DEGRADATION, REHABILITATION AND CONSERVATION OF FOREST COVER IN HOMA HILLS KARACHUONYO-KANAM, HOMABAY COUNTY

ONG’ONGE ALLAN MENYA

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MAY 2018
DECLARATION

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

Signature…………………… . Date…………………………..

Ong’onge Allan Menya

BDS/7/00035/2/2014

This project has been submitted for examination with my approval as university supervisor.

Signature…………………… . Date…………………………..

Isabella Sile

Management University of Africa
DEDICATION

I dedicate this work to God almighty, my family especially my mother who has always believed in me without any doubt and friends.
ACKNOWLEDGEMENT

I want to give my sincere gratitude to my supervisor Isabella Sile for her guidance and direction. I also take this opportunity to acknowledge my facilitators through whom I developed my logical faculties. Finally, to my friends Sharon Kasivwa and Winnie Nyambegera for their continuous availability for open discussions allowing a different perspective on the subject matter.
ABSTRACT

Degradation, rehabilitation and conservation of forests as a topic of choice should be seen as wholesome one looking at the problem, providing a solution to the current existing problem and eventually providing a sustainable solution to avoid a repeat of the problem again. Degradation in this context was taken from an ecological perspective to mean destruction of an ecosystem. This destruction leans typically towards deforestation by agents such as farmers’ developers and settlers who are pushed by exterior forces which were consider as causes such as population increase, poverty and others. Deforestation was therefore the focus of the study and has been listed as one of the top ten environmental issues in the world by the United Nations. This study then looked at the causes and effects of deforestation but not stop there. It also looked at the solutions to the problem of deforestation such as reforestation means of rehabilitating the environment in question. This did not stop there but it did still delve into providing a mitigation solution to avoid the problem recurring again and this looked at sustainable forest management and conservation. The primary target population was the residents of Kanam B sub-location and the secondary target group were the institutions set in place by both the national and county governments. The sample size constituted of a primary population of not less than 30 persons as stipulated by the research manual and have to be permanent residents of the said area. The second group that was part of sample size were at least two representatives from government institutions who did provide relevant technical data and information that was used to corroborate the information from the residents. The instruments used in this case was the questionnaire tailored to suit the various groups in the target population whose interaction was through focus discussion groups guided by the questionnaire. Collected data was presented in the form of tables and figures indicating the response rate, descriptive characteristics of the population and the four research questions. Recommendations included stakeholder involvement for project implementation success, linkages of the various institutions dealing in environmental and wildlife issues. Conclusion was the existence of actual degradation of the environment in Kanam.
# TABLE OF CONTENTS

DECLARATION................................................................................................................................. i

DEDICATION .................................................................................................................................. ii

ACKNOWLEDGEMENT ................................................................................................................... iii

ABSTRACT ........................................................................................................................................ iv

LIST OF TABLES .............................................................................................................................. 1

LIST OF FIGURES ........................................................................................................................... 2

ACRONYMS AND ABBREVIATIONS ............................................................................................... 3

OPERATIONAL DEFINITION OF TERMS ....................................................................................... 4

CHAPTER ONE ................................................................................................................................. 7

INTRODUCTION ............................................................................................................................. 7

1.0. Introduction .......................................................................................................................... 7

1.1. Background ......................................................................................................................... 7

1.1.1. Global Perspective ............................................................................................................. 7

1.1.2. Local Perspective .............................................................................................................. 10

1.2. Statement of the Problem ..................................................................................................... 11

1.3. Objectives ............................................................................................................................ 13

1.3.1. Overall Objective ............................................................................................................. 13

1.3.2. Specific Objectives .......................................................................................................... 13

1.4. Research Questions ............................................................................................................. 13

1.5. Justification of the Study ..................................................................................................... 13
1.6. Scope of the Study ................................................................. 14

1.7. Chapter Summary ................................................................. 15

CHAPTER TWO ............................................................................... 16

LITERATURE REVIEW ................................................................ 16

2.0. Introduction ............................................................................. 16

2.1. Theoretical Literature Review ..................................................... 16

2.1.1. Agents and Drivers of Deforestation ....................................... 16

2.1.2. Effects of Deforestation ......................................................... 17

2.1.3. Forest Restoration, Rehabilitation and Reclamation .................. 18

2.1.4. Sustainable Forest Conservation ........................................... 20

2.2. Empirical Literature Review ...................................................... 21

2.2.1. Agents and Drivers of Deforestation ....................................... 21

2.2.2. Effects of Deforestation ......................................................... 25

2.2.3. Forest Restoration, Rehabilitation and Reclamation .................. 26

2.2.4. Sustainable Forest Conservation ........................................... 26

2.3. Summary and Research Gap ..................................................... 27

2.4. Conceptual Framework ............................................................. 28

2.5. Operationalization of Variables ............................................... 28

2.6. Chapter Summary ................................................................. 29

CHAPTER THREE ......................................................................... 30

RESEARCH DESIGN AND METHODOLOGY .................................. 30

3.0. Introduction ............................................................................. 30
3.1. Research Design .................................................................................................................. 30
3.2. Target Population .................................................................................................................. 31
3.3. Sample and Sampling Technique ......................................................................................... 31
3.4. Instruments ........................................................................................................................... 32
3.5. Pilot Study .............................................................................................................................. 32
3.6. Data Collection Procedure .................................................................................................. 32
3.7. Data Analysis and Presentation ............................................................................................ 33
3.8. Ethical Consideration ............................................................................................................ 33
  3.8.1. Informed Consent ............................................................................................................ 33
  3.8.2. Voluntary Participation ................................................................................................... 34
  3.8.3. Confidentiality ................................................................................................................ 34
  3.8.4. Privacy ........................................................................................................................... 34
  3.8.5. Anonymity ...................................................................................................................... 34
3.9. Chapter Summary ................................................................................................................ 34

CHAPTER FOUR ...................................................................................................................... 35

RESEARCH FINDINGS ............................................................................................................. 35

4.0. Introduction ......................................................................................................................... 35
4.1. Presentation of Research Findings ....................................................................................... 35
  4.1.1. Response Rate ............................................................................................................... 35
  4.1.2. Descriptive Characteristics ............................................................................................ 36
  4.1.3. Agents and Drivers of Deforestation ............................................................................. 38
  4.1.4. Effects of Deforestation ................................................................................................ 38
SECTION E: WILDLIFE AND RELATED ISSUES .............................................................. 63

APPENDIX III: INFORMED CONSENT FORM ......................................................... 64
LIST OF TABLES

Table 4.1: Response Rate .................................................................................................................. 35
Table 4.2: Gender .................................................................................................................................. 36
Table 4.3: Age ........................................................................................................................................ 37
Table 4.4: Agents and Drivers of Deforestation.................................................................................... 38
Table 4.5: Daily Total, Precipitation ...................................................................................................... Error! Bookmark not defined.
Table 4.6: Temperature, Monthly Maximum Average.............................................................................. 40
Table 4.7: Temperature, Minimum Monthly Average .............................................................................. 41
Table 4.8: Relative Humidity at 06Z ...................................................................................................... 42
Table 4.9: Relative Humidity at 12Z ...................................................................................................... 43
Table 4.10: Indigenous Trees ............................................................................................................... 44
Table 4.11: List of Animals .................................................................................................................... 45
LIST OF FIGURES

Figure 4.1: Response Rate ........................................................................................................... 36
Figure 4.2: Gender ....................................................................................................................... 37
Figure 4.3: Age ............................................................................................................................ 37
Figure 4.4: Daily Total Precipitation ......................................................................................... 39
Figure 4.5: Temperature, Monthly Maximum Average .............................................................. 41
Figure 4.6: Temperature, Monthly Minimum Average ............................................................... 42
Figure 4.7: Relative Humidity at 06Z ....................................................................................... 43
Figure 4.8: Relative Humidity at 12Z ....................................................................................... 43
### ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>KEFRI</td>
<td>Kenya Forestry Research Institute</td>
</tr>
<tr>
<td>KFS</td>
<td>Kenya Forestry Services</td>
</tr>
<tr>
<td>KWS</td>
<td>Kenya Wildlife Services</td>
</tr>
<tr>
<td>MDGs</td>
<td>Millennium Development Goals</td>
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<tr>
<td>SDGs</td>
<td>Sustainable Development Goals</td>
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<td>SFM</td>
<td>Sustainable Forest Management</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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OPERATIONAL DEFINITION OF TERMS

**Biodiversity:** This is defined as the diversity among animal and plant species within an environment (Dictionary.com, n.d.).

**Deforestation:** This is defined as the clearing of virgin forests, or intentional destruction or removal of trees and other vegetation for agricultural, commercial, housing, or firewood use without replanting (reforesting) and without allowing time for the forest to regenerate itself. Deforestation is one of the major factors contributing to the greenhouse effect and desertification (Business Dictionary, n.d.).

**Dependency Theory:** This is the notion that natural resources flow from the periphery (nations which are considered poor) to the core nations which are considered rich) at the expense of the former (Dependency Theory, 2018).

**Desertification:** The process by which productive arid and semi-arid land is rendered economically unproductive (World Commission on Environment and Development, 1987)

**Ecosystem:** This is defined as a system, or a group of interconnected elements, formed by the interaction of a community of organisms with their environment (Dictionary.com, n.d.).
Modernization Theory: This is a model used to explain the process of modernization in societies through a progressive transition from a traditional to a modern society. It involves adoption of new technologies (Modernization Theory, 2018).

Rehabilitation: This is the reestablishing of productivity and some, but not necessarily all, of the plant and animal species originally present within an environment. Because of ecological or economic reasons, rehabilitated forest may include species not present in the original forest. In time, the original forest’s protective function and ecological services may be reestablished (Lamb & Gilmour, 2003).

Rostow’s Theory: Fully referred to as Rostow’s 5 stage model for economic growth Presumes that there are 5 stages to ensure that a nation grows economically. These stages are characterized by various milestones under them. Stage 1: Traditional Society where a society is reliant on subsistence production, barter trade and agriculture. Stage 2: Transitional Stage where there is specialization in production which leads to surplus production and infrastructure development. Stage 3: Take-off there is industrialization, growth in investments, regional growth and political change. Stage 4: Drive to Maturity where there is diversification, innovation and less reliance on imports. Stage 5: High Mass Consumption where there is a high orientation on consumer goods, quality and
durability are taken seriously and the service sector becomes dominant (Rostow's Stages of Growth, 2018).

**Sustainable Development:** Economic development characterized by low growth rate, absence of pollution, and greatly diminished environment impact. Described by the Brundtland report as the "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (Business Dictionary, n.d.)
CHAPTER ONE
INTRODUCTION

1.0. Introduction
This study aims to determine the causes, effects, control strategies and solutions of deforestation in Kanam B sub-location. This chapter gives the background of the study taking into account the global and local perspective. It also gives the statement of the problem, objectives, research question, justification of the study and finally the scope of the study.

1.1. Background
The background presents two perspectives of global and local in order to give a top to bottom understanding on the issue of forests, afforestation and deforestation as they are interlinked.

1.1.1. Global Perspective
Stockholm 1972

There has been a continual inert recognition of the role that the environment plays in the world which led to the first meeting by world leaders under the United Nations banner in Stockholm, 5th to 16th June 1972 dubbed the United Nations Conference on the Human Environment. This conference produced 26 principles to inspire and guide the world nations in the preservation and enhancement of the human environment. A framework for environmental action plan were also developed that carried with them recommendations. The actions in the plan included a global environmental assessment programme of evaluation, review, research, monitoring and information exchange; environmental management activities such as goal setting and planning, international consultation and agreements; and supporting measures such as public information, organisation, financing,
education and training. This is the time at which the resolution to adopt a World Environment Day was made (United Nations, 1972).

Of interest was the general debate specifically on Development and Environment which a considerable emphasis was placed by speakers from then developing nations to reduce the gap between poor and rich countries through improvement of the human environment, exploitation of natural resources, effective and less wasteful utilization of natural resources, need for clean water and air, technical assistance in the dissemination of information etcetera (United Nations, 1972).

**Brundtland Commission**

This was initially known as World Commission on Environment and Development led by Gro Harlem Brundtland whose mission was to lead the world nations towards the path of sustainable development up to the year 2000 and beyond. It came 10 years after Stockholm and it was wound up in 1987 after successfully releasing their report named Our Common Future. The commission broke down the barriers in which human activities and their effects were compartmentalised in according to nations, sectors and even broad areas of concern. They went and termed these dissolved barriers as an interlocking crisis and not a separate crisis. The commission noted that deforestation by highland farmers was noted as a cause of flooding on lowland farms; To curtail deforestation, reformation of forest revenue systems and concession terms could increase revenue collected which in turn would be used to promote efficient and long-term forest use; Developing nations face the greatest risk associated by the challenges posed by desertification, deforestation and pollution; Deforestation coupled with over cultivation, is the lead cause of droughts and floods; there is need for immediate action as there is little time left for the corrective action on the causes and effects of deforestation, desertification, toxic wastes and acidification.
which are live in the form of threats such as climate change, ozone depletion and species loss. The report reiterated that we need to spend less time with scientists trying to research and debate cause and effects as we already know enough to warrant action (World Commission on Environment and Development, 1987).

**Earth Summit**

After another 10 years resulted in Earth Summit in 1992 that looked into the issues of global climate change, biological diversity, deforestation and desertification to which the following documents came up: Rio Declaration on Environment and Development (1992) and Agenda 21.

**Rio Declaration on Environment and Development 1992**

This carried 27 principles and made a reaffirmation of the declaration that was adopted in Stockholm 1972, working towards the international agreements with the interest of protecting and preserving the integrity of the global environment all the while recognising the integral and interdependent nature of the earth as our home (Keating, 1992).

**Agenda 21**

United Nations Conference on Environment and Development (UNCED), again reiterated what was in the Brundtland Commission report that we the environment and economic development cannot be thought of as isolated fields (Keating, 1992). As the name suggests, it was composed of 21 Agendas in a document over 700 pages long to reconcile the environmental and economic needs of the world. Of interest was Agenda 11 which sought to combat deforestation. This was to be achieved through control of forest harvesting; control of uncontrolled degradation and conversion of forests to other types of land use; develop values of existing forests under sustained cultivation by indigenous technologies and agroforestry. It also calls for more trees to be planted by individuals, institutions and
businesses to reduce pressure on old forests, breed more resilient trees, protect trees from pollutants, halt destructive shiftcultivation, minimise wood waste, development of urban forestry for the greening of all places where people live etcetera (Keating, 1992).

A lot has been built on the above including the forest principles which are not legally binding to the member states of the United Nations (UN). Moreover, important legally binding agreements (Rio Convention) were opened for signature that include: Convention on Biological Diversity, Framework Convention on Climate Change (UNFCCC) and United Nations Convention to Combat Desertification. The most recent addition was in the Sustainable Development Goals (SDGs) that gave forests remarkable attention in six different goals. The sustainable development goals were a follow up to the Millennium Development Goals (MDGs). These SDGs that touch on forestry were: SDG6 to ensure availability of sustainable management of water and sanitation for all; SDG11 to make cities and human settlements inclusive, safe, resilient and sustainable; SDG12 to ensure sustainable production and consumption patterns; SDG1 to take urgent action to combat climate change through its impacts; SDG14 to conserve and sustainably use the oceans, seas, marine resources for sustainable development; SDG15 to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse and degradation and biodiversity loss (United Nations, 2018).

1.1.2. Local Perspective

Vision 2030

This need for environmental conservation has not been ignored by the Kenya Vision 2030 which seeks to transform the economic environment without harming the physical environment including the forests. This will be achieved through the formulation of a
national land use mater plan to ensure organisation and conservation of various environments and ecosystems. Projects such as Tana and Lake Victoria catchment initiatives to be implemented which calls upon forest conservation in areas such as the Mau that is under threat and land cover.

As part of the emerging issues under the Vision 2030 programme has been poaching and illegal logging of forests. Acknowledgement of the biodiversity held by various forests including Mau forest, Cherenganyi Hills, coastal forests of Arabuko-Sokole, mountain forests such as Mt. Kenya, Aberdare Range, Mt. Elgon, Kakamega Forests. Also of concern has been the documentation of threatened ecosystems of national and global importance (Ministry of Devolution and Planning, 2013).

1.2. Statement of the Problem

Deforestation has been a major challenge in the world in the eve of economic development and this has been attributed to the increase of population and their direct need for resources to meet their daily needs. This has unfortunately been done at the expense of the country’s natural resources which includes the forests which has high rate of deforestation (Elias, Lininger, May-Tobin, & Roquemore). As Kenya is seeking to develop using the Vision 2030 agenda, deforestation continues to be a reality an if not checked lead to desertification inevitably which is much more difficult of a process to reverse due to harsh climatic conditions.

Forests according to the Food and Agricultural Organization (FAO) have always been known to provide important environmental benefits such as conservation of water catchments and acting as carbon sinks in the view of increasing carbon emissions in the world. Forests have also been known to act as a cushion to the rapid climatic changes through adaptation. In Kenya, the area of forest cover is estimated to be slightly over 5% of
forest and tree cover. The gazetted forests cover is about 1.3 million hectares out of which 9% is industrial exotic plantations which supply wood material to various wood industries (Ministry of Devolution and Planning, 2013).

From an ecosystems perspective, it has also been observed that the large wildlife enjoyed by Kenya has reduced in the last 40 years by about 40% and this has been attributed to encroachment into their environment by humans for settlement, agricultural land and livestock activities. These are some of the activities that come with an increase in population attributed to development in other sectors (Ministry of Devolution and Planning, 2013).

According to the National Forest Program factsheet, 80% of the national energy supply is met from wood fuel which places more pressure on the existing forests especially in the rural areas where alternative energy sources are yet to be found. Kanam is one such area where there is a reliance on wood fuel for cooking in the form of firewood or charcoal. The National Forest Program due to need was developed to increase forest cover, boost the forestry sector addition to the economy which stands at 2.9%, enhance resilience to climate change and improve livelihoods (Ministry of Environment and Natural Resources, 2016).

Karachuonyo located in Homabay is in the lake basin and according to the the forest cover report, had 2.59% forest cover. This rating puts it only ahead of Kisumu at 0.44%, Marsabit at 1.7%, Migori at 0.64% and Siaya at 0.42%. This indicates the strain on the ecosystem such as low agricultural output due to low rains, deforestation, soil erosion, climate regulation, water regulation, etc. Deforestation in Kenya is estimated to be at 50,000 hectares annually with a subsequent loss yearly of over 2 billion shillings (Njoroge, 2016).
1.3. Objectives

1.3.1. Overall Objective

The overall objective of the research is to study agents and drivers of deforestation and degradation of Homa Hills using Kanam B as a sample area, rehabilitate to prevent further deforestation and land degradation of the ecosystem in the area through sustainable forest management.

1.3.2. Specific Objectives

i. To determine the agents and drivers of deforestation in Kanam B?

ii. To learn the effects of deforestation in Kanam B?

iii. To determine how can Kanam B be rehabilitated to reverse deforestation?

iv. To establish how Kanam B be conserved/managed to prevent deforestation after rehabilitation?

1.4. Research Questions

The following research questions guide the study:

i. What are the agents and drivers of deforestation in Kanam B?

ii. What are the effects of deforestation in Kanam B?

iii. How can Kanam B be rehabilitated to reverse deforestation?

iv. How can the rehabilitated area of Kanam B be conserved/managed to prevent deforestation?

1.5. Justification of the Study

This study was justified by the fact that deforestation is a reality and if left unchecked can result in further environmental degradation to the point of turning the region into a desert which makes habitation very difficult. Deforestation poses a local and regional problem
through destabilization of the hydrological cycle leading, short term economic gains through clearing of forests for farmlands and in the long run rendering the farmlands unreliable to the farmers for productivity, increased burden on the national government to provide for these community members and reduction on the money invested in other development sectors (Walker, 1993). As intimated by the topic of choice, it give a tree part approach indicating that the problem as being deforestation who causual effect is degradation of the environment and a solution to the problem through which is rehabilitation. The environment at hand is beyond what would require the efforts of conservation and hence the need for rehabilitation in order to have something to conserve.

The first line of direct beneficiaries are the residents of Kanam as they will understand their environment better and be conscious about it. Better techniques to ensure sustainability of their environment shall be achieved as their needs shall be met economically and those of the environment also met. The second line shall be the government authorities who will have an easier time implementing their strategies within the region with ease after the interraction.

1.6. Scope of the Study

The study was carried out between January to March 2018 in Kanam B sub location which is located in Karachuonyo Constituency, Homabay County. Homabay County is located in the East African country of Kenya. Homabay lies in a lake basin and is bordered by five other counties and Lake Victoria. The five counties are Migori, Ki, Nyamira, Kericho and Kisumu. The town which the county has gotten its name from was originally known as Chic Onuno in the Luo language which means Onuno’ market when translated. In the year 1925, the colonialists renamed it to Homabay because it was overlooking the Got Huma which again translated to English is Famous Hill. Due to the colonialists’ inability to
pronounce the word Huma, they called it Homa and the residents adopted the name Homabay.

Kanam B is located on the foothills of Homa Hills overlooking Lake Victoria. The Luo and Abasuba people located in the county are predominantly fishermen and small scale farmers who grow traditionally millet, yams, cassava, groundnuts mainly but due to the environmental changes have reverted to maize, millet and tobacco. Currently, the region has a semi-arid climatic conditions with temperatures ranging at 27 degrees during the cold season and 34 degrees during the hottest months. The region especially Kanam used to receive two rainy seasons in March-May and September-November which is currently unpredictable and has been reduced to scattered showers making even faring difficult (Kenya Information Guide, n.d.).

The target group were residents from Kanam B sub location who will have a firm knowledge in the phenomena being investigated and have basic information which the research was built on. The second group were those from the administrative end and will include government workers from the county government and parastatals who provide technical information.

1.7. Chapter Summary

The chapter has sought to give an understanding and genesis to the problem sought to be researched, giving the exact problem. It follows to list out the general objectives that are to be attained. A justification has been given and this has further been built through Chapter Two from a theoretical perspective. Also the geographical area of the study has been given together with the target population to allow for a better understanding of the scope.
CHAPTER TWO
LITERATURE REVIEW

2.0. Introduction
This chapter presents the literature review through the theoretical and empirical aspects. The theoretical literature review uses the fundamental theories associated to deforestation while the empirical literature review indicates what has done by other researchers. Research gaps were then be identified thus justifying the need of the research.

2.1. Theoretical Literature Review
This section looked at the theories surrounding the causes, effect and control strategies surrounding deforestation. They were then be linked to the research questions that have been listed.

2.1.1. Agents and Drivers of Deforestation
To understand the determinants of deforestation, it is important to understand and distinguish between the agents of deforestation and its causes. The agents of deforestation are identified by actions that do the actual destruction of forests and include: slash and burn by farmers, commercial farmers, ranchers, loggers, firewood collectors, developers of infrastructure and others who cut down the forests. Causes of deforestation are the forces that motivate the above listed agents to clear the forests (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012). When the agents and causes of deforestation are combined, they are referred to as sources of deforestation which most literature terms as direct and indirect causes of deforestation. It should also be observed that there are two forces that affect deforestation: competition between humans and other species for the remaining available land that meets the needs on it which leads to the conversion of forest land to other uses;
failure or the economic systems to show the true value of the environment in the pursuit of natural resources. The former is seen as direct causes and the latter as indirect causes.

### 2.1.2. Effects of Deforestation

Climate change is any substantial change in measures of temperature and precipitation lasting for a long period. Natural factors have always been seen as the cause of this but human activities are linked presently as the major cause of the changes that are being experienced. The term climate change has been interchangeably used with global warming but do not mean the same thing as global warming refers to the average increase in the temperature of the atmosphere closer to the earth. Global warming is then but an aspect of climate change (Climate Change Indicators in the United States, 2016). Climate change like every other measure uses indicators which are both a cause or effect of climate change. Deforestation plays a part as a cause of climate change and this can be seen from the relationship between forests and the climate. The absence of the forests then causes an imbalance leaving certain factors of the environment without check such as wind, humidity, temperature and precipitation.

Water cycle has been seen as the continuous process of water evaporating from the earth’s surface due to the sun and loss of water through transpiration by plants and then condensing forming droplets. The droplets then become clouds or ice crystals depending on the temperature and when sufficiently heavy, it falls back onto the earth’s surface as precipitation. When the precipitation falls onto the earth, it infiltrates through the soil and the excess that does not infiltrate the soil, then flows into rivers and lakes as surface runoff. The water in the soil is then taken up by plants and trees and some returned to the air through transpiration. This process is cyclic and this I the ideal water cycle. Deforestation possess a challenge as it interrupts this cycle from various fronts such as increases surface runoff and reduces infiltration as there is very little vegetation cover to regulate this and
also due to the damaging of the soil by excess sun radiation in a manner making it resistant to infiltration.

Biodiversity is short for biological diversity. Forests contain a variety of plants, animals and birds per square inch than any other environment on the earth’s landscape. Conservation of our forests protects a great percentage of the land based animal and plant species. This biodiversity is what provides a wide array of services necessary for human well-being. Some of these services are: Provisioning services, which are the products obtained from the forests; Cultural services, which are the immaterial benefits humans derive from the forest ecosystem through spiritual development, recreation, aesthetic but not limited; Regulating services, these are the benefits obtained from the ecosystem processes such as purification of water and air. The undervaluing of the biodiversity within forests is what is allowing for the destruction through deforestation and valuing their products which is myopic. This biodiversity can be rehabilitated if the factors that led to their degradation can be effectively controlled or permanently removed (Secretariat of the Convention on Biological Diversity, 2010).

2.1.3. Forest Restoration, Rehabilitation and Reclamation

Restoration is seen as the attempt to return the or recreate a new ecosystem that is as close as possible as the original ecosystem that existed; Rehabilitation is an attempt to return the new ecosystem to similar levels of productivity to the original environment and some of the original biodiversity as there is a realization in the apparent reality that the ecosystem exists; Reclamation is the attempt to regain only the structure and productivity of the original ecosystem. The overall effect of forest degradation or in this case deforestation can be summed up as loss of human well-being, loss of biodiversity and loss of ecological goods and services. This the leaves us with the following questions: What are the options for the forest landscape? What is the desired look of the said forest landscape in the
coming years? What goods and services is desired from the forest landscape? How can we manage the landscape? By answering these questions, ability to determine why and how the forest landscape should be brought to life again considering the setting and ecological and socioeconomic rationale (Lamb & Gilmour, 2003). Rehabilitation should be understood to be a long-term plan that needs a lot of foregoing of short-term benefits.

Degraded ecosystems tend to be able to recover without and intervention but many do not due to very little of the original plant and animals remaining on the site or a change in the biophysical environment such as soil fertility and persistent disturbances. Natural recovery tends to be a very slow and this increases the chances of further disturbances and cause more degeneration, providing for the need of human intervention to accelerate the process (Lamb & Gilmour, 2003).

For recovery of the degraded environment to be possible, certain preconditions must be met: Removal of disturbing agents such as those discussed in the causes of deforestation without which recovery will not be possible; Original and exotic plant and animal species that have been introduced to the site as new colonists, must be allowed to move across the landscape and recolonize the deforested area; Soils at the site must be able to sustain the original and new species that are being reintroduced and introduced through toleration; Weed and animal pests must be removed from the environment to allow for reestablishment of the new or original colony (Lamb & Gilmour, 2003).

Rehabilitation has two approaches that can be used namely the human well-being and the ecological integrity approach. The human well-being approach, ensures that everyone has a role to play in shaping of decisions that affect their ability to meet their needs while the ecological integrity approach seeks to maintain the diversity and quality of ecosystems while at the same time enhancing their capacity to adopt to changes and provision for the
needs of future generations (Lamb & Gilmour, 2003). These two can work hand in hand to give a sustainable approach to rehabilitation of ecosystems as the highest quality of landscape restoration is when both are improved while the lowest quality of restoration is when emphasis is placed on only one of the two approaches.

2.1.4. Sustainable Forest Conservation

Sustainable forest conservation/management can be traced back to the Forest Principles and the Chapter 11 of Agenda 21. In the preamble of the forest principles, the guiding objective is to contribute to the management, conservation and development issues and opportunities. This then draws our attention to principle 2b that requires forest resources and forest lands to be sustainably managed to meet the social, economic, ecological, cultural and spiritual need of present and future generations (United Nations, 1992). This concept has then developed to the present where there is use of criteria and indicators of sustainable forest management (SFM).

Criteria and indicators seek to provide a tool for assessment of trends and change in forest conditions and management systems. It does this by identification of the main elements of SFM. The indicators are then used for identification of information needed to monitor change both in the forest, forest environment and management systems used. The information collected is then used to provide action points to all the parties involved from regional to the local level. Seven criteria have been identified as essential to the quest for SFM, these are: Enabling Conditions for SFM; Forest Resource Security; Forest Ecosystem Health and Condition; Flow of Forest Produce; Biological Diversity; Soil and Water; Economic Social and Cultural Aspects. All these criteria have indicators with which monitoring and assessment is possible through qualitative and quantitative measures (Criteria and Indicators For Sustainable Management of Natural Tropical Forests in China: Rationale and Methods, 2003).
2.2. **Empirical Literature Review**

This section critiques the work done by other researchers and presents the hypothesized variables.

### 2.2.1. **Agents and Drivers of Deforestation**

Expansion of farm land which is the largest contributor to deforestation. The agents in developing nations of such are those who live below the poverty line and rely on agriculture as their main source of income. Also as the land degrades, people venture into the forest land which is considered more fertile (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012).

Forest plantations that are seen as a benefit in reducing the rate of deforestation but have a negative effect still. This is attributed to the fact that natural forests are cleared to allow for the commercial trees to be grown through which shift cultivation is practiced. As the commercial forests grow, the rate of deforestation also increases. This also causes a disturbance in the original forest ecosystem and overall forest cover (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012).

Logging has a catalytic effect in aiding deforestation and forest degradation through provision of access roads into forests and opening the interior to settlers who clear the forest for farmland. This has been observed mainly in the tropical rainforests of the world that account for 60% of the earth’s forests. Fuelwood collection is usually not a major cause of deforestation but it poses a threat when the population increases and demand for fuelwood is high (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012). This is observed in the tropical dry forests and degraded forest areas.

Overgrazing is very common in the dry tropic areas where pasture land is degraded and are subject to soil erosion. The topsoil in these areas tends to be very loose to the point that
wind carries it away and rain water washes it off. Overgrazing happens in the presence of an increased number of farm animals such as sheep and goats that reproduce very fast to the point that the land cannot support them and they strip the land off vegetation. This causes the herders to move into stripping trees to provide feed for their livestock (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012). Sprouting and new trees are also eaten by the livestock.

Fires are considered as a very good tool for clearing the forest for agriculture and forest management. If abused due to the difficulty in control, it can cause deforestation (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012).

Mining carries a similar effect on the catalyst to deforestation. It is also coupled with the specific mineral being mined and those that require open cast mining can lead to very rapid rates of deforestation as large tracts of land are cleared at once to reach the mineral ore (Griffiths & Hirvelä, 2008).

Urbanization, industrialization and infrastructure development is another cause for deforestation. This is attributed to the fact that expansion of urban areas require land to establish the necessary supporting infrastructure to meet the needs of the population. This is done with a view of future increase and caters for such clearance of land (Sands, 2005).

Other causes that have the capability of large scale deforestation are wars and use of weapons of mass destruction that can level land in an instant clearing all trees and everything else if dropped in a forested region. Tourism which encourages clearing of forests in tropic and subtropical regions for building of lodges and resorts that when uncontrolled can have no concern for the environment. In developing nations, tourism is seen as a good source of income and thus ignoring the effects of deforestation is a great possibility (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012).
Anon takes a stand that the consumerism nature of developed nations is the main cause of deforestation in the world. The developed nations consume four fifths of the world’s produce despite only having about a quarter of the world’s population. This consumerism is one of waste and does not utilize resources completely and hence more demand. He decries that this causes deforestation through demand for forest products and anything related logging, mining, cash crops etc. (World Rainforest Movement, 1990).

Colonialization had an effect of interrupting the indigenous ways of land ownership, management and conservation that existed thousands of years before the arrival of the colonialists. The indigenous people had a better understanding of their environment and their belief systems was intertwined with their natural environment. Colonialization also turned self-sufficient economies into zones of agriculture export production (Colechester & Lohmann, 1993).

Exploitation by developed and industrialized countries offers a reinforcement of the dependency theory. The wealthy nations with a deficit of natural resources seek to cover this by obtaining resources from the least developed nations. This tends to be unsustainable as it maximizes on the short term gain which is in contrast to the amount of time it takes for a natural forest to regenerate (Colechester & Lohmann, 1993).

The debt burden has also contributed of this fast rate of deforestation as underdeveloped nations have to meet their debt obligations. This urgency to repay the debts allows for taking up of unsustainable solutions which include selling of natural resources such as oil and minerals which require destruction of forests to extract them (Colechester & Lohmann, 1993).

Overpopulation and poverty though controversial and inextricably linked as issues are believed to be the main cause of deforestation. The increase in the number of people causes
a proportional increase in demand for food, habitation and resources. This leads to further
deforestation through clearing of forests (Colechester & Lohmann, 1993). Development,
more so economic has been branded as the magic wand for poverty and turns a blind eye to
the intricate and inseparable nature of sustainable development.

Land rights, land tenure and inequitable land distribution and resources is also another
cause of deforestation as there is an absence of property rights at the edge of the forests
which are destroyed as need arises without consideration ever increasing property
boundary illegally (Sands, 2005). Poorly defined land tenure is generally detrimental for
the forests and local populace (Chomitz, Buys, De Luca, Thomas, & Wertz-Kanounnikoff,
2007).

Economic development relationship and deforestation is seen as a complex one
(Humphreys, 2009). Development from the modernization theory and Rostows Model of
Growth view can be argued that: development will increase land productivity and insinuate
thereby that the need to clear forests reduces to meet food requirements; development will
produce further incentive through capital to expand and clear more forest land all in the
same breath. The increase in financial power and increase in demands for agricultural
produce and wood products also increased the rate of deforestation. The rich farmers are
argued that they are able to better finance deforestation as compared to the poor farmer
who cannot afford the technological innovations to clear the forests (Chomitz, Buys, De
Luca, Thomas, & Wertz-Kanounnikoff, 2007). These technological innovations make
farming more profitable thus attracting investors cum farmers into the business and hence
more increase in deforestation and movement into new frontiers.
Forests have been grossly undervalued and the pitch of value being added post extraction to them has been sold thus reinforcing a negative attitude towards the forests (Sands, 2005).

Corruption and political causes has been identified as another main cause of deforestation according to FAO report in 2001. This has given room to illegal forest practices that defeat the legality of enforceable contracts, sale of illegal permits, fake declaration of logged volumes, harvesting of protected tree species, smuggling of tree species across borders (Contreras-Hermosilla, 2001).

### 2.2.2. Effects of Deforestation

During assessment and study of the effects of forests on climates and climates on forests and as intimated by Rudolf Geiger, we should be distinguish from microclimates, regional climates and global climate from each other (Geiger, 1957) (Gupta, Thapliyal, & Joshi, 2005). This is done so by increase in the concentration of carbon dioxide in the atmosphere and thus increase the greenhouse effect; change in wind flows due to bare land and increased temperatures (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012).

Disruption of the water cycle which could be through inability of the land to retain much water thus creating a dry climate. The water resources also tend to be affected by as their level reduces in the water table, increased siltation due to washing away of the top soil and increased surface runoff, widening of river banks due to increased volumes of water from surface runoff (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012).

Forests contain a huge biodiversity and deforestation destroys the habitats belonging to some of the animal and plant species. Animal species are forced to move into areas where humans are as a means of adaptation to feed on farm animals, crops and get sleeping
habitats. This in turn leads to human and wildlife conflict that can result in either death and in most cases it is the animals who are then forced to move or die due to starvation.

Forests contribute to the economy and their destruction inhibits potential and future revenue streams. These loses could be direct and indirect as result of diversion of funds to mitigate on the effects of deforestation such as floods and droughts or sale of wood and wood products (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012).

Exposure of indigenous communities to civilization which will erode their traditional lifestyle and breakdown the social institutions in an almost similar fashion to colonization. These communities can them be displaced and sent to new environment in which they shall be at a disadvantage due to lack of both hard or soft skills required by their environment, this can cause them to plummet into poverty as they will now rely on money as opposed to the natural resource for the day to day survival (Chakravarty, Gosh, Suresh, Dey, & Shuka, 2012).

2.2.3. Forest Restoration, Rehabilitation and Reclamation

Gilmour and Lamb suggest that deforestation should be addressed on site-level and landscape-level and this will be true for the Kanam B area. The site itself requires rehabilitation through panting of trees but it should be coordinated with the landscape which is hilly, has loose soil and rocky outcrops and some areas have undergone extensive erosion. They go ahead and state that reason as to why the biophysical environment will not recover naturally if the fact that there is repeated disturbances which is normally the case. This was observed in the Loess Plateau in China.

2.2.4. Sustainable Forest Conservation

In Kenya, more emphasis has been placed on the human well-being approach also known as the anthropogenic approach at the expense of the ecological approach. This is despite
the ecological approach being incorporated in the legal framework surrounding natural resource management. A case in point is the Mau forest ecosystem conservation that has faced a lot of resistance on the ecological front (Muigua, Wamukoya, & Kariuki, 2015). A follow up of degraded environments will also reveal this flaw in implementing sustainability that requires a combination of the ecological approach and another (Lamb & Gilmour, 2003).

The currently available sustainable forest management principles are borrowed from the Constitution of Kenya 2010, Environment Management and Coordination Act, international law and treaties that Kenya is a signatory to. These principles include sustainable principle, polluter pays principle, public participation and prevention principle (Muigua, Wamukoya, & Kariuki, 2015). After rehabilitation of Kanam B ecosystem, it would be prudent to apply the principle of prevention that seeks to avert damage to the environment before its occurrence through public participation.

2.3. Summary and Research Gap

More research needs to be done in Kenya on forests especially in the remote areas of the country. Beyond development of laws and policies to assist in enforcing and encouraging environment conservation and preservation, actual work needs to be done in the sensitization of people on the need to conserve their environment using community based natural resource management (CBNRM). CBRNM is has not been encouraged and has no defining policies to peg it on as it still relies on national values and principles of governance that are weak or in the infancy stages and growing very slowly. As Glo Harlem intimated, actual conservatin and reversal of the known effects of environmental degradation is now needed rather than more research. The research is sufficient at this stage following the calls of environmental awareness in 1970’s after the world war 2 up to the present time.
2.4. Conceptual Framework

**Independent Variables**

- AGENTS AND DRIVERS OF DEFORESTATION
- EFFECTS OF DEFORESTATION
- FOREST RESTORATION, REHABILITATION AND RECLAMATION
- SUSTAINABLE FOREST CONSERVATION

**Dependent Variable**

DEFORESTATION

2.5. Operationalization of Variables

The variables were two that is the independent variables and dependent variables. The independent variable was those that are surrounding the issue which in this case is deforestation. This issue was then being taken to be dependent variable. This operationalization of variables has been so due to the issues approach which seeks to understand the problem, rectify it and prevent it from happening again. To understand the issue of deforestation, we have to look at the causes which are both direct and indirect and then its effects. The causes and effects help us identify problems and provide a wholesome
solution to them. Without deforestation, then we would not need to understand its causes and effects and eventually provide a solution.

2.6. Chapter Summary

The chapter has assisted in understanding deforestation and appreciate forests. The understanding of deforestation has been done so by explaining and giving examples of agents and drivers of deforestation and eventually the effects that it poses to the environment. After an appreciation and acknowledgement of deforestation as a problem, restoration, rehabilitation and reclamation has also helped us understand the services offered by the forests and the need to have them back. It also helps us realize the extent to what reversal measures can be taken and in this case, it is rehabilitation. Left alone, reforestation is a broad concept and an aspect of solution to the problem of deforestation as it does not recognize biodiversity and the ecosystem as rehabilitation. The chapter closes by introducing management of forests as a means of conservation.
CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

3.0. Introduction

This chapter contains the research design that indicates the type of research used followed by a justification using cited authority. This was followed by an identified and justified target authority, sample and sampling technique, instruments, data collection procedure, data analysis procedure and ethical considerations.

3.1. Research Design

The research design seeks to indicate the type of research while at the same time providing justification to the type of research by citing authority. The research employed was documentary research as it used official documents to answer questions developed from the questionnaire (Mugenda & Mugenda, Research Methods, Dictionary, 2012). The methodology employed for the proposal was made from an observational perspective that included interaction with residents and forest officers on the ground to provide a base for chapter one. Chapter two was aided by books from writers and various document analysis including journals research papers and newspapers. The final research subject to institution approval was then used incorporate the use of questionnaires to conduct formal interviews and focus discussions. Consideration given to the documents was their quality and these varied from government reports, newspapers, legal materials, books, interviews and discussions. These documents passed when assessed according to the following four factors of authenticity, credibility, representativeness and meaning (Mugenda, Social Science Research, Theory and Principles, 2011).
3.2. Target Population

The target population is a particular entity of people, objects or units that a researcher can generalize reasonably in their research findings (Mugenda, Social Science Research, Theory and Principles, 2011). The target population were the stakeholders within the Kanam area and this will include the residents, county government in particular the environment department and government institutions mandated to oversee the forests and those linked to it such as Kenya Forestry Services (KFS), Kenya Wildlife Service (KWS) and Meteorological Department.

The county government is a justified part of the population as they are to work hand in hand with the national government institutions to ensure success in their conservation and forestry management endeavours. The KFS was so due to the fact that they were to provide data linked to the forest such as ecological diversity in terms of tree species, forest coverage through the years etc. The KWS did provide data on the ecological diversity linked to animal species and even human and wildlife conflict within the area linked to environmental changes.

3.3. Sample and Sampling Technique

A sample is a group of individuals, objects, items or cases already selected from the accessible population (Mugenda & Mugenda, Research Methods, Dictionary, 2012). This is because it is not often possible to collect data from an entire population. Sampling is the process of selecting the above mentioned sample from the population to be included in the study. The sampling technique that was used here is simple random sampling due to the fact that there is an accurate population frame which is sequentially listed and well defined (Mugenda, Social Science Research, Theory and Principles, 2011).
3.4. **Instruments**

Instrumentation is considered as one of the most important components of a research design as it is what is used to collect data and information. The instrument used here was a questionnaire in obtaining the required data and information. The questions were in such a way that they avoided inaccuracies due to biases. The questionnaires were used in focus group discussions with the locals who are elderly and due to one reason or another maybe unable to fill them on their own. Interviews were also conducted guided by the questionnaire to the various government institutions.

3.5. **Pilot Study**

This was a pretest done prior to the main study to determine the accuracy of the research instrument. This was to be determined by validity and reliability.

3.5.1. **Validity**

This is defined as the extent by which an instrument and in this case, the questionnaire will perform as it is required. The specific validity was based on the content whereby they assessed what was needed and collection of specific information relating to the subject matter. This relied on taking the representative question and evaluating it against the desired outcome (Mugenda, Social Science Research, Theory and Principles, 2011).

3.5.2. **Reliability**

This was related directly to the consistency by which the questionnaire gathered the information.

3.6. **Data Collection Procedure**

Data was collected through use of questionnaires which acted as the primary source and in instances where the data was available from secondary sources it were retrieved through the assistance of the various interviewees from the government offices. Focus group
discussions was used on the locals who were to be elderly and a source of information. The locals were gathered for a sitting at a venue of choice and convenience to allow for these discussions. For the government institutions, interviews were carried out on employees who had experience in the selected field or as appointed by the organization. The individual acted as a representation of the organization views from a professional perspective.

3.7. **Data Analysis and Presentation**

Data was put up in form of tables and where necessary, figures were used in the form of charts, histograms etc.

For presentation, convergence and corroboration amongst the documents was looked into by using two different data sources and methods, this does breed credibility in the final paper. It also reduces the potential bias. Finally, the Management University of Africa research manual has been used to come up with the format that includes presentation in the form of tables.

3.8. **Ethical Consideration**

This was achieved through use of multiple tools listed below after presentation of the letter of introduction from the Management University of Africa. This was explained and presented to the respondents for signing where necessary.

3.8.1. **Informed Consent**

This was a process in which the researcher sought acceptance through written consent from the appointed or potential respondent as to whether accept or decline participating in being an active respondent (Mugenda, Social Science Research, Theory and Principles, 2011).
3.8.2. Voluntary Participation
This was an active process in which both parties sharing information could at any time freely decide to whether withdraw or continue participating in the research (Mugenda & Mugenda, Research Methods, Dictionary, 2012).

3.8.3. Confidentiality
This was an active process in which both parties sharing information could at any time freely decide to whether withdraw or continue participating in the research (Mugenda, Social Science Research, Theory and Principles, 2011).

3.8.4. Privacy
This was the style, setting and circumstances under which the researcher conducted the research to obtain information. For the interviews the setting was a one on one with the respondent after they had filled the general information questionnaire and reviewed the questions (Mugenda, Social Science Research, Theory and Principles, 2011).

3.8.5. Anonymity
Anonymity stems from the word without name or nameless (Mugenda, Social Science Research, Theory and Principles, 2011). The data and information was presented in a manner that was without name and if need be, a respondent number used.

3.9. Chapter Summary
The perspective on the research design and methodology used here were those of a social science approach infused with a community development projects approach which was heavily customizable and not fixed. This was due to the varying target population nature.
CHAPTER FOUR
RESEARCH FINDINGS

4.0. Introduction

This chapter contains data to understand the topic in two sections and three subsections each. The first section are findings based on the three target groups; residents, meteorological department and KWS/KFS. The second section is in three subsections to give an understanding of the causes, effects and solutions.

4.1. Presentation of Research Findings

4.1.1. Response Rate

A copy of the project proposal was handed upon request to KWS Headquarters as part of the facilitation of data request processing to facilitate for the research to be conducted. Interviews were carried out in three parts; Residents, KWS and Meteorological Department, and no questionnaires were handed out to the respondents. There was a total of 37 respondents combined. Table 4.1 shows this information quantitatively.

Table 4.1: Response Rate

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents</td>
<td>35</td>
<td>94.6</td>
</tr>
<tr>
<td>KWS</td>
<td>1</td>
<td>2.7</td>
</tr>
<tr>
<td>Meteorological Department</td>
<td>1</td>
<td>2.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
4.1.2. Descriptive Characteristics

This section gives the detailed breakdown of the descriptive characteristics of the respondents such as gender, age, education, amount of time lived in the area and level of management.

Gender

62% of the respondents were male and 38% were female. This has been shown using Table 4.2 and Figure 4.2.

Table 4.2: Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>62</td>
</tr>
<tr>
<td>Female</td>
<td>38</td>
</tr>
</tbody>
</table>

Figure 4.1: Response Rate
Figure 4.2: Gender

![Gender Chart]

Age

Figure 4.3 and Table 4.3 both show in detail the age of the respondents. A majority of them being between the ages of 36 to 45 making about 35.1% of the respondents.

Table 4.3: Age

<table>
<thead>
<tr>
<th>Age</th>
<th>18-25</th>
<th>26-35</th>
<th>36-45</th>
<th>46-59</th>
<th>60+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>2</td>
<td>6</td>
<td>13</td>
<td>11</td>
<td>5</td>
<td>37</td>
</tr>
<tr>
<td>Percentage</td>
<td>5.4</td>
<td>16.2</td>
<td>35.1</td>
<td>29.7</td>
<td>13.6</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 4.3: Age
4.1.3. Agents and Drivers of Deforestation

Table 4.4 presents the agents and drivers of deforestation within the Kanam area.

Table 4.4: Agents and Drivers of Deforestation

<table>
<thead>
<tr>
<th>Agents</th>
<th>Logging, slash and burn by farmers, firewood collection and free range grazing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivers</td>
<td>Population increase, poverty and land tenure</td>
</tr>
</tbody>
</table>

4.1.4. Effects of Deforestation

The expected effect of deforestation was loss of biodiversity and to a large extent, change in climatic conditions.

Precipitation

Table 4.5 shows the daily total precipitation between 2004 and 2016. Data from this section was obtained from Kenya Meteorological Department, Kisumu Station.

Table 4.5: Daily, Total Precipitation

<table>
<thead>
<tr>
<th></th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUNE</th>
<th>JULY</th>
<th>AUG</th>
<th>SEPT</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>157.9</td>
<td>49.3</td>
<td>108.2</td>
<td>323.6</td>
<td>37.4</td>
<td>36.6</td>
<td>26.7</td>
<td>115.5</td>
<td>220.2</td>
<td>85.6</td>
<td>126.6</td>
<td>136.5</td>
</tr>
<tr>
<td>2005</td>
<td>92.0</td>
<td>53.2</td>
<td>142.7</td>
<td>169.2</td>
<td>308.3</td>
<td>50.9</td>
<td>55.2</td>
<td>81.7</td>
<td>34.6</td>
<td>82.8</td>
<td>90.8</td>
<td>5.4</td>
</tr>
<tr>
<td>2006</td>
<td>43.1</td>
<td>30.3</td>
<td>176.7</td>
<td>217.8</td>
<td>127.1</td>
<td>97.8</td>
<td>33.7</td>
<td>59.7</td>
<td>98.6</td>
<td>105.4</td>
<td>346.2</td>
<td>259.7</td>
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<td>2007</td>
<td>100.6</td>
<td>143.7</td>
<td>154.1</td>
<td>103.3</td>
<td>143.3</td>
<td>80.7</td>
<td>143.5</td>
<td>64.4</td>
<td>58.6</td>
<td>21.0</td>
<td>106.3</td>
<td>59.1</td>
</tr>
<tr>
<td>2008</td>
<td>27.9</td>
<td>48.2</td>
<td>101.6</td>
<td>115.1</td>
<td>165.2</td>
<td>67.0</td>
<td>165</td>
<td>70.9</td>
<td>145</td>
<td>205.1</td>
<td>84.1</td>
<td>35.9</td>
</tr>
<tr>
<td>2009</td>
<td>115.0</td>
<td>63.9</td>
<td>79.9</td>
<td>273.7</td>
<td>118.9</td>
<td>27.6</td>
<td>31.5</td>
<td>76.9</td>
<td>279.2</td>
<td>47.9</td>
<td>123.8</td>
<td>187.3</td>
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<tr>
<td>2010</td>
<td>96.9</td>
<td>110.5</td>
<td>175.5</td>
<td>324.4</td>
<td>210.5</td>
<td>27.3</td>
<td>14.0</td>
<td>138.4</td>
<td>158.1</td>
<td>63.4</td>
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<tr>
<td>2011</td>
<td>64.6</td>
<td>18.8</td>
<td>179.6</td>
<td>58.5</td>
<td>150.6</td>
<td>111.0</td>
<td>20.6</td>
<td>396.7</td>
<td>88.0</td>
<td>147.5</td>
<td>258.0</td>
<td>79.6</td>
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<tr>
<td>2012</td>
<td>0.0</td>
<td>43.4</td>
<td>95.0</td>
<td>309.0</td>
<td>131.2</td>
<td>115.5</td>
<td>37.2</td>
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<td>2013</td>
<td>54.2</td>
<td>31.3</td>
<td>238.4</td>
<td>203.0</td>
<td>99.6</td>
<td>63.7</td>
<td>35.9</td>
<td>93.0</td>
<td>151.4</td>
<td>77.9</td>
<td>102.1</td>
<td>135.0</td>
</tr>
<tr>
<td>2014</td>
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<td>29.5</td>
<td>178.3</td>
<td>66.8</td>
<td>99.1</td>
<td>99.1</td>
<td>97.8</td>
<td>177.9</td>
<td>8.6</td>
<td>142.2</td>
<td>106.0</td>
<td>137.6</td>
</tr>
<tr>
<td>2015</td>
<td>3.5</td>
<td>34.7</td>
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The precipitation patterns seem within the normal with highs and lows indicating periods of El Nino and La Nina which has been an occurring phenomenon that tends to be cyclic in nature.

Figure 4. 4: Daily Total Precipitation
Temprature

Table 4.6 gives the temperature maximum average that also seems to be within a constant not showing any significant change despite being high in general.

Table 4. 6: Temperature, Monthly Maximum Average

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The area with a great dip in temperature from Figure 4.5 can be explained by points of missing data.
Figure 4.5: Temperature, Monthly Maximum Average

Temperature lows, indicated by Table 4.7 and Figure 4.6 are also seemingly constant.

Table 4.7: Temperature, Minimum Monthly Average

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Within the relative humidity recorded at the standard times, there has been no significant changes within the ten-year period as indicated by Table 4.7 and Table 4.8.

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Figure 4. 7: Relative Humidity at 06Z

Table 4. 9: Relative Humidity at 12Z

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<td>62</td>
<td>52</td>
</tr>
<tr>
<td>2012</td>
<td>35</td>
<td>31</td>
<td>42</td>
<td>57</td>
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<td>55</td>
<td>53</td>
<td>53</td>
<td>46</td>
<td>53</td>
<td>55</td>
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<tr>
<td>2013</td>
<td>49</td>
<td>40</td>
<td>47</td>
<td>57</td>
<td>54</td>
<td>48</td>
<td>38</td>
<td>50</td>
<td>49</td>
<td>0</td>
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</tr>
</tbody>
</table>

Figure 4. 8: Relative Humidity at 12Z
4.1.5. Forest Restoration, Rehabilitation and Reclamation

Presence or absence of the wildlife that formed part of the ecology can give a bearing of what the original ecosystem of Kanam was like in its prime before destruction by humans and human activities. This would be due to the fact that the animals listed have a specific preference to certain habitats and its loss could lead to them moving due to the environment being unconducive. Knowledge of this can then advice to whether restoration, rehabilitation or reclamation can be possible. Table 4.10 presents the list of some of the indigenous trees that occupy or used to occupy the Kanam area. Their names are given in the local dialect.

Table 4.10: Indigenous Trees

<table>
<thead>
<tr>
<th>Indigenous Tree (Luo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ochol</td>
</tr>
<tr>
<td>Sangla</td>
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<tr>
<td>Otho</td>
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<tr>
<td>Powo</td>
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<tr>
<td>Ale</td>
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<td>Onera</td>
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</table>

Table 4.11 presents a list of animals that were very synonymous with the area. Some though absent such as the elephant, were spotted in the 1930’s, buffaloes, baboons, wild pigs, impala 1970’s. The baboons’ sightings have been made by the residents as most recent in 2018 March, which contradicts the information held by KWS. Elephants were linked in the early 1900’s to the tsetse fly invasion in Lambwe Valley thus their mass removal was instituted and this also led to a loss of other species. The species records by KWS are based on reports of human and wildlife conflict coupled with census conducted.
during the day. This then misses out on capturing of nocturnal and other animals within the list.

Table 4. 11: List of Animals

<table>
<thead>
<tr>
<th>Animal</th>
<th>Present</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bushbuck (Ngao)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Duiker (Mwanda)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Cape Hare (Apuoyo)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Baboon (Bim)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Spotted Hyena (Ondiek)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Eland (Abuor)</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Impala/Hartebeast (Nyakech)</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Hedgehog (Munglu)</td>
<td>✓</td>
<td></td>
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<tr>
<td>Porcupine (Chiew)</td>
<td>✓</td>
<td></td>
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<tr>
<td>Buffalo (Jowi)</td>
<td>✓</td>
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<tr>
<td>Leopard (Kwach)</td>
<td>✓</td>
<td></td>
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<tr>
<td>Monkey (Ong’er)</td>
<td>✓</td>
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<tr>
<td>Elephant (Liech)</td>
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<td>✓</td>
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<tr>
<td>Hippopotamus (Rao)</td>
<td>✓</td>
<td></td>
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<tr>
<td>Crocodile (Nyang’)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Porcupine (Fuko)</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

4.1.6. Sustainable Forest Conservation

It was noted that KFS on occasion has tried to plant trees within the area to no success according to interviews with the residents. KFS has also tried to have some sort of civic engagements with the residents to enlighten them on the benefits of trees and the need to conserve them.
4.2. Limitations of the Study

The study was limited by the fact that this was an undergraduate project which could not allow me to obtain some data. An example was with the Kenya Meteorological Department which only gave data of up to ten years for undergraduate studies as per their policy. The department also lacks a station in Homabay County which makes the data obtained a far reflection of the areas which are kilometres apart and experience different micro climates. No more information was provided to whether there existed the presence of volunteer weather stations from which data could be obtained increasing the accuracy of the study highly. It was not possible to obtain information from KFS since the nearest station was located in Maseno 132kms from the area of study and a limited budget and time to conduct the research.

4.3. Chapter Summary

The chapter has presented the response rate and the descriptive characteristics of the respondents especially the residents. It has also highlighted the agents and drivers of deforestation within the area, analysed the effects of deforestation. It has also given findings that can be used to determine the original ecosystem of the area hence determining the next possible step of either reclaiming, restoration or rehabilitation.
CHAPTER FIVE

SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

5.0. Introduction

This chapter highlights major findings of the study giving recommendations. The recommendations are tangible and include specific activities in achieving the them through implementation.

5.1. Summary of Findings

5.1.1. Agents and Drivers of Deforestation

Indiscriminate logging for commercial firewood at the lake for fuel for frying and preserving fish at the beaches has been a major challenge as no tree capable of producing firewood was spared. This was due to the level of poverty experienced by the residents and lack of income generating activities, logging for firewood was seen as the only alternative. The tree stumps that would also allow for regrowth of new trees are also not spared as these are also uprooted. The logging activities has been noted to be ongoing late at night or early mornings before arrival of the forest rangers.

5.1.2. Effects of Deforestation

There was no significant change to the weather patterns observed as the data was not specific to the area under study. It was noted however by the residents that there has been a gradual decline in rainfall and this was noted in the reduction of the number of planting seasons. The planting seasons have reduced from two to one. This was despite the existence of two rainy seasons that does not offer sufficient rainfall for farming. The residents also aware of the benefits of infiltration, said that when it rained, it was in torrents as opposed to drizzle which can be easily absorbed into the ground. Torrential
rainfall accompanied by strong gusts of wind has led to an increased surface runoff and erosion.

### 5.1.3. Forest Restoration, Rehabilitation and Reclamation

The biggest challenge has been on free range grazing, where animals feed indiscriminately on growing trees. This was because there was no one to watch over these animals as they were left to wander on their own. The residents were also seemingly not motivated to plant trees as they sighted a lot of obstacles in light of multiple options. The biggest being that they were unable to fence their lands to keep off the free range grain animals. Also the free range grazing has some bit of advantage as a phenomenon sited by Allan Savory was seen whereby the open pastures had green and blooming grass whilst the fenced areas were undergoing some yellowing indicating plant decay while still in the soil.

### 5.1.4. Sustainable Forest Conservation

On matters conservation of the existing parcels, residents suggested that they would want to be more involved in environmental conservation but at a fees. This was because the conservation required them to take their time away from other economic activities and they needed some compensation.

### 5.2. Recommendations

For any successful forest conservation and management program to be successful by the tasked institutions, an involvement of all the stakeholders will be prudent. The institutions should ensure that the residents buy in into the agenda and own it as opposed to have it imposed on them. Without stakeholder involvement, no matter how good the proposals, they will be thwarted by the residents. An example would be to hire the locals as forest rangers.
The involved institutions were many each performing important roles and it would be wise for all their data to be used to make sense of the whole picture of the area. Institutions acting as an island, are always at a disadvantage as they will only see as far as their capabilities can accord them. Seriousness should also be taken on matters of social research as they tend to be centred on the actual problems experienced by the common man. A revival and proper support of the research departments the institutions will be a step in the right direction.

Environment related institutions should seek to open up more stations within the country to ensure for more accuracy in terms of data collected. These stations should be well staffed and funded. The funding should not only be through the government or donors but they should be able to generate their own income. Staffing can also be through offering of internships so as to enable the young and energetic minds be absorbed into the system. Such stations could be in the form of volunteer weather stations in primary and secondary schools or university compounds.

Universities offering social sciences should consider taking up research on behalf of institutions based on project papers like this. This would help in ensuring that data contained by these institutions can be made sense of in a critical manner hence providing local based solutions. This would also help in boosting the status of our universities in the world as practical and not just theoretical. Such interactions can also help universities better their classroom experience for students and produce field ready students.

5.3. Conclusion

This research should not be taken as conclusive and gives room for furthering the conservation agenda in Kanam and Homabay county. There was great need to mitigate against the drivers of forestation and environmental degradation thus giving no excuse to
those who have been caught acting as agents. The drivers represent a social problem that cannot be ignored of poverty and development but finding a balance. The effects of deforestation and environment degradation was evident and should not be ignored until it is too late. Rehabilitation and restoration of the Kanam ecosystem will require the efforts of both residents and government.
REFERENCES


APENDIX I: LETTER OF INTRODUCTION

Ong’onge Allan Menya
Management University of Africa
BDS/7/00035/02/2014
Nairobi, Kenya.

11th January 2018

Dear Sir/Madam

RE: INTRODUCTION

I am Ong’onge Allan Menya a student from Management University of Africa pursuing an undergraduate degree in Development Studies. I am conducting a research on DEFORESTATION, DEGRADATION AND RESTORATION OF FOREST COVER IN HOMA HILLS KARACHUONYO-KANAM, HOMABAY COUNTY. I would like to distribute some questionnaires to you for the purposes of collection of the respondents’ basic data and thereafter conduct a short interview that will be used for academic purposes only. Your acceptance to this exercise and participation will be highly appreciated.

Yours Sincerely,

Ong’onge Allan Menya.
0724 538 469
APPENDIX II: RESEARCH QUESTIONNAIRES

The information given will strictly be used for academic purposes only and it will be treated with absolute confidentiality. Some questions will require actual data

SECTION A: GENERAL INFORMATION

Gender: Male ☐ Female ☐

Age: 18-25 ☐ 26-35 ☐ 36-45 ☐ 46-59 ☐ 60 and Above ☐

1. What is your highest level of education qualification attained?

None ☐ Primary ☐ Secondary ☐ Diploma ☐ Degree ☐ Masters ☐

Other (please specify) .................................................................

2. For how long have you lived in the area?

0-10 ☐ 11-20 ☐ 21-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61 and Above ☐

3. Level of management

Top level management ☐

Middle level management ☐

Operational level management ☐

4. What is your designation.................................................................

5. What is your working experience in the industry (years served)?

0-5 ☐ 6-10 ☐ 11-15 ☐ over 15 ☐
SECTION B: RESIDENTS

1. How frequently does it rain in Kanam?

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2. What economic activity do you undertake?
   - Growing Crops [ ]
   - Raising Live stock [ ]

3. What are the nature of the crops that you grow?
   - Grain [ ]
   - Vegetables [ ]
   - Fruits [ ]

4. How would you rate the ease of practicing farming in Kanam B, considering the environment conditions?
   - Very Easy [ ]
   - Easy [ ]
   - Fair [ ]
   - Difficult [ ]
   - Very Difficult [ ]

5. How would you rate the quality of produce that you get from farming on average?
   - Very Poor [ ]
   - Poor [ ]
   - Average [ ]
   - Good [ ]
   - Very Good [ ]

6. Which two livestock form the bulk of your livestock combined?
   - Cows [ ]
   - Goats [ ]
   - Sheep [ ]
   - Donkeys [ ]

7. Are you aware of the benefit of trees to the environment?
   - Yes [ ]
   - No [ ]

8. Has the number of trees in the environment reduced or grown in number?
   - Grown [ ]
   - Same [ ]
   - Reduced [ ]

9. Have you tried to plant trees?
   - Yes [ ]
   - No [ ]
SECTION C: WEATHER AND CLIMATE

1. What is the rainfall in Homabay/Kanam B during the following periods?

a) High

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<tr>
<th>Year-Period</th>
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b) Low

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c) Average

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2. What is the temperature in Homabay/Kanam B during the following periods?

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4. What is the dew point in Homabay/Kanam B during the following periods?

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5. What is the cloud cover in Homabay/Kanam B during the following periods?

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SECTION D: FOREST ECOSYSTEM

1. What is the forest cover of Kanam B/Kachuonyo/Homabay?

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<tr>
<th>Year</th>
<th>% Forest Cover</th>
<th>Forest Acreage</th>
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2. What is the greatest reason for forest loss in Kanam?


3. What are the methods used in forest clearance in Kanam?


4. What are the challenges faced in the conservation of the forest cover in Kanam?


5. What are the indigenous trees that grew in the area?


6. What are the trees species that can be planted in the area currently?


7. What are the sustainable forest management techniques used to conserve forests by KFS?


61
8. What is the possibility of the forest regenerating on its own?

9. What are the interventions that can be adopted to rehabilitate the area?

10. Have the residents of Kanam area been sensitized on the need to conserve the forest cover?

Yes □ No □
SECTION E: WILDLIFE AND RELATED ISSUES

1. What are the wild animals that currently inhabit Kanam area?

2. Has there been any species loss from the Kanam environment?
   Yes ☐ No ☐

3. If yes, what are the species that have been lost in Kanam area?

4. What would you consider to be the reasons for species loss?

5. Has there been any human wildlife conflict in the area?

6. What animals have been the greatest source of human-animal conflict?

-----------------------------------------------------------------------------------------------
APPENDIX III: INFORMED CONSENT FORM

Study Objectives
You have been appointed on behalf of the institution to participate in this study on the factors influencing special economic zones in Kenya. The study will involve a general information section that will collect your details and thereafter an interview that will require facts and your personal views on the economic zones.

Confidentiality
Views from the interview will be held strictly confidential and not divulged to anybody. All interviews will take place in a setting in comfortable to you that will ensure privacy and security. Your name and information collected based on personal views shall not appear anywhere. Information shall use a questionnaire, interview which can be recorded in voice and writing.

Risks and Benefits
No risks are anticipated as a result of taking part in the exercise.

Participation
Your participation in this exercise is voluntary and you may refuse to answer any question or participate in the whole process.

CONSENT
I have read and understood the above information and all questions pertaining to this research have been answered to the best of my knowledge. I also understand that by signing this consent form, I have agreed to participate in this voluntary study.

Name:...........................................................................................................

Signature:.................................................................................................

Date:..........................................................................................................