Determinants of Beekeeping in Enhancing Environmental Conservation in Arid and Semi Arid Lands in Kenya: A Case of Lomut Ward, West Pokot County

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DECLARATION

I, the undersigned, declare that this research project is my original work and that it has not been presented in any other university.

Sign …..…….. **Date …….**

Sarah Chemtai Sialuk

L50/62326/2013

This project has been submitted for examination with our approval as university supervisors.

Sign …..... **Date.....**

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DEDICATION

This research project is dedicated to my loving family members and to my friends for the support and motivation that they gave me towards making the project a success.

ACKNOWLEDGEMENT

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ABBREVIATIONS AND ACRONYMS

ASAL Arid and Semi-Arid Lands

CABESI Camel Bee Silk

CBS Central Bureau of Statistics

DPI Daily Per Capita Income

FAO Food and Agriculture Organization

GoK Government of Kenya.

HCA Honey Care Africa

IHC International Honey Commission

KNBS Kenya National Bureau of Statistics

NRI Natural Resource Institute

SMEs Small and Micro Enterprises.

SPSS Statistical Packages for Social Sciences

ABSTRACT

The main purpose of this study was to assess the determinants of beekeeping as an alternative economic activity in enhancing environmental conservation in arid and semi-arid lands in Kenya, a case of Lomut ward West Pokot County, Kenya which is categorized as ASAL and this activity has been practiced in the region for some time. The study was guided by the following research objectives; to determine the effects of afforestation for bee keeping on environmental conservation, to assess how protection of water catchment areas for bee keeping purposes affect environmental conservation, to investigate how intercropping influence environmental conservation and to find how technology adoption for bee keeping influence environmental conservation. In this research, survey study research design was used. This study targeted 220 respondents and a sample size of 136 was then selected. Purposive sampling was used to select CABESI officials operating in the region and simple random sampling was used to select 126 community residents. Questionnaires and interview schedules were used to collect primary data. The study used descriptive and inferential statistics as the main methods of data analysis. The analysis and presentation of data focused on the frequencies, percentage and tables. The study will benefit the general public from the conserved environment and the biodiversity of wildlife, various bodies of the government and NGOs in line with the achievement of vision 2030, which seeks to enable the transition of small scale farms and improving the living standards of people in arid and semi-arid regions and form a useful foundation upon which future studies can be undertaken by other researchers taking into account the suggestions for further studies. The study found that bee keeping encourages planting of trees which encourages conservation of the environment, rivers and springs have been protected for environmental conservation by bee keepers, that bee keeping has contributed a lot to pollination of flowering plants, intercropping, adoption of modern bee hives, modern apiary management and adoption of modern honey harvesting methods. The study recommends that the addition of a little technical information on the existing however, can lead to greatly improved methods of carrying out the activity for environmental conservation, the Government through the ministry of environment, water and natural resources should set to improve the practice by planting trees and encouraging the locals to practice afforestation, the government through the ministry of sports, culture and the arts should intervene in the gender biasness in this region. Women in the area should be empowered to participate in every economic activity just like the men. Taboos and traditional beliefs discouraging women from bee keeping should be scrapped off, development partners should facilitate the involvement of women in beekeeping activities in the study area. Development partners should fund research to ascertain ways of improving harvesting and marketing of bee products to enhance their quality and quantity.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Beekeeping contributes to food security, poverty reduction, employment creation and income generation in not only in the arid and semi arid areas in Kenya but in majority of the sub-Sahara Africa rural areas (Abellán, 2002). Honey is the most important primary product of beekeeping both from a quantitative and economic point of view, and has been used by mankind for many years as source of food, medicine and for religious and cultural ceremonies (Cartland, 2007; Mcinerney 2004; Molan, 2009). Apiculture is currently one of the most widespread agricultural activities carried out throughout the world.

According to Roubik (2002), apiculture in general and improved apiculture in particular contributes to environmental protection and sustainable agriculture through a reduction of environmental effects from tree felling for traditional bee hive construction and from fire hazards from smoking of hives. Encouragement of apiculture and increases in output of hive products would be in accordance with agricultural sector policies of many African Governments. These often seek the improvement of household food security concurrently with raising incomes and stabilizing cash flows through improving productivity of various agricultural and diversified agricultural activities.

Environmental conservation is an action or practice aimed at protecting the environment on individual, organizational or governmental levels for the benefit of the natural biodiversity and humans. Researchers have observed beekeeping as one of the underdeveloped socio-economic activities that could have high potential for promoting environmental conservation and food security in Africa (Roubik, 2002).

This is because of the bees economic value obtained from sale of their products that include; Honey, Wax, Pollen, Propolis, Royal Jelly, and Bee Venom. Support in crop pollination which facilitates high agriculture yield for crop farmers and their ability to promote high yield for seeds that develop to new plants which in turn, promotes re-forestation as part of environmental conservation. It has now been proved true that climate variability, especially rainfall variability is real (IPCC, 2010 in Muli et al., 2007). Rainfall patterns have become so unreliable, and this has affected food availability, food accessibility, food utilization and food systems stability. This has also worsened on food insecurity issue among the vulnerable and marginalized groups. It has also become a determinant on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows (Lietaer, 2007). Pastoralism-based livelihood systems that are already vulnerable to food insecurity face immediate risk of increased famine as new patterns of pests and diseases attack the livestock.

Habitat loss is a global threat to biodiversity. The world's increasing population, poverty and the drive for economic growth are the underlying pressures that contribute to habitat loss and fragmentation. Land degradation also threatens biodiversity. To some degree, most forest areas in the world is fragmented, while parts of grass- and shrub-lands are highly degraded gaps in vegetation cover caused by fragmentation can isolate populations of certain species and lead to their demise (Pryanishnikov & Katarina, 2003). While land and water degradation render habitats unhealthy thus threatening species survival. There are approximately 56 million bee hives in the world, which produce an estimated 1.2 billion tons of honey. About a quarter of the honey produced is traded and 90% of the exportation is made from

around 20 countries that produce honey. China has the highest number of beehives with 65 million units and with honey production of 306,000 tons.

Average honey production per hive is 20 kg throughout the world, and this figure is 33 in China, 40 in Argentina, 27 in Mexico, 64 in Canada, 55 in Australia, 40 in Hungary, and 16 kg in Turkey. These countries are also the highest honey exporting countries in the world. The countries that are the best honey importers are Germany, the United States of America (USA), Japan, England, Italy, Switzerland, France, Austria and other European countries. In addition to honey, bee products such as propolis, royal jelly, pollens and wax are also significant in the world trade. On the other hand, in countries with developed agriculture, in addition to production of bee products, vegetative production is exercised in order to increase quantity and quality (Izadi & Cahn, 2000).

According to a study by FAO (2011), it was found out that depending on the assets people have the structures and processes those determinants on them, tradition, and the vulnerability context under which they operate, they choose livelihood strategies that best provide them with livelihood outcomes. Livelihood strategies are composed of activities that generate the means of household survival (Ellis, 2000). Livelihood strategies change as the external environment over which people have little control changes. Sometimes unsustainable and unproductive Livelihood strategies continue because of tradition and habit (Izadi & Cahn, 2000) at other times livelihood activities are introduced as coping strategies in difficult times. In this study, livelihood outcomes will entail poverty reduction, food security, welfare, and asset ownership. The benefits from bee keeping come through provision of honey, wax, propolis and pollination (Krell, 2001). The product, honey, has a long shelf life well suited for rural communities' without much infrastructure. It has also a high

nutritional and medicinal value and hence contributes immensely to the community health and wellbeing in the short-term. Bee production globally has been growing steadily, with demand growing at a faster rate (Al-Jedah, Martin & Robinson, 2003).

The sub-Saharan region has always depended on bee keeping as an economic activity merely to supplement their little available food and not as a means of environmental conservation. It has been advocated for by development agents, because its nature, low input requirement, cheap labour base and is friendly to the harsh desert conditions. It does not depend on soil, and it can be a single means of living for families with very little or no soil (Kizilaslan & Kizilaslan, 2007).

The Kenyan government in its strategy for development of apiculture and emerging livestock crisis has identified honey production and development of apiculture as one of the few means by which people in ASAL areas can earn an income and make them better adapt to climate change without damaging the environment they depend on to survive. Bee-keeping is practiced in the arid and semi arid areas/lands both by individual small scale farmers and Common Interest Groups (CIGs).According to a report by the Ministry of Livestock (RoK, 2001) bee keeping can be carried out successfully in 80 percent of the country. It is especially suitable in ASAL where other modes of agriculture are not very possible.

Beekeeping contributes to incomes as well as food security through provision of honey, beeswax, propolis, bees' venom and royal jelly in medicine. It also contributes to seed and food crop production through pollination and conserves natural environment. The country's potential for apiculture development is estimated at over 100,000 metric tonnes of honey and 10,000 metric tonnes of beeswax. However, at the moment only a fifth of this potentials being exploited (RoK, 2005). Despite this, and the downward trend in global production of honey, the Kenyan case

has however been different. Findings by the Ministry of trade in 2001 indicated that production in Kenya has been steadily growing for instance from 17,259 metric tonnes in 2004, 19,071 in 2006 and 22,803 in 2000 (RoK, 2001). In Kenya, over 90% of beekeepers use traditional methods that presumably lead to honey of low quality (Mbae, 2009).

In ASAL, traditionally many communities have practiced bee keeping but owing to the fact that the techniques and equipment they have used are of low quality, quantity and quality of honey produced has been of low quality to attract good prices. Although there is unmet demand for honey in both national and international markets, beekeepers face a number of problems that prevent them from taking advantage of existing opportunities, such as continued natural resources degradation and destruction of the environment, climate changes, inefficient beekeeping methods, lack of market information, and difficulties in getting their honey from remote rural areas to urban-based buyers (Gichora, 2003). There are no economies of scale in the approach, wide spread lack of investment capacity, poor infrastructure and equipment, lack of technical, management and business skills. Many efforts that have focused on only one aspect that is training beekeepers how to take care of bees without intervening on other aspects that ensure sustainability have had short-lived determinants and at the end the farmers/beekeepers end up reverting to the old way of doing things.

Maurice (2006) argues that beekeeping can help to conserve environment mainly in three interconnected ways: increasing the number of honeybees in an area should improve the pollination success of numerous flowering plant species; the income generated from beekeeping can help to alleviate pressure on the local resource base; and there is a potential to alter the way the people view their local environment.

1.2 Statement of the Problem

Ideally, beekeeping is an important sustainable and alternative source of income benefiting communities living in ASAL areas. Beekeeping can also be a practical tool for raising the economic capability of the communities living in these regions as well as creating awareness on the importance of good management of the environment and for stimulating its conservation by improving their biodiversity. ASAL is characterized by rainfall variability thus livestock production is the major economic activity in these regions has been adversely affected by these trends. This has immensely affected food security among the communities living in these regions (Rosenzweig, 2003). The community has resorted to hunting and destroying the few forests in the region in the look for food as well as doing some minor cultivation thus destroying the environment.

Currently however, due to lack of knowledge among rural communities and bad economic practices, beekeeping and its products have been ignored and not recognized as not only a very viable alternative economic activity in these regions but also friendly to the environment. Despite the favourable natural environmental conditions for beekeeping existing in almost all ASAL and the potential for building sustainable livelihoods in these areas, beekeeping often lacks the necessary attention as an alternative economic activity. Poverty, land degradation, loss of wildlife habitats and biodiversity, deforestation, environmental pollution and food insecurity still characterizes the livelihood of ASAL. Their livelihoods are still dependent on the less productive and environmental destructive pastoralism. Beekeeping still needs support to fully exploit its great potential in conserving forests and natural ecosystems and in reducing poverty. It is based on these problems that this study sought to identify the

major determinants to the growth of the sector in this region focusing on its capability to conserve and improve the environment and give appropriate recommendations.

1.3 Purpose of the Study

The study solely aimed at assessing the determinants of beekeeping in enhancing environmental conservation in arid and semi arid lands.

1.4 Objectives of the Study

The study was guided by the following research objectives.

1. To investigate how afforestation for bee keeping influence environmental conservation
2. To assess how protection of water catchment areas for bee keeping purposes affect environmental conservation
3. To assess how intercropping for bee keeping influences environmental conservation
4. To assess how application of technology for bee keeping has influenced environmental conservation

1.5 Research Questions

1. How does afforestation for bee keeping purposes affect environmental conservation?
2. What role does protection of water catchment areas for bee keeping purposes affect environmental conservation?
3. How does intercropping for bee keeping influence environmental conservation?

4. How does the adoption of modern hives for bee keeping influence environmental conservation?

1.6 Significance of the Study

This study is significant to various stakeholders. First, it anticipates helping the communities living in ASAL to formulate strategies to improve their production of honey, ensure food security, reduce reliance on pastoralism and conserve the environment using the results of the analysis. This study will analyze, describe, implement, communicate and monitor strategies aimed at conserving the environment.

Information generated by the study will guide policymaking process by the various bodies of the government and NGOs in line with the achievement of vision 2030, which seeks to enable the transition of small scale farms and improving the living standards of people in arid and semi arid regions. This will facilitate increased food security in the country and foster economic development. The study will also be of importance to the general public who will benefit from the conserved environment and the biodiversity of wildlife.

Lastly, this study is also form a useful foundation upon which future studies can be undertaken by other researchers taking into account the suggestions for further studies. Findings of the study will also provide useful literature for other scholars who may wish to further explore the area of bee keeping and its challenges.

1.7 Delimitations of the Study

The study was conducted between the months of April and July, 2014 on the determinants of beekeeping in enhancing environmental conservation in arid and semi

arid lands. It targeted bee keepers living in arid and semi arid areas who were the respondents of the study.

1.8 Limitations of the Study

Some of the respondents were not willing to fill the questionnaires hence leading to spending more time explaining to them the importance of the research. These hampered the information needed by the researcher in the required time frame. This study only focused on selected honey producing households in arid and semi arid lands. There are other aspects entailed in the integrated agro enterprise approach such as production, marketing, business organization and support services which were beyond the scope of this study.

1.9 Assumptions of the Study

This study was based on the following assumptions that the selected sample volunteered information to the researcher. The second assumptions of the study was that the respondents who were selected for the study gave accurate information that helped the researcher answer the necessary research questions and achieve the objectives of the study. Lastly, study was able to raise enough financial resources for the conduction of the study to completion.

1.10 Definition of Significant Terms

Afforestation: This is the practice of planting trees where there were no trees. In this study the term is used to refer to the practice of planting trees where there will none and also replanting (Nkamleu, 2007).

Arid and semi arid land– refers to an area characterised by a severe lack of available water which in some cases hinder the growth and development of plant and animal life. Pastoralism is the main source of livelihood in this area.

Beekeeping: refers to keeping of bees in arid and semi arid lands for economic and environmental purposes only.

Environmental conservation: This is the practice of protecting the natural environment for the benefit of both the natural environment and humans. In this study environmental conservation is used to mean protection of the forest cover in ASAL lands (Nkamleu, 2007).

Intercropping: involves integrating crops of different varieties together with bee hives for the purpose of environmental conservation.

Land degradation: Decline in the productivity of land until it is biologically useless.

Modern technology: involves the use of current machinery, skills and knowledge on bee keeping aimed at environmental conservation activities.

Water catchment: This is an area where water is collected by the natural landscape. In this study it's used to mean where all rain and runoff water eventually runs to i.e. Rivers, dams and streams.

1.11 Organisation of the Study

The research study comprises of five chapters namely chapter; one, two and three. Chapter one deals with the background of the study, problem study, research objectives, hypothesis, significance of the study, delimitation of the study and the possible limitations that were encountered by the researcher. Chapter two basically deals with reviewing of theories and the past studies. The past studies offer insights and are beneficial in guiding and providing information to the study. Chapter three: Research design and methodology. It encompasses: the research design which the researcher used. The study area, the target population and the sample size that the researcher obtained the information from, research instruments which the study will employ in collecting the information, validity and the reliability of the research instruments, data collection procedures, data analysis procedures, operational definition of variables and ethical consideration. Chapter four contains data analysis, presentation and interpretation while chapter five provides a summary of findings, discussion, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the works of ascribed scholars and researchers in a manner that the study will offer a crucial perspective of the existing research that is in relation to the determinants of beekeeping as an alternative economic activity in enhancing environmental conservation in arid and semi arid lands. The chapter shows clear loop holes in knowledge to be addressed and equally uses the relevant themes to the study to advance and discuss in consistence with the requirements of the title and objectives herein. Therefore, the review attempts to point out the relationship between the past and current situation in the beekeeping in enhancing environmental conservation in arid and semi arid lands. This chapter will similarly review the theoretical review, empirical review and give an insight regarding issues of the objectives of the study.

2.2 Afforestation for Bee Keeping on Environmental Conservation

Afforestation has been defined by Nkamleu (2007) as the practice of planting trees where there were no trees. It is often used to refer to the practice of planting trees where there was none and also replanting. Beekeeping projects are an ideal tool to raise awareness about the value of forests and engage people in conscious protection, conservation and sustainable resource management. Beekeeping could also be used to deal with the issue of property rights over natural areas, an issue that has been proven to be essential in the sustainable use of natural resources. Bee-reserves can be established with exclusive access for beekeepers, as has been done in the United Republic of Tanzania (MNRT, 2008). Beekeeping can be introduced in

reforestation projects, paying special attention to the use of native and melliferous plants that provide a rich and varied source of nectar and pollen. Beekeeping can also be promoted as an alternative activity for communities living near forest rehabilitation programmes during which access to the forest may be forbidden or limited. The products of the beehives honey, pollen, propolis and wax are a rich source of nutrients that could replace the nutrients which communities would obtain by collecting edible forest products. The necessary financial, extensional and technological support to fully exploit the great potential of beekeeping in the conservation of forest and natural ecosystems and in poverty-reduction programmes should therefore be allocated.

A livelihood should enhance capabilities while not undermining the natural resource base (Adolkar, Kioko & Mwanycky, 2003). Beekeeping goes beyond this, because it actually helps to sustain the natural resource base. Throughout the world, beekeeping has traditionally been part of village agriculture. Now, as farming practices change, it is essential to ensure that beekeeping is retained and encouraged in order to provide continued populations of pollinating insect.

Beekeeping livelihoods are built upon natural resource stocks: bees, flowering plants and water. Bees collect gums and resins from plants and use plants and trees as habitat for nesting. Bees are a natural resource, and freely available in the wild. Where bees have not been poisoned, damaged or harmed, they will collect wherever they are able, provided the natural conditions include available flowering plants. Wild or cultivated areas, wetland and even areas where there may be land mines all have value for beekeeping. Beekeeping is possible in arid areas and places where crops or other enterprises have failed; the roots of nectar-bearing trees may still be able to reach the water table far below the surface in these areas. This makes beekeeping

feasible in marginal conditions, which is important for people who need to restore their livelihoods or create new ones (Ellis, 2000).

Beekeeping fits in well alongside many other livelihood endeavours because it uses the same natural resources as, for example, forestry and agriculture and conservation activities. There is no competition with other insects or animals for these resources that otherwise would be inaccessible to people (Hoshiba and Sasaki, 2008). Beekeeping ensures the continuation of natural assets through pollination of wild and cultivated plants. Flowering plants and bees are interdependent: one cannot exist without the other. As bees visit flowers, they collect food and their pollination activities ensure future generations of food plants, available for future generations of bees and for people too. It is a perfect self-sustaining activity. Pollination is difficult to quantify, but if it could be measured it would be the most economically significant value of beekeeping (Hoshiba & Sasaki, 2008).

The dry lands are ecologically marginal areas, and consequently they require special management strategies and effort to make sound use of the vast resources they contain. In general, rainfall in the dry lands is relatively low and unreliable, and varies greatly in space and time. Because of these factors, water availability and accessibility is highly variable and is a major constraint to production. The soils in the ASAL areas are highly erodible, which is determined mainly by slope, land use, vegetation cover and shallowness (Winter & Cava, 2006).

Wild bees nest in the cavities of trees and old hollow trees. Deforestation, changes in land use, or the clearing of land for agriculture and the excessive use of pesticides; constitute major direct threats for bees. It is therefore important to raise awareness among farmers, forest communities and communities living around forests,

about the important role that bees play in agriculture and in maintaining biodiversity and ecosystems (Winter & Cava, 2006).

According to the 2009 population census, approximately 34% of the Kenya's population lives in the ASALs. The population densities in these areas are generally low at about 2 persons/km2. This coupled with the migratory nature of the inhabitants make public provision of vital social services difficult. The ASAL population, however, has been increasing because of natural population growth and migration from densely populated, high potential areas such as Laikipia, parts of Baringo county and Machakos. Population growth puts more pressure on the fragile environment and causes stiff competition for various resources. The utilization of relatively high potential areas within dry lands previously used as fallback grazing and blockage of migratory or access routes to key resources like water are some of the causes of social and human wildlife conflicts.

In Africa, Asia, Central and South America it is often the most poor and most remote people, with few other livelihood options, who practice beekeeping. Many of these poorest people are living in areas that are rich in natural resources, such as tropical forests and woodlands, and beekeeping is a feasible way for them to create food and income using the natural resources around them (Maurice, 2006).

Beekeepers and honey hunters are sometimes perceived to cause damage to forests, through the careless use of fire during harvesting and because they kill trees to make beehives. Beekeepers in some parts of Africa make bark hives by peeling cylindrical sections of bark from mature trees, which then die. The Forest Department/IRDP Beekeeping Survey explored this issue in the Zambia's North West Province from 1987-1992 (Claus, 1992).

The researchers also estimated that trees/km2 were destroyed by beekeepers in the whole province but this figure was later challenged by the honey trading company NWBP who believed the Beekeeping Survey had overestimated the number of beekeepers and therefore the number of trees harvested (Muzama, 1996). Despite this discrepancy researchers argued that even if the higher figure was accurate this was still well within the forests capacity to regenerate sustainably.

2.3 Protection of Water Catchment Areas for Bee Keeping Purposes on Environmental Conservation

A catchment is an area where water is collected by the natural landscape. According to Everett (1982), water catchment is an area where water is collected by the natural landscape. The idea of water protection and bee keeping originates from the fact that bees need water to cool up and for the purpose of honey and wax production. In a catchment, all rain and run-off water eventually flows to a creek, river, dam, lake, ocean, or into a groundwater system. These include; rivers, dams and groundwater systems. Water catchment areas are responsible for providing the community with safe, high quality drinking water. Human activities such as agriculture, septic systems and land clearing have the potential to impact the health of water catchments (Gardner & Stern, 2002). Caring for rivers, dams and groundwater environments helps ensure healthy catchments and provides our community with: clean drinking water, natural areas for recreation, habitat for plants and animals, healthy vegetation and waterways, reliable and clean water for stock and irrigation and opportunities for sustainable agriculture and industry.

The principle of water balance underpins the understanding of catchment hydrology in catchment areas such as the common oasis in the ASAL. Over a period

of time, the amount of water stored within a catchment in groundwater, soil moisture or surface poundage will be the difference between the amount of water entering the catchment mainly from rainfall and the amount of water leaving it through surface runoff, base flow, vapour transpiration and groundwater recharge i.e. water can neither be created nor destroyed, but its source can be moved from place to place (Gould, Saupe and Klemme, 2009) thus the need to protect the catchment area.

Recognizing this need of water by bee keepers helps in understanding the hydrologic implications of planting trees around water catchments and gives a basis for making informed decisions concerning afforestation. The world population is slight above 6 billion and is expected to double in the next 50 years. Water catchment areas maintain conditions that make life possible. Globally forests which are a major catchment area cover only 30% of the world's surface. Competitive global economy drives the need for more money in the economically challenged tropical countries (Everett, 1982).

Deforestation is has a result of the interaction of environmental, social, cultural and political forces in a given region (Goletti & Rich, 2008). The three main causes of deforestation in the world are; agriculture, infrastructure expansion and wood extraction. Population growth is a major hindrance to attainment of sustainable development. Tropical forests are world's reservoir of ecosystem and biodiversity hotspots. Most of tropical forests are in developing countries and threatened with high rate of deforestation, hence major effect of global climate change, and loss of plant and animal species. Forests also house indigenous cultures, people with knowledge and information about nature. Transforming forest to wipe out indigenous people is a moral crime. Carbon trading/avoided deforestation, sustainable forest management

and forest certifications are options in the world agenda for discussion as the possible ways of alleviating deforestation (Hoshiba & Sasaki, 2008).

Cattle ranches are leading causes of deforestation, with agriculture being the second. They have also bred conflict, corruption, political protection and violence. The soy expansion and cattle ranching has proved to increase deforestation and generation of social, economic and cultural problems to indigenous and landless peasants, but the World Bank through the IFC, has continued to fund these ventures. However, a sustainable cattle grazing is not linked to environmental losses. Sustainable livestock grazing can enhance plant species richness, diversity of grasslands and is widely used as a management tool in conservation programs of natural grasslands, as restoration of grassland reversing decline (Lictaer, 2007).

2.4 Intercropping for Bee Keeping on Environmental Conservation

Intercropping is considered as the practical application of ecological principles such as diversity, crop interaction and other natural regulation mechanisms. Intercropping is defined as the growth of two or more crops in proximity in the same field during a growing season to promote interaction between them (Ofori and Stern, 1987). Available growth resources, such as light, water and nutrients are more completely absorbed and converted to crop biomass by the intercrop as a result of differences in competitive ability for growth factors between intercrop components. The more efficient utilization of growth resources leads to yield advantages and increased stability compared to sole cropping (Ofori & Stern, 1987).

Furthermore, the multifunctional profile of intercropping allows it to play many other roles in the agro ecosystem, such as resilience to perturbations, protection of plants of individual crop species from their host-specific predators and disease

organisms, greater competition towards weeds, improved product quality and reduced negative impact of arable crops on the environment (Clark and Carney, 2008).

Nitrogen fixing legumes can be included to a greater extent in arable cropping systems via intercrops. Legumes contribute to maintaining the soil fertility via nitrogen fixation, which is increased in intercrops due to the more competitive character of the cereal for soil inorganic N. This leads to a complementary and more efficient use of natural sources. Intercropping of grain legumes and cereals therefore offers an opportunity to increase the input of fixed nitrogen into agro ecosystems without compromising cereal N use, yield level and stability (Ofori & Stern, 1987).

Intercropping is a method for simultaneous crop production and soil fertility building and it may also contribute to the prevention of nitrogen leaching risks sometimes observed from sole crops such as grain legumes due to changes in incorporated residue chemical quality involving nutrient turnover (Willey, 1990). It is also an ecological method to manage pests, diseases and weeds via natural competitive principles that allow for more efficient resource utilization (Pogio, 2005). These same competitive principles also contribute to an improved quality of intercrop products. The inclusion of N2 fixing crops in an intercrop leads to the utilization of the renewable resource of atmospheric nitrogen which increases the sustainability of the agro ecosystem. Intercropping can also be regarded as a practice to increase the production of less stable crops such as grain legumes and hereby contribute to lowering the protein deficit in EU at lower risk for the farmer (Gosh *et al.,* 2004).

Many concepts have been developed to assess yield advantages as a result of the divergent production goals of different intercropping systems which include; land equivalent ratio (LER) and relative yield total (Willey, 1990). Intercropping of cereals with legumes has been popular in humid tropical environments (Tusbo *et al.,* 2005)

and rain-fed areas of the world (Gosh *et al.*, 2004) due to its advantages for yield increment, weed control (Poggio, 2005), insurance against crop failure, low cost of production and high monetary returns to the farmers (Ofori & Stern, 1987), improvement of soil fertility through the addition of nitrogen by fixation and transferring from the legume to the cereal (Gosh *et al.*, 2006), improving yield stability, socio-economic and some other advantages (Willey, 1979). Intercropping being an agricultural practice can be used for decreasing the dependency on chemical herbicides in weed control (Banik *et al.*, 2006) and defined as the growing of two or more crop species simultaneously in the same field during a growing season (Ofori & Stern, 1987). Intercropping generates beneficial biological interactions between crops, increases grain yield and stability, helps use the available resources more efficiently and reduces the weed pressure (Jensen, 2007). The intercropping may lead to an overall yield advantage (Shafik & Soliman, 1999)

Beekeepers are always interested to observe the herbaceous plants, shrubs and trees that are especially important for bees, and will often know whether the bees are collecting nectar and/or pollen. Often beekeepers will recognize, from the colour of pollen being carried by workers arriving at the hive, which plant species the bee has been visiting. It has been widely reported that decrease in size of arable land and loss of soil fertility due to poor land management have implication on farm yields and community wellbeing (Ogbodo *et al.*, 2012; Ferencz & Balog, 2010).

Traditional home gardening agro-forestry practice involves growing of various food crops mixed together with and higher trees within one farm plot (Wiersum, 1997). Taking an advantage of trees' heights, farmers can suspend several beehives within a small farm plot provided that there are sufficient forages to bees. As observed by Verma and Attri (1998) in India, a small size farm plot can hold up to 50

hives using modern technologies without affecting other farm production activities. Similarly, Wiersum (1997) documented that, beekeeping is the best practice in small to medium farm plots like home gardens since it enhance productivity through improved pollination and reduce competition on land resources. The current ownership of land is limited which lowers than the national average household land holding (URT, 1998). Since human population is growing fast, it is likely that access to arable land is more competitive in the near future, a situation that will have an implication on food production among other challenges.

2.5 Technology Use in Bee Keeping on Environmental Conservation

The importance of bees for global food security and agricultural production ensures that there isn't lack of pollinators in the world (Azien & Harden, 2009). The decline in pollinators is visible with the current attitude of bee keepers. Bee keepers perceive apiculture as a hard business since there are many different ways of running it (Barlović, 2009). Many beekeepers do not have the bees as their only income; but acts as a part-time job or a profitable hobby (Barlovic, 2009). Research suggests that there are a number of factors that may influence the development of the local bee keeping such as demographical factors of the key stakeholders in agriculture sector (Klein *et al.*, 2007).

It has been promoted widely in many countries as a major rural development engine (Kamatara, 2006). Not only does the practice of beekeeping have intrinsic health benefits through providing a food source of great nutritional value which is lacking in rural areas, but also requires few inputs and capitalizes on a ready supply of pollen and nectar from crops they pollinate (NET Uganda, 2002).

Beekeeping is emerging as a very successful agricultural practice for rural area based people in less developed countries mainly due to its economic benefits from the products of this practice (Kugonza, 2009). In Uganda, honey, beeswax, propolis, royal jelly and bee venom are the major financial products (Kamatara, 2006); with pollination as the major biodiversity benefit (Delaplane, 2008). Since food security cannot be achieved without income security, beekeeping could be a useful tool for improving rural economy; however, people are reluctant on taking up this enterprise.

Agricultural research has not given due emphasis to assessment and understanding of modern methods of bee farming especially in developing countries where the scholars and policy makers have not been able to adequately demonstrate the importance of these modern methods to livelihoods. Modern beekeeping can easily be embarked on because investment is low; it does not require large area of land and there is no need for daily care (Matanm *et al.,* 2008). Adopting improved technologies and improved management practices would greatly improve the yields and quality of honey (Bees for development, 2000). Even though considerable attention is given in reports and documents to the significance of beekeeping in Uganda, little research and development in beekeeping has been conducted. It is estimated that Uganda produces 5,000 tonnes (MAAIF, 2000) which is only 1% of the national annual production potential estimated to be 500,000 tonnes (Horn, 2004). Efforts to increase production would require proper assessment of the factors affecting the adoption of beekeeping and associated technologies. It is this research gap that prompted the curiosity of this study.

In order to promote diversification in agriculture and reduce poverty in Uganda, beekeeping is one of the major agricultural activities being upheld by the government programmes of poverty alleviation (MAAIF 2000). It offers a great

potential for income generation, poverty alleviation, sustainable use of forest resources and diversifying the export base. The most important service the honeybees render to mankind is pollination of agricultural and forestry crops (FAO 2009; Commonwealth, 2002). In contrast with other agricultural projects such as livestock, poultry and fish farming, beekeeping is a relatively low investment venture that can be undertaken by most people (women, youths, the disabled and the elderly). With beekeeping, there is no competition for resources used by other forms of agriculture. Additionally, it is environmentally friendly and can be productive even in semi-arid areas that are unsuitable for other agricultural use (FAO, 2009). There is availability of market for bee products both locally and internationally (UEPB, 2005), and it is important to note that pharmaceutical and cosmetic industries utilize bee products such as honey, royal jelly, beeswax and propolis (UEPB, 2005).

In recent years, livestock production with potential application of modern technologies has technically advanced. However, satisfying the basic needs of the rural people to improve their standards of living is still a challenge despite technological advances (Kugonza, 2009). Beekeeping as an important area of livestock agriculture has not received sufficient attention in the past (Matanmi *et al.*, 2008) as it does presently.

Most beekeepers have had beekeeping as a hobby when retired which never emphasized the activity as a major economic activity and environmental conservator but it is a decreasing trend among senior citizens (Lannek, 2012). It seems difficult to tempt a new generation into a business with low market prices both for the pollinating services and for the products provided by the bees. The majority of beekeepers are still employing traditional production systems and also limited with poor technical skills (Mustapha, 2000; Mwakatobe, 2006). Lacking sufficient scientific

documentation that could be useful to guide sustainable beekeeping (Marcelian *et al.*, 2009), and therefore making its utility being unrealized.

2.6 Theoretical Framework

The study was guided by sustainable livelihoods theory advanced by DFID, (1999). According to this framework, poverty reduction interventions should focus on empowering the poor to build on their own opportunities, supporting their access to assets, and developing an enabling policy and creating an institutional environment. This approach, though focuses on environmental conservation, tends to place people and their priorities at the centre of development, trying to understand the differences between groups of people and working with them in a way that is appropriate to their current livelihood strategies, social, environment and ability to adapt (Muli *et al.*, 2007).

The livelihood approach dates back to the contributions of several scholars between the mid-1990s and the early 2000s as a new way of thinking about the objectives, scope and priorities for development. Its emergence had all the qualities of a classic paradigm shift (Solesbury, 2003). Therefore, livelihoods approaches are basically participatory. Moreover, they try to balance economic, institutional, social and environmental sustainability. Livelihoods approaches recognize the dynamic nature of livelihood strategies and people's flexible responses to changing situations. In this context the issue of destruction of the environment, desert encroachment, rainfall variability and food insecurity is a real problem and it has and is affecting totally the issue of food security among the marginalized communities in Kenya (Meda, Lamien, Millogo & Nacoulma, 2005).

These are communities that have been depending on agriculture for their livelihoods. The rising temperatures and the unpredictable rainfall variations have immensely contributed to poor agricultural production hence adding to the existing problem of food insecurity in the regions. This calls for an adoption of a different source of livelihood, hence the need for the study on adoption of bee farming in enhancing environmental conservation. The study will provide useful information to the bee farmers and policy makers towards improved bee farming methods.

According to the sustainable livelihoods framework, the vulnerability context within which people pursue their livelihoods includes trends for example, economic or resource trends, shocks (for example, conflict, economic shocks, natural shocks, seasonal fluctuations in prices, production, health, employment opportunities (Stokols & Altman, 1987). These factors can have a direct impact on people's assets and on the options available to them to pursue beneficial livelihood strategies. The vulnerability context of poor people's livelihoods is usually influenced by external factors outside their direct control and is dependent on wider policies, institutions and processes to support people in order for them to be more resilient to the negative effects of trends, shocks and seasonality, development policy-makers and practitioners can support people's access to assets and help ensure that critical policies, institutions and processes are responsive to their needs (Ashley & Carney, 1999).

The study help in identifying the shortcomings of the policy makers and institutions in the effective adoption of bee farming in enhancing environmental conservation in semi arid lands. Livelihood approaches have proved to be valuable in analyzing complex trends such as rainfall variability and situations in which a key objective is to strengthen peoples overall resilience as the future becomes more uncertain and linking these to practical action (Clark & Carney, 2008).

2.7 Conceptual Framework

The conceptual framework outlines a model that the study shall employ in analyzing how the various factors determinants beekeeping in enhancing environmental conservation in arid and semi-arid lands. This model shall be as in Figure 2.1:

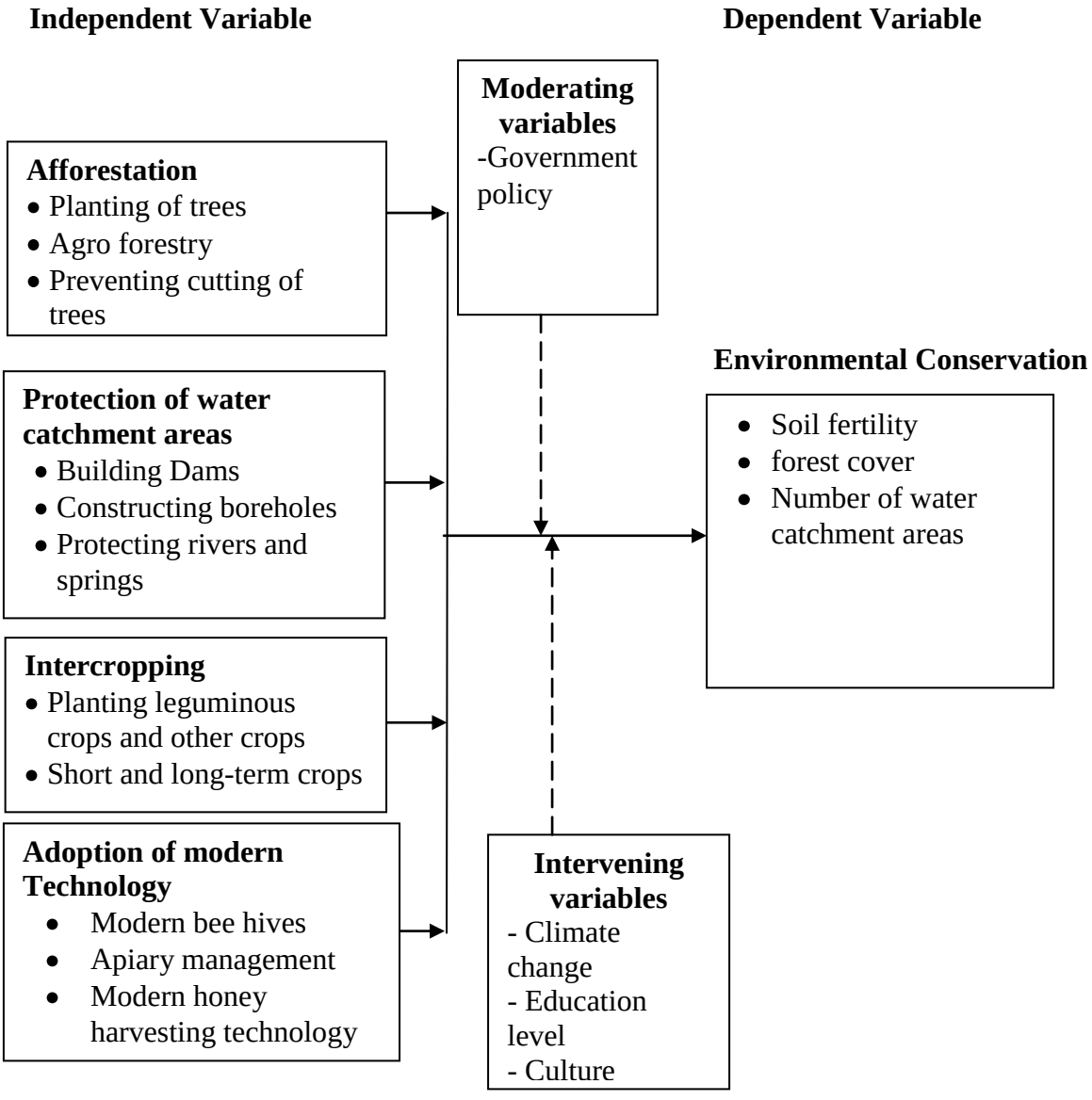

Figure 2.1 Conceptual Framework

As outlined in the conceptual framework, various aspects influence beekeeping in enhancing environmental conservation in arid and semi-arid lands.

These factors are divided into four key areas which are: Afforestation is the activity of planting vegetation for the sake of bee keeping. Bee keepers practice afforestation and agroforestry to ensure nectar and shelter for bees. The forests of Kenya occupy only a small area of country's total land surface and majorly in the wetlands. Forests are yet extremely important ecosystems in terms of supporting economic and ecological functions, and for maintaining the genetic diversity of plants, animals and insects such bees' i.e. biological diversity. The principal conservation policies are meant to achieve production and protection functions in and around forests. In terms of ecological services, most of the large rivers in Kenya originate from forests. Forest degradation occurs when either large track of forest are removed without re-planting, replaced with unsuitable species or significant alteration of species composition.

Water makes up one of the major ingredients of honey. Water catchment areas are among the most productive earth's ecosystems owing to the interaction between water, soil, vegetation and light for a greater part of the year. Their depth of the water allows photosynthesis to take place, making lands productive life-supporting ecosystems.

2.8 Knowledge Gap

Environmental sustainability is a key issue for human societies throughout the 21st century's world. All countries need to secure sufficient quality in the short and the long term of natural resources, ecosystems, and the diversity of plant and animal species, including the human living environment. In the social and behavioural sciences, environmental degradation, human well being, and environmental conservation have been research topics for several decades (Bechtel & Churchman, 2002), giving rise to journals like Ecological Economics, Environment and

Behaviour, Human Ecology Review, and Journal of Environmental Psychology. Recently, environmental psychology has been broadened to incorporate sustainability problems (Gardner & Stern, 2002; Winter & Koger, 2004).

Although, there is importance in the natural ecosystem of ASAL for bee keeping, honey bees populations have suffered a dramatic decline in recent years due to ignorance on the conservation of the natural environment needed for bee keeping and a number of biotic constraints. Little is known about the importance of bees in nature preservation and agriculture, and the influence of beekeeping on the life of humans. Therefore beekeeping, although practiced by millions of small farmers in the developing world, is often not fully appreciated by forestry departments and policy-makers.

The concentration of this study is that organizations involved in research in ASAL concentrate more on empowerment of local communities economically and not on environmental conservation. As such, the aim of the study is to evaluate the roles or determinants of bee keeping in enhancing environmental conservation in ASAL, a case of Lomut ward West Pokot County. The focus of this research was to address this gap in environmental conservation and bring forth the need for bee keeping as a better away of enhancing environmental conservation.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents detailed description of the research design and a description of the method applied in carrying out the research study. It outlines the procedure used to gather data that is: study area, research design, population and sampling technique, the research instrument, data collection and data analysis

3.2 Research Design

A research design is considered as a scheme for research, dealing with at least four problems that are in relation to the study case, that is, which questions to study, what data to collect, which data is relevant and how to analyze the results. The best design normally depends on the research questions and also the orientation of the researcher (Robson, 2003). In this research study, a descriptive survey study will be the appropriate research design to be used. A survey study is a study of a certain situation rather than a wide-spread statistics. It is a method used to narrow down a wide field of research into an easily researchable topic. This design was suitable to be used because of the large area of interest of the study i.e. Lomut ward part of West Pokot.

3.3 Target Population

Target population refers to the entire group of individuals or objects to which researchers are interested in generalizing the conclusions. The target population usually has varying characteristics and it is also known as the theoretical population.

The target population for a study is the entire set of units for which the data are to be used to make inferences. Thus, the target population defines those units for which the findings of the survey are meant to generalize. Establishing study objectives is the first step in designing a survey. Target populations must be specifically defined, as the definition determines whether sampled cases are eligible or ineligible for the survey.

The geographic and temporal characteristics of the target population need to be defined. For this study, the researcher's target population was 200 community residents who are beekeepers residing in the ward and 20 CABESI officials in these ward. Purposive sampling technique was used to select the target population.

Table 3.1 Target population of the respondents

Target group	**Number**
Community residents	200
CABESI officials	20
Total	**220**

Source: Lomut Ward Office (2014)

3.4 Sampling Procedure and Sample Size

Sampling procedure refers to a technique of selecting a part of population on which research can be conducted, which ensures that conclusions from the study can be generalized to the entire population. While sample in a research study refers to any group on which information is obtained. The researcher used stratified sampling technique to select the respondents. The target population for the community residence and CABESI officials was (220), the Krejcie and Morgan (1970) table (see Appendix IV) for determining a sample size was used. These gave a sample size of community residence and CABESI officials of 136 respondents.

Stratified sampling technique was applied. The, sample was selected from each of the stratum as shown in the Table 3.2 based on the composition of the target population. The sample size was based on proportionate population distribution on target population.

Table 3.2 Sample size

Project	Target population	Sample size
Community residents	200	12
CABESI officials	20	124
Total	**220**	**136**

3.5 Data Collection Instruments

The study employed the use of both the questionnaires and interview schedule.

3.5.1 Questionnaires

This tool was developed by the researcher with the aid of the supervisors. The study preferred this tool because it can collect data from a large sample over a short period of time. This tool contained both open and closed ended question. Closed ended question are easy to analyze since they are in immediate usable form, easy to administer as each item is followed by alternative answer and are economical in terms of time and money. Open-ended questions stimulate a person to think about his/her feeling or motives and to express what he/she consider most vital The questionnaires were administered to the community residents.

3.5.2 Interview Schedule

This is a method of collecting data that involves presentation of oral verbal stimuli and reply in term of oral verbal responses (Kothari, 2003). The study hired the respondent type of interview where the interviewer retains all control throughout the

process. The researcher used the interview schedule for guidance during the interview process. The interview schedule design is meant for the CABESI officials. It enabled the researcher to collect the information based on the objective of the study and balance between quality and quantity of data collected and also more information that cannot be directly observed or is difficult to put down in writing.

3.6 Validity and Reliability of Research Instruments

The research instruments for the study were tested for reliability and validity to ensure that they captured the aims and objectives of the research.

3.6.1 Validity of Research Instruments

Validity is the accuracy and meaningfulness of inferences, which are based on the research results. It is the degree to which results obtained from the analysis of data actually represent the phenomenon under study (Mugenda & Mugenda, 2003). Validity answers the question 'are my findings true?' (Kerlinger, 2000). To test the content validity of instruments, the researcher discussed the instruments with experts and specialists in University of Nairobi to ensure that all the concepts under investigation were measured. A pilot study also aided in improving the validity of the instruments. Items were checked to ensure they accurately measured the concepts of under study were clear and understood by the respondents.

3.6.2 Reliability of Research Instruments

To determine the reliability of the instruments, pre-testing through piloting was done in one CABESI group in the region but not in the study. The reliability of the items was based on the estimates of the variability among the responses to the items. The reliability coefficient was determined using Karl Pearson's product

moment correlation coefficient because the method was more accurate as it determined the stability of the instrument. The instruments were re-administered again to the same respondents after a period of two weeks and identification maintained. A reliability index alpha greater than or equal to 0.7 was considered to be high enough for the instrument to be used in the study (Mugenda & Mugenda, 2003).

3.7 Data Collection Procedures

The researcher acquired a permit from the University of Nairobi to conduct the research and National Commission for Science, Technology and Innovation (NACOSTI). The Deputy County Commissioner from Pokot Central Sub County gave approval for the research to be undertaken in Lomut Zone. The researcher sought consent and approval from CABESI to administer the interview schedules and sought permission from the region officials to administer the questionnaire to the community residents. The researcher distributed the questionnaires and collected them immediately after the exercise to ensure efficiency in collection of the data. The researcher then sought an appointment with CABESI so as to interview its officials at their preferred time.

3.8 Data Analysis Procedure

The data was collected and analyzed through descriptive statistics, where tables, frequencies were used in interpreting the respondent's perception on issues in the questionnaires. Therefore, to answer the research questions, after data had been collected and analyzed, it was then presented using frequency distribution tables. The data collected for the purpose of this study was adopted and coded for completeness and accuracy. Statistical Package for Social Science (SPSS) program was used for

data analysis and interpretation. The researcher used descriptive statistics to analyze the data into meaningful information that was used to make conclusions and recommendations. The descriptive statistics used measures of central tendency such as mean, median and mode to describe a group of subjects.

3.9 Ethical Considerations

Data was handled carefully, so that information about individual people and even institutions was used in ways that recognised those people's initial ownership of information and which respects them as fellow human beings who are entitled to dignity and privacy (Kothari, 2003). Permission to interview orally, especially when the interview was obtained. It was made clear that declining to participate or withdrawing at any stage, would not carry any adverse consequences. The permission of University of Nairobi, School of Continuing and Distance Education to conduct the research was obtained. This research was designed to be free of active deception. In the data generation process every effort was made to ensure accuracy.

3.10 Operational Definition of Variables

Table 3.3 Operational Definition of Variables

Objective	Indicators	Predictors	Measurement scale	Tools of analysis	Types of tools
Effects of afforestation for bee keeping on environmental conservation,	Forest cover Water availability Soil fertility	Planting of trees Agro forestry Preventing cutting of trees	Nominal and Ordinal	Descriptive statistics. tables and pictures	Frequency distribution tables
Protection of water catchment areas for bee keeping purposes effect environmental conservation	Forest cover Water availability Soil fertility	Building Dams Developing boreholes Protecting rivers and springs	Nominal and Ordinal	Descriptive statistics Tables and pictures	Frequency distribution tables
Inter-cropping for bee keeping influences environmental conservation	Forest cover Water availability Soil fertility	Mixed cropping Contour farming	Nominal and ordinal	Descriptive statistics. tables and pictures	Frequency distribution tables
Technology use in bee-hive and environmental conservation	Forest cover Water availability Soil fertility	Modern bee hives Apiary management Harvesting methods	Ordinal and nominal	Descriptive statistics Tables and pictures	Frequency distribution tables

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter presents the data analyzed in answering the study objectives for the topical issue. The data was collected through the use of both descriptive and inferential statistics. The data was then presented in tables and graphs and the findings presented discussed. This enabled the researcher to draw inferences on the determinants of beekeeping as an alternative economic activity in enhancing environmental conservation in arid and semi arid lands in Kenya. Data findings were then linked with the researcher's opinion in relation to the existing knowledge for the intricate interpretation and discussion. This chapter is organized in sections beginning with presentation of respondents' background information and subsequent sections have been organized following the research objectives.

4.1.1 Response Rate

Out of the 136 questionnaires that were sent out, 126 were returned completed with 93 percent response rate. The rest 10 (7.0%) of the questionnaires could not be retrieved some of the reason being too committed, and others could be not be traced. This is a reliable response rate for data analysis as Babbie (2002) posited that any response of 50 percent and above is adequate for analysis. Table 4.1 indicates the questionnaire response rate.

Table 4.1 Response rate

Rate	Frequency	Percentage
Responded	126	93.0
Did not respond	10	7.0
Total	**136**	**100.0**

The response rate for the study is high as 126 of residents from Lomut ward participated in the study with 19 CABESI officials.

4.2 Background Information of the Respondents

The study sought to assess the background information of the respondents in terms of their age, gender, level of education, marital status, their work experience and their scale of beekeeping in terms of bee hives that they have. The results were analyzed and presented below.

4.2.1 Ages of the Respondents

The researcher found it important to collect the respondents' background information in terms of age since age plays a critical role in the economic activity undertaken by someone. The findings were presented on the Table 4.2. It was segmented into 5 different groups with 5 year differences whereas the first group and the last were classified differently in order to accommodate respondents of every age bracket.

Table 4.2 Ages of the respondents

Ages of the respondents	Frequency	Percentage
Below 25	6	4.8
25-30	72	57.1
31-35	18	14.3
36-40	18	14.3
41-50	6	4.8
Above 50	6	4.8
Total	**126**	**100.0**

According to the Table 4.1, 72 (57.1%) of the total number of respondents were aged between 25 to 30 years, 18(14.3%) were aged between 31 and 35 years and the same percentage were aged between 36-40 years whereas those aged below 25 were 6(4.8%) same as those aged between 41-50 years and above 50. This could be due to the fact that the youth aged between 25 and 30 years are economically very active and are engaged in several economic activities to earn an income. The youth also make up a higher percentage of the entire generation in the country.

4.2.2 Gender of the Respondents

The respondents' background information in terms of gender was also sought. This was necessary as masculinity and feminity affects respondent's perception of issues in relation to engagement in economic activities especially in the region of the study. It was also meant to remove any gender biasness in the study and ensure that views are found from both female and male. This was analyzed and presented in the Table 4.3

Table 4.3 Gender of respondents

Gender of Respondents	Frequency	Percentage
Male	90	71.4
Female	36	28.6
Total	**126**	**100.0**

From the above findings, out of the 126 respondents, 90 (71.4%) were male while the female gender was represented by only 36 (28.6%). The study noted that the majority of the respondents were of male gender (71.4%) whereas women were less with 28.6% representation. In the region there is gender biasness in the involvement of economic activities. The results contradicts Maurice (2006) research in Kakamega and Kwale counties that showed that beekeeping is an income generating activity that can be undertaken by women on or near their homesteads, this is important because the number of economic pursuits open to women in rural Kenya is limited. This feature has made the project particularly attractive to women, especially those who have been involved with previous government sponsored beekeeping projects. Maurice (2006) established that several of the more successful beekeepers in Kwale and Kakamega were women who have previously been involved in government sponsored beekeeping projects.

4.2.3 Marital Status of the Respondents

The study sought to assess the respondents' background information in terms of their marital status. The respondents were asked to indicate whether they were single, married, divorced or widowed. This data was analyzed and presented on the Table 4.4.

Table 4.4 Marital status of the respondents

Marital status	Frequency	Percent
Single	60	47.6
Married	48	38.1
Divorced	12	9.5
Widowed	6	4.8
Total	**126**	**100.0**

Table 4.3 indicates that, out of the 126 respondents, 60 (47.6%) were still single, 48(38.1%) were married whereas 12 (9.5%) were divorced and only 6 (4.8%) of the total number of respondents were divorced. From the findings, it is evident that a majority of the respondents are single (47.6%) and there are less cases of divorce shown by the 4.8% cases of divorce in the study.

4.2.4 Level of Education

The study sought to establish the background information of the respondents in terms of level of education. The level of education influences the engagement of a person in an economic activity and how they deem the activity viable. This was analyzed and presented in the Table 4.5.

Table 4.5 Level of education

Educational Level	Frequency	Percentage
Informal/None	48	38.1
Primary	36	28.6
Secondary	36	28.6
Certificate/Diploma	6	4.8
Total	**126**	**100.0**

From the data, 48(38.1%) of the total number of respondents were of informal level of education, 36 (28.6%) were of primary level of education and a similar number had a secondary level and the only 6 (4.8%) were of certificate and diploma level of education. There was no respondent with other levels of education such as CPA qualifications or PhD. From the findings it's evident that a majority of the respondents are illiterate shown by the 38.1% agreement that they have an informal form of education whereas very few people have certificates and diploma level of education.

4.2.5 Experience of the Respondents in Bee Keeping

Bee farmers with longer period of time in the activity are more experienced and can well explain the determinants of bee keeping as an alternative economic activity for ensuring environmental conservation. The researcher therefore set out to investigate how long the respondents had been practicing bee keeping in the number of years. This data was analyzed and presented on the Table 4.6.

Table 4.6 Experience of the respondents

Experience of the respondents	Frequency	Percentage
Less than 5 years	66	52.4
5-10 years	60	47.6
Total	**126**	**100.0**

From the findings on Table 4.6, out of the 126 respondents, 66 (52.4%) had practiced bee keeping for less than five years whereas 60 (47.6%) had an experience of between 5 and 10 years in the activity and none of the respondents had over ten year experience in the economic activity. This is due to the fact that most of the respondents were youth who are still young and have not engaged in the economic

activity for long. Maurice (2006) research found that bee keepers in Kwale level of local knowledge on the subject of beekeeping amongst project participants was in general low with less than quarter of beekeepers having kept bees previously.

4.2.6 Bee Keeping Production

The researcher found it important to collect data on the level of production of the respondents in terms of the number of hives they own. This data was analyzed and presented on the Table 4.7

Table 4.7 Level of production of the respondents

Number of hives	Frequency	Percentage
Less than 5	90	71.4
5-10	36	28.6
Total	**126**	**100.0**

Table 4.7 shows that 90 (71.4%) of the total number of respondents are small scale producers owning less than five hives whereas only 36 (28.6%) of the respondents own between five and ten hives. None of the respondents indicated to own more than ten hives.

4.3 Effects of Afforestation for Bee Keeping on Environmental Conservation

Research objective one of the studies sought to asses the effects of afforestation for bee keeping on environmental conservation. The respondents were asked to rate their level of agreement on a Likert scale of five on the effect of afforestation programmes for keeping and environmental protection levels in Lomut ward. The findings were analyzed and presented in the Table 4.8

Table 4.8 Effects of afforestation for bee keeping on environmental conservation

Statements		SA	A	N	D	SD	T	M
Bee keeping encourages panting of trees which encourages conservation of the environment	**F**	90	8	6	12	0	126	4.5
	%	71.4	14.3	4.8	9.5	0	100	90
Agro forestry is the current agricultural trend for crop growers within the area	**F**	60	54	6	0	6	126	4.3
	%	47.6	42.9	4.8	0	4.8	100	86
Bee keeping has successfully prevented natives from cutting trees	**F**	84	24	0	18	0	126	4.4
	%	32.2	56.2	6.6	3.3	1.7	100	88

From the study findings (table 4.8), it was found that majority of the respondents 90% were of the opinion that bee keeping encourages panting of trees which encourages conservation of the environment, 86% agree that agro forestry is the current agricultural trend for crop growers within the area while 88 % of them agreed with the fact bee keeping has successfully prevented natives from cutting trees.

Beekeeping livelihoods are built upon natural resources such as flowering plants and water. Bees collect gums and resins from plants and use plants and trees as habitat for nesting. Bees are a natural resource, and freely available in the wild. The study also notes that that agro forestry is the current agricultural trend for crop growers within the area as evidence by the 86% agreement of this opinion and bee keeping has successfully prevented natives from cutting trees according to 88% of the respondents of the study.

The study further revealed that afforestation for bee keeping purposes has led to climate change that is quite conducive for planting crops. Through this agroforestry is practiced along. Beekeeping plays a role in the conservation of forests and natural systems. The flowers of forest trees are the primary food of honey bees. Beekeeping

provides local communities with an economic incentive to protect the natural environment and, where they have the opportunity to do so, local people can be encouraged to engage in conservation projects. These findings are consistent with the findings of Hoshiba and Sasaki (2008) who argue that beekeeping ensures the continuation of natural habitat through pollination of wild vegetation. They stated that flowering plants and bees are interdependent and one cannot exist without the other though plants are of much benefit in the interdependence.

According to Adolkar, Kioko, and Mwanycky (2003) beekeeping helps to sustain the natural resource base throughout the world. Beekeeping is possible in arid areas and places where crops or other enterprises have failed; the roots of nectar-bearing trees may still be able to reach the water table far below the surface. This makes beekeeping feasible in marginal conditions, which is important for people who need to restore their livelihoods or create new ones (Ellis, 1998). Therefore, sustainable beekeeping helps in protecting trees; this also reduces soil erosion and in turn conserves biodiversity. Moreover, communities receive economic benefits from standing trees (fuel, increased water production, erosion protection among others). As a group, beekeepers have a vested interest in protecting and planting trees - the source of their honey.

4.4 Protection of Water Catchment Areas for Bee Keeping Purposes on Environmental Conservation

Bee keeping encourages the need for water; thus water catchment areas are protected as a result of practicing bee keeping. Research question two of the study sought to assess how protection of water catchment areas for bee keeping purposes

affect environmental conservation. The findings were analyzed and presented in the Table 4.9.

Table 4.9 How protection of water catchment areas for bee keeping purposes on environmental conservation

Statements		SA	A	N	D	SD	T	M
Dams in the area have been encouraged by bee farming	**F**	72	42	6	6	0	126	4.4
	%	57.1	33.3	4.8	3.8	0	100	88
Boreholes in the area are water reservoirs for bees	**F**	54	66	0	0	6	126	4.3
	%	42.9	52.4	0	0	4.8	100	86
Rivers and springs have been protected for environmental conservation by bee keepers	**F**	90	30	6	0	0	126	4.7
	%	71.4	23.8	4.8	0	0	100	94

From the study findings (Table 4.9), it was found that majority of the respondents 94% were of the opinion that rivers and springs have been protected for environmental conservation by bee keepers, 88% of them agreed that dams in the area have been encouraged by bee farming while 86% of them agreed with the fact that boreholes in the area are water reservoirs for bees. From the table 4.8; it is evident that rivers and springs have been protected for environmental conservation by bee keepers. Bees rely on water for cooling themselves and in production of honey.

The study found that majority of the respondents 94% were of the opinion that rivers and springs have been protected for environmental conservation by bee keepers, 88% of them agreed that dams in the area have been encouraged by bee farming while

86% of them agreed with the fact that boreholes in the area are water reservoirs for bees. As bees visit flowers, they collect food and their pollination activities ensure future generations of food plants, available for future generations of bees and for people and other animals too. It is a perfect self-sustaining activity. Pollination is difficult to quantify, but if it could be measured it would be the most economically significant value of beekeeping (FAO, 2011).

4.5 Intercropping for Bee Keeping on Environmental Conservation

Bees are an important agent of pollination. They encourage the development of biodiversity of both flora and fauna. Many flowering plants depend on insects, such as bees, to transfer pollen. Inadequate pollination results in low yields of uneven and small fruits. The researcher sought to establish how growing of cultivated crops, native trees and herbaceous plants for bee keeping has improved environmental conservation. The findings were analyzed and presented in the Table 4.10.

Table 4.10 Intercropping for Bee Keeping on Environmental Conservation

Statements		SA	A	N	D	SD	T	M
Intercropping between cultivated crops, native trees and herbaceous has contributed to environmental	**F**	72	48	0	0	6	126	4.4
	%	57.1	38.1	0	0	4.8	100	88
Intercropping leguminous plants (beans) with other crops for bee keeping has improved soil fertility	**F**	54	66	0	6	0	126	4.3
	%	42.9	52.4	0	4.8	0	100	86
Intercropping short and long term crops for bee keeping has improved environmental conservation	**F**	84	36	0	6	4.8	126	4.8
	%	66.7	28.6	0	4.8	0	100	96

According to the study 96% of the respondents agreed that bee keeping has contributed a lot to pollination of flowering plants, 88% of the respondents were of the opinion that fauna in the area has been protected due to bee keeping and a further 86% said bee keeping has contributed to the diversity of flora. The study found out that bee keeping has contributed a lot to pollination of flowering plants as shown by the 96% agreement of this fact by the respondents. Bee keeping greatly influences the kind of flora and bees are a major part of the ASAL fauna. Bees are important pollinators and many ecosystems depend on the pollination of bees for their existence and for increasing their genetic diversity through cross-pollination (Molan, 2009). Laurent and Rathahao (2003) found that crops pollinated by bees have been proven to produce higher yields and better quality, often at no extra cost for the farmer. Yet, many farmers consider bees and other pollinators as harmful insects.

Also research study conducted by Maurice (2006) in Kenya established that In Kwale the honeybees provide a pollination service to both the natural and the cultivated vegetation in the area, and thus benefit conservation objectives. The use of MFHs helps to reduce bee mortality during harvesting thus removing one check on bee population growth, and the use of management techniques that reduce absconding (i.e. providing water and food for bees), can potentially increase the pollinator population of the area which should help some species of vegetation to set seed and spread. This shows that bee keeping project have increased the number of honeybees in their project areas and this will improve the pollination success of numerous plant species.

4.6 Technology for Bee Keeping on Environmental Conservation

As the fourth objective of the study, the study wanted to determine the level at which farmers in Lomut ward had adopted current technology on bee keeping aimed at conserving the environment. The study looked at the extent to which respondents agreed and disagreed on the adoption of modern bee hives like langstroth, top bar among others, use of better apiary management techniques and current honey harvesting methods that minimises wastes and ensure that environment is safe guarded i.e. fires caused by traditional methods of harvesting are minimised. The results are presented in Table 4.11.

Table 4.11 Technology for bee keeping and environmental conservation

Statements		SA	A	N	D	SD	T	M
Our hives are modern (langstroth, top bar) as opposed to traditional hives	**F**	90	30	0	6	0	126	4.6
	%	71.4	23.8	0	4.8	0	100	92
We have employed modern methods of apiary management that conserves the environment	**F**	84	36	0	0	6	126	4.5
	%	66.7	28.6	0	0	4.8	100	90
Our method of harvesting are environmental friendly	**F**	96	24	0	6	0	126	4.7
	%	76.2	19	0	4.8	0	100	94

The results of the analysis shows that majority 90 (71.4%) said that they use modern bee hives like Langstroth that tend to have the best colonisation rate thus, high quality and quantity of honey produced. Only 4.8% said that they do not use modern bee hives. The results further shows that 84 (66.7%) of respondents agreed

that they have employed modern methods of apiary management that conserves the environment. Lastly, 96 (76.2%) of respondents of residents said that they use current methods of harvesting honey that is environmentally secure and reduces chances of fires. Contrary to the results of the study Maurice (2006) research in Kakamega and Kwale sub counties found out that the use of Langstroth hives (MFH) in Kakamega has not had a noticeable impact on the state of the local environment while in Kwale deforestation has also limited traditional beekeeping by reducing the number of suitable trees to place log hive in.

4.6.1 Hindrances to Bee Keeping on Environmental Conservation

The researcher sought to establish the challenges and hindrances to bee keeping for environmental conservation. The findings were analyzed and presented in the Table 4.12

Table 4.12 Hindrances to bee keeping on environmental conservation

Statements		**SA**	**A**	**N**	**D**	**SD**	**T**	**M**
Environmental conservation has been hampered by ignorance of the people on the practise of bee keeping	**F**	90	30	0.0	6	0.0	126	4.6
	%	71.4	23.8	0.0	4.8	0.0	100	92
The people in the area still use the traditional bee keeping methods which has a negative effect on the forests like fires during harvesting of honey	**F**	84	36	0.0	0	6.0	126	4.5
	%	66.7	28.6	0.0	0	4.8	100	90
Pest control using pesticides has killed bees and contributed t the destruction of the environment	**F**	96	24	0.0	6	0.0	126	4.7
	%	76.2	19	0.0	4.8	0.0	100	94

According to the study 94% of the total number of respondents were of the opinion that pest control using pesticides has killed bees and contributed t the destruction of the environment, 92% of the respondents were of the opinion that environmental conservation has been hampered by ignorance of the people on the practise of bee keeping and 90% of them the people in the area still use the traditional bee keeping methods which has a negative effect on the forests like fires during harvesting of honey.

The findings from the study indicate that bee keeping is faced by quit a number of challenges majorly pest control using pesticides has killed bees and contributed to the destruction of the environment as shown by the 974% agreement of this fact by the respondents. Environmental conservation is also hampered by ignorance of the people on the practise of bee keeping as most of the respondents still use traditional bee keeping practises which has a negative effect on the forests like fires during harvesting of honey. Bees are also under threat and need to be conserved. They are threatened by habitat destruction and killed by environmental pollution, pesticides in particular. In some parts of the world indigenous bee species are threatened by the importation of alien species which compete for food and dilute their genetic integrity (FAO, 2011). These findings concur with the findings of Barlović (2009) who argues that the decline in pollinators is visible with the current attitude of bee keepers. Bee keepers perceive apiculture as a hard business since there are many different ways of running it but most. Research by Klein et al., (2007) and Henderson, (2009) suggests that there are a number of factors that may influence the development of local bee keeping practices such as demographical factors, chemicals used, method of the practice of the key stakeholders in the sector. A study by Laurent and Rathahao (2003) established that the excessive use of pesticides in agriculture can harm bees

directly and indirectly. Bees bring the pesticide-contaminated pollen and nectar to their hive and slowly poison their offspring as the pollen and nectar are fed to the bees.

4.6.2 Ways in Which Bee Keeping Can Contribute to Environmental Conservation

The researcher sought to analyze the ways in which bee keeping can contribute to environmental conservation. The findings were analyzed and presented in the Table 4.13

Table 4.13 Ways in which bee keeping can contribute to environmental conservation

Statements		SA	A	N	D	SD	T	M
Afforestation will reduce the level of soil erosion	**F**	114	6	6	0	0	126	4.8
	%	90	4.8	4.8	0	0	100	96
Environmental conservation will lead to improved farming activities	**F**	84	36	0	0	6	121	4.5
	%	66.7	28.6	0	0	4.8	100	90
Bee keeping will encourage growth of forest cover in the ASAL	**F**	90	30	0	6	0	126	4.8
	%	71.4	23.8	0	4.8	0	100	96

According to the study 96% of the respondents agree that afforestation will reduce the level of soil erosion and a similar number are of the opinion that bee keeping will encourage growth of forest cover in the ASAL while 90% agree that environmental conservation will lead to improved farming activities**.** The study established that afforestation as a result of bee keeping will reduce the level of soil erosion thus encourage growth of forest cover in the ASAL and improve farming activities**.**

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

It helps the researcher to summarize the findings of the study undertaken, discuss, conclude and make necessary recommendations based on the findings of the study. It therefore, presents a summary of findings from the data analysis and generates conclusions from questions that were answered by the respondents and presents the way forward on the improvement of the problem under investigation. The study sought to at assessing the determinants of beekeeping as an alternative economic activity in enhancing environmental conservation in arid and semi arid lands; a case of Lomut Ward West Pokot County, Kenya. This study set out to determine the effects of afforestation for bee keeping on environmental conservation, assess how protection of water catchment areas for bee keeping purposes effect environmental conservation, investigate how intercropping influence environmental conservation and the influence of technology adoption for bee keeping affected environmental conservation in Lomut Ward..

5.2 Summary of the Findings

Based on the responses of the study, the researcher summarized the findings as below. The study has established that bees provide numerous benefits to the natural environment and have a critical role in its sustainability. Their role is not readily recognized, even though bees are needed for the pollination of many cultivated crops and for maintaining biodiversity in ‘islands’ of non-cultivated areas.

5.2.1 Effects of Afforestation for Bee Keeping on Environmental Conservation

According to the study, 90% of the total number of respondents agree that bee keeping encourages planting of trees which encourages conservation of the environment, 86% are of the opinion that agro forestry is the current agricultural trend for crop growers within the area while 88 % of them agreed with the fact that bee keeping has successfully prevented natives from cutting trees.

5.2.2 Protection of Water Catchment Areas for Bee Keeping Purposes Affect Environmental Conservation

From the study findings showed that majority of the respondents 94% were of the opinion that rivers and springs have been protected for environmental conservation by bee keepers, 88% of them agreed that dams in the area have been encouraged by bee farming while 86% of them agreed with the fact that boreholes in the area are water reservoirs for bees.

5.2.3 Intercropping for Bee Keeping Influence Environmental Conservation

The results of the study showed that farmers in Lomut ward mixed different varieties of plants; leguminous, herbaceous, short-term and long-term to ensure that soil fertility and pollination was high. The study learnt that the connection between bees and crop yields for farmers creates a synergy that can be used to further conservation efforts such as agro-forestry or afforestation projects.

5.2.4 Technology Adoption for Bee Keeping Influence on Environmental Conservation

Various technological methods were found to have been adopted by farmers in Lomut ward that are environmental and ecologically friendly. For instance, majority

of farmers were found to be using modern bee hives (Langstroth and top-bar) to ensure high colonisation rate and maximum output (honey and wax) is realised. The results also showed that the farmers through CABESI have been trained on new methods of apiary management and also provide with the modern hives. Lastly, the study found out that farmers have also embraced modern methods of harvesting of honey. They have been provided with protective clothing and modern equipment for harvesting by the organisation which are environmental friendly.

5.3 Conclusions

Bees are some of nature's most fascinating creatures, they are also incredibly important. Their intimate dependency relationship with plants makes bees a crucial component of successful ecosystems the world over. Results from the study indicate that the majority of respondents fall within the productive ages 25-30 years. It was realized that women are not fully involved in beekeeping activities. It is vital to make the beekeeping industry more vibrant, to contribute to the national goal of reducing poverty, improving community livelihoods and maintaining sustainable natural resources. It was also found out that there exists gender biasness in the region. Culturally, women are not allowed to practice bee keeping as it is seen as it is not their role to provide and engage in any economic activity.

The findings show that there exists a significant relationship between bee keeping practices and the environment. Bees are the major pollinators for continuity of survival of most plants. It is due to this fact that bee keeping encourages the growth and development of vegetation in arid and semi arid lands.

The determinants of bee keeping which include water, trees and flowers exist in the natural environment and thus the environment affects bee keeping and vice

versa. Bees need water to cool and also in the production of its products such as honey and wax. Bee keepers are charged with the responsibility of protecting water catchment areas and providing water for the bees. Bees are important for biodiversity. The natural coexistence of all creatures in their natural habitat ensures the continuity of survival and completion of the natural food chain. Bees need nectar from flowers as the plants are pollinated. It was revealed that lack of appropriate beekeeping knowledge and financial constraints were the most challenging obstacles to beekeeping. As responded by CABESI officials, they have rarely been visited by beekeeping extension officers and thus have not received adequate training. But in reality, there is poor implementation of extension services in the region especially on beekeeping services.

Beekeeping also has the potential to teach people something new about their environment by providing a slightly different economic link between the individual and the local environment than farming does. In this sense beekeeping may encourage farmers to learn more about their environment and to manage it for more than just crops.

5.4 Recommendation

Beekeeping is a widespread activity with some little existing local knowledge and skills. The researcher recommends that the addition of a little technical information on the existing, however, can lead to greatly improved methods of carrying out the activity for environmental conservation.

1. The study recommends that the government through the ministry of environment, water and natural resources should set to improve the practice by planting trees and encouraging the locals to practice afforestation. It should

come up with tree nurseries in the region and provide irrigation services to the local community to encourage them practice tree planting.

2. Development partners should facilitate the involvement of women in beekeeping activities in the study area. This can be achieved through women's access to information, extension and training, and exchange visits to increase their participation in beekeeping activities, and consequently improve household incomes and livelihoods.

3. Development partners should fund research to ascertain ways of improving harvesting and marketing of bee products to enhance their quality and quantity and hence improve the livelihoods of people in the study area and ultimately encourage conservation of the natural environment.

5.5 Contributions to Body of Knowledge

The study had the following contribution to the body of knowledge,

Table 5.1 Contributions to body of knowledge

objectives	Contributions
1. To investigate how afforestation for bee keeping influence environmental conservation	1. The study noted that bee keeping has encouraged afforestation in ASAL. Bees exist in the natural environment and ensure the continuity of vegetation through pollination
2. To assess how protection of water catchment areas for bee keeping purposes affect environmental conservation	2. The study revealed that bees need water. Water catchment areas are thus protected for environmental conservation
3. To investigate how intercropping for bee keeping influences environmental conservation	3. Intercropping improves environmental conservations through soil fertility and pollination
4. To assess how adoption of technology for bee keeping has influenced environmental conservation	4. Use of modern hives and harvesting techniques improves environmental conservation

5.6 Suggestion for Further Research

This study presents significant findings that can facilitate effective measures of conserving the environment and enhancing economic livelihoods of people in the ASAL through bee keeping. However, there is still a lot of ground to be covered. The following suggestions for further research are made.

1. Further study should be made to determine the role of the communities living in ASAL on environmental conservation
2. Challenges facing bee keeping as a major economic activity
3. Seeking other alternative sources of energy for preservation of the natural environment
4. The relationship between economic activities practiced by people in ASAL and environmental conservation.

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APPENDICES

APPENDIX I: LETTER OF TRANSMITTAL

SARAH SIALUK

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ELDORET

Dear recipients

I am Sarah Sialuk masters student in the University of Nairobi carrying out a research study on determinants of beekeeping as an alternative economic activity in enhancing environmental conservation in arid and semi arid lands. The information collected will be used to make recommendations for improvement of environmental conservation in arid and semi arid lands.

You are therefore kindly requested to participate and respond as best as you can to items in the questionnaire/interview guide. The information provided will be treated with utmost confidentiality and will be used only for the purpose of this study alone.

Let me take this opportunity to thank you in advance for taking part in this study.

Yours sincerely,

SARAH SIALUK

APPENDIX II: QUESTIONNAIRE FOR BEE KEEPERS

This questionnaire is made up of two sections A and B. Please answer each question by writing on the spaces provided or tick (√) against the boxes provided. The information provided will be used for the purpose of this research only; therefore do not write your name on the answer sheet. Please note that there are no correct or wrong answers.

Section A: Background Information

1. Age

   Below 25 years [ ] 25 – 30 years [ ] 31 – 35 years [ ]

   36 – 40 years [ ] 41 – 50 years [ ] above 50 years [ ]

2. Gender

   Male [ ] Female [ ]

3. Marital status

   Single[ ] Married [ ] Divorced [ ] Widowed [ ]

4. Highest level of Education and training attained

Informal/none [ ] Primary[ ] Secondary [ ]

Certificate/Diploma [ ] Bachelors Degree [ ] others [ ]

5. For how long have you been practicing bee keeping in number of years

Less than 5 years [ ] 5-10 years [ ]

11 –15 years [ ] Over 15 years [ ]

6. How many bee hives do you own?

Less than 5 [ ] 5-10 [ ]

11 –15 [ ] Over 15 [ ]

Section B: Afforestation for Bee Keeping on Environmental Conservation

7. To what extent do you agree with the following statements in regard to effects of afforestation for bee keeping on environmental conservation? **Key: 5:** Strongly Agree**; 4:** Agree; **3:** Undecided; **2:** Disagree and **1**: Strongly Disagree

Statements	**5**	**4**	**3**	**2**	**1**
Bee keeping encourages planting of trees which encourages conservation of the environment					
Agroforestry is the current agricultural trend for crop growers within the area					
Bee keeping has successfully prevented natives from cutting trees					

Any other opinion

……

……

Section C: Protection of Water Catchment Areas for Bee Keeping on Environmental Conservation

8. To what extent do you agree with the following statements in regard to how protection of water catchment areas for bee keeping purposes affect environmental conservation

Key: 5: Strongly Agree**; 4:** Agree; **3:** Undecided; **2:** Disagree and **1**: Strongly Disagree

Statements	**5**	**4**	**3**	**2**	**1**
Dams in the area have been encouraged by bee farming					
Boreholes in the area are water reservoirs for bees					
Rivers and springs have been protected for environmental conservation by bee keepers					

Any other opinion

……

……

Section D: Intercropping for Bee Keeping on Environmental Conservation

9. To what extent do you agree with the following statements in regard to how intercropping for bee keeping influence environmental conservation

Key: 5: Strongly Agree**; 4:** Agree; **3:** Undecided; **2:** Disagree and **1**: Strongly Disagree

Statements	**5**	**4**	**3**	**2**	**1**
Intercropping between cultivated crops, native trees and herbaceous has contributed to environmental conservation					
Intercropping leguminous plants (beans) with other crops for bee keeping has improved soil fertility					
Intercropping short and long term crops for bee keeping has improved environmental conservation					

Any other opinion

……

……

Section D: Technology Adoption for Bee Keeping on Environmental Conservation

10. To what extent do you agree with the following statements in regard to technology adoption in bee keeping influence environmental conservation?

Key: 5: Strongly Agree**; 4:** Agree; **3:** Undecided; **2:** Disagree and **1**: Strongly Disagree

Statements	**5**	**4**	**3**	**2**	**1**
Our hives are modern (langstroth, top bar) as opposed to traditional hives					
We have employed modern methods of apiary management that conserves the environment					
Our method of harvesting are environmental friendly					

Any other opinion

……

……

11. Kindly rate the following statements as to the extent to which you agree on them on the challenges and hindrances to bee keeping for environmental conservation

Key: 5: Strongly Agree**; 4:** Agree; **3:** Undecided; **2:** Disagree and **1**: Strongly Disagree

Statements	**5**	**4**	**3**	**2**	**1**
Environmental conservation has been hampered by ignorance of the people on the practise of bee keeping					
The people in the area still use the traditional bee keeping methods which has a negative effect on the forests like fires during harvesting of honey					
Pest control using pesticides has killed bees and contributed to the destruction of the environment					

Any other opinion

……

……1

2.Kindly rate the following statements as to the extent to which you agree on them on the ways in which bee keeping can contribute to environmental conservation

Key: 5: Strongly Agree**; 4:** Agree; **3:** Undecided; **2:** Disagree and **1**: Strongly Disagree

Statements	**5**	**4**	**3**	**2**	**1**
Afforestation will reduce the level of soil erosion					
Environmental conservation will lead to improved farming activities					
Bee keeping will encourage growth of forest cover in the ASAL					

Any other opinion

……

……

The end

Thank you

APPENDIX III: INTERVIEW SCHEDULE

FOR BEE KEEPING ASSOCIATION OF KENYA (BKAK) AND COMMON INTEREST GROUPS (CIGS) OFFICIALS

1. Which organization do you work for?

_____

2. What department do you work in?

_____

3. How long have you been working in this area?

_____

_____

_____

4. How does afforestation for bee keeping influence environmental conservation?

_____

_____

_____

5. What role does water catchment areas for bee keeping purposes play in environmental conservation?

_____

_____

_____

6. How doe intercropping for bee keeping influence environmental conservation?

_____

_____

_____

7. How doe technology adoptions for bee keeping influence environmental conservation?

_____

_____

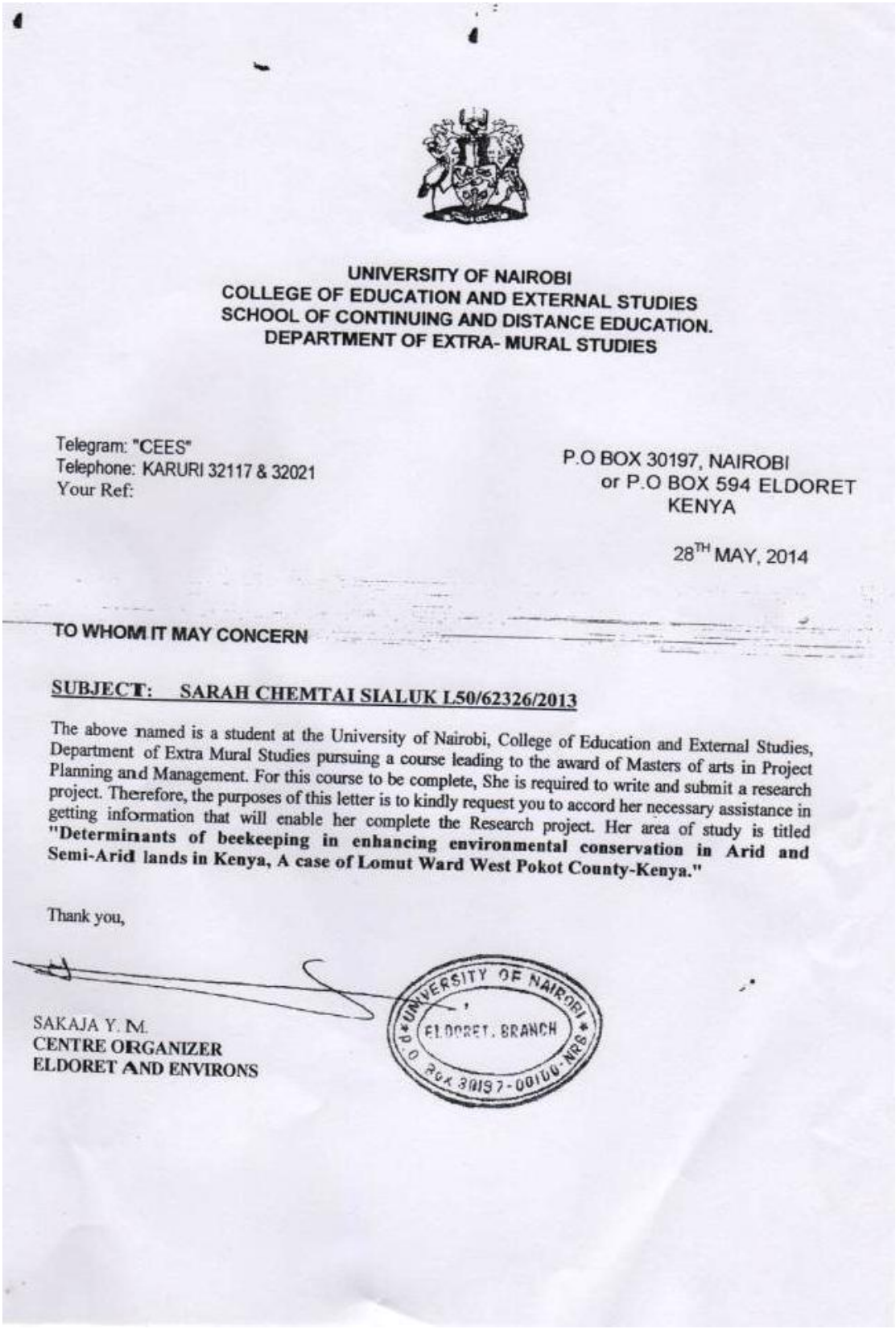
_____

_____

APPENDIX IV: TABLE FOR DETERMINING SAMPLE SIZE

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

APPENDIX V: RESEARCH PERMITS



UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION.
DEPARTMENT OF EXTRA- MURAL STUDIES

Telegram: "CEES"
Telephone: KARURI 32117 & 32021
Your Ref:

P.O BOX 30197, NAIROBI
or P.O BOX 594 ELDORET
KENYA

28TH MAY, 2014

TO WHOM IT MAY CONCERN

SUBJECT: SARAH CHEMTAI SIALUK L50/62326/2013

The above named is a student at the University of Nairobi, College of Education and External Studies, Department of Extra Mural Studies pursuing a course leading to the award of Masters of arts in Project Planning and Management. For this course to be complete, She is required to write and submit a research project. Therefore, the purposes of this letter is to kindly request you to accord her necessary assistance in getting information that will enable her complete the Research project. Her area of study is titled **"Determinants of beekeeping in enhancing environmental conservation in Arid and Semi-Arid lands in Kenya, A case of Lomut Ward West Pokot County-Kenya."**

Thank you,

SAKAJA Y. M.
CENTRE ORGANIZER
ELDORET AND ENVIRONS

UNIVERSITY OF NAIROBI
ELDORET, BRANCH
P.O. BOX 30197-00100-NRB

REPUBLIC OF KENYA

Fax:
E-mail: dcpokotcentral@gmail.com
Radio Call

DEPUTY COUNTY COMMISSIONER
POKOT CENTRAL SUB-COUNTY
P.O. BOX 1-30603
WEI-WEI,

MINISTRY OF INTERIOR
&
COORDINATION NATIONAL GOVERNMENT

REF: NO. ED 12/7 VOL 2 (80)

Date: 11th June, 2014

TO WHOM IT CONCERN

Dear Sir/Madam

RE: SARAH CHEMTAI SIALUK

The above named person is a student from university of Nairobi pursuing a course leading to Master of Arts in project planning and management. The research is meant only for academic purposes.

This is kindly to request you to accord her the necessary support she may require as she conducts her research.

Thanks in advance.

DISTRICT COMMISSIONER
POKOT CENTRAL DISTRICT
P. O. Box 1-30603 Weiwei

David M. Mulei
For: Deputy County Commissioner
Pokot Central Sub-County.