and burn is left infertile and surrounding organisms quickly absorb the nutrients in the soil.

This is one of the most important predisposing conditions that underlined deforestation is our growing population. Our numbers are currently growing at the rate of 1,000 million new individuals every decade. In the last half of the 20th century, we will have more than doubled our numbers from 2,500 million to 6,000 million people (WRI, 1994). Most of the population increase is occurring in developing countries, those nations least equipped to absorb them. 3.4 billion More people requiring food, energy, shelter, water, wood, paper, and all the other goods and services that come from the forests.

Approximately 4.5 billion people or 75 per cent of the world's population, live in the developing countries and a 1,000 million of them live in abject poverty. Most of those countries are in the tropics where deforestation is a serious problem. Furthermore, an estimated 2.8 billion live in rural areas and are dependent on agriculture to meet their basic needs.

2.3 Logging and Deforestation

The small farmer plays a big role, but it is modern industry that too cuts down the trees. The logging industry is fueled by the need for disposable products. (Lind and Morrison, 1974) eleven million acres a year are cut for commercial and property industries. Heller 1990 found that McDonald's needs 800 square miles of trees to make the amount of paper they need for a year's supply of packaging, Entity Mission found that British Columbia manufactures 7, 500,000 pairs of chopsticks a day, and the demand for fuel wood is so high that predictions say that there will be a shortage by the year 2000 (UNESCO, 1979). Logging does too have its repercussions. The logging industry not only tries to accomplish all this but it even indirectly helps the "shifted cultivators" and others to do more damage. The roads that the loggers build to access the forests and generate hydroelectric power create an easy way for many people to try to manipulate the forest resources. The amount of damage that this adds to the forests cannot be measured nor can that of the illegal logging concluded Turner 1978.

2.4 Economic Restructuring

In recent years, economic globalization has brought about profound changes in countries around the world. (According to Perre Hiernaux, unpublished Manuscript) generally there has been a trend of decentralizing government and reducing the role that government plays in the everyday life of its citizens. In developing countries this shift has put a greater strain on forest resources, which have customarily been treated as state property (UNEP, 2000). Whether determined by a market economy or dictated by a command economy, management of forestland has been the responsibility of public forest services. Forest exploitation firms have dealt through these bureaucracies who generally ensure some sort of control over the allocation of forestlands (Hiernaux, .1998).

Today the governments of many developing countries have decentralized their control over the forestry sector and privatized many of the state-owned forest industries (UNEP, 2000). Additionally the privatization of land under decentralization causes conflicts between the purchasers of land and the traditional, flexible land use by indigenous groups and local peoples. Tensions invariably arise, sometimes leading to violence and armed conflicts (Turner,. 1996).

2.5 Cattle Grazing and Deforestation

Another of the more devastating forces behind deforestation is cattle grazing. With the international growth of fast food chains this seems to be an evident factor in the clearing of trees today (Hiernaux, 1998). Large corporations looking to buy beef for hamburger and even pet food seek cheap prices and are finding them with the growth of cattle grazing. In the Amazon region of South America alone there are 100,000 beef ranchers (Anon., 1996). As the burger giants of industrialized society are making high demands for more beef, more forests are being torn down. Statistics from less than two decades ago, 1989, indicate that 15,000 km squared of forests are used expressly for the purpose of cattle grazing (Meyers, 1998). Once the trees are gone the land is often overgrazed.

2.6 Ranching

One of the more well-known regions where the expansion of cattle ranching has caused serious deforestation is Central America. Ranching has been part of the culture

of rural Central America since colonial times (Hinckley, 1937). Dominated by large landowners, it was concentrated on the fertile valley soils of the central highlands of the Isthmus and along the dry Pacific coast (Knapp et al 1991). With the opening of American markets for cheap beef and improved local infrastructure in the second half of this century, ranchers expanded their operations by moving into the humid forests of the Atlantic watershed. According to Perre Hiernaux, Peder N. and Laussine Diarra Unpublished manuscript cattle pasture was originally established in the flat valley bottoms on soils best suited for permanent agriculture, but eventually spread to the forests in the surrounding mountains. Many ranchers took possession of large tracts of forested land and contracted labourers to clear it with chainsaws and fire (Hiernaux, 1998), more common method of acquiring new pastureland was to purchase the "improvements" to the untitled land held by slash-and-burn farmers. These so-called "improvements" were little more than a few opening in the forest made by the farmers to plant their crops (Brown, 1998). After obtaining the squatter's rights, the rancher would then finish the land clearing, sow the grass, and fence in the property. Once the land was transferred to the rancher, the farmer would vacate the property and move deeper into the forest to repeat the same cycle of deforestation (Henklocker, 1999)

Although reliable land use data is not available, it is estimated that the area of land under permanent pasture in Central America increased from 3.9 million hectares in 1955 to 13.4 million hectares in 1995 (Sunderlin and Rodriguez, 1996; FAO, 1998). The more than tripling of the pasture area was at the expense of the region's tropical forests. Ranching was a very attractive alternative to other land uses in that it was reasonably profitable in the short term, carried only moderate levels of risk and uncertainty, required little labour, and had well established markets with less volatile price fluctuations than other cash crops. Beef production rose until 1979 when it leveled off because of a softening in the demand and the imposition of American importation restrictions (Bremen and De wit, 1983).

Open-range grazing as is also practiced in the dry woodlands and savannas of Africa has been a major contributor to deforestation when herd populations exceed the carrying capacity of the range. It has also seriously degraded the composition and quality of the forest because it is practiced too intensively (Coughnour et al 1990).

2.7 Consumption Rates

Clearly, without any demand there would be no economic reason for cutting down the trees. As human population continues to grow, so does the demand for forest-derived goods (UNFPA, 1991).

The importance of our consumption patterns to the exploitation of forestlands cannot be denied. Developing countries produce about 25 per cent of the world's industrial wood products -- sawn wood, panels, wood pulp, paper -- and almost 90 per cent of its fuel wood. In the case of industrial forest products, it is difficult to generalize the importance of international market demand. Sawn wood and plywood are good indicators of natural forest disturbance (and susceptibility to subsequent deforestation) and exports clearly show the relative importance of the international markets (Molles, 2002)

Since 1980, paper and paperboard production has increased six-fold in the developing countries. The majority of production comes from plantations of fast-growing species that were established on non-forest lands, forest fallow lands, or logged over forests. In some cases the natural forest was cleared to establish the plantations. To a very limited degree, natural forests have been harvested to supply mixed tropical hardwoods as the raw material for pulp and paper production.

Most new pulp and paper production in developing countries has gone to meet the demands of growing local populations, populations that are, in many cases, increasingly more affluent.

2.8 Poverty

Poverty is the socio-economic environment that limits peoples' economic options, damages health, limits the formation of rural capital, and reduces income-generating opportunities, and limits institutional and infrastructure development. It is an underlying condition that facilitates deforestation (Bryant et al, 1997). There is some evidence from the industrialized countries of the North that suggests as societies become more economically secure they reach a point where the economic development pressures that drive deforestation are replaced by a growing environmental concern and a greater appreciation of environmental values. However, for most developing countries the point is off in the far distant future. (UNEP, 1998)

The urban poor have very few options. There are few prospects of off-farm employment in either the urban centers or the rural areas. For those opportunities that do exist, there is intense competition for the few jobs available. Illiteracy further limits the options of many because they do not have the basic tools needed to pursue other economic alternatives to subsistence farming (UNEP, 2000). In such a case, people have migrated from the overpopulated, depressed regions to the forest frontier in search of a more prosperous, more secure life. Hand-in-hand with poverty comes food insecurity and chronic undernourishment. With few alternatives available to them, these urban poor have turned to the forest forests as a short-term solution to their economic problems.

The relationships between urban poverty and deforestation and population growth and deforestation have been inconclusive because the dynamics of urban land use are very complex and deforestation is rarely the consequence of one single cause, but is rather a product of the interaction of many forces. (UNESCO, 2002). The effect of population pressures as a predisposing condition for deforestation is dependent on the influences of the carrying capacity of the land, the prevailing land use practices, and the importance of forest-derived products and services to the local people, and the strength or weakness of the institutional framework in place. In most cases, a rising population pressure and a prevailing climate of urban poverty are important conditions that facilitate deforestation (FAO, 2000). At the same time slash-and-burn farmers are some of the poorest, least-privileged people in the world. They live in the more remote areas of their countries, areas that receive little or no attention from the political and economic decision-makers. They do not have access to more modern technologies that could increase their productivity and economic security (State of the Environment Report, 2000).

2.9 Mining and Petroleum Exploration

Mining and oil exploration are locally important to deforestation. Large mines like those of Carajás in Brazil and the Copper belt of Zambia consumed vast quantities of indigenous woodlands to supply fuel to their smelting operations before plantations of fast-growing species were established (Ciesla, 1995). The impact of gold mining has been widely publicized, particularly placer mining in the Amazon, but its negative impacts have affected the indigenous peoples and the quality of the water more than

the adjacent forests. Oil exploration activities, such as the clearing of the seismic lines in the forests of eastern Ecuador, not only destroy the forests but also open them up to colonization by subsistence farmers who follow the exploration crews (FAO, 1998; 2001).

2.10 Poor Government Policies

Although universally recognized as a problem, the lack of coordination of the policies of the various government agencies continues to frustrate sustainable development efforts. Narrow sectoral analysis and planning processes have led agencies to adopt conflicting objectives; having produced them without due consultation and consideration of their impacts on neighboring sectors (UNESCO, 2002) Government leadership in land use planning has been universally very weak, due in part to a planning process that has been non-participatory in nature. If interest groups do not buy into the land use plan for their own perceived benefits, the plan becomes non-functional. Many government agencies, not only the forestry departments, have prepared ambitious plans that are far beyond their capacity to implement (Roberts et. al., 1997) The resulting failures contribute to the growing distrust and lack of respect for government and to the current disillusionment with government and its role in society.

Internationally, forestry has suffered from the lack of strong leadership. This has manifested itself countless times in international foray where forestry and forest-related concerns have received lower priority than other sectors by decision-makers when allocating resources (UNEP, 2000)

2.11 Other Causes

Beyond the major causes of deforestation lay some supplementary ones that too stack the odds against forests around the globe. Acid rain and the building of dams have their share of harmful effects. The race to produce cash crops such as fruit, spices, sugar tobacco, soap, rubber, paper, and cloth has given cause to many to try to farm them by using soil and other products that can be retrieved by destroying the forests. Even those in industrialized countries may participate in the destruction of forests in the 3rd world. The need for products in industrialized countries drives production in other poorer, less developed countries. This production is at the cost of the trees and the services that they provide (Turner, 1978).

2.11.1 The Consequences

Deforestation presents multiple societal and environmental problems. The immediate and long-term consequences of global deforestation are almost certain to jeopardize life on Earth, as we know it. Some of these consequences include: loss of biodiversity; the destruction of forest-based societies; and climatic disruption. Deforestation is causing a loss of biological diversity on an unprecedented scale. Although tropical forests cover only six percent of Earth's land surface, they happen to contain between 70 percent and 90 percent of all of the world's species. As a result of deforestation, we are losing between 50 and 100 animal and plant species each day. Inevitably, the loss of species entails a loss of genetic resources. Many of these species now facing the possibility of extinction are of enormous potential to humans in many areas; especially medicine. As of 1991, over 25 percent of the world's pharmaceutical products were derived from tropical plants (Meyers, 1998). By contributing to the extinction of multiple species of plants and animals, we might be destroying the cures for many of the diseases that plague the human race today.

2.11.2 Erosion

The lushness of the world's tropical forests is somewhat deceptive. Although these forests assume to be lush and full, the underlying soils are very poor, almost all the nutrients being bound up in the vegetation. The problem is that once forests have been cut down, essential nutrients are washed out of the soil all-together. This leads to soil erosion. As of now, about 80 percent of the soils in the humid tropics are acidic and infertile (Duble, 2000). When there are no trees to keep the soil in place, the soil becomes ripe for erosion. It dries and cracks under the sun's heat. Once the soil temperature exceeds 25 degrees centigrade, volatile nutrient ingredients like nitrogen can be lost, further reducing the fertility of the remaining soil (Meyers, 1998). Furthermore, rainfall washes remaining nutrients into rivers. The social impact of soil erosion can be quite severe. Those who settle into the forest regions are forced to move every year or so due to soil erosion. They find areas where they can cultivate. When those areas are no longer good for growing, they move to another region.

2.11. 3 Flooding

Flooding is a quite serious consequence of deforestation. Clearing the forest dramatically increases the surface run-off from rainfall, mainly because a greater proportion of the rain reaches the ground due to a lack of vegetation that would suck up the excess rainfall. "Tropical forests can receive as much rain in an hour as London would expect in a wet month, and a single storm has been measured as removing 185 tonnes of topsoil per hectare" (Dublely ,2000). In tropical regions where the forests are dense, flooding is not as serious a problem because there is vegetation to absorb the rainfall. It is in areas where there is little vegetation that there is a problem. Hence, to avoid the disastrous effects of flooding, tropical forests need to remain dense and lush (Udo, 1983)

2.11.4 Climate Change

Although all consequences of deforestation are potentially serious, perhaps the most serious consequence is that of climate change due to the loss of trees. Earth has an atmosphere, which contains a variety of gases, all in a delicate balance, to ensure life on Earth (Brown, 1998). One of these gases in Earth's atmosphere is carbon dioxide; a gas which helps moderate heat loss to outer space. Insulating gases such as carbon dioxide are called "greenhouse gasses because their function is much like that of the glass in a greenhouse: they allow solar heat into the system, but discourage its escape" (WRI, 1985). Other greenhouse gases include methane, chlorofluorocarbons, nitrous oxide, and ozone. If there are additional greenhouse gases, there will be a gradual increase in temperature on Earth's surface. This could lead to changes in weather patterns, sea levels, and other cycles in nature that directly affect life on earth as we are experiencing now (Karanja, 2001).

Carbon dioxide levels increase for a number of reasons; but one of the main factors contributing to the increase of carbon levels is decay of woody material. The only way to help moderate the levels of carbon dioxide in the atmosphere is through plant life. Alive plants and trees absorb the carbon dioxide from decaying plants and trees. With a decrease in trees and plant life (due to deforestation) it is much harder to moderate these levels. Ultimately, the amount of carbon will increase due to a lack of plant life present to keep the carbon dioxide levels in check (UNEP, 2002).

2.11.5 Measures being undertaken to Deforestation

In Brazil efforts have been made to stop all new permits for clearing land in the Amazon River basin. This comes after reports that the rate at which the world's biggest rain forest is being destroyed jumped nearly 30 percent last year (Ellis and Swift, 1988). Ministry of Environment in Brazil has been reviewing all existing permits to cut down trees in the region, pursue irregularities in court and compile a list of cleared areas covering more than about 5,000 acres, where it would "intervene immediately" to fight the "champions of deforestation"(Walker, 1993).

In Kenya, since 1986, researchers at the Kenya Forest Research Institute (KEFRI) have been developing a Social Forestry Programme to reverse deforestation by easing pressure on registered forests. Social forestry involves small-scale planting and management of trees by individuals or communities on their land, enabling them to meet their basic social and economic needs without destroying forests (Gaathara, 1998).

It involves the integration of a variety of techniques and approaches for different sub-Saharan climatic conditions to increase productivity and incomes. At the same time, more trees are grown on the farms to provide secure supplies of fuels, fruits, fodder, and building and fencing materials (Njuguna, 1999). The project, which provides tree seedlings to farmers, is also supposed to educate the community on the material benefits of growing trees on the farm and effective use of their products.

Farmers are introduced to multipurpose tree species like mango trees which, in addition to providing fruits, have stems that can be used as fuel wood. The Environment Liaison Centre International has initiated a network of local NGOs to sensitize communities on analogous forestry. They intend to establish demonstration plots, tree nurseries and demonstration arboreta (Ministry of Environment Kenya, 1994).

CHAPTER THREE

METHODOLOGY

3.0 Research Design

The study was descriptive, which used qualitative research methods. The qualitative methods were used because of their suitability to reveal the real experiences necessary in providing a more profound understanding and analysis of all related aspects. Since qualitative methods are information driven, they provided a more holistic picture and analysis of this escalating problem that requires immediate attention that if not addressed, we lose a valuable resource. The qualitative methods used included in-depth interviews and questionnaires. The study therefore used the non-experimental survey research design.

3.1 Sample Size

Because of the nature of the study and time frame, a total of 60 people were selected from the area. The units of study in the survey were households considering that in the study area they are wide apart, therefore simple random sampling as a technique was used.

3.2 Data Collection Methods

3.2.1 Questionnaire

The questionnaire was divided into three parts and used mainly to collect primary data. The first part consisted of a total of 10 questions that were administered to a total of 60 people. This part searched to establish the background and the history of the respondent. This included information about his/her age, education level, sex, occupation and the place of living. The second part assessed the awareness and the level of knowledge of the respondent on the issue of deforestation in Aberdare forest and its consequences. The third part involved questions under the activities that led to deforestation and how it affected the environment, further more it involved the questions on what is being done to overcome the problem. The questionnaire was used in a way that the researcher held face-to-face interview with the respondent and

asked the questions while filling in the respondent's answers. This method was selected partly because some respondents were unable to write or read or both.

3.2.2 Observation

Observation involved systematically selecting, watching, and recording behaviors so as to come up with first hand data in order to prove whether the information given by the respondents was right. Observation also helped the researcher to relate the literature review with what was happening in the field. Further more direct observation helped the researcher to acquire sufficient information, which would have rather not been availed from other methods like the questionnaire due to insufficient knowledge about the matter, due to their technicalities.

3.2.3 Interviews

Interviews involved oral questioning of respondents, either individually or as a group. This method was most suitable when dealing with illiterates and it also permitted in depth data exploration. This gave the researcher an opportunity to ask more questions as they arose from the respondent's explanation.

3.2.4 Literature Review

This method involved the use of other related literature to provide more information. Secondary data was obtained from documentary sources that included mapping, photography and recording. This was acquired from the University of Nairobi library, Ministry of Natural Resources, Ministry of Environment the Department of Forestry and publications from the daily press.

3.2.5 Data Analysis

Data analysis was done using the SPSS computer package.

CHAPTER FOUR

4.0 PRESENTATION AND DISCUSSION OF RESEARCH FINDINGS

4.1 Background Information of Respondents

Background characteristics of respondents were sought so as to get a clear understanding of people participating in the study.

Gender

Table 1: Gender of respondents

<i>Gender</i>	<i>Frequency (f)</i>	<i>Percentage</i>
Male	24	40
Female	36	60

Sixty (60) percent of respondents were females while forty (40) percent were males.

Age

Table 2: Age of respondents

<i>Age</i>	<i>Frequency (f)</i>	<i>Percentage</i>
18 -24	10	17
25 – 31	18	35
32 – 38	12	25
39 – 45	8	13
46 – 52	1	02
53 and Above	1	08

Thirty five (35) percent of the respondents were between the age of 25-31, twenty five (25) percent were between 32-38, seventeen (17) percent were between 18-24, eight (8) percent were between 40-52 and 52 and above respondents.

Education

Table 3: Education Status of Respondents

<i>Education</i>	<i>Frequency (f)</i>	<i>Percentage</i>
No Education	6	12
Adult Education	6	12
Primary	14	30
Secondary	14	30
College/Institution	6	12
University	3	04

Twelve (12) percent did not have any education, twelve (12) percent had adult education, thirty (30) percent had gone to primary while thirty (30) percent had gone to secondary, twelve (12) percent had college certificates and only four (04) percent had been to the university.

Employment status

Table 4: Profession of the Respondents

<i>Employment</i>	<i>Frequency (f)</i>	<i>Percentage</i>
Employed	34	57
Unemployed	10	17
Student	8	13
Others	6	13

Fifty seven (57) percent of the respondents were employed, seventeen (17) percent were unemployed, and thirteen (13) percent were students while thirteen (13) percent belonged to others.

Distance of Residence from the Forests

Table 5: Area of Residence

<i>Distance of Area of Residence</i>	<i>Frequency (f)</i>	<i>Percentage</i>
Far	18	30
Not far	42	70

The majority (70 percent) of respondents stayed near the forest while only 30 percent stayed far away from the forest in table 6.

4.2 Causes of Deforestation in Aberdare Forest

Deforestation of the forest was the product of the interaction of the many environmental, social, economic, cultural, and political forces at work In this case of Aberdare forest, deforestation was a process that involved competition amongst different land users for scarce resources, a process exacerbated by counter-productive policies and weak institutions.

Table 6: Causes of Deforestation in Aberdare

<i>Cause</i>	<i>Frequency (f)</i>	<i>Percentage</i>
Logging	60	100
Market Pressure	12	20
Population	40	67
Poverty	46	77
Land access and land tenure	12	20
Greed and land grabbing	44	73
Political interests	16	27
Weak government institutions	60	100
Government policy	20	33
Undervaluation of forest resources	8	13
Social factors	18	30
Slash and burn farming	2	3
Infrastructure	60	100
Fire wood and charcoal burning	52	87

Table 7 shows that all the respondents (100) attribute deforestation to logging, weak government institutions and infrastructure development, 87 percent said it was because of charcoal and fire wood collection, 77 percent said it was poverty, 73 percent said it was population, 67 percent said it was population pressure, 33 percent attributed it government policies, 27 percent said it was due to political interests, 73 percent said it was greed factors and land grabbing percent said it was due to market pressure and 30 percent attributed it to social factors.

4.2.1 Logging

Like most forest sector statistics, the estimates of Aberdare's deforested area is not precise due to the poor record keeping and lack of field supervision of logging operations. Logging in this area was often characterized by a "cut-and-get-out" mentality in logging companies. In this case, most of the logging involved the short-term exploitation of only industrial wood products. Because the intensity of logging was high there has been high felling damage and residual waste, no long-term regulation of the harvest, and poor natural regeneration of commercially useful species. The removal of high volumes per hectare has led to serious degradation of the forest, even causing their destruction in extreme cases where clear-cutting has been observed.

Massive illegal logging occurred when timber was cut, sold, bought or transported in violation of regional, national or international laws. The place or method of harvesting may be illegal, as well as the manner in which the timber enters the marketplace. The majority of illegal timber extracted from this forest was by the locals who took advantage of the situation. These people who were mainly squatters went into the forest to cut down trees for charcoal and also for their domestic use of the firewood.

4.2.2 Market Pressures

In Aberdare forest, it was found out that another major cause of deforestation in the area was the demand for forest products and the demand for other goods (mostly food) that is produced on deforested lands. The demand for forest products continues to rise as population and affluence grow.

4.2.3 Population and Poverty

According to interviews conducted in the study area, the exact number of people who live by clearing the forest to plant subsistence crops was not known, but the accepted figure 530,000 households living within a radius of five kilometers from the forest estates. The predisposing condition of deforestation in the forest is poverty. Although poverty is not a "cause" of deforestation, it is a condition of life that the majority of people in this world must endure.

4.2.4 Land Access and Land Tenure

Some respondents felt it has been politically less painful to look the other way and ignore deforestation than to deal with the difficult issues of land reform. They further observed that under these circumstances, clearing the forest and planting annual crops for a few seasons before moving on to clear more land has been a logical farming strategy. The Government has either been unwilling to title state lands to small farmers or their land titling procedures are so complicated and so costly that small farmers find it impossible to obtain legal title. They say that lack of ownership has excluded them from obtaining credit for much needed farm inputs and has discouraged any long term investment that could have led to increased productivity, prosperity, and enhanced well-being. The short-term alternative has been to clear-and-burn the forest.

4.2.5 Government Policies

The research also revealed that policies and institutional weakness of the governments have significantly contributed to deforestation. Some respondents felt that some of the policies were devised without a complete understanding of all of the issues involved and all of the potential impacts. This is often the case when decisions were made that resulted in deforestation because political decision-makers do not appreciate the real value of forests' goods and services compared to other land uses. "In many cases deliberate decisions were made to favour a small group of politically and economically powerful individuals at the expense of society at large." expressed one respondent

The respondent complained that the majority of the population feels that tree ownership rests with the state. "There is no incentive for the rural population to invest their labour in forest management because the benefits derived are only enjoyed by the government officials." he added.

4.2.6 Weak Government Institutions

In Kenya, the forestry departments have had a low status within governments relative to competing land uses, reflecting the economic power base in the countries. The

respondents felt that as a consequence, the departments have been ineffective in successfully putting forth pro-forestry arguments to the political decision-makers and to the public at large. Even when there are adequate policies and legislation in place, the weakness of the departments in enforcing the law, resisting political pressures, and maintaining a field presence has bred contempt and indifference for the law. Man also felt that corruption in the Kenyan government has had a disastrous impact on forest conservation. Most respondents said that corruption has also undermined the respect for forestry departments at large as administrators of the law. This has had a direct impact on people's attitudes towards the forestry departments' efforts to stop deforestation.

4.2.7 Consequences of Deforestation

The intrusion of men and logging machinery with the resulting changes in the forest ecosystem has displaced many forms of animal life, particularly birds and the small mammals. Previously inaccessible tracts of this forest was opened up by logging companies when they build new haul roads and removed a portion of the forest biomass, making it easy for the other land users to clear the remaining trees. In short, logging provided the local settlers access to the forests. This led to the wide deforestation through illegal logging.

Consequences of Deforestation

Table 7: Consequences of Deforestation

<i>Consequences of deforestation</i>	<i>Frequency(F)</i>	<i>Percentage (%)</i>
Reduction in recreation area	50	83
Water shed management	40	67
Forest fires	10	17
Local climate regulation	10	17
Impact on industrialization	30	50
Loss of biodiversity	60	100
Erosion	40	67

Table 7 shows that all respondents 100 per cent cited loss of biodiversity as a consequence, 83 percent said there was reduction in recreation area, 50 percent feared for impact on industrialization, 67 cited impacts on water shed management and erosion and 17 percent feared impact on forest fires and local climate regulation.

4.3 Logging May Hinder Forest Regeneration

One of the consequences of logging in Aberdare forest is that the use of heavy equipment, log skidding, soil compaction and burial of seedlings by excess woody debris took a heavy toll on any naturally regenerated seedlings.

Environmental impact assessments of logging operations in this area clearly demonstrated that destructive logging practices using heavy machinery had seriously reduced the forest's ability to carry out vital environmental and ecological functions. These activities had seriously resulted in the loss of indigenous species of trees like the Muhugu, *Newtonia Buchananii* (Mukoi) and the *Trichilia-roke* (Mutuati) trees, among others.

4.3.1 Water Shed Management and Erosion

Aberdare forest provides a buffer to filter water and to hold soil in place. It has sustained water and soil resources through recycling nutrients. In watersheds of the forests where they are degraded or destroyed, minimum flows have been witnessed

during the dry season, while peak floods and soil erosion increase during the wet season.

Many respondents felt that this can be blamed on the logging industry for accelerating erosion, weathering and humus decomposition, and leading to widespread formation of soils with low nutrient and absorptive capacities.

4.3.2 Social consequences

The social consequences of deforestation in Aberdare forest have had devastating long-term impacts. To the local communities the destruction of Aberdare forest meant the destruction of their life-style and the breakdown of their social institutions. Individuals of Aberdare forest and collective rights to the forest resource have been frequently ignored and local peoples and local communities have typically been excluded from the decisions that directly impact upon their live.

4.3.3 Industrialization

Inadequate of timber supply and other wood products are affecting industrialization in Nairobi. However, the forest has become an unsustainable source of fuel wood to the neighboring urban poor as well as a source of poles for the construction industry in the city. It is an urban forest which because of its location has been subjected to immense pressure from a variety of resource including threats to convert it to real estate though other estate have been constructed leading to deforestation and hence reduction of wood in this industries.

4.3.4 Forest Management Options

Table 8: Forest Management Option

<i>Forest management option</i>	<i>Frequency (F)</i>	<i>Percentage</i>
Forest programmes	10	17
Partnership development suitable forest management	15	25
Reduced logging	60	100
Close to nature forest	12	20
Agro forestry	40	67
Community outreach	60	100
Corruption reduction	60	100
Policy framework	40	67
Legislatures	60	100
Current management practices	30	50

Table 8 shows that all respondents 100 percent suggest community outreach, corruption reduction, reduced logging, as forest management options. 67 percent suggest policy framework and agro forestry. 50 percent suggest current management options, 25 percent said partnership development, and 20 percent said close to nature, 17 percent said should be put in place forest programmes.

4.4 Forest Programmes

The distinctive features of the forest environment which are its ecological complexity and the duration of the vegetative and growth cycles of trees, mean that forest programme are markedly specific. The government has organized a management plan and it consisted of the following features of analyses and surveys. The analysis helped to understand the potential of the forest and restrictions to be taken into account, both within the forest (natural environment, ecological factors, forest stands, access and drainage works and equipment, protection against erosion and fire and so on. The surveys and syntheses concerning the compatibility of various functions and their possible classification, areas for specific purposes (physical protection, access, bio-reserves,) the choice of silvicultural treatment methods, principal and secondary

species, ages and size for logging, the planning of necessary operations (felling, forestry operations, public works).

4.4.1 Partnership

One of the lessons of trying to contain deforestation in Aberdare forest is that the people who are meant to benefit from the forests must be made full partners in the process of identifying and implementing solutions. The country has been holding consultations with professional forestry partners and local authorities as the most recent development initiative partnership with nature protection associations. This now forms part of many task forces, dealing in particular with the protection of the forest resources.

This participation process involves people identifying their own problems and agreeing on a course of action to solve them. Governments assist with the material and human resources that people do not have at their disposal.

4.4.2 Reduced Impact Logging

Reduced impact logging systems are currently being developed through organizations in response to concerns over the ecological and economic sustainability of harvesting natural tropical forests at stand. Reduced impact logging systems are now using an array of best harvesting techniques that reduce damage to residual forest, create fewer roads and skid trails, reduce soil disturbance and erosion, protect water quality, mitigate fire risks help maintain regeneration and protect biological diversity. This ecological damage is maintained by taking an inventory of trees before harvesting is cutting only mature trees.

4.4.3 “Close-To-Nature” Forestry

This management method as adapted by many countries of the temperate and boreal zones and is being initiated in Kenya (Attiwill 1994). This management method emulated natural disturbance regimes, use local and site adapted species for planting, increase the diversity of species, age and structure in the forest stands, maintain important micro- structures such as dead and decaying wood, protect important key habitat and limit the use of pesticides, fertilizers, drainage and damaging machinery.

This method largely relies on the use of natural processes and self steering mechanisms. This includes management techniques such as the retention of particular trees and habitats in order to mimic natural forests following natural disturbances.

4.4.4 Agro-forestry

Agro forestry has been considered to be a productive system which conserves biodiversity, mainly when it is based upon traditional knowledge as it causes minimal land degradation and preserve biodiversity as well as native crop diversity.

4.4.5 Community Outreach

This government with many organizations and individuals has been conducting community education that encourages participation in forest management by the people surrounding the forest. This has included conducting seminars and public education through the local councils, encouraging local participation in management activities such as boundary planting and involving local councils in the regulating the movement of timber.

There has also been developing projects which foster sustainable productive systems in area reserves and providing good and services that would otherwise be extracted from the forest. The local community is also being encouraged to get involved in ecotourism enterprises and other income generating projects that are related to forest protection and nature reserve establishment. The government is also helping principle forest conservation education centers in selected principle forest reserves and developing them to providing goods and services that would otherwise be extracted from the forest.

4.4.6 Corruption Eradication

Corruption is a subject that was until recently considered a taboo until it come to the forefront of the international and local dialogue on forests. It has been openly discussed by governments, Non Government Organization, the Private sector and International Organizations through a range of initiatives. All this interest has been stimulated by an increasing awareness worldwide of the immense costs associated with corruption.

In Kenya, various independent environmental Non Governmental Organizations, acting as “watchdogs” in collaboration with the media, have been instrumental in uncovering illegal operations and have frequently succeeded in forcing corrective action. The media has been used intensively to monitor and evaluate illegal activities and to provide an easy communication channel for “whistleblowers”. Enhanced public awareness of the nature of forest resources and the way in which they are used has helped in creating pressure for better governance. With this increasing awareness that corruption in the private sector is costly, a wide range of initiatives to reduce its impact are being undertaken by governments, Non Governmental Organizations the private sector and the international assistance agencies.

4.4.7 Legislation and Institutions

Management of natural resources in Kenya is characterized by virtual absence of clear management systems in forest. This is now being taken care of by the establishment of silvicultural systems by the department. This is with the help of skilled personnel and other resource managers. This has resuscitated and encouraged research on natural forest systems over the recent years.

4.4.7.1 Policy Framework:

The management of forest resources is governed by the national forest policy. This is implemented mainly through the forest department in the Ministry of Environment and Natural Resources, which manages most forest land. It is complimented by the Kenya Wildlife Service forest in parks and Non Governmental organizations like the Green Belt Movement.

4.5 Current Management Practices

With the increase in logging and its eventual ban in 1982, most management practices have focused mainly on plantations with natural forest activities confined to maintenance of infra, protection and control of extraction of minor forest products and wildlife management. This ban on logging in 1982 was enabled the government to gain control of the situation. This in principle has enabled the government to sustain and carefully supervise logging of Camphor, Meru Oak, Maesopsis eminii and other

species important for the furniture and veneer industries. It has proved difficult, however, to control even such limited use in Kenya.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Environmental problems have been fueled by the vicious cycle of logging, illegal encroachment and persistent poverty amongst others.

Catastrophic impact is seen in accelerating soil erosion which results in permanent loss in agricultural productivity and in the destruction of biodiversity-rich indigenous forests.

The deterioration of natural resources in this forest has not only destroyed the environment, but also undermined the very foundation on which economic growth and long-term prosperity depend.

It was noted that the people are partially aware of how to protect the forest environment, thus the majority of the respondents argued that there is need of providing extensive environmental education.

People's awareness towards the dangers resulting from the degradation was advanced thus the mitigation measures only need to be emphasized. The challenge is that the area of forest cover and the integrity of forest ecosystems are being lost as the result of excessive human demands and shortsighted use of the landscape.

Recommendations

Forests that are perceived to have low value will be most likely be cleared and replaced by other more attractive land uses. It is therefore important that people's perceptions be based on as complete an understanding as possible of the true value of all the goods and services that forests provide.

In recent years, much has been said and much written about the potential of both ecotourism and pharmaceutical research as saviors of the tropical forests. These have

been important alternatives to slash-and-burn farming at a very local level. The magnitude of the challenge and the need for meaningful benefit sharing with the hundreds of millions of person's involved dwarfs their limited potential to generate grassroots benefits.

Areas which will need to be addressed include: resource assessment, research and monitoring, human resources development, institutional development and piloting. The main aim of the entire programme is improving forest management. There is the need to articulate a clear policy with regard to genuine traditional forest dwellers possibly providing for their settlement nears the natural forest where their continued occupation of forest is not consistent with conservation through to changing lifestyles.

Piloting should be employed as a useful mechanism to inform managers as well as the policymaking process without making costly mistakes. Since a proportion of environmental benefits from natural forest accrue to the international community, sustained contributions for that quarter are expected towards natural forest management and conservation especially in setting up mechanisms for sustainable funding.

Questions of continuity of financing for natural forest management should be the primary concern for agencies and other groups involved in the sector and appropriate financing mechanisms (e.g. forest funds, revenue-sharing, trust funds) identified for management of individual's forests or general programmes.

REFERENCES

- Anon., (1996); World Resources: A Guide to the Global Environment 1996-97, Oxford University Press, p.365
- Anthony G. (1994), High Canopy Forest Management In Kenya September Blackwell science Pty Ltd
- Brown, D. and Kathrin S. (1998); Shifting Cultivators as Agents of Deforestation: Assessing the Evidence, Natural Resource Perspective Number 29, April 1998, Overseas Development Institute, London
- Bryant, D., Daniel N. & Laura T. (1997); The Last Frontier Forests - Ecosystems and Economies on the Edge, World Resources Institute, Washington, p.42
- Byron, N. and Gill S. (1998); Indonesia and the 1997-98 El Niño: fire problems and long term solutions, Natural Resource Perspective Number 28, April 1998, Overseas Development Institute, London
- Calow P. (1998). The Encyclopedia of Ecology and Environmental Management
- Canadian Forest Service (1996). The State of Canada's Forests 1995-1996, Natural Resources Canada, Ottawa, p.112
- Canadian Forest Service (1998); The State of Canada's Forests 1997-1998, Natural Resources Canada, Ottawa, p.110
- Ciesla, William M., (1995); Climate change, forests and forest management: an overview, FAO Forestry Paper 126, Forest Resources Division, FAO, Rome, Italy.
- Cunningham P. and Saigo, Barbara W. (2000). A Global Concern, Mc Graw Hill publishers.
- ~~Dr~~ Mackay, Donald (1999). Underlying Causes of Deforestation and Forest Degradation. Analysis and policy recommendation.
- Drigo, R. (1998); Unpublished Personal Communication, Forest Resources Assessment Programme, Forest Resources Division, Fao, Rome, Italy.
- Emerton, L. & Karanja, F. (2001). Valuation of forest resources in East Africa. Nairobi, Kenya, African Centre for Technology Studies (ACTS) and World Conservation Union (IUCN) Eastern Africa Regional Office (EARO).
- Eva H, Glinni, A, Mayaux, P, Richards, T, and Stibig, H.T, (1998); Identification of Deforestation Hot Spot Areas in the Humid Tropics, TREES Publication Series B No.4, European Commission, Luxembourg, p.79
- FAO (1993); Forest Resource Assessment 1990: Tropical Countries, FAO Forestry Paper 112, Rome

FAO (1997); State of the World's Forests 1997, Food and Agriculture Organization of the United Nations, Rome, Italy, p.200

FAO (1998); Statistical Databases, Food and Agriculture Organization of the United Nations, Rome, Italy, <http://apps.fao.org/>

FAO (1998); FAO Yearbook: Forest Products, FAO Forestry Series No.3, Food and Agriculture Organization of the United Nations, Rome, Italy

Gathaara, G. (1999). Aerial Survey of the Destruction Of Mt Kenya, Imenti and Ngare Ndare Forest Reserves. Nairobi, Kenya, Kenya Wildlife Service (KWS).

Gereta, E., Wolanski, E., Borner, M. & Serneels, S. (2002). Use of an Ecohydrology Model to Predict the Impact on the Serengeti Ecosystem of Deforestation, Irrigation and the Proposed Amala Weir Water Diversion Project in Kenya. *Ecohydrology and Hydrobiology*, 2(1-4): 135-142.

Githiko, Antony (1994) High Canopy Forest Management in Kenya

Hansen, K. (1997); Final Report: Draft Chapter 1, Background Paper No. 1, World Commission on Forests and Sustainable Development, p.8

Hiernaux P. (1998). Effects of Grazing on Plant Species Composition and Spatial Distribution In Rangelands of The Sahel. *Plant Ecology* 138; 191-202.

† I.U.C.N (1996) Communities and Forest Management: Recommendations of the I.U.C.N Working Group on Community Involvement in Forest Management to the Intergovernmental Panel on Forests.

✓ IUCN (World Conservation Union). (1996). Forest cover and forest reserves in Kenya: policy and practice. Nairobi, Kenya, IUCN-EARO.

Laarman, Jan and Rodger S., (1992); Global Forests: Issues for Six Billion People, McGraw-Hill Inc., New York, p.337

Leonard, H.Jeffrey (1987); Natural Resources and Economic Development in Central America, International Institute for Environmental Development, Oxford, p.279

Lowe, J.J.; K.Power, S.L.Gray (1994); Canada's Forest Inventory 1991, Information Report PI-X-115, Petawawa National Forestry Institute, Canadian Forest Service, p.67

Matiru, Violet (2004), Forest Cover and Forest Reserves in Kenya- I.U.C.N Africa Programme, January. Mc Graw Hill publishers.

Meyers, Norman (1992); The Primary Source: Tropical Forests and Our Future, W.W.Norton & Compant, London, p.416

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

Nigel D., (1992). Forests in Trouble a review of the Status of Temperate Forest Worldwide Report. , World Wildlife Fund for Nature October
54 University Street.

Njuguna, P., Mbegera, M. & Mbithi, D. (1999). Reconnaissance survey of forest blocks in the west and east of the Rift Valley. Nairobi, Kenya, Permanent Presidential Commission on Soil Conservation and Afforestation.

Poore, D., Peter B., John P., Simon R., and Timothy S. (1989); No Timber Without Trees: Sustainability in the Tropical Forest, Earthscan Publicans, London, p.252

Review of the Status and trends of and major threat to the forest biological diversity. Secretariat of the convention on Biological Diversity series 7. March 2002.

Review of the Status and Trends of and Smaller Major Threats to the Forest Biological Diversity. Secretariat of the Convention on Biological Diversity series 7. March 2002. Ad Hoc technical expert group on forest biological diversity.

Roberts, ~~Ralph~~ W. and George, S.N. (1997); Leadership and Governance in World Forestry

Status of the Worlds Forest Report (2001), By U.N.F.A.0- Rome 2001.

Status of the Worlds Forest Report (2001). By United Nations Food and Agricultural Organization

UDO, R (1983). The Human Geography of Tropical Africa London Heinemann Educational Books.

World Resource Institute (1985). World Resources 1999: A report by the World Resources Institute in collaboration with the UNEP and UNDP. New York and Oxford: Oxford University Press.

APPENDICES

Appendix I: Questionnaire

KAMPALA INTERNATIONAL UNIVERSITY
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

RESEARCH TOPIC:

“Deforestation and environmental degradation” A case study of Aberdare forest,
Central Province, Kenya.

RESEARCH QUESTIONNAIRE

SECTION ONE: PERSONAL INFORMATION

- 1.0 Gender**
- (a) Male ☐
- (b) Female ☐

1.1 Age:

18-24	25-31	32-38	39-45	46-52	53+
☐	☐	☐	☐	☐	☐

1.2 Education status

No education

Adult education

Primary education

Secondary education

High school education

College/ institute

University

- 1.3 Employment Status**
- a) Employed ☐
- b) Unemployed ☐
- c) Student ☐
- d) Other ☐

- 1.4 Area of residence**
- Is it far from the forest?
- a) Yes ☐
- b) No ☐

SECTION TWO: CAUSES OF DEFORESTATION

- 2.1 What comprises of the environment?**
- a) Air ☐

18.5
14.0
21.5
17.5

71.5

- a) Soil ☐
- b) Water ☐
- c) All of the above ☐
- d) I do not know ☐

2.2 What do you understand by the term deforestation?

- a) Cutting down of trees
- b) Clearing of the natural vegetation to use the land for other purposes.
- c) Acquiring land for other purposes other than for tree plantation.
- d) I do not know
- e) No correct answer

2.3 Why is Aberdare forest being cut down?

- a) For timber production
- b) Firewood for domestic uses
- c) To acquire land for agriculture
- d) To acquire land for development.
- e) All of the above
- f) None of the above

2.4 How has the above activity affected the surrounding environment?

.....

.....

.....

2.5 Do you consider deforestation of this forest as having created more negative consequences than positive ones?

.....

.....

2.6 If the forest is said to have any positive attributes please state some of them

.....

.....

.....

SECTION THREE: MEASURES

3.0 What is the meaning of afforestation?

.....

.....

.....

3.1 What is forest conservation?

.....

.....

.....

3.2 Do you think forest conservation is necessary?

.....

.....

.....

3.3 Mention some of the activities involved in conservation?

.....
.....
.....

3.4 Who is responsible for the forest conservation?

- | | |
|-----------------------------------|--------------------------|
| a) Local people | ☐ |
| b) Politicians | ☐ |
| c) Environmentalists | ☐ |
| d) Government | ☐ |
| e) Non governmental organizations | ☐ |
| f) All of the above | ☐ |

Give reasons for your answer.

.....
.....

Do you think that more awareness on the importance of forests should be created?

- | | |
|--------|--------------------------|
| a) Yes | ☐ |
| b) No | ☐ |

3.5 Has the media played any role in the awareness campaign on the importance of forests?

.....
.....
.....

- | | | |
|---------------------------|-------------|--------------------------|
| If yes, has the role been | a) positive | ☐ |
| | b) Negative | ☐ |

3.6 Can you suggest other ways of creating a wider awareness on the conservation of forests?

.....
.....
.....
.....
.....

3.7 Do you think the law has had an impact in the fight against deforestation and conservation of the environment?

.....
.....
.....
.....
.....

3.9 Do you think the community has any role to play in the conservation of the environment?

.....
.....
.....