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THE ROLE OF ENVIRONMENTAL DIPLOMACY IN ADDRESSING  
DEFORESTATION BY THE SMALL HOLDER FARMERS IN MAU FOREST  
COMPLEX, KENYA

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A Research Project submitted in partial fulfillment for The Degree of Master of Arts  
in  
International Conflict Management

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## **DECLARATION**

I, Chemutai Irene hereby declare that this research project is my original work and has not been presented for a degree in any other University.

Signed..... Date.....

Chemutai Irene

## **CERTIFICATION AND APPROVAL**

This project has been submitted for examination with my approval as University Supervisor;

Signed..... Date.....

Dr. Shazia Chaudhry

## **DEDICATION**

To my dear family

## **ACKNOWLEDGEMENT**

I thank the Lord God for giving me His grace and strength that has enabled me to undertake this research. Special thanks go to Dr. Shazia Chaudhry, for the guidance and valuable assistance at each stage of this research. I also wish to acknowledge all those who assisted me towards the completion of this research work.

To my family, I express profound appreciation for their support and understanding during the entire duration of my studies.

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## **ABSTRACT**

With the increase in population growth there has been spiralling demand for land for plantations and other forms of agriculture. Conversion of forest to agriculture, industrialization and the spread of infrastructure have collectively been identified as principal drivers of deforestation by most forest conservation workshops. The review of the literature suggests imminent human activities have led to deforestation and forest degradation. Mau forest being one of the largest forests in Kenya had been the center of attention due to the continuous encroachment of the forest land by the communities around the forest. The general objective of the study therefore was to establish the causes and impacts of deforestation by small holder farmers in Mau forest, to determine the environmental effects of deforestation by small-holder farmers in Mau forest and to establish the role of environmental diplomacy on reducing deforestation by small holder farmers in Mau forest. The study is anchored on Neo-Malthusian Theory and Scarcity Theory. The study used descriptive research design. The target population of the study was 3 Kenya Forest Service Managers from each of the 3 forest stations and 164 small-holder farmers in the Mau Forest. Interview guide and semi-structured questionnaires were the research instruments used to collect primary data. Descriptive statistics including measures of central tendency and dispersion were used to analyses the data. In addition, regression analysis was used to study the relationship between deforestation of Mau forest by small holders' farmers and environmental influences. Results were presented using tables. The findings of the study revealed that majority of the people living around Mau forest lack proper education which limits their ability to acquire employable skills to be employed in other sectors of the economy other than depending on the forest and its resources for their livelihood. Deforestation was found to have major effect on ecosystem by slowly turning the tropical zones into deserts, depletion of water resources, leads to climatic change that affect agricultural by lowering the yields and the gross domestic product of the country. In addition, environmental diplomacy was found to have significant effect on reducing deforestation by small holder farmers. The study recommends that on creating awareness to the small-holder farmers on the devastating effects of deforestation as well as trains them on better farming practices that will not lead to encroachment of forest land. The government also need to fast track on land reform policies to ensure that those living around Mau forest are resettled soonest possible. Further all the relevant ministries should embark on environmental diplomacy as a strategy to curb deforestation by people living around Mau forest. The study suggests that future researcher should focus on challenges affecting environmental diplomacy approach as a means of curbing deforestation in Mau forest.

## CHAPTER ONE

### INTRODUCTION TO THE STUDY

#### 1.1 Background of the Study

Kenyan economy whose dominant activity is agriculture with unique natural ecosystems is supported directly or indirectly by forest ecosystems that provide a constant movement of important goods as well as services<sup>1</sup>. Crucial water catchments are characterised by closed forests that harbour a big size of Kenya's biodiversity between these forest major blocks are the Mau complex, Mt. Kenya, the Aberdare, Mt. Elgon and Cherangani Hills. The key Water towers in Kenya originate from these mountains .More than 70% of the electric power in Kenya arises from the hydro-electric power. These forests cause amplified precipitation during the rainy season to guarantee permanent river flow even in dry seasons. Mau forest is the largest water reserve in Kenya which stores rain water during the wet seasons which is utilized during the dry seasons.

The depletion of Mau complex by settled small-scale farmers in the forest have had an antagonistic consequence on the volume of water bodies and the experts have warned against continuous ruining of Mau forest that may lead to a catastrophic environmental damage that may reduce the amount of rainfall thereby affecting crop production thus affecting food security in the country that may affect the livelihood of millions of Kenyans .The Mau Forest Task Force recognized the time between 1996 and 2005 to have undergone the greatest forest cover damage in the country. It used to cover 400 thousand hectares, but 100 thousands of these have been expropriated. But more than 100,000 hectares which accounts to one quarter of the protected forest

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<sup>1</sup>Beentje, Ihlenfeldt, H.D. and H.J. (1990) The forests of Kenya. *Mitteilungen aus dem Institut für Allgemeine Botanik Hamburg*, **23**, 265-286.



reserve has been cleared and settled over the last 15 years. The cutting of trees has led to the occurrence of drought in the surrounding hills and valleys<sup>2</sup>.

To address the global concern on deforestation and forest degradation, in 2014, the European Commission (EU) invited member states, international organizations, third countries, NGOs, private sector and research organizations to discuss and develop future strategies relating to the issue of deforestation. The dares of deforestation and forest degradation cut through several policies. Safeguarding policy consistency via a clear, coherent tactics and intensive act of diverse participants is crucial. The African Union distinguishes woodlands and forests as significant resources for inspiring the continent from scarceness, particularly with respect to food, energy, timber, a wide range of environmental services and non-timber forest yields that reinforce ecosystem utilities in the care of agricultural efficiency as well as sustainability. Over the recent past, Kenya taken steps to reduce forest degradation and deforestation by participating in international forest dialogues in order to adopt international approaches that promote sustainable forest management at national and local levels<sup>3</sup>.

Environmental diplomacy is needed now more than ever. Diplomatic exertions and political appointment at all stages have a significant contribution in nurturing the outline of sustainable land-use agenda and deforestation contests. Exertions are required on relying messages regarding forests, to warrant that their part does not decline from civic outlook and that forest policy and their associations with other policy fields make a great contribution in policy debates. While there are noted

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<sup>2</sup>Obare, L. (1998) Underlying Causes of Forest Degradation and Deforestation in Kenya. World Forest Movement.

<sup>3</sup>IIED, Sustainable Development Goals and Forest. IIED, UK.IIED, (2014c. p. 39).

failures originating from the past processes, forests depletions has slowed, ozone depleting chemicals have reduced and the world has generally stopped using leaded gas with the exception of only three countries (Afghanistan, North Korea and Myanmar). Focus has now shifted on forests which have several environmental impacts such as the regulation of the hydrologic cycle, prevention of soil erosion, preservation of biodiversity and mitigating climate change. However, despite the efforts environmental activism and awareness, it is obvious that there is still increased depletion of forests in the areas covered by tropical rainforest and the rate of destruction of the tropical rain forest is also rising worldwide<sup>4</sup>.

The Constitution provides for concessions to natural resources including forest concessions in Article 71(1), subject to ratification by parliament. Article 174 provides for the objects of devolving national government functions while schedule 4 provides for the devolution of forestry functions. Increased forest cover is one of the targets of the Kenya's Vision 2030. Vision 2030 seeks to transform Kenya into a middle-income nation assuring all its citizens a high quality life by 2030. Vision 2030 is implemented in subsequent five-year medium-term plans. It places the environmental sector in the social pillar and emphasises the need to conserve natural resources to support economic growth. In forestry, the goal is to increase forest coverage and ensure sustainable management of natural forest resources so as to ensure environmental protection and boost economic growth<sup>5</sup>.

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<sup>4</sup>Ndegwa, L. W. Monitoring the State of Mt. Kenya Forest through use of Multi-Temporal Landsat Data .Department of Geography .(Phd Thesis, Miami University Oxford, Ohio, USA, 2015).

<sup>5</sup>RoK, Ministry of Environment and Natural Resources in August 2016 .National Forest Programme 2016-2030.

## 1.2 Statement of the Research Problem

Deforestation is a major concern in the East Africa region including Kenya as communities around the forests which are the major water catchment areas continue encroaching into the forest land<sup>6</sup>. In Kenya, drivers of deforestation vary in magnitude and forest type. They also vary in environmental, social and economic contexts. Most people live in high and medium-potential agro-ecological zones suitable for agriculture and most forests with closed canopies are also located here. Agricultural expansion and urbanisation are the main causes of degradation and deforestation. Despite the benefits attributed to preserving the forest cover and afforestation to increase forest cover on improving the economies of the country<sup>7</sup>, perennial drought, poor rainfall and poor crop yield is evidence that Kenya is currently facing an environmental crisis due to heavy deforestation<sup>8</sup>.

In Kenya, these drivers are clearly mirrored on governance that involve inadequate application of basic silvi-cultural and ecological principles for forest management and the Tragedy of the commons resulting in conflicts over natural resources; policy drivers- relating to overgrazing and inadequate regulation of grazing in forest reserves and community lands; Economic drivers characterised by clearing of forest for agriculture, degradation of forest, charcoal and fuel wood from unsustainable production, infrastructure and urbanisation, conversion of communal forest to agriculture, mining within forest areas and illegal logging; and Technology drivers that include unsustainable utilisation, including overgrazing, conflict at multiple

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<sup>6</sup>Ochieng, R.M. A review of state degradation of the Mau Forest and how it can be mitigated. (GRIN: Find Knowledge, 2014)

<sup>7</sup>Ndegwa, L. W. Monitoring the State of Mt. Kenya Forest through use of Multi-Temporal Landsat Data. Department of Geography. (Phd Thesis, Miami University Oxford, Ohio, USA, 2015)

<sup>8</sup>William, C. M. The implications of changes inland use on forests and biodiversity: a case of the "half mile strip" on Mount Kilimanjaro, Tanzania. 2013 LUCID Working Paper. International Livestock Research Institute, Nairobi, Kenya.

levels, fires are deliberate, accidental, poorly managed and they destroy forests and wildlife damage impacting regeneration. The result has been climate change that has had adverse effects, not only to the areas around the forests but to the whole country<sup>9</sup>. Despite the benefits attributed to preserving the forest cover and afforestation to increase forest cover on improving the economies of the country.<sup>10</sup>

Although environmental diplomacy enshrined in new policy, National Forest Policy 2014, has been put into place to control the deforestation and manage Kenyan forests, minimal results have been achieved so far celebrated as a progressive policy in managing deforestation and addressing the gap in the previous legal and policy frameworks. However, communities around the forests engaging in subsistence farming and other deforestation agents continue destroying forests due to lack of awareness and compliance to the policy. This has been further exacerbated by lack of sufficient information on the exact levels of deforestation, the economic and social impacts of the same. There is a big potential to increase timber production by individual farmers on their farms, but small-scale farmers without having an umbrella organisation have limited possibilities to add value to their tree growing and processing. Individual farmers working on their own have limited access to market and price information, no bargaining power to benefit from economies of scale, high transportation and other costs as well as limited access to recent technologies from forests to markets. With limited sales quantities, there is neither an incentive to go for further processing, such as sawn wood and treated poles production, nor to fully benefit from integrated logging and use of different size logs and residues. The study for Mau forest by the Gatsby Charitable Foundation shows small-scale tree farmers

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<sup>9</sup>William, C. M. The implications of change in land use on biodiversity and forests: a study on the "half mile ILRI, Nairobi, Kenya.

<sup>10</sup>Ndegwa, L. W. Monitoring the State of Mt. Kenya Forest through use of Multi-Temporal Landsat Data. Department of Geography. (Phd Thesis, Miami University Oxford, Ohio, USA, 2015)

have many options along the value chains, but for economies of scale an umbrella organisation is needed to provide better extension services, negotiation powers and inputs availability <sup>11</sup> . Consequently, this study aims at assessing the role of environmental diplomacy in addressing deforestation by smallholder farmers in Mau forest, Kenya.

### **1.3 Research Questions**

The study aims at answering the following research questions

1. What are the causes of deforestation occasioned by smallholder farmers in Mau Forest, Kenya?
2. What are the environmental effects of deforestation caused by small-holder farmers in Mau forest, Kenya?
3. What is the role of environmental diplomacy in minimizing the environmental effects of deforestation by small scale farmers in Mau Forest, Kenya?

### **1.4 Objectives of the study**

The main aim of the study is to establish the role of environmental diplomacy in addressing deforestation by smallholder farmers in Mau Forest complex, Kenya.

#### **1.4.1 Specific Objectives**

The specific objectives for this study are:

1. To assess the causes of deforestation by smallholder farmers in Mau Forest, Kenya.
2. To determine the environmental effects of deforestation by small-holder farmers in Mau Forest, Kenya.

3. To investigate the role of environmental diplomacy on reducing deforestation by small-scale holder farmers in Mau Forest, Kenya.

### **1.5 Literature Review**

International Environmental Diplomacy issues originate from Brunt land Report, Stockholm UNCHE, Rio Earth Summit UNCED 1992; with the recognition that global cooperation is needed to solve the identified diversity problems and the transboundary environmental problems related to the protection of common resources (endangered species, fisheries, forests, rivers and other transboundary resources. The global environmental concerns include climate change and sustainable development goals (SDG).The diversity actors are diplomats, environmental action Apart from the inefficient utilization of natural resources (food wastes, ineffective bio-energy) exerts more pressure on the forests<sup>12</sup>.

The biodiversity environmental components entail forest conservation to maintain water, soils, and major wildlife habitat. In Kenya the forest ecosystem supports the main sectors of the economy namely agriculture, power generation, tourism and industrial growth. The recent past in Mau forest has seen its exploitation and depletion without its protection by communities surrounding the forests hence threatening the water tower of our country<sup>13</sup>.The increase in human population has resulted in the decline of the Mau forest over the years caused by human population increase. This has resulted in increased demand for agricultural land, poor management of forests,

both legal and illegal logging, inadequate information on the benefits of conserving forests by the communities, forest fires especially during dry spell <sup>14</sup>.

The world rural poor populations depend on environmental resources. Income generated from the natural forests resources represents 28% of total household income living in the rural setup which is sometimes greater than the intercropping contribution. Forests hold peoples ways of life, spirituality, identity. Forest resource depletion affects negatively the communities living and dependent on forest products like the Ogiek community in Mau forest<sup>15</sup>. Forest degradation and deforestation are significant results in global warming, accounting for a minimum of 20% of greenhouse gas emissions globally <sup>16</sup>. This makes the depletion and loss of forests a fundamental issue for climate change mitigation and adaptation<sup>17</sup> Eighty per cent of the Earths above-ground terrestrial carbon and 40% of below-ground terrestrial carbon is found in forests. Consequently, combating forest degradation and deforestation has been viewed as one of the efficient ways of lowering carbon emissions. The international community is moving towards a system that will provide incentives for curbing the emissions brought about by deforestation, degradation and other forest land-use changes<sup>18</sup>.

Deforestation is an outcome of a difficult collaboration of number controllers, where a few are extremely context-specific. Inclusive however, increasing per capita depletion and demographic growth are the key controlling powers. Development of profitable as well as subsistence agriculture is extremely the utmost significant driver of

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deforestation - current as well as upcoming. Most upcoming forest conversion to other land uses will happen in Africa and Latin America<sup>19</sup>.

### 1.5.1 The Mau Forest Complex

The major geomorphologic topographies of the Mau forest composite involve the hills, escarpments, rolling land as well as the plains (Figure 1). The forest mainly constitutes of rolling land topography with slopes ranging from 2% in the plains to above 30% in the foothills. Geological previous researches indicated that the area is mostly comprised of tertiary and tertiary volcanic deposits<sup>20</sup>.

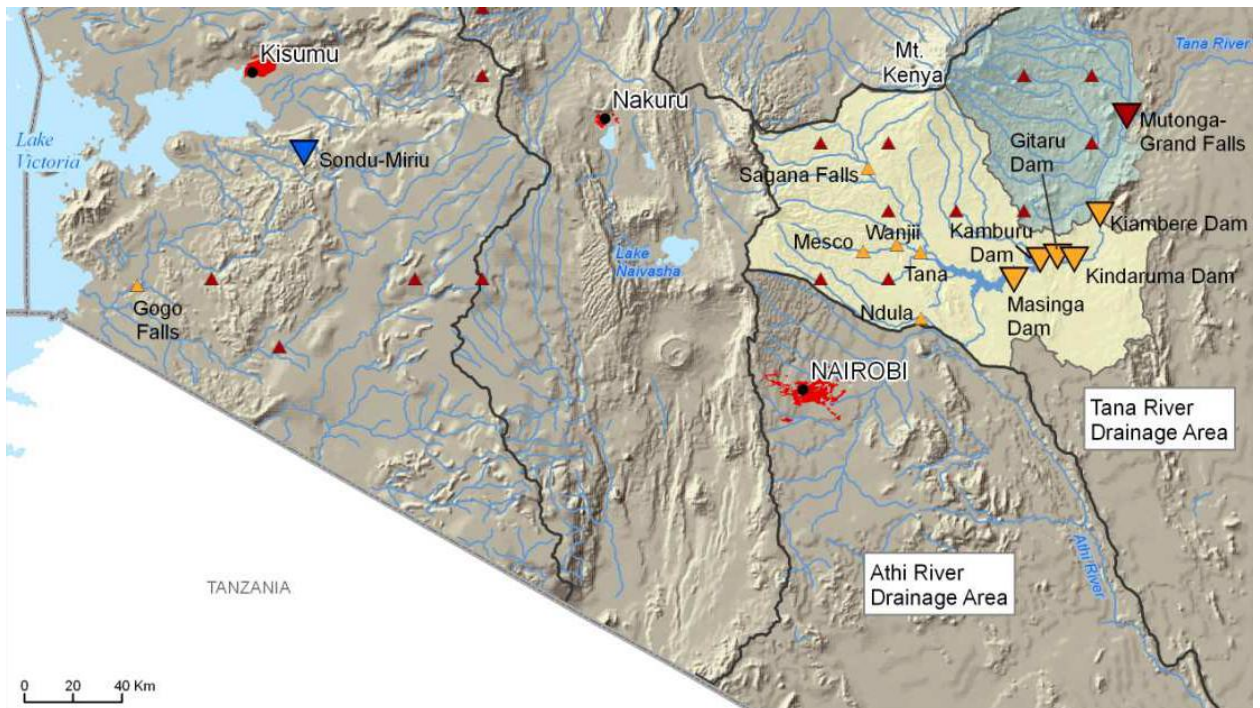


Fig. 1. Physical features, including the Mau Forest Complex drainage network (World Resources Institute, 2007).



### **1.5.2 Causes and effects of deforestation in Mau forest, Kenya**

The principal agricultural uprising about 8,000 years back transitioned people from their known life style of hunting and gathering to crops farming as well as livestock keeping, a life style that resulted in the destruction of natural environment and forests to give in food for use. With a population of over 7 billion people globally, Agriculture is attributed to 71% of global steamy deforestation. The forest coverage in the world is soon going to be rare, hence provoking conflicts in the communities. Agriculture stands the chance of being the key provider of climate adjustment as the invention and intake of food is accountable for nearly a fifth of the production generated from the greenhouses. The worldwide inhabitants is planned to develop to over 9 billion persons by 2050 thereby increasing insist for foodstuff to increase by more than 60% to sustain human life of global diet of their need<sup>21</sup>.

In the previous decade, about 13 million hectares of forest went out of existence annually, a part corresponding to spinning the equator with football ground placed nearly end to end 47 times over<sup>22</sup>. Between 2000 and 2012, profitable agriculture was the contributor of the forest loss which accounted for 71% of the worldwide tropical deforestation<sup>23</sup>. Deforestation contributes to about 12% of the global carbon dioxide secretions<sup>24</sup>. Ending deforestation is considered the most inexpensive climate resolutions and is vital to gathering the globally approved objective of preventing global warming to less than 2 degrees Celsius. Also assist in guarding our planet's most biodiversity ecosystems<sup>25</sup>. Developing signal also shows that large forest sections, such as the Amazon, control rainfall and that trailing these forests may

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weaken global foodstuff making<sup>26</sup>. The repercussions are clear with world-wide agriculture is on the indefensible path. Unless a main conversion is undertaken on how possessions are formed, deforestation will hasten to offer extra agricultural land to feed the growing middle class, which will in turn create more revenue variation, prejudice, global warming, and biodiversity failure. Since the possibility for change is inevitable the same is already witnessed happening<sup>27</sup>.

Forest covers about 30% of the entire earth which is nearly 3.9 billion hectares. This compared with the initial rate covered by the forest which was about 6 billion hectares<sup>28</sup>; is an indication of a slow but steady decrease in forest cover. Among the 64, 16 had fairly a significant forest cover of over one million hectares both but they have lost it over the past decades. Countries like Chad, Mongolia and the Islamic Republic of Iran had over ten million hectares of forest which have reduced to slightly above one million hectares. The forest area that have lingered rather stable only in Central and North America, and same extended in Europe in the precedent decade. Also assist in guarding our planet's most biodiversity ecosystems<sup>29</sup>. The repercussions are clear with world-wide agriculture is on an indefensible path. The prolific region that contributes nearly 20% of the state's area is actually the average and high probable agro-ecological regions and is beneath agriculture, nature minerals and forests. Based on the 1990 Forest Resource Assessment (FAO), Kenya is categorised amid the states that has small forest area which is below 2% of the entire area of the land.

The diminishing forest cover up have a Spartan result on the climate, wildlife, and streams, social inhabitants particularly forest dwellers<sup>30</sup>.

The Mau Forest Complex is made up of 22 distinct masses and is the main of the state's five water towers forest covering about 403 775 ha. It supplies a series of the state's main water channels that lengthen from Lakes Turkana, Natron and also Victoria which has a greater sustainability over the most important financial making activities like the production of hydropower, hospitality as well as tourism and agriculture. Regardless of its state's general status, a larger portion of the forest has been destroyed and tainted, just within the recent past few decades. A lot in this harm has occurred in the recent past. Due to the persistence of elimination of forest treasury as well as constant extensive encroachment, over 100 000 ha of forest has been destroyed since 2000, representation of about one-quarter of the Mau Complex area<sup>31</sup>.

Due to an existence of an escarpment, the flora in the Mau forest is different at various altitudes. It is observed that, the Rainfall in some areas like the western side is high and constant with no dry on spell, and having an average yearly rainfall of about 2,000 mm. Different the western side, in the sheer slopes of the escarpment, featured by a blend of evergreen, a moist Montane Forest, deciduous and semi-deciduous trees is witnessed. The common canopy altitude in this escarpment is approximately 20 meters. The most common types of tree in this area are *Cyatheamanniana*, *Enseteentricosum*, *Acanthus eminens* and *Lobelia gibberoa*. Also assist in guarding our planet's mainly biodiversity ecosystems<sup>32</sup>. Developing signal also shows that large forest sections, like the Amazon, control rainfall and that trailing these forests may

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weaken global foodstuff making<sup>33</sup>. The repercussions are clear with world-wide agriculture is on an indefensible path. The prolific area which is approximately 20% of the Kenya's land coverage which is actually the high probable agro-ecological regions and is beneath agriculture, nature reserves and forests. This forest also comprises mainly of *Juniperusprocera*, *Hypericumrevoltum*, *Oleacapensis*, *Podocarpuslatifolius* and *Dombeyagoetzeni*. Also assist in guarding our planet's most biodiversity ecosystems<sup>34</sup>.

The main large wild animals available in the forest area are mainly Bongo, Golden cat, Yellow backed Duiker, Leopard, Giant forest hog, Buffalo, Hyena, Colobus Impala and Monkey. The Bongo, Yellow backed Duiker, Elephants and Leopard are a number of the imperative mammals of global maintenance concern. The other nationwide vanishing genus establish barely in this forest are for instance the Porto the striped Hyena and the spotted Necked Otter.

Not only the forest rich in a number of species, but also rich in a range of birds acquiring the second rank amid of the forests west of the Rift Valley. No prevalent bird types exist in this forest although it portrays the most endowed montane avifauna in the whole of Eastern Africa. Nearly 173 geniuses have been seen in the forest<sup>35</sup>.

The Mau forest is the habitat of the major set of forest inhabitant, commonly known as the Ogiek. Since ancient period, the Ogiek community have been dwelling within the Mau forest, with the forest being their main source of survival as well as housing. Just like the other people, the community share the forest amongst themselves, using

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<sup>35</sup>Obare L.&J. B. Wangwe, Underlying Causes of Forest Degradation and Deforestation in Kenya. Kenya, html

the natural landmarks like rivers, valleys and hills to their limits. In the period 1904-1918, the colonial administration attempted to expel the public out of the forest, although with no achievement. In the year 1932 the forest area was gazetted whereas these individuals dwell in the forest. As a result of the gazetting of the forest by the colonial people, the community was forced out again, but this time round, the action was in vain, since the forest dwellers moved even deeper into the forest due to lack of communication.

They understand very little about their credibility. It was unheeded of for the administration to ask for the communal and said that one administrative official who irritated in 1935 was reprimanded and dismissed by the senior<sup>36</sup>. The postcolonial administration didn't change its feelings for the Ogieks people. It tried to expel the people in 1972 as well as 1977/87 expulsions, the regime taught the persons to assemble everywhere in the forest place for them to be relocated away in the short coming days.

A minor fraction (about 25%) adopted this whereas others moved deeper into the forest. In 1972, the administration thrived in expelling the persons though most of them relocated back into the forestry after only six months. The local management then estranged that the portion of the forest rehabilitated into estate forest, divided it into plots of five acre each hence assigned them persons. The forest dwellers, commonly called the Ogiek, said that the people given the small portions of five acres are not the original Ogieks, but just the migrants that are living near the forest area. In this era, the forest was already gazetted and in the management of the forest section.

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<sup>36</sup>Peter Wass, 1995. *The indigenous Forests in Kenya: Status, Management and Conservation*.

The forest section was not convoluted in the vibrant destruction of the forest as well as the distribution of the land<sup>37</sup>.

The groups living around the forest as well rest on the forest particularly throughout the dry spell. A case study conducted in Njoro area East of the Mau forest specified that the cultivation in this zone exploit the estate region to produce food crops particularly vegetables throughout the dry periods<sup>38</sup>.in the recent days, it exist a deleterious conservational effect on the forest subsequently the vibrant destruction started, hence thriven in expelling the persons. These groups hence, started keeping livestock in 1952.

The Forest riches contributed a high moral for the Ogieks to strongly conserve the forest, hence taking it a very significant resource for them. It was found that, at whatever time this group inhabited the forest, they employed their habitual team to conserve it. To achieve the forest appropriately the Ogieks assigned obstruct of forests to tribes to inhabit. The forest regions were initially engaged by a clan which shares it base on the household tree. Each household provides a designation to their portion of forest, for proof of identity as well as understanding of other people and traditions admiration for borders; the limits were acknowledged<sup>39</sup>.

### **1.5.3 Causes of Deforestation**

There are a number of reasons why the Mau forest has been destroyed. Of the causes of this, the main reasons of deforestation in Mau forest are discussed below:

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<sup>37</sup>Ministry of Environment and Natural Resources, 1994. Kenya Forest Master Plan

<sup>38</sup>Michael Ochieng Odhiambo, 1998.Policy Dialogue Series No.1. & 2.

<sup>39</sup>Obare L.&J. B. Wangwe, Underlying Causes of Forest Degradation and deforestation in Kenya. Kenya, html

### **1.5.3.1 Persistently high demand for wood**

Extraordinary claim for timber is a conspicuous and obstinate cause of deforestation. Global request is mainly produced by over-consuming developed states, but local request can as well be higher, mainly in those states in which timber is largely and simply opened reserve. Wood is typically used for furniture construction, house-building, paper and fuel. Yet there is scant signal of national or global rules intended to talk and diminish claim for timber as ways of tumbling deforestation<sup>40</sup>.

Collective call was explicitly quoted as a fundamental reason for deforestation by the workspaces in Bangladesh, Ecuador, Cameroon, the Philippines and Papua New Guinea. El Salvador, for instance piercing to the trade of timber to sawmills, and Nepal noted an amplified figure of furniture industrial units.

The main Logging corporations in Kenya, Comply and Timsales, are located in the following centres and towns; Nakuru and Elburgon correspondingly, on the limits of the forest. Logging is the major financial generating business in Elburgon and employs about 30,000 people. The giant firms assemble wood use for trade, whereas hundreds of moderate loggers provide the native sell in towns like Molo town, Nakuru, and Elburgon as well as neighbouring towns<sup>41</sup>.

### **1.5.3.2 Spiralling demand for land for plantations and other forms of agriculture**

Agriculture is estimated as the proximate driver for around 80 percent of deforestation in the world. The most important driver of deforestation in Latin America (around 2/3 of total deforested area) is for commercial agriculture. In Africa and sub-tropical Asia

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<sup>40</sup>. Ministry of Planning and National Development, ( 2008 – 2012) Government of Kenya (GoK), Nairobi.

<sup>41</sup>GoK (2009).Report of the Government’s Task Force on the Conservation of the Mau Forest Complex.

it accounts for around 1/3 of deforestation and is of similar importance to subsistence agriculture. Conversion of forest to agriculture, primarily to produce food for export to industrialized countries, also continues apace in many countries around the world, with devastating impacts. Crops traded in large volumes, such as soya (which is used in foods, as animal feed, and now to produce biodiesel to fuel vehicles) require more and more land for cultivation, leading to the destruction of large tracts of forest in places such as the Amazon. Less well known instances that were also reported include the ginger cash crop in the Chittagong Hill Tracts; and the production of coca (used in cosmetics and food as well as to produce cocaine) in Colombia<sup>42</sup>.

### **1.5.3.3 Industrialization, urbanization and infrastructure**

Industrialization, urbanization and the spread of infrastructure have jointly been recognised as chief drivers of deforestation by utmost forest preservation workshops. Whilst the growth of needy financial prudence is obviously precarious, there appears to be actual diminutive signal of any move in the direction of forest-friendly economic expansion, in spite of requirements and anxiety from wedged groups, immigrants and public society groups. The trade segments in the country most clearly recognized as an actual risk to forests were mining, gas and oil, especially in Cameroon, Bangladesh, India, Columbia, Papua Collective call was explicitly quoted as a fundamental roots of deforestation by the workspaces in Cameroon, Bangladesh, the Philippines and Papua New Guinea, El Salvador, for instance piercing to the trade of timber to sawmills whereas Nepal noted an amplified figure of timber production industrial units. The administration thriven in expelling the persons though most of them relocated back into the forestry after only six months. New Guinea and the

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<sup>42</sup>GoK (2008c).Kenya Vision 2030.Sector Plan for Environment, Water and Sanitation.



Philippines. Infrastructure, like housing, building of roads, housing, dams as well as other large-scale building is an extra prime cause of deforestation. Urbanization which involves growth and expansion of urban centres is a major cause of forest loss.

#### **1.5.3.4 Encroachment and illegal logging**

Ordinarily, 5,000 ha of forest vanished annually in Kenya over unlawful logging, infringement, elimination for reimbursement of persons and cultivation. In 2001, the removal of 67 000 ha of forest was reasonable as desired to resolve landless Kenyans and persons internally expatriated by political chaos. This elimination though caused in a major commotion of the purposes the water towers in Kenya. Unlawful timber gathering is as well extensive because the logging ban isn't sufficiently obligatory, emphasising the essentiality of increase the volume of Kenya Forest Service to do so<sup>43</sup>.

#### **1.5.3.5 Vulnerability to climate change, pests and diseases and fires**

Forests and woodlands are predominantly susceptible to change of climate. World environmental bodies have developed robust policies to mitigate deforestation which are rarely adopted especially in developing nations. In Kenya for example, though had amended policies directed to management of forests by introducing the National Forest Policy 2014, minimal results have been achieved due to lack of awareness and familiarity with the policy. Forests and woodlands are particularly vulnerable to climate change. This is because the impacts of climate change and variability lead to changes in land cover and land use, increase the incidence of pests, diseases and fire

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<sup>43</sup> 2008 – 2012. Ministry of Planning and National Development, Government of Kenya (GoK), Nairobi.

outbreaks and foment loss of livelihoods. Monoculture forest plantations are especially prone to pest attacks and an exotic pest known as blue gum chalcid is currently threatening eucalyptus trees in Kenya. First reported in western Kenya in 2002, it has now spread to most parts of the country. This pest is native to Australia and research to develop integrated management approaches (including biological measures) that can bring it under control is underway<sup>44</sup>.

An estimated 3,000 ha of state forests are lost to fires annually in Kenya. These fires are either spread accidentally from neighbouring private farms or are started deliberately as an act of sabotage. It is therefore recommended that a participatory approach to formulating and implementing forest policies and projects is adopted in order to ensure local community support<sup>45</sup>.

#### **1.5.3.6 Weak policy formulation and enforcement**

The main drivers of deforestation in Kenya are as a result of weak enforcement of rules governing the forest, as well as a poor institutional capacity. Weak policy formulation and implementation on Mau forest by the actors is positively identified as an additional cause for the deforestation. Also the interest of the politicians, by giving their supporters portions of the forest for their political investment accelerates the rate of deforestation. Macro-economic policies, such as rising exports; Structural change;

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<sup>44</sup>FAO 2009.State of the World's Forest 2009.Rome, Food and Agriculture Organization.

<sup>45</sup>GoK (2009).Report of the Government's Task Force on the Conservation of the Mau Forest Complex.

resident's force as well as trade liberalization equally contribute to Mau deforestation<sup>46</sup> .

Policy frameworks for management of forests have also been a topical concern as forest policies fail to meet the intended objectives. World environmental bodies have developed robust policies to mitigate deforestation which are rarely adopted especially in developing nations. In Kenya for example, though had amended policies directed to management of forests by introducing the National Forest Policy 2014, minimal results have been achieved due to lack of awareness and familiarity with the policy. The communities around forests are still compliant to the previous policy which is seven decades old a creation of the colonialists. The policy denies a wide choice of community involvement and endorsement in its resolution making progressions, doesn't encourage long term forest administration, does not give room for collaborative forest management, more concerned with control and distribution rather than management, and fails to take into consideration the lifestyle of the forest cohabitants. It further fails to clarify issues of forest resource ownership, accessibility, mechanism for civic endorsement as well as rectify in its legal and secretarial measures. The strategy was passed by the Forest Act which gives a lot of authority to the Minister for Natural Resources. While the current policy, National Forest Policy 2014, addresses the shortcomings inherent in previous policies, it has been adopted and the communities around forests are not fully aware of the legal and management frameworks therein<sup>47</sup> .

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<sup>46</sup>The Underlying Causes of Deforestation and Forest Degradation (2010):A Case Study of the Mau Forest in Kenya

<sup>47</sup>Kenya, Ministry of Environment and Natural Resources. (2016). National Forest Programme of Kenya .MENR, Nairobi, Kenya.

#### **1.5.4 Effects of Forest Degradation and Deforestation in Mau forest by small-scale farmers**

The expansion and intensification of agriculture have significantly reduced the coverage of woodland and forests, broken forest areas into smaller isolated fragments and shortened the structure of the remaining forests. The significances of these variations seen both off-site and on-site include the following: The communities around forests are still compliant to the previous policy which is seven decades old a creation of the colonialists. The policy offers a limited public participation in the decision making processes, and lays more emphasis on the control and distribution instead of the actual management, do not promote sustainable management, fails to consider the lifestyle of the forest dwellers and avails no avenue for collaborative forest management. It also ignores matters regarding forest resource ownership, mechanism for public redress and approval in its administrative and judicial procedures. Once the cumulative effects carbon is released into the soil organic matter and biomass there will be global-climatic change in the long-run. These biophysical variations have both economic and social implications, with the communities that are highly dependent on forests as source of livelihood being affected the most. Forest resources are a source of firewood, food and medicines which currently have to be acquired from forests that are further away. The congestion in the forest areas being occupied exerts pressure on the remaining forests<sup>48</sup>.

The previous research conducted in Mau have shown the association between deforestation and the rate at which forest degradation occurs, but the impact on the

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<sup>48</sup>2008 – 2012. Ministry of Planning and National Development, Government of Kenya (GoK), Nairobi.

quality of water and the effect on tourism as a result of the migration of the flamingos.

Lake Nakuru is the home to various flamingos.

The encroachment of the Mau forest has led to drastic land fragmentation, destruction of wetlands previously existing within the fertile upstream parts and deforestation of the headwater catchments. The global environmental concerns include climate change and sustainable development goals (SDG). The diversity actors are politicians, diplomats, environmental action groups, journalists and scientists who need to establish synergies. The inefficient utilization of natural resources (ineffective bio-food wastes, energy) exerts more pressure on the forests. Consumption patterns are not influenced by policies<sup>49</sup>.

The biodiversity environmental components entail forest conservation to maintain water, soils, and major wildlife habitat. In Kenya the forest ecosystem supports the main economy sectors namely tourism, agriculture, industrial growth and power generation.

Influences of deforestation of Mau forest on agricultural actions on Lake Nakuru are clear when forest cover attached to the soil in a lake basin is demolished, resulting to a growth in sediment transport and land erosion, which reduces the volume of the lake water and this limits light penetration into the water column. World environmental bodies have developed robust policies to mitigate deforestation which are rarely adopted especially in developing nations. In Kenya for example, though had amended policies directed to management of forests by introducing the National

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<sup>49</sup>UNEP, United Nations Environment Programme. 2011. Forest in a green economy, a synthesis and UNEP (2011). Forests Investing in Natural capital.

Forest Policy 2014, minimal results have been achieved due to lack of awareness and familiarity with the policy<sup>50</sup>.

The Lake Nakuru catchment basin is affected by the destruction of the Mau forest which has a huge impact on both the catchment hydrology and biodiversity. The forest was fairly stable in the Central and North America while it experienced great expansion in Europe in the previous decades. Also assist in guarding our planet's most biodiversity ecosystems<sup>51</sup>. Developing signal also shows that large forest sections, such as the Amazon, control rainfall and that trailing these forests may weaken global foodstuff making<sup>52</sup>. The repercussions are clear with world-wide agriculture is on an indefensible path. The prolific area which is about 20% of the country's total area is actually the medium and high probable agro-ecological regions and is beneath agriculture, nature reserves and forests. Based on FAO Forest Resource Assessment 1990, Kenya is categorised amid the countries with small forest cover of less than 2% of the total land area. The dwindling forest cover has a Spartan result on the climate, wildlife, and streams, social inhabitants particularly forest dwellers<sup>53</sup>.

Deforestation is an outcome of a difficult collaboration of number controllers, where a few are extremely context-specific. Inclusive however, increasing per capita depletion

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<sup>50</sup>Owido S.F.O, Chemelil C.M, Nyawade F.O, Obadha W.O (2003) Effects of Induced Soil compaction on Bean (Phaseolus Vagaries) Seedling Emergence from a Haplicphaeozon soil. *AgriculturaTropica ET subtropica* 36: 65-69.

<sup>51</sup>J. H. Lawton et al., "Biodiversity Inventories, Indicator Taxa and Effects of Habitat Modification in Tropical Forest," *Nature* 391, no. 6662(1998): 72–76.

<sup>52</sup>D. C. Nepstad et al., "Interactions among Amazon Land Use, Forests and Climate: Prospects for a Near-Term Forest Tipping Point," *Philosophical Transactions of the Royal Society B: Biological Sciences* 363, no. 1498 (2008): 1737–46; G. B. Bonan, *Forests and Climate Change: Forcings, Feedbacks, and the Climate Benefits of Forests*, *Science* 320, no. 5882 (2008): 1444–49; J. Vidal, "Climate Change: How a Warming World Is a Threat to Our Food Supplies," *Guardian*, April 13, 2013, <http://www.theguardian.com/environment/2013/apr/13/climate-change-threat-food-supplies>.

<sup>53</sup>Obare L. & J. B. Wangwe, *Underlying Causes of Deforestation and Forest Degradation in Kenya*, html

and demographic growth are the key controlling powers. The development of profitable as well as subsistence agriculture is extremely the utmost significant driver of deforestation - current as well as upcoming. Most upcoming forest conversion to other land uses will happen in Africa and Latin America<sup>54</sup>. Desertification is as a result of unsustainable land use practices and extreme climatic variation including overcutting of forest cover<sup>55</sup>.

Deforestation causes soil and water resources flooding and loss thus disrupting the global water cycle<sup>56</sup> hence is an outcome of a difficult collaboration of a number controllers, where a few are extremely context-specific. Inclusive however, increasing per capita depletion and demographic growth are the key controlling powers. Agriculture and precisely development of profitable as well as subsistence agriculture, is extremely the utmost significant driver of deforestation - current as well as upcoming. Most upcoming forest conversion to other land uses will happen in Africa and Latin America<sup>57</sup>.

The effects of deforestation inclusive however, increasing per capita and demographic growth depletion are the key controlling powers. The development of profitable as well as subsistence agriculture is extremely the utmost significant driver of deforestation - current as well as upcoming.

Deforestation results in land degradation when the land is shallow and steeply sloping when the state of the soil is easily erodible or when clearing is accompanied by poor

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<sup>54</sup>FAO.2015a. Kenya Country report.<http://www.fao.org/3/a-az251e.pdf>

<sup>55</sup>Angelsen, A.A stylized model of incentives to convert, maintain or establish forest. Background Paper for World Bank Policy Research Report entitled "At Loggerheads: Agricultural Expansion, Poverty reduction and Environment in the tropical forests - 2012. 2013

<sup>56</sup>Bruijn zeel, L. A. Hydrological functions of tropical forests: not seeing the soils for the trees? *Agriculture, Ecosystems and Environment* (2014) 104: 185-228.

<sup>57</sup>FAO.2015a. Kenya Country report.<http://www.fao.org/3/a-az251e.pdf>

management. Agricultural activities such as absence of soil conservation measures, shifting cultivation with inadequate fallow periods, unbalanced use of fertilizers, and cultivation of fragile lands and faulty planning and management of irrigation among others cause land degradation. The Ogiek community have been Mau forest dwellers and have been dependent on the forests for survival and housing. They cohabit the forests in the midst of their clans sharing features such as hills, rivers and valleys among themselves. There was a failed attempt to expel the public from the forest by the colonial government between 1904-1918. Even during the 1932 gazette of the forests, individuals still cohabited them. The colonialists made another informal attempt to evict them in 1941 even preceding the gazetting but failed since there was no formal communication with the administration<sup>58</sup>.

Tropical deforestation, including the biodiversity environmental components, entails forest conservation to maintain water, soils, and major wildlife habitat. In Kenya the forest ecosystem supports the main sectors of the economy namely agriculture, tourism, power generation and industrial growth. The greatness of productions depends on the biomass of the forests deforested, the rates of deforestation, and other biomass reductions that result in forest utilization<sup>59</sup>.

### **1.5.5 Environmental diplomacy and issues of deforestation**

Environmental diplomacy is a process through which diplomatic actions are taken and inputs are mobilized to produce specific outputs on the environment. This process of actions emerges at the historically constructed conjunctures in global environmental

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<sup>58</sup>Peter Wass, 1995. Kenya's Indigenous Forests: Status, Management and Conservation.

<sup>59</sup>R. A. Houghton,(2005). The Woods Hole Research Center, Woods Hole, Massachusetts, USA.



governance trajectories<sup>60</sup>. Back in 1972, representatives from 114 countries came together to right the wrongs that had been depleting the environment. “Tropical forests were falling at an alarming rate. Whale populations were in a death spiral. Our cities were choked with smog, our rivers had turned into fire traps, and we were getting the first inklings that all of our industrial activity might actually be warming the globe”<sup>61</sup>. It is this convention that brought together 114 countries in Stockholm, Sweden, at the U.N. on the Human Environment Conference that gave birth to environmental diplomacy. Environmental diplomacy is a global effort focusing on collective responsibilities in taking care of the environment. It focuses on reducing human environment conflict by involving everybody in the process of managing our environment<sup>62</sup>.

With the increase in population growth aspects of the population such as technological change and economic development are likely to increase the demand for natural resources. On the other hand population growth will also lead to more environment degradation. In addition to these resources’ previous exploitation, there will definitely be a decrease in supply creating a conflict.<sup>63</sup> In conjunction to that, climate change is a threat multiplier, aggravating current vulnerabilities and increasing the uncertainty levels. With the trends brought into play by population

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<sup>60</sup> A Historical Constructivist Perspective of Japan's Environmental Diplomacy, (2016). Katsuhiko Mori, International Christian University. [web.isanet.org/...a8e68aad-9abf-4add-....](http://web.isanet.org/...a8e68aad-9abf-4add-....)

<sup>61</sup> Greg Hanscom, “40 years of environmental diplomacy — what do we have to show for it?” 2012. Retrieved from <http://grist.org/politics/40-years-of-environmental-diplomacy-what-do-we-have-to-show-for-it/>

<sup>62</sup> Ibid

<sup>63</sup> UNEP, Environmental Diplomacy. Retrieved from <http://staging.unep.org/disastersandconflicts/Introduction/EnvironmentalCooperationforPeacebuilding/EnvironmentalDiplomacy/tabid/54581/Default.aspx>

growth and climate change, the world needs environmental diplomacy now more than ever<sup>64</sup>.

The growing importance of environmental diplomacy is driven by the need to provide an integrated approach to ensure conflict prevention, mediate against environmental degradation and build peace amongst communities sharing natural resources. Environmental diplomacy employs different strategies that include but are not limited to enquiry, negotiations, conciliation, mediation, arbitration and expert determination. Negotiation may be perceived as the most efficient mechanism for environmental diplomacy in terms of time management, costs and protection of relationships which has been termed as the most appropriate cause of action for majority of the disputes<sup>65</sup>.

Forest-based negotiation diverts attention from positions to interests, which raises concern on a variety of creative options and possibilities and for the parties to reach a consensus that fully meets the needs of the interested parties. Mediation on the other hand focuses on providing interventions in a standard manner where the opinion of the third party who has no authoritative or limited decision-making capabilities but could help the parties in conflict in reaching mutually acceptable solution of the dispute<sup>66</sup>. The deforestation rates reported from surveys and field studies FAO, 1995, 2000<sup>67</sup> indicate a higher value than the one estimated through remote sensing,

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<sup>64</sup> Ibid

<sup>65</sup> Muigua, K. "Resolving Environmental Conflicts Through Mediation in Kenya" Ph.D. Thesis, Unpublished, University of Nairobi. 2011

<sup>66</sup> Emmett P. Fiske. 'Re-conceptualising Environmental Conflict Resolution: The Developmental Facilitation Approach', p. 1. 2001. Available at <file:///A:\Reconceptualisingenvironmentalconflictresolution.htm>

<sup>67</sup> FAO - Food and Agriculture Organization. 2001. Global Forest Resources Assessment 2000. Main Report. FAO Forestry Paper No. 140, FAO, Rome, Italy.

although this is not applicable in all scenarios. DeFries and Hansen (2004)<sup>68</sup> utilized the satellite data and reported higher rates than that of FAO (2001) from 5 out of the 6 nations. Determining the accuracy of the ground-based estimates is a hard task since the errors estimates of FAO have not been established. Prior national communications from Zimbabwe and Bolivia speculated deforestation rates that were six times lower than the FAO report, 1999<sup>69</sup>.

It is evident that carbon emissions as a result of deforestation undermine the impact of the total emissions. That is the rate of carbon stocks is declining in majority of the forests without a rise in the forest coverage. This can be illustrated best by loss of biomass linked to selective wood harvest, ground fires, forest fragmentation, grazing, browsing and shifting cultivation and biomass accumulation in the expansion and recovery of forests. These variations in biomass are hard to detect through use of satellite data than variations in forest coverage and harder to document using census data despite significant changes in carbon. Deforestation could be reduced by the tropical country governments who intend to mitigate it through adequate funding of environmental legislations, building institutional capacity in remote forest regions and support for economic alternatives to extensive forest clearing (including carbon crediting) as suggested recently in the Brazilian Amazon<sup>70</sup>.

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<sup>68</sup>DeFries R. S., R. A. Houghton, M. C. Hansen, C. B. Field, D. Skole, and J. Townshend. 2002. Carbon emissions from tropical deforestation and regrowth based on satellite observations for the 1980s and 90s. *Proceedings of the National Academy of Sciences* **99**:14256-14261.

<sup>69</sup>Houghton, R. A., and K. Ramakrishna. 1999. A review of national emissions inventories from select non-Annex I countries: implications for counting sources and sinks of carbon. *Annual Review of Energy and the Environment* **24**:571-605.

<sup>70</sup>Fearnside, P.M. 2000. Global warming and tropical land-use change: greenhouse gas emissions from biomass burning, decomposition and soils in forest conversion, shifting cultivation and secondary vegetation. *Climatic Change* **46**:115.

## 1.6 Justification of the Study

Deforestation is a problem that is characteristic to every nation. Developed nations have however put up policies to ensure sustainable use of the forests. This is because deforestation is also beneficial to the entire economy. For instance not less than 145 world economies are currently involved in wood production<sup>71</sup>. While developing nations such as Kenya has also benefited from deforestation, effective policies have not been put in place to ensure sustainability. As a result there has been heavy deforestation that has made the environment vulnerable to negative effects of deforestation. Kenyan forests, has in the recent past been on the limelight as a result of deforestation that has been taking place in the forest. The impacts of deforestation in the forests have not only been felt in Kenya but within the region. Kenyan forests are also a home to a number of indigenous communities and as a result, eviction within the forest has jeopardized lifestyle and livelihood for a number of families. Protection of the forests has also been politicized by politicians who have used it to drive their own selfish agendas thus bringing deforestation as a center of discussion and in the public limelight. However, despite efforts to put up policies to ensure sustainability of the forest, there has been continuous depletion of the forest that we have not been able to comprehend. There is dearth of information on how much forests have been destroyed in Kenya. Several conflicts have been witnessed around the forest while the countries are facing drastic climate change evident by the long drought that has led to loss of lives and property. There is therefore need to understand the effects of deforestation, causes and challenges on the implementation of an effective framework to ensure sustainability of the Kenyan forests. The information on the environmental effects of deforestation to small-holder farmers from the study may be used by the

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<sup>71</sup> Angelsen, A. A stylized model of incentives to convert, maintain or establish forest. Background Paper for World Bank Policy Research Report entitled "At Loggerheads: Agricultural Expansion, Poverty reduction and Environment in the tropical forests - 2012. 2013

government and other stakeholders in developing policies and recommendations for sustainable management of forests in Kenya and other East African countries.

Forest management bodies and other institutions charged with the responsibility of managing forests are responsible for ensuring sustainability of the activities in and around the forests. The information from this study may help such organizations understand and appreciate the challenges exposed to addressing deforestation, and measures to be put in place to support sustainability.

The general public may use the information from this study to enable them understand and appreciate the environmental effects of deforestation and therefore encourage a better environment for afforestation. The information from the study may also form a source of literature for other researchers and academicians who are willing to carry out further studies in the same field.

### **1.6.1 Knowledge Gaps**

Ouko, Odhiambo and Boitt ,2016; Boitt ,2016; Oginga,2015 carried out studies on Mau Forest to determine the how deforestation occasioned by human activities affected the Mau Forest environment and found that people activities adversely affected the forest biodiversity, water tower, soils, lake salivation and the volume of water is affected. The human activities of illegal logging of trees, fire, and expansion of agricultural land for crop farming had contributed to forest degradation in Mau forest and emphasized the need for environmental diplomacy to mediate conflict of resources in Mau Forest. This study intends to bridge the knowledge gap existing on the role of environmental diplomacy in addressing deforestation by smallholder farmers in Mau Forest, Kenya.

## **1.7 Theoretical Framework**

The study will be based on Neo- Malthusian Theory (1798) and latter Boserup (1965) and scarcity of resources theory. Neo-classical theory of population growth stated that increased human activities would lead towards increasing stress on functioning of the environment and that will ultimately lead to environmental degradation. This could result from either emitting too much waste into the environment or exploiting the natural environment to the point of approaching or transcending ecological thresholds such as deforestation and overgrazing. Malthus stated that a growing population exerts pressure on agricultural land, forcing the cultivation of poorer and poorer quality land. Later studies suggest that growing population exerts pressure on the demand of natural resources which can no longer be met without damaging the ability of the resources to support human life. Rapid growth of human population is often identified as one of the main factors behind environmental degradation.

### **1.7.1 Neo-Malthusian Theory**

According to Malthus (1798), over the long run population and resources remain in a state of equilibrium mediated by the available technology of food production and the prevailing living standard. According to neo-Malthusian theory, population dynamics contribute to a vast amount of environmental degradation in much of the developing world. Malthus (1798) and latter by Boserup (1965) elucidated the relationship between population growth and development. Malthus argued that population growth is the root cause of poverty and human sufferings, Boserup explained how technological advancement and increased innovation in the agriculture was the result of increased density of population. However, both views provided an alternative way

of explaining the relationship between population growth and development. Recently environmental economists found emerging importance in the relationship between population growth and development<sup>72</sup>.

Increases in population can lead to increased carbon dioxide levels in the developing world in many ways. Demographic transitions in rural areas and, sometimes, relocation policies that encourage the urban poor to migrate to rural areas to engage in farming, logging, extractive activities, and road building, can lead to rapid rural population growth. Many of the economic activities that this burgeoning population pursues (i.e., slash-and-burn agriculture; burning wood to produce charcoal to provide energy for cement plants; clearing forests for homes, crops, grazing herds, or roads; etc.) have the simultaneous impact of cutting trees and clearing of forests. Consequently, forest coverage reduces sharply with the increased population. This focus on environmental resource shortages has been extended by recent neo-Malthusians to argue that population size is also a major cause of environmental degradation. The neo-Malthusian theory will inform the research in identifying population related factors such as the need for infrastructural development, farming, grazing land and urban development, environmental diplomacy and their relationship with deforestation<sup>73</sup>.

Any attempts in Neo- Malthusian framework of simply dividing the volume of resources by the number of people on the globe will fall into suffice. During the last one decade, it has been increasingly realized that relationship between population, environment and development is a complex issue. Population impacts on the

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<sup>72</sup>Boserup, E. (1965) *The Conditions of Agricultural Growth*. Chicago: Aldine.

<sup>73</sup> T. R. *An Essay on the Principle of Population*.(New York: Penguin Books. 1983

environment primarily through the use of natural resources and production of wastes and is associated with environmental stresses like biodiversity, air and water pollution and increased pressure on arable land<sup>74</sup>. This theory explains clearly how population outbursts in an economy result to deforestation to create more arable land to meet the ever increasing demand for food and shelter as established by this study where Mau Forest Complex forest coverage has declined from 4695 km<sup>2</sup> in 1985 to 4041 km<sup>2</sup> since 2010. The predicted forest cover in 2030, 2050 and 2080 are 3538, 3124 and 2680km respectively, all implying a tremendous decline in the forest cover unless serious conservation is undertaken<sup>75</sup>.

### **1.7.2 Scarcity Theory**

Scarcity was at the centre of the widely known arguments popularized by Malthus's *1798 Essay on the Principle of Population*. He argued that populations tend to grow geometrically, while food production grows arithmetically, resulting in increasing pressures on the resources which results in catastrophic outcomes<sup>76</sup>. A scenario where the available environmental resources cannot adequately serve a significant portion of the population is referred to as Environmental scarcity. This arises when environmental damage depletes a large chunk of the resources or when increase in population consumes the entire pool of available natural resources. The presence of environmental scarcity in a region brings the distinction between wealthy individuals in the society who are willing to protect resources from depletion and the poor members who are struggling to survive. Under such instances, the entire state or

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<sup>74</sup>Shrivastav.a.,A (1992), : .'Overpopulation: The Great. Red Herring?" .Economic and PoliticalWeekly, 19 (September), pp. 2032-2037.

<sup>75</sup>Banana, A, M. Buyinza, E. Luoga and P. Ongugo. Emerging Local Economic and Social Dynamics Shaping East African Forest Landscapes. Forests and Society – Responding to global drivers of change

<sup>76</sup>Malthus, T. R. (1798) *First Essay on Population*. Reprinted. London: MacMillan



nation begin to experience civil unrest and economic breakdown. The environmental activists have become more concern about the rate of depletion of natural resources globally. Necessities such as fresh water to drink and land on which to live have scarce in some of the most impoverished nations in the world. The challenge is even getting access into countries that are viewed as world leaders as the gap between poor and the rich grows wider. Environmental scarcity is termed as the main cause of lagging development<sup>77</sup>.

Complex factors have been pointed out as the main causes of environmental scarcities. Resource degradation and depletion are a function of the size of the resource-consuming population, the physical vulnerability of the resource and the practices and technologies of the uses of this population. The population size and its practices and technologies are in subsequently yields many other variables, starting with the status of women to the availability of financial and human capital<sup>78</sup>.

Furthermore, the depletion and degradation of resources, combined, constitute to one of three environmental scarcity sources. Degradation and depletion result in a decline in the total supply of resources which implies to a decline in the amount of the total portion of resources. But changes in consumption behaviour and population growth also results in more scarcity by increasing the resources' demand. Therefore, if a certain set of population mainly dependent on a particular population set is dependent on a fixed amount of cropland then the size of cropland allocated to an individual will be smaller which will force him/her to exploit all the resources within the slice so as

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<sup>77</sup>Jose Cuesta (2013)Resource Scarcity from an applied Economic Perspective, GA. J. INT'L & COMP. L. Vol. 42:11,pp 12-33

<sup>78</sup>Ahmad, M. H., Azhar, U., Wasti, S. A. and InamZ. (2015) Interaction between Population and Environmental Degradation. *The Pakistan Development Review* 44 : 4 Part II (Winter 2005) pp. 1135–1150

to open more land for agriculture. In most nations, the availability of resources is being squeezed by both demand and supply pressures<sup>79</sup>.

The third reason for scarcity is lack of equity in the distribution of power and wealth whose outcome is the unequal distribution of the resource pie with some societal groups receiving larger slices of the resource pie whereas some receive small slices which can hardly sustain their livelihoods. This unequal distribution was noted to be common in every case examined by the research team. This imbalance can be attributed to institutions and ethnic relations and class inherited from the colonial era. Often it is reinforced and sustained by international economic relations compelling developing nations to depend on a few exports of raw materials. The heavy external debts can also encourage countries to utilize their highly productive environmental resources such as their best forests and croplands in the generation of hard currency instead of using it to support the most disadvantaged population segments<sup>80</sup>.

Deforestation is one form of the supply-induced environmental scarcity since it destabilizes soils and changes local hydro-logical cycles due to the disruption of the key of the eco-system links. For the Small holder farmers of the Mau Forest, fuel wood remains the most accessible and inexpensive energy source. Brown (2010) points out the main causes of food shortages; a rising demand as a result of growing population, and a decline in supply due to climate change and soil erosion, these challenges could be solved by increasing water and water productivity, reducing carbon emissions, limiting grain exports and promoting poverty reduction. Lufumpa

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<sup>79</sup>Homer Dixon, T. F. (1996, November). Environmental scarcity, mass violence, and the limits to ingenuity. *Current History*.359 – 365.

<sup>80</sup>Jose Cuesta (2013)Resource Scarcity from an applied Economic Perspective, GA. J. INT’L & COMP. L. Vol. 42:11,pp 12-33.

(2005) demonstrated the relevance of the interrelated issues of land degradation, deforestation, water scarcity, low agricultural productivity, the effect of civil conflict and threats to biodiversity. There are major policy implications, such as, the need of individuals and institutions to reconcile immediate survival strategies with long-term resource security, objectives and environmental protection. The specific policy recommendations include cross-cutting policy initiatives and sector-specific interventions to promote greater institutional reform and solve gender disparities<sup>81</sup>.

The close association between resource scarcity and poverty is evidenced by studies by various scholars, although actual link between them is not clear. Ideally, the exact association between resource scarcity, poverty and poverty reduction has not been clearly brought out which makes it necessary to conduct further research so as to explain those relationships. Some studies appreciate the complexity of the issues beyond just 'resource scarcity as the cause of poverty; other studies appreciate the fact that 'scarcity is caused by poverty; yet little studies have explored the exact impact and reasons for occurrence of the association. In the instances where the researchers have explored these fields to greater extent, they have concluded that scarcity of resources is a political issue that leans more on the access and distribution of resources than the actual shortages of resources. Additionally, those studies conclude that improvement in resource efficiency perhaps is related to improved demand management which forms an ideal response to issues of resource scarcity<sup>82</sup>.

Therefore, this theory underpins to support this study in determining the role of

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<sup>81</sup>Fredrick Owino, chairman (2009), "Report of the Prime Minister's Task Force on the Conservation of the Mau Forests Complex." Republic of Kenya.

<sup>82</sup>Fredrick Owino, chairman (2009), "Report of the Prime Minister's Task Force on the Conservation of the Mau Forests Complex." Republic of Kenya

environmental diplomacy in addressing deforestation by small holders in Mau Forest, Kenya.

## **1.8 Methodology of the Research**

### **1.8.1 Research Design**

The research used evocative analysis as the study plan. Since the design attempts to conclude the existing position of the phenomenon, it is therefore the most appropriate for the study. Orodho<sup>83</sup> asserts the fact that surveys are functional in relating opinions, values and information of some occurrence in the public. This research then, sought to find out and analyze the outlook, approach, attitudes and awareness on environmental effects of deforestation to small-holder farmers in Kenya.

### **1.8.2 Site of the Study**

The study was carried out in Mau Forest and its environs. The Mau Forest has three forest stations managed by the Kenya Forest Service. Mau forest is the largest forest in Kenya and the center of attention due to the continuous encroachment of the forest land by the communities living around the forests.

### **1.8.3 Target Population**

The target population for the study included the small-farmers around the Mau Forest in Kenya, Kenya Forest Service Officers and small holder farmers around the forested areas in Kenya.

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<sup>83</sup>Orodho, J.A. Elements of Education and Social science Research Methods.(Nairobi: Masola Publishers, 2005) p. 31

#### **1.8.4 Sampling Techniques and Sample Size**

The participants of the study were selected through purposive sampling. This sampling method enabled the researcher chose persons to provide in-depth information on environmental effects of deforestation to small scale farmers in Kenya. The sample will include 3 Kenya Forest Service Managers from each of the 3 forest stations and 164 small-holder farmers in the Mau Forest.

#### **1.8.5 Data Collection Instruments**

In the study both primary as well as secondary data were collected. Interview guide and semi-structured questionnaires were the research instruments used to collect primary data. Interview guides was used to collect data from the forest managers. Interview guides are appropriate when the researcher focuses on getting in-depth information about the phenomenon under study and when the sample population is small. Questionnaires were used to collect data from small holder farmers in the Mau Forest. Secondary data was collected through document reviews and analysis. Sources of secondary data included published books, e-journals and forestry magazines.

#### **1.8.6 Data Analysis**

The analyses of data as well as presentations were both qualitative and quantitative in nature. Qualitative raw information that was obtained from the interviews was reduced and categorized into clusters with universal subjects. The substance inside the themes was then scrutinized through the guidance of the research objectives. The SPSS was used to code and organize the data. Quantitative data was summarized into descriptive statistics of, percentages and frequencies. Computation of frequencies will

be used as an arithmetical technique of arranging raw data into significant way to ease understanding. The results were offered in the form of tables as well as graphs.

### **1.9 Scope and Limitations of the Research**

The study carried out in the Mau Forest and its environs. Mau is the Kenya's biggest forest and the center of attention due to the continuous encroachment of the forest land by the communities around the forest. It is the main water catchment areas and the ongoing drought in the country has been linked to the deforestation in the Mau Forest. The study was focus on the causes, effects and measures to address deforestation in Kenya. It was assess the perceptions of the small-holder farmers, forest officers and forest managers on the environmental effects of deforestation to small holder farmers in Kenya.

The study was limited by the large number of community members, and forest officers in and around forests in Kenya, which could not make it possible to cover a wide range of forests in the country. The study therefore was delimited to small-holder farmers and forest officers in and around the Mau Forest. Confidentiality was a major concern during data collection since most of the respondents such as the forest officers and mangers claimed that it was against their organization's policy to share information on matters connected to the administration of the forests. The confidentiality policy could restrict respondents from revealing much information about the study problem and this would result in sampling errors thus affecting the results of the study. The researcher addressed this by informing the participants on the purpose of the study and seeking approval from the management in support of the research and the research outcomes. Participants were also informed that they could

participate in anonymity and therefore none of the respondents was to be victimized for their answers.

### **1.10 Chapter Outline**

Chapter one introduces the topic of our research study, by first setting the broad context of our research study, the research question, objectives of the study, literature review, rationalization, theoretical framework, as well as the methodology of the study. Chapter two provides the background of causes and effects of deforestation in Kenya and lists the causes of deforestation in the country. Chapter three looks at the environmental effects of deforestation by small-holder farmers in Kenya. Chapter four analyses the role of environmental diplomacy and challenges for reducing deforestation in order to limit the environmental effects of deforestation in Kenya while chapter five presents the conclusion of the study, provides recommendations as well as giving opinions on further study areas.

## **CHAPTER TWO**

### **CAUSES AND IMPACT OF DEFORESTATION IN KENYA**

#### **2.1 Introduction**

Deforestation refers to the conversion of a previously forested area into a non-forested area through activities such as agriculture, grazing or urban development which make use of the formerly forested land. It is a complex society problem varying in geographical and social contexts with known major drivers related to agricultural expansion. In developing countries the deforestation has seen continuous disturbed water regulation as well as the destruction of forest resources which act as a source of livelihoods for many of the world's poorest. This chapter presents the findings and discussions on the first objective of the study that focused on identifying the causes of deforestation in Kenya. It is divided into three sections. The first section presents the general information of the sampled population in terms of age, education, gender and marital status. The second section presents the challenges small holder farmers face while the third section discusses the causes of deforestation in Kenyan forests.

#### **2.2 General information on the Sampled Population**

The study targeted a sample size of 164 respondents including 9 key informants from 3 forest stations in the Mau forest. A total of 153 respondents, 71 women and 82 men, filled in and returned the questionnaires while 3 men and 3 women key informants were interviewed making a response rate of 95.7%.

##### **2.1.1 Gender and category of the Respondents**

The study required to set up gender of the respondents for the respondents. Majority of the respondent (53.6%) were men whereas 46.4% of the respondents were women.



This is a signal that the two genders were concerned in this study and thus the outcome from the study did not suffer from gender bias. Table 2.1 presents the gender and category of the respondents who participated in the study.

**Table 2.1: Gender of the Respondents**

<b>Gender</b>	<b>Frequency</b>
<b>Men</b>	82(53.6%)
<b>Women</b>	71(46.4%)
<b>Total</b>	<b>153(100%)</b>

### **2.1.2 Distribution of respondents according to age**

Age of the respondents was sought in this study and results disaggregated by gender. Majority of the respondents (29.6%) were aged above 50 years, while the minorities were below 18 years of age. Table 2.2 below presents the comparison of the ages of the respondents.

**Table 2.2: Distribution of respondents by Age**

<b>Age Group</b>	<b>Total</b>
18– 34	5.6%
35 – 39	18.1%
40 – 44	17.8%
45– 49	28.9%
50 and above	29.6%
<b>Total</b>	<b>100.0%</b>

The ages of the respondents were evenly distributed indicating that both women and men across the ages are involved in small scale farming. However, as age progressed more people joined small scale farming.

### 2.1.3 Distribution of the respondents according to education level

This section sought to establish the highest level of education reached by the respondents who took part in the study. The level of education was important as it is an important variable in regard to acquisition of knowledge and skills in getting engaged in employment opportunities.

**Table 2.3: Highest Level of Education achieved**

	<b>Total</b>
Primary	54.2%
Secondary	37.8%
Diploma	7.6%
Undergraduate	2.4%
<b>Total</b>	<b>100.0%</b>

Majority of the farmers had attained primary (level 1) education (54.2%) while 2.4% had attained undergraduate degree. This shows that the area is composed of people with low levels of literacy. Lack of proper education limits the ability of the residents around Kenyan forests to diversify their economy and again to acquire employable skills to be employed in other sectors of the economy other than depending on the forest and its resources for their livelihood. As a result farming becomes the last option or resort for these residents. This puts pressure on the existing forest since the livelihoods of these ‘uneducated’ people are based on hunting and gathering, grazing

into the forest land and small scale farming. The common small scale farming practices such as shifting cultivation, slash and burn, girdling and under burning of trees to pave way for sunlight penetration, is characteristic of these areas around the forest as the residents struggle to make ends meet. This is certainly detrimental to the forest and its resources.

### **2.1.4 Years in Small Scale Farming**

This section sought to establish the number of years a small holder farmer has taken in farming. The number of years in farming is important in assessing the experience the farmers have gain over the years on the causes and effects of deforestation.

**Table 2.4: Experience in small scale farming**

<b>Years</b>	<b>Percent</b>
1-3	24.2%
4-6	57.8%
More than 6	18.0%
<b>Total</b>	<b>100.0%</b>

From the survey, majority of the respondents 57.8% has been involved in agricultural activities for between 4–6 years while 18% of the respondents have been farming for more than six years. Therefore 75.8% of the respondents are well conversant with small holder farming in forested land hence well acquainted with issues of crop production and trends of productivity over the years. Certainly, this knowledge/information puts the respondents in a superior position to understand and appreciate the impacts of deforestation on crop production and accordingly has in place effective adaptation strategies.

## **2.2 Causes of Deforestation**

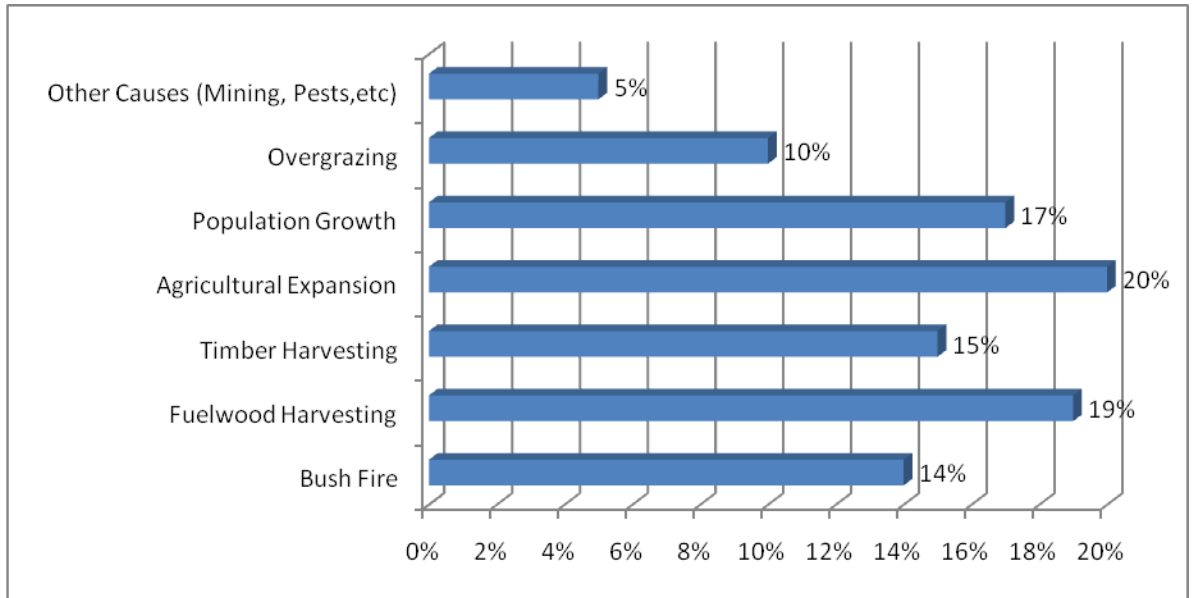
In determining the activities or practices the small holder farmers were exposed to an open ended question where they were supposed to identify their activities or practices that they perceive are linked to deforestation. Additionally interview with the forest managers focused on seeking their opinions on the causes of deforestation in Kenya. Small holder farmer behaviour and practices on land uses, including actions that are accompanied by such uses encompass the activities that lead to deforestation. The study identified several activities and practices that result in deforestation of Kenyan forests. The results of this study support Adger<sup>84</sup> who indicated that the competition for space between human beings and other species is illustrated by land conversion (including forestry areas) to agriculture, urban development, agriculture, surface mining, fuel wood collection, industry and unsustainable forest use.

### **2.2.1 Activities that cause deforestation**

The common activities mentioned by the respondents as the cause of deforestation in Kenya include population growth, fuel wood harvesting, bush fires, timber harvesting, population growth, clearing forests for agriculture and overgrazing. The figure below represents the frequently mentioned activities

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<sup>84</sup>Adger, N. People, Trees the missing sink and the greenhouse effect .Centre for Social and Economic Research on the Global Environment (CSERGE) Working Paper GEC 94-14. 1993



**Figure 2.1: Activities Causing Deforestation**

According to figure 2.1 above, several factors are linked to deforestation in the study area. The respondents agreed that agricultural expansion was the major cause of deforestation with 20% frequent mention. These results support Amor who also indicated that the expansion of agricultural land can easily be proxied to deforestation. He attributed this to the fact that the main source of deforestation is the expansion of agricultural land which contributes to around 60 per cent of total tropical deforestation.

Second was fuel wood harvesting which scored 19%. The results of this study support Odoemena<sup>85</sup> who also reported fuel wood harvesting as a customary supply of power for home, and that since the lean economic wealth of the underprivileged rural households in the state, they regularly discover it efficiently tricky to way out to other

<sup>85</sup>Odoemena, B.C. An econometric analysis of the micro-level determinants of conversion of woodland to arable cropping in Enugu state. An unpublished Ph.D thesis submitted to the department of Agricultural Economics, University of Nigeria, Nsukka. 2006.

basis of power for home activities (pressing clothes, cooking) apart from fuel wood thus resulting to forest exploitation typically deforestation.

Population growth was the third major cause of deforestation in the study areas at 17% while timber harvesting was frequently mentioned by 15% of the respondents. These results support findings in Indonesia where timber harvesting largely contributes to deforestation compared to subsistence-oriented shifting cultivation<sup>86</sup>. Such plantations also come with the need for access roads which also interfere with forest cover while providing access for shifting cultivators and others to the forest frontier. This could be the reason why 14% of the respondents mentioned bush fire as an activity that has contributed to deforestation in the study area. Slash and burn agriculture which is described as shifting agriculture involves taking up a forested land and clearing it for agriculture, growing crops on the formerly forested land till the nutrients and and/or the site is overtaken by weeds exhausted then moving on to clearing another forest land. Certainly, the shifting agriculture practice is argued to be the major agent of deforestation<sup>87</sup>.

Overgrazing also contributed to deforestation in the study area. 10% of the responses considered overgrazing as a driver to deforestation. Similarly, Hays<sup>88</sup> links over grazing to deforestation since during such activities, animals remove the vegetation which is then blown away by the winds together with the top soil, transforming

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<sup>86</sup>Chomitz, K. M. and Griffiths, C. Deforestation, shifting cultivation and tree crops in Indonesia: nationwide patterns of smallholder agriculture at the forest frontier. Research Project on Social and Environmental Consequences of Growth-Oriented Policies, Working Paper 4. (World Bank, Washington DC. 2012)

<sup>87</sup> Amor, D.. Road impact on deforestation and jaguar habitat loss in the Selva Maya. Ph. D. dissertation. Ecology Department, Nicholas School of the Environment, Duke University. 2008

<sup>88</sup>Hays, J. Deforestation and desertification in China. 2008.  
<http://factsanddetails.com/china.php?itemid=389&catid=10&subcatid=66>

grasslands into desert. Amor<sup>89</sup> also found out that among pastoralist communities where herding is the only means of survival and not farming overgrazing is the major cause of deforestation. Other causes that were mentioned include mining, pesticides, sport activities and natural disasters at 5% frequent mention.

The results of this study support Pearce and Brown<sup>90</sup> who argued that the main force affecting deforestation is competition between humans and other species for the remaining ecological positions on land and in coastal regions. Since the human need for land space is increasing, they look out for forest land which on the other hand does not increase. They start using forest land for other activities such as industry, infrastructure, urban development, agriculture and others. This substantial conversion of forest land to other uses poses a competition with other species living in the forests.

## **2.2.2 Processes linked to deforestation**

Apart from the activities that cause deforestation in the study area, respondents also identified several processes that cause deforestation.

### **2.2.2.1 Poor perception on the effects of deforestation**

Lack of clear understanding on the effects of deforestation was mentioned by the key informants interviewed as a major process leading to deforestation. The residents, due to lack of the understanding on the ecosystem, do not really appreciate the need to forests to prevent deforestation, residents need to understand why we need to keep the forests. According to one of the forest managers from Soget forest station who was interviewed on 4<sup>th</sup> July 2017, he stated that the residents here are very illiterate; most

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<sup>89</sup> Ibid

<sup>90</sup> Pearce, D. and Brown, K. Saving the world's tropical forests. In: The Causes of Tropical of Tropical Deforestation. The economic and statistical analysis of factors giving rise to the loss of the tropical forest, eds. Brown, K. and Pearce, D. pp 2-26. UCL Press, 2014

of them have not been into schools. They do not understand why they should abandon their source of their livelihood which is mainly trading on the forest products and do not understand how forests support ecosystem and hence need to be protected. All they know is that they need to farm on the land available and provide food for themselves. They would easily encroach into forest land and start cultivating. We have been in constant war with them and the main reason is that they do not appreciate the need for forests". In support of this assertion, another forest manager from Malakat forest station was interviewed on 6<sup>th</sup> July 2017, and stated that for us to really understand the causes of deforestation; we need to look at the processes that lead to deforestation. We have been mentioning the activities enough times that cause deforestation. People living around here do not recognize these activities as causes of deforestation. In fact there is an instance when one of the farmers once told us that when they plant, they are also providing forest to replace what existed through their crops. Their perception is that farming is afforestation and even if there is an impact they have on the forest by grazing around it, such impact is so minimal that cannot lead to complete destruction of the whole forest".

#### **2.2.2.2 Marketing and availability of markets for forest products**

Deforestation is also a product of availability of market for forest products. The economic activities in the forests have viable markets outside the forested area therefore propelling the destruction of forests as residents venture in the economic activities. One of the forest managers from Chepalungu forest station who was interviewed on 10<sup>th</sup> July 2017 stated that deforestation is not entirely a problem of the communities around here. If you look at this forest you will find out that the main agent of destruction is economic activities. People come here to get fruits and honey which they are able to sell immediately they get out of the forests at very good prices.



This makes such activities lucrative to the locals. They therefore put up bee hives in the forests and plant fruits in the middle of the forests. There will be need for roads and as you know, that frequent interference also leads to forests destruction. The officer also indicated that the locals are also able to market their products effectively and effortlessly due to shortage of forest products such as fruits and honey to distant and near towns. Some of the forest products marketed by these locals include food products (nuts, mushroom, oil seed, and fruits), fiber products (bamboos, grasses, and leaf), animal products (honey, bush-meat, shell, and eggs), extractive products (gum, latex, and dyes), medicinal and cosmetic plant products, fuelwood, timber, charcoal among others. The implication of higher percentage of the respondents engaged in marketing their forest products in the study area is enough indication to show that much of the forests are being deforested in the area due to economic reasons.

#### **2.2.2.3 Availability of credit and other financial support to forest destruction activities**

Certain forest destruction activities such as timber harvesting are very expensive and require a lot of support from the government and local politicians. The forests are protected by the Kenya Forest Service and therefore one has to get a license to harvest timber. Additionally, there are banks who readily offer financial support to legal and illegal harvesting of timber alike. An officer interviewed from Chepalungu forest station has this to say "Forest offers a lot of economic benefits especially in the line of timber. However timber harvesting is normally very expensive because of regulations. But in the society people always have ways of going round policies. Corruption perpetuates illegal harvesting of timber. Since it is an economic activity that equally has returns, banks are readily available to offer financial assistance to the business.

This further perpetuates opportunities for deforestation. Additionally, financial support comes from extended families and friends”. These findings support assertion from Nzeh and Eboh<sup>91</sup> who found out that people engaging in any enterprise (forestry or otherwise) need credit to support the activities; be it from bank, friends, personal saving, cooperatives among others, if not, the enterprise will be unstable.

## **Conclusion**

The finding of the study revealed majority of the people living in around Mau forest lack proper education which limits their ability to acquire employable skills to be employed in other sectors of the economy other than depending on the forest and its resources for their livelihood. As a result forest encroachment becomes part of their engagements as they embark on hunting and gathering, grazing into the forest land and small scale farming. Locals around Mau forest recognizes forests as important resources for uplifting their life from poverty, especially with regard to energy, food, timber, a wide range of non-timber forest products. The communities are engaging in subsistence farming and other deforestation activities which continue to destroy Mau forests. This may also be attributed to lack of awareness and compliance to the policy as the subsistence farmers attribute farming as a form of afforestation. As population increase and there is need to meet the basic needs majority of the household derive their income from activities conducted in the forest. Overgrazing, time harvesting and firewood harvesting were the main activities that lead to the destruction of large tracts of forest in places. Encroachment for settlement of people and cultivation had been rampant which have increased agricultural expansion and intensification which have decreased the overall area of forest in Mau. Bush fire was also cited as cause of

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<sup>91</sup>Nzeh, C.E.P. and Eboh, E.C. Socio-economic analysis of income effects of Forest products activities among rural households in Enugu State, Nigeria. *Journal of Tropical Agriculture, Food, Environment and Extension*, Vol. 7, No.1 ISSN 1119-7455.2008. Pages 22-26.

deforestation; according to the findings, fires are either spread accidentally from neighbouring private farms or are started deliberately as an act of sabotage.



## **CHAPTER THREE**

### **ENVIRONMENTAL EFFECTS OF DEFORESTATION BY SMALL-HOLDER FARMERS**

#### **3.1 Introduction**

Forest degradation or destruction has led to both positive and negative outcomes to small holder farmers in Kenya. While there are certain factors that also perpetuate the impact of deforestation on farmers there are situations that limit the abilities of the farmers in promoting deforestation. It is therefore forms a vicious cycle that requires proper mitigate measures to ensure minimal exposure to the effects of deforestation on small holder farmers. This section will discuss these impacts by first assessing the perpetual issues that the farmers feel that apart from propelling deforestation, still has an impact on their ability to stop deforestation. Further the section discusses the resultant effects of deforestation and how it is related to small scale farmers in Kenya.

#### **3.2 Factors influencing deforestation of natural forests by small holder farmers**

Apart from the fact that deforestation poses a great impact to the farmers either positively or negatively, why is it difficult to stop this practice? In assessing this question, the study sought to identify the factors that influence tree destruction or deforestation by the farmers. The farmers were presented with six questions in 5-Likert scale. They were to rate their perception in a scale of 1-5 where 1-strongly disagree and 5-strongly agree. The responses were averaged per statement and the results displayed in the table below.

**Table 3.1: Factors Promoting Deforestation by Farmers**

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Mean	SD
Lack of available market for timber products and profits from the same	12%	7%	29%	39%	13%	3.35	1.16
Experience of the farmer in agriculture and its benefits.	6%	20%	22%	42%	10%	3.30	1.09
Training of the farmer on the value of forests to agriculture	9%	13%	23%	36%	19%	3.43	1.19
Size of the household and yield from farming	9%	20%	23%	35%	13%	3.23	1.18
Level of education	13%	18%	22%	32%	15%	3.18	1.27

Most of the respondents (55%) agreed that training of the farmer on the value of forests to agriculture is a contributor to deforestation by farmers. Majority of the respondents (52%) also agreed that lack of available market for timber products and profits from the same, and experience of the farmer in agriculture and its benefits influences deforestation by farmers. Almost half of the respondents (48%) agreed that size of the household and yield from farming influences deforestation by farmers while, 47% of the respondents agreed that level of education influences deforestation.

### **3.2.1 Regression model for factors influencing destruction of natural forests by farmers**

In order to establish the relationship between factors influencing destruction of natural forests and deforestation of Natural Forests by Small Holder Farmers, the researcher conducted ordinal logistic regression model. In statistics, ordinal logistic regression is a regression model for ordinal dependent variables that is when the response categories are ordered. According to Rensis Likert, Likert scale is commonly used to measure respondents' perception by asking the extent to which they agree or disagree with a particular question or statement. Likert suggested that a typical Likert scale item has 5 to 11 points that indicate the degree of agreement with a statement such as 1=Strongly Disagree to 5=Strongly Agree. In SPSS ordinal logistic regression is a statistical technique that is used to predict behavior of ordinal dependent variables with a set of independent variables. Ordinal logistic output assist in determination of the independent variables parameters (if any) have a statistically significant effect on dependent variable.

**Table 3.2: Logistic Regression for factors influencing deforestation of natural**

Variables	Coefficients	SE	Sign	Odds ratio
Training of the farmer on the value of forests to agriculture	-2.64	9704.98		0.15
Lack of available market for timber products and profits from the same	-2.09	0.87		0.52
Experience of the farmer in agriculture and its benefits	-1.10	97 4.98		0.23
Level of education	0.92	1.01	0.36	2.51
Size of the household and yield from farming	0.15	0.72	0.83	1.17
Constant	0.57	9704.98	1.00	1.18

From the logistic regression output, the negative coefficient values show that the factor reduces deforestation by the coefficient of the factor expressed as a percentage. The positive coefficient values denote the positive effect of each factor to deforestation. At 95% confidence level, training of the farmer on the value of forests to agriculture, lack of available market for timber products and profits from the same, and experience of the farmer in agriculture and its benefits variables were found to be significant at p value <0.05. Level of education, and size of the household and yield



from farming variables had insignificant effect at p values >0.05 in contributing to natural forests harvesting.

The logistic regression model below presents the effect of each variable assessed to deforestation.

$$Y=0.57 - 1.10 X_1 - 2.09X_2 - 2.64X_3 + 0.15X_4 + 0.92X_5$$

Where;

Y is Deforestation of Natural Forests by Small Holder Farmers

X<sub>1</sub> is Experience of the farmer in agriculture and its benefits

X<sub>2</sub> is Lack of available market for timber products and profits from the same

X<sub>3</sub> is Training of the farmer on the value of forests to agriculture

X<sub>4</sub> is Size of the household and yield from farming

X<sub>5</sub> is Level of education

The results indicated that training of the farmer on the value of forests to agriculture, availability of market for timber products and profits from the same, and experience of the farmer in agriculture and its benefits, have a significant influence on deforestation of natural forest by small holder farmers. All these factors negatively affect deforestation of natural forest by small holder farmers. When there is lack of available market for timber products and profits from the same, the harvesting of natural forests is reduced because the farmers would not be able to gain from the timber business and therefore prefer other sources of income and not timber. What drives deforestation by small holder farmers maybe the lucratively timber business.

Agricultural training seems to influence natural forests harvesting negatively. This means an increase in the number of agriculturally trained small holder farmers; the level of harvesting of natural forests may be reduced. The reduction of natural forests harvesting may be due to the knowledge the small holder farmers can receive from the

training that may include conservation measures and consequences of deforestation to the environment. On the other hand, untrained small holder farmers (though some are educated) are not knowledgeable on issues to do with environmental sustainability. Small holder farmers with advanced level of agricultural training are equipped with knowledge of conservation measures and impacts of certain agricultural activities to the environment. This may lead to reduction of them relying on natural forests as a source of firewood. The small holder farmers who are trained are likely to implement measures they gained from the training and this may result in them desisting from natural resource exploitation. Small holder farmers who are not agriculturally trained are not very knowledgeable of environmental conservation and possible future consequences resulting from deforestation.

Experience of the farmer in agriculture and its benefits also influence the deforestation of natural forests negatively. Due to increase in the years of experience, the small holder farmers are likely to reduce reliance on clearance of natural forests for agricultural purposes but rather be able to enhance the fertility already existing land space and utilize it for agriculture. The farmers are knowledgeable on the impacts and government policies, such as penalties and taxes, for exploiting the natural forests. In contrast, the less experienced farmers are likely to increase natural forests depletion as they are not or less aware of environmental sustainability problems and solutions.

Size of the household and the yield farm the firm or gains from other agricultural activities, and level of education of the farmers were insignificant in explaining the variations in the destruction of natural forests. These factors are important in the

model though their contributions to deforestation are negligible. The behavior of a farmer with or without education is the same in terms of natural forests harvesting. This is in contrast with the level of agricultural training.

### **3.3 Effects of deforestation by small holder farmers in Kenya**

To assess the effects of deforestation by small holder farmers, the respondents were presented with five statements on likert scale and asked to state how much they agreed with each statement. The responses ranged from 1-strongly disagree through 3-neutral to 5-strogly agree. The responses were averaged per statement and the results displayed in the table below.

**Table 3.3: Effects of deforestation by smallholder farmers**

	Neither						
	Strongly	Agree nor		Strongly			
	Disagree	Disagree	Disagree	Agree	Agree	Mean	SD
Deforestation leads to devastating effects to the environment that slowly turns the tropical zones to deserts.	6%	12%	18%	43%	22%	3.63	1.13
Through deforestation, there is lack of trees to purify water and therefore there is depletion of water resources	6%	3%	16%	52%	23%	3.84	1.01
Deforestation has negative influence on agriculture as it creates climate change which leads to lower yields	9%	13%	10%	51%	16%	3.53	1.18
Deforestation leads to economic losses as well as social consequences	10%	12%	22%	43%	13%	3.38	1.16

Three quarters of the respondents (75%) agreed that through deforestation, there is lack of trees to purify water and therefore there is depletion of water resources. This

is in line with Angelsen (2013) who found out that with removal of part of the forest, the area cannot hold as much water creating a drier climate. Water resources affected by deforestation include drinking water, fisheries and aquatic habitats, flood/drought control, waterways and dams affected by siltation, less appealing water related recreation, and damage to crops and irrigation systems from erosion and turbidity. Two thirds of the respondents (67%) agreed that deforestation has negative influence on agriculture as it creates climate change which leads to lower yields. These findings support Jones and Thornton<sup>92</sup>, who argued that the increased deforestation has devastating effects on crop yield especially in Africa and Latin America where the aggregate yields of maize in smallholder rain-fed systems are likely to show a decrease of 10% by 2055 due to climate change arising from continuous destruction of forests. Other studies have also linked climate change and decreased food production especially by subsistence farmers to deforestations. Specifically, Chomitz et al.<sup>93</sup> argue that deforestation disrupts normal weather patterns creating hotter and drier weather thus increasing drought and desertification, crop failures, melting of the polar ice caps, coastal flooding and displacement of major vegetation regimes. Majority of the respondents (62%) agreed that deforestation leads to devastating effects to the environment that slowly turns the tropical zones to deserts. These findings support Dregne<sup>94</sup> who postulate that deforestation disrupts normal weather patterns creating hotter and drier weather thus increasing drought and desertification, crop failures, melting of the polar ice caps, coastal flooding and displacement of major vegetation regimes. In the dry forest zones, land degradation has become an

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<sup>92</sup> Jones P. G , Thornton PK (2003) *Global Environ Change* 13:51–59.

<sup>93</sup>Chomitz, K. M.; Buys, P.; Luca, G. D.; Thomas, T. S. and Wertz-Kanounnikoff, S. 2007. *At loggerheads? Agricultural expansion, poverty reduction and environment in the tropical forests*. World Bank Policy Research Report. World Bank, Washington D C.

<sup>94</sup>Dregne, H. E. *Desertification of Arid lands*. (Harwood Academia Publishers, London. 2005)

increasingly serious problem resulting in extreme cases in desertification. On whether deforestation leads to economic losses as well as social consequences, slightly more than half of the respondents agreed (56%). Similar arguments were echoed by Hansen, that by destroying the forests, all potential future revenues and future employment that could be derived from their sustainable management for timber and non-timber products disappear. Hansen found out that the tropical forests destroyed each year amounts to a loss in forest capital valued at US \$ 45 billion.

### **Conclusion**

Forest degradation or destruction has led to negative outcomes which affect the ecosystem and the country economy at large. The regression analysis revealed that farmers need to be trained on the value of forests and water catchment areas as this may reduce reduces deforestation, lack of available market for timber products could also reduce deforestation as household embark on timber harvesting due to availability of ready market. This notwithstanding the size of the household was a factor found to have positive or negative impact of forest destruction. The study revealed that deforestation leads to devastating effects to the environment that slowly turns the tropical zones to deserts, depletion of water resources, climate change which leads to lower agriculture yields, economic losses as the gross domestic product of a country is adversely affected. As the population is set continue growing, majority of the population around Mau may continue relying on forest for their livelihood which may lead to lead to soil erosion, floods, and the desiccation of large tracts of land. In this regards government interventions in form of land reform policies, improving education level in the region among other interventions are necessary in order to avert serious problems which may result out of extreme cases in desertification.

## **CHAPTER FOUR**

### **ENVIRONMENTAL DIPLOMACY AND DEFORESTATION**

#### **4.1 Introduction**

World over it is recognized that deforestation has devastating effects to the environment, survival and future generations. Just as explained in chapter three, deforestation is linked to forest depletion, erosion, flooding, climate change and low productivity in agriculture which affects the nation negatively economically and socially. Chapter two also indicated that the small holder farmers have a lot to do with the deforestation in Kenya. The activities that they consider their livelihoods are linked to deforestation. Solving this menace therefore requires strategies that meet the needs of the small holder farmers as well as the need for the environment. This is where environmental diplomacy comes in. this section discusses the various environmental diplomacy strategies employed in reducing deforestation in Kenya by small holder farmers.

#### **4.2 The role of environmental diplomacy**

Environmental diplomacy is a process through which diplomatic actions are taken and inputs are mobilized to produce specific outputs on the environment. The growing importance of environmental diplomacy is driven by the need to provide an integrated approach to ensure conflict prevention, mediate against environmental degradation and build peace amongst communities sharing natural resources. Environmental diplomacy employs different strategies that include but not limited to negotiations, enquiry, mediation, conciliation, expert determination and arbitration. In assessing the role of environmental diplomacy in deforestation, the respondents were exposed to an open ended question and the interviewees interrogated on the same. The results of the

study indicate that diplomacy has a role in balancing the needs of the people as well as the needs of the environment. A conservancy manager interviewed at Chepalungu forest station on 10<sup>th</sup> July 2017 stated that they condemn destruction of forests. He noted that environmental issues related to forest destruction have increasing international attention. However there is need to understand that some of these activities that cause destruction of forests are what the people staying around these forests depend on for their livelihood. According to the conservancy manager, strategies therefore that focus on reducing deforestation cannot be solved without the call for cooperation in order to address environmental security. He opined that, globally such corporations have led to the signing of various bilateral, regional and global agreements towards environmental issues. He reiterated that this has been carried out by states and international institutions that believe on better environment for the world to protect lives and future generations. Such agreements include the Kyoto Protocol which gives an approach to international politics of climate change, United Nations Framework Convention on Biological Diversity (CBD), African Convention on the Conservation of Nature and Natural Resources just to name a few.

A response from another officer from the same station indicated that people staying around the forests have their needs, which they believe needs to be met by their environment. They are predominantly involved in agriculture although at small scale for subsistence. However these activities deplete the forests and the environment at large. He noted that an agreement between the users of the forests and the strategies to conserve the forest is therefore necessary in resolving conflicts that may arise from the needs of environment conservation and the people around the forests. According



to Caidweil<sup>95</sup>, conflict arises and may escalate when the activities of the people around the forests mount pressure on the environment and the natural forests and the need to conserve them. Forest Manager interviewed in the study from Soget forest station on 4<sup>th</sup> July 2017 stated that “the need for agreements in forest conservation has been necessitated by the changing needs in the world where within a relatively few years, major environmental issues have emerged of which unilateral national action has proved ineffective and consequently national governments, in cognizance of their common interests in these issues, have developed cooperative arrangements to cope with them. Therefore, with the growing pressure of human activities on natural resources and the environment, the potential for serious conflict may increase. It is worth noting that environmental diplomacy came into the limelight after a series of strategies that were implemented and failed in the past. The results of the study indicate that despite the fact that there had been treaties in the past there has been a lot of failures as the environment continue to be depleted.

It is based on the need to implement environmental conservation strategies that are effective, that the need for environment diplomacy was raised. Accordingly, during the convention of biological diversity<sup>96</sup> in Kuala Lumpur Malaysia in 2004, it was concluded that despite the fact that environmental treaties continue being signed; the global environment is progressively worsening. It came as warning from the world scientists attending the convention who raised that alarm that we are in the midst of a period of mass extinction of species, fisheries are depleted worldwide, and water shortages loom on every continent. They called for an urgent strategy to salvage the situation. The recommendation from the convention focused on strategies that will

enhance implementation. This is where environmental diplomacy played a center stage.

In support of this assertion, a forest manager at Malakat forest station interviewed on 6<sup>th</sup> July 2017 argued that “environmental diplomacy came in as a solution to perennial cases of well drafted strategies that cannot be implemented”. He noted that there has been lack of support from the local communities on such strategies and with effect the strategies fail. This is because the strategies does not involve them and does not provide alternatives on how to strike a balance between their needs and the needs for a good environment. Consequently, there is massive destruction of the ecosystem while most wildlife faces extinction. To create a balance between needs and achieve the objective of environmental conservation, a range of provisions including great number of conditions generally described as ecological or environmental’ requirements are needed. Environmental diplomacy creates a way of reconciling the slow pace of implementation of environmental conservation strategies with the earnest growth of global ecological decline. The unique characteristics of environmental diplomacy therefore create adapting measures, attitude changes and strategies that will ensure speedy implementation of agreed products of environmental conservation and preservation of forests.

#### **4.3 Environmental influences of small holder farmer activities on deforestation**

In assessing the environmental influences of small holder farmers’ activities on deforestation, the respondents were asked to indicate their level of agreement with the following statements on the concerns that might be a source of conflict at the Mau forest region. The responses were rated on a five point Likert scale where: 1- Very

small extent, 2- Small extent, 3- Neutral, 4- To a larger extent and 5-To a very large extent. The mean and standard deviations were generated from SPSS and are as illustrated in table below.

**Table 4.1: Environmental influences of small holder farmers activities on deforestation**

	<b>Very small extent</b>	<b>Small extent</b>	<b>Neutral extent</b>	<b>Larger extent</b>	<b>Very large extent</b>	<b>Mean</b>	<b>SD</b>
Human activities by the small holder farmers affect the overall ecological situation at the forests	10%	32%	20%	36%	3%	2.90	.878
The erratic weather patterns experienced in the forest regions are as a result of forest depletion	15%	38%	23%	21%	2%	2.57	.655
Livelihoods has been negatively affected by the rapid increase in human population and reduced farm sizes within the region	12%	18%	16%	45%	9%	3.21	.990

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Animal and human wellbeing related activities	39%	21%	23%	10%	7%	2.24	.8261
has led to increased water pollution							
The declining crop output is linked to soil degradation	13%	29%	25%	30%	4%	2.82	.804
due to deforestation							

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From the results a total of 59% of the respondents were neutral, to a large and very large extent who indicated that human activities by the small holder farmers affect the overall ecological situation at the forests. On whether the erratic weather patterns experienced in the forest regions are as a result of forest depletion 46% were neutral, to a large extent and a very large extent, 35% were to a small extent. On the opinion that livelihoods has been negatively affected by the rapid increase in human population and reduced farm sizes within the region, 72% were neutral, to a large extent and very large. On whether, animal and human wellbeing related activities have led to increased water pollution a total of 70% were neutral, large extent and very large extent. On the opinion that the declining crop output is linked to soil degradation due to deforestation, a total of 40% were neutral.

#### **4.3.1 Regression Analysis on the impact of environmental influences on deforestation by small holder farmers in Mau region**

The researcher carried out regression analysis between the independent and dependent variables of the study. In order to conduct the regression analysis the set of items that measured deforestation by small holder farmers in Mau region were aggregated by

computing the average. Regression analysis was then used to test whether there existed interdependency between deforestation by small holder farmers in Mau region and environmental influences. The findings of the regression analysis output was as shown Table 4.2

**Table 4.2: Regression analysis of deforestation by small holder farmers on Environmental influences**

		Estimate	Standard Error.	Critical Ratio.	P-value
deforestation					
Environmental influences	<--- by small holder farmers in Mau region	.170	.045	3.782	.000

From the parameter estimates Table 4.2 above, At 95% confidence interval the results shows that deforestation by small holder farmers in Mau region is significant when regressed against environmental influences at  $\beta = 0.170$  and p value  $< 0.05$ ). This means that the predictor of deforestation by small holder farmers in Mau region affects environment

#### **4.4 Non-environmental influences of small holder farmer activities on deforestation**

In assessing the non-environmental related activities that small holder farmers have on deforestation, the respondents were asked to indicate their level of agreement with the following statements on the concerns that might be a source of conflict at the Mau forest region. The farmers were presented with six questions in 5-Likert scale. They

were to rate their perception in a scale of 1-5 where 1-strongly disagree and 5-strongly agree. The responses were averaged per statement and the results displayed in the table below.

**Table 4.3: Non-environmental related activities that small holder farmers have on deforestation**

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
There is no fairness and there is a lot of favoritism in Mau region with regards to political freedom and representation	8%	13%	23%	43%	13%	3.40	1.108
The tension among communities are attributed to the high level of unemployment in the Mau region compared to other regions	2%	5%	16%	56%	21%	3.88	.864
Absence of equity in allocation of resources in the region has been a cause of animosity along tribal lines	0%	14%	22%	56%	9%	3.59	.840

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Tension is linked to skewed budgetary allocation for infrastructure development in favour of some localities	2%	6%	17%	52%	23%	3.89	.888
Access to education is skewed to only certain regions and communities at the Mau	2%	3%	7%	45%	43%	4.23	.864

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On the opinion whether, there is no fairness and there is a lot of favoritism in Mau region with regards to political freedom and representation 56% agreed. Most of the respondents 77% agreed that the tensions among communities are attributed to the high level of unemployment in the Mau region compared to other regions. On whether, absence of equity in allocation of resources in the region has been a cause of animosity along tribal lines, 43% agreed. Most of the respondents 75% agreed that tension is linked to skewed budgetary allocation for infrastructure development in favour of some localities. Most of the respondents 88% agreed Access to education is skewed to only certain regions and communities at the Mau.

#### **4.4.1 Regression Analysis on the Influence of non-environmental activities on deforestation by small holder farmers in Mau region**

The researcher further carried out regression analysis between the deforestation by small holder farmers in Mau region and non-environmental activities. In order to conduct regression analysis the set of items that measured deforestation by small holder farmers in Mau region and non-environmental activities were aggregated by computing the average. Regression deforestation by small holder farmers in Mau

region and non-environmental activities, the findings of the regression analysis were as shown in Table 4. 4

**Table 4.4: Regression analysis of deforestation by small holder farmers on Non-environmental Influences**

		Estimate	Standard Error.	Critical Ratio.	P-value
Non-environmental influences	deforestation by small holder farmers in Mau region	.263	.045	5.824	.000

As shown in Table 4.4, deforestation by small holder farmers in Mau region is significant when regressed against non-environmental influences at  $\beta = .263$  when p value  $<.05$ . This means that the predictor of deforestation by small holder farmers in Mau region affected non environmental influences

### **Conclusion**

The finding of the study revealed that human activities by the small holder farmers affect the overall ecological situation at the forests leading to erratic weather patterns experienced in the forest regions, soil degradation among others. Strategies employed previously to address deforestation which is linked to forest depletion, erosion, flooding, climate change and low productivity in agriculture failed to meet the intended objectives since that people living around Mau forest were not involved. Recently, environmental issues related to forest destruction have increasing international attention which has led to the signing of various bilateral, regional and global agreements towards environmental issues that relates to addressing needs of



the people living around Mau forest. The need for agreements in forest conservation has been necessitated by the need to embark on environmental diplomacy in deforestation which had started to bear fruits despite the failure of the former strategies. Environmental diplomacy creates a way of reconciling the slow pace of implementation of environmental conservation strategies with the earnest growth of global ecological decline. In spite of the environmental diplomacy embarked on by the government there were still concerns ranging from unfair treatment of the residents depending on political affiliation, lack of equity in allocation of resources, tension is linked to skewed budgetary allocation for infrastructure development in favour of some localities.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter is a synthesis of the entire report and contains the summary of the findings, conclusion arrived at and policy recommendations arising from the study. Research gaps identified during the study are also identified as basis for future studies.

#### **5.2 Summary of the Study**

This section presents a summary of the main findings of the study based on the three core objectives that the researcher sought to accomplish. Overall, the findings of the study revealed that environmental activities and environmental diplomacy had a significant role on deforestation by small-scale holder farmers in Mau Forest, Kenya.

The first objective of this study was to establish the causes and impacts of deforestation by small holder farmers in Kenya. According to the results of the study, deforestation is largely as a results of competition between humans activities such as timber harvesting, agricultural expansion, overgrazing and bush fire which is either spread accidentally from neighbouring private farms or are started deliberately as an act of sabotage. These activities are further perpetuated by lack of clear understanding on the effects of deforestation where people living around Mau forest argue that subsistence farming is part of afforestation, availability of market for forest products and availability of credit and other financial support to forest destruction activities. In addition, population growth and high level of illiteracy were major causes of

deforestation and majority of the people living around Mau forest could not secure formal employment hence mainly rely on the forest products for their livelihood.

The second objective of the study was to determine the environmental effects of deforestation by small-holder farmers in Kenya. The study found out that the environmental effects of deforestation include, devastating effects to the environment that slowly turns the tropical zones to deserts, lack of trees to purify water that leads depletion of water resources. Deforestation was also found to have a negative influence on agriculture as it creates climate change which leads to lower yields. In addition, subsistence farming taking place in Mau forest lead to soil erosion, floods, and the desiccation of large tracts of land.

The third objective of the study was to establish the role of environmental diplomacy on reducing deforestation by small holder farmers in order to limit the environmental effects of deforestation in Kenya. It was evident from the study that the strategies that were employed before failed because of lack of local's involvement but the results indicated that environmental diplomacy bore fruit as it led to the signing of various bilateral, regional and global agreements towards environmental issues that relates to addressing needs of the people living around Mau forest. Environmental diplomacy created a way of reconciling the slow pace of implementation of environmental conservation strategies with the earnest growth of global ecological decline. Environmental diplomacy creates adapting measures, attitude changes and strategies that will ensure speedy implementation of agreed products of environmental conservation and preservation of forests. Despite the benefits attributed to environmental diplomacy, the study revealed that there is unfair treatment of the

residents depending on political affiliation, lack of equity in allocation of resources; tension is linked to skewed budgetary allocation for infrastructure development in favour of some localities. Both environmental and non-environmental activities were found to have a significant effect on deforestation of Mau forest.

### **5.3 Conclusion of the Study**

From the results of the study, the researcher concludes that majority of the people living around Mau forest lack proper education which limits their ability to acquire employable skills to be employed in other sectors of the economy other than depending on the forest and its resources for their livelihood. In addition, availability of market for forest products and availability of credit and other financial support to forest destruction activities influences deforestation.

Deforestation was found to have major effect on ecosystem by slowly turning the tropical zones into deserts, depletion of water resources, leads to climatic change that affect agricultural by lowering the yields and the gross domestic product of the country. People living around Mau forest need to be trained on the value of forests and water catchment areas as this may reduce reduces deforestation,

Environmental diplomacy was found to have significant effect on reducing deforestation by small holder farmers. The strategy worked very well by involving the locals through signing of various bilateral, regional and global agreements towards environmental issues that relates to addressing needs of the people living around Mau forest. Environmental diplomacy created a way of reconciling the slow pace of implementation of environmental conservation strategies with the earnest growth of

global ecological decline. In addition, environmental diplomacy created adapting measures, attitude changes and strategies that will ensure speedy implementation of agreed products of environmental conservation and preservation of forests. Both environmental and non-environmental activities propagate conflict between human needs and the natural forests.

#### **5.4 Recommendations of the Study**

Following the findings of this study, that people living around Mau forest lack proper education that limits their ability to acquire employable skills to other sectors of the economy. This study recommends that government should put more emphasis on ensuring that the young generation attains the basic education up to Kenya Secondary Education. This will not only enable them to acquire some basic skills but also to enable them understand the impact of deforestation on the ecosystem.

Availability of market for forest products and availability of credit and other financial support to forest destruction activities influences deforestation. Following this finding, the study recommends that policies put in place banning the sale of various forest products to curb deforestation.

Based on the finding that, deforestation slowly turning the tropical zones into deserts, leads to depletion of water resources, leads to climatic change that affect agricultural by lowering the yields and the gross domestic product of the country. The government should embark on creating awareness to the small-holder farmers on the devastating effects of deforestation as well as train them on better farming practices that will not lead to encroachment of forest land.

Population growth around Mau forest led subsistence farming taking place in Mau forest lead to lead to soil erosion, floods, and the desiccation of large tracts of land due to shortage of land. Following this finding the study recommends that government need to fast track on land reform policies to ensure that those living around Mau forest are resettled soonest possible.

The finding of the study revealed that environmental diplomacy had significant effect on reducing deforestation by small holder farmers. This study therefore recommends that all the relevant ministries should embark on environmental diplomacy as a strategy to curb deforestation by people living around Mau forest.

The study further revealed that that there is unfair treatment of the residents living around Mau forest based on their political affiliation, lack of equity in allocation of resources and tension is linked to skewed budgetary allocation for infrastructure development in favour of some localities. Following this finding the study recommend that relevant ministry should put in place policy measures that are context based and can balance the needs of the people and the environment. The locals should be consulted when developing such policies to encourage adoption.

Moreover, Ministry of Education should revise the Curriculum in Kenyan schools to take into consideration the need to educate Kenyans on the value of forest and the need to preserve forest land. Awareness should start at early age to ensure early appreciation and understanding on the need to reduce deforestation.

### **5.5 Suggestions for Further Research**

It is important to note that this research has filled a lot of gaps left by previous researchers on role of environmental diplomacy in addressing deforestation by the small holder farmers in Mau forest, Kenya. Nonetheless, the study also leaves some gaps which future researchers should focus their studies on. Future research should focus on the challenges affecting environmental diplomacy approach as a means of curbing deforestation in Mau forest. This is because the study revealed that several bilateral, regional and global agreements towards environmental issues have been signed with a view to address environmental effect of deforestation. Future researcher should also evaluate the factors that led to failures of other treaties that have been signed in the past. Finally, future researchers ought to incorporate more reserved forest and water catchment areas to ascertain whether environment diplomacy is the best frameworks in curbing deforestation

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**APPENDICES**

**APPENDIX 1: Questionnaire for small-holder farmers**

**PART A: DEMOGRAPHIC INFORMATION AND CAUSES OF DEFORESTATION**

1. Please indicate your gender

Male [ ], Female [ ]

2. Marital status.

Married [ ], Single [ ], Divorced/Separated/Widowed [ ]

3. Age bracket

18– 34 [ ], 35 – 39 [ ], 40 – 44 [ ], 45– 49 [ ], 50 and above [ ]

4. Level of Education

Primary [ ], Secondary [ ], Diploma [ ], Certificate [ ] Undergraduate [ ]

5. How many years have you been in small scale farming?

1-3[ ], 4-6[ ], More than 6 [ ]

6. Mention the activities that cause deforestation in Kenya?

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7. Apart from the activities that cause deforestation what are some of the processes that support/cause deforestation in Kenya?

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**PART B: ENVIRONMENTAL EFFECTS OF DEFORESTATION**

8. How do you agree with the following factors influencing deforestation of natural forests by small holder farmers? (5-Strongly Agree, 4-Somehow Agree, 3-Neutral, 2-Disagree, 1-Strongly Disagree)

	5	4	3	2	1
a) Level of education					
b) Size of the household and yield from farming					
c) Training of the farmer on the value of forests to agriculture					
d) Experience of the farmer in agriculture and its benefits.					
e) Lack of available market for timber products and profits from the same					

9. How do you agree with the following statements on the effects of deforestation by small holder farmers?

	5	4	3	2	1
a) Deforestation leads to economic losses as well as social consequences					
b) Deforestation has negative influence on agriculture as it creates climate change which leads to lower yields					
c) Through deforestation, there is lack of trees to purify water and therefore there is depletion of water resources					
d) Deforestation leads to devastating effects to the environment that slowly turns the tropical zones to deserts					

**PART C: ENVIRONMENTAL DIPLOMACY AND DEFORESTATION**

10. What are the roles of environmental diplomacy in deforestation in Kenya?
11. How do you agree with the following environmental influences of small holder farmers activities on deforestation in Kenya? **(5-Strongly Agree, 4-Somehow Agree, 3-Neutral, 2-Disagree, 1-Strongly Disagree)**

	5	4	3	2	1
a) The declining crop output is linked to soil degradation due to deforestation					
b) Animal and human wellbeing related activities has led to increased water pollution					
c) Livelihoods has been negatively affected by the rapid increase in human population and reduced farm sizes within the region					
d) The erratic weather patterns experienced in the forest regions are as a result of forest depletion					
e) Human activities by the small holder farmers affect the overall ecological situation at the forests					

12. How do you agree with the following non-environmental related activities that small holder farmers have on deforestation in Kenya? **(5-Strongly Agree, 4-Somehow Agree, 3-Neutral, 2-Disagree, 1-Strongly Disagree)**

	5	4	3	2	1
a) Access to education is skewed to only certain regions and communities at the Mau					
b) Tension is linked to skewed budgetary allocation for infrastructure development in favour of some localities					
c) Absence of equity in allocation of resources in the region has been a cause of animosity along tribal lines					
d) The tension among communities are attributed to the high level of unemployment in the Mau region compared to other regions					
e) There is no fairness and there is a lot of favoritism in Mau region with regards to political freedom and representation					

**Appendix ii: Interview guide for heads of organizations**

1. What are the causes of deforestation in Kenya?

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2. What are the environmental effects of deforestation on small-holder farmers in Kenya?

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3. What is the role of environmental diplomacy for reducing deforestation in order to limit the environmental effects of deforestation in Kenya?

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