AN EXPLORATION OF THE IMPACTS OF SOCIO-ECONOMIC ACTIVITIES ON THE LOSS OF BIODIVERSITY IN THE MASERU AND BEREA DISTRICTS OF LESOTHO

By

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DECLARATION

I declare that "**An exploration of the impacts of socio-economic activities on loss of biodiversity in Maseru and Berea districts of Lesotho"** submitted for examination purpose, is my own work and that all the resources that I have used or quoted have been indicated and acknowledged by means of complete references.

19/01/2015

Signature **Date**

(Mr)

ABSTRACT

Biodiversity is a fundamental characteristic of life on Earth and encompasses the whole range of variation in living organisms. Lesotho has been subjected to tremendous biodiversity change over the last two centuries, primarily due to socio-economic activities. A number of socio-economic factors have contributed to the loss of biodiversity. However, worldwide experience has shown that, the consequences emanating from loss of biodiversity are sometimes irreversible as some species are threatened by extinction. The study aimed at exploring the impacts of socio-economic activities that result in loss of large game animals, predators and indigenous plants species in Lesotho.

To serve this objective, both quantitative and qualitative research methodologies were used to collect data. Quantitative research method was used in pre-post tests whilst qualitative research method was used in interviews and focus group discussions to collect data.

The finding and results of the study show that, impacts of human vectors such as immigration, migration, settlement, economic and recreation activities in Lesotho have the impacts to the loss of large game animals, predators and indigenous plants. It is imperative therefore, for Lesotho to find ways to establish more parks and botanic gardens that could offer opportunities for re-introduction of species in Lesotho, thus, adding value to the existing parks.

Key words: Overgrazing, habitat-destruction, indigenous species and extinction.

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DEDICATION

- This project report is dedicated to my mother, who stepped into my financial crises whenever I needed it. She remained a source of strength and security when I stood on shifting ground.
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ACRONYMS AND ABBREVIATED WORDS

CCs	Community Councils
GAs	Grazing Associations
H. E. P.	Hydro-electricity Power
MRAs	Management Resource Areas
NEMA	National Environmental Management Act
NPGRC	National Plant Genetic Resource Centre
NRMS	Natural Resource Management System
RMAs	Range Management Areas
SADC	Southern African Development Community
SWCP	Soil and Water Conservation Project
NPGRC	National Plant Genetic Resource Centre

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1. Introduction to the study

The research was conducted in the Maseru and Berea districts of Lesotho. It investigates socio-economic activities including unsustainable harvesting, settlement, economic and recreational activities. Lesotho is a Southern African country barely the size of Belgium and the former is about 30,355 square kilometres. Lesotho as a Southern part of Africa is surrounded by the Republic of South Africa. Lesotho gained its independence on 4th October 1966 after the British colonisation that lasted for almost 100 years from 1868 to 1966 (Murray, 2001). In addition, Sanders (2003) mentioned that, King Letsie the third was a ruler of a constitutional Monarch after the death of his father; Moshoeshoe the second in 1988.

The country is divided into 10 administrative districts, which differ in terms of size, topography, climate and level of development. In addition, the country consists of urban and rural residential areas. Biological Diversity in Lesotho (2000) stated that, the country is divided into four ecological zones namely, the Lowlands, Foothills, Maluti and Senqu River Valley. The ecological zones are illustrated on Figure 1.1.

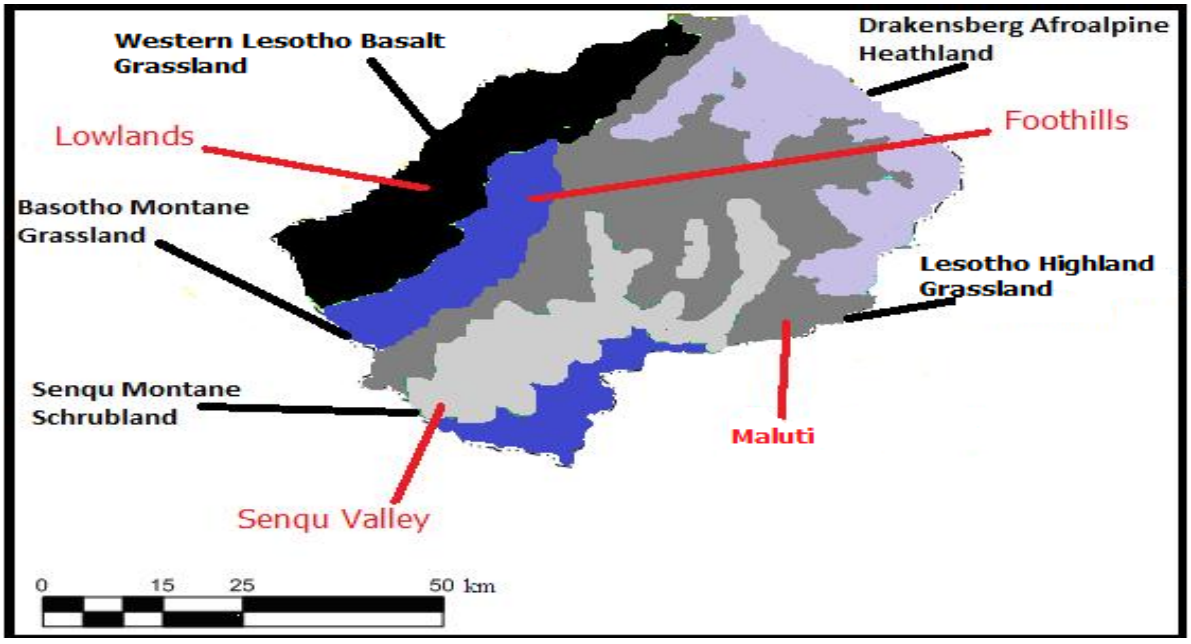

Figure 1.1: The Map of Lesotho showing major ecological zones and biomes: ***Source Biological Diversity in Lesotho, 2000:13.***

The majority of Lesotho population is concentrated in the western lowlands where agricultural land is fertile. Bureau of Statistics (2011) indicated that, the majority of the population resides in the lowlands' areas (see Table 1.1).

Table 1.1: Population distribution in ten districts of Lesotho: ***Source: Bureau of Statistics, 2011.***

DISTRICTS	POPULATION DISTRIBUTION
LOWLANDS AREAS	
BEREA	223,659
LERIBE	321,451
BUTHA-BUTHE	121,341
MASERU	389,742
MAFETENG	310,327
MOHALE'S HOEK	297,123
Total	***1,663,643***
HIGHLANDS AREAS	
MOKHOTLONG	146,743
QACHA'S NEK	196,874
QUTHING	120,122
THABA-TSEKA	156,981
Total	***620,720***

1.2. Climate of Lesotho

Bureau of Statistics (1999-2000) stated that, the altitude of Lesotho ranges from 1,388 to 3,482 meters above sea level. The country experiences warm moist summers and cold dry winters. According to Schmitz and Rooyani (1987), the climate of the Lesotho is semi-arid to sub-humid. The climate is greatly influenced by the variation in the altitude of the Drakensberg Mountains (Mitchell, 1992). Temperatures in the lowlands reach maximum of 39°celcius in summer while in winter they can reach -18°celcius, with the mountain tops being the coldest (Lesotho, 2007). Lesotho (2000a) stated that, summer months receive

approximately 85% of rainfall whilst snow is recorded in the winter months mainly in the highlands.

1.3. Justification for the study

According to Chakela (1997), the mountain region of Lesotho has a rich biodiversity with very specific endemism. McVean (1977) showed that, large game animals including lions (*Pantera leo*) and buffaloes (*Syncerus caffer*) used to be present in Lesotho but have became extinct in recent times. This study investigates the impacts of socio-economic activities and economic activities that can result in loss of large game animals, predators and indigenous species in Lesotho.

1.4. Aim of the study

Basotho diet, medicine, architecture, sports, crafts and religion have all been affected by environmental degradation and loss of biodiversity (Lesotho, 2009). Historical records from Germond (1967) indicated that, major vegetation changes have taken place in Lesotho within different ecological zones. Concurring with the preceding stance, Killick (1963) and McVean (1977) put that, the lowland of Lesotho used to have dense grassland with an open woodlands and riverside willow along major rivers. On the other side, Osborne and Tiger (1992) stated that, up to 16 species of birds that occurred in Lesotho prior to 1940 could be extinct since there are no recent records of their presence since that this time to present days. However, Lynch and Watson (1990) and Kopij (2006) mentioned that, Sehlabathebe National Park serves as a refugee for several wildlife, birds and plant species. The aim of the study is to explore the impacts of socio-economic activities that can result in loss of large game animals, predators and indigenous species to Lesotho.

1.5. Research questions

- What are the impacts of socio-economic activities on biodiversity? To what extent, if any, do these socio-economic activities contribute to loss of large game animals, predators and indigenous species in Lesotho?
- Name large game animals, predators and indigenous species in Lesotho that may have decreased or disappeared due to socio-economic activities?
- What public outreach or awareness campaign programmes, if any, are used for promoting the sustainability of biodiversity?

1.6. Research objective

What is the relationship between socio-economic activities and loss of biodiversity?

1.7. Delimitation of the study

The study explores the impact of socio-economic activities resulting to loss of biodiversity in Maseru and Berea districts of Lesotho. Lesotho has been subjected to tremendous biodiversity changes over the last two centuries primarily due to an ever increasing pressure on land and extraction of natural resources. As a result, people are interested in how Lesotho will be engaged on the processes of preserving biodiversity. The researcher had realised that curbing biodiversity loss in Lesotho is a problem which few people are interested in. According to Marake *et al.* (1998), very little research has been conducted on biodiversity loss as such; there is limited recent literature on biodiversity legislations and monitoring in Lesotho particularly within the context framework of biological diversity.

CHAPTER 2: LITERATURE REVIEW

2.1. Definition of concepts

2.1.1. Biodiversity

According to Maclaurin and Sterelny (2008), biodiversity refers to the numbers and variability existing among living organisms and life supporting systems found in the living world. The phrase encompasses all species of plants, animals and microorganisms, together with the ecosystems and ecological processes within which the species and organisms are found. The phrase also includes natural wild types as well as domesticated varieties of crops and livestock. According to Sarkar *et al.* (2006), loss of biodiversity simply means decline of species that can result into extinction due to traits that put them in danger of disturbance and exploitation.

2.1.2. Components of Biodiversity

The ecosphere and its ecosystem can be separated into two categories: namely a-biotic and biotic components (Kennelly *et al.*, 2012). A-biotic components include water, air, nutrients and solar energy while biotic components include plants, animals, macro and micro-organisms. In this regard, to measure biodiversity loss in this study, the scope had been based on large game animals, predators and indigenous species in Lesotho.

2.1.3. Importance of biodiversity on ecosystem

According to Maclaurin and Sterelny (2008), biological diversity is a global asset that is expected to benefit people in all parts of the world. This we know to be true, as people have relied on ecosystems to meet their basic needs such as food, water and other natural resources indirectly from biological sources. Basotho use stink grass to make Potele a Sesotho dish made of traditional vegetables and pap.

2.1.4. Ecological role of biodiversity

The millions of living species play a part in maintaining the environmental conditions on which they and people depend. Millennium Ecosystem Assessment (2003) stated that, ecosystems provide support of production and services such as purification of air, water, stabilization and moderation of the climate, decrease of flooding, drought and other environmental disasters. Adding to the preceding stance, according to Ehrlich and Ehlirch (1981), these biological processes also play a vital role in recycling carbon, oxygen and other elements in the soil, water and air continuum. Plants including shrubs and trees act as biological filters by helping cleansing the environment (Crane, 2013).

2.1.5. Economic value of biodiversity

Earth ecosystem provides valuable services supporting human life. According to Muck and Zeller (2006) environmental requirements such as food and shelter generally limit the distribution of species. Lesotho (2001) stated that, local people in Lesotho are dependent on terrestrial fauna for food, medicinal and other purposes. On similar sentiment Hall *et al.* (2004) put that, about 15 percent of the world's energy consumption is supplied by fuel-wood and other plants material in developing countries. Basotho are using broom grass (*Thysanolaena maxima*) for making brooms and frameworks their houses. According to Van Rooyen *et al.* (2004), common reed (*Phragmites australis*) in Maputaland in Kwazulu-Natal is used for hut building, fencing, thatching and craftwork.

2.2. Flora and Fauna of Lesotho

2.2.1. Flora in Lesotho

Biological Diversity in Lesotho (2000) stated that, Lesotho falls within five main bioregions. Basotho Montane Grassland, Western Lesotho Basalt Grassland, Lesotho Highland Grassland, Drakensberg Afroalpine Heathland and Senqu Montane Shrubland. Figure 1.1 on page 1 shows the major biomes in Lesotho.

2.2.2. Fauna in Lesotho

Lesotho has a variety of fauna that include five classes of vertebrates. These include mammals, birds, reptiles, amphibians and fish. The invertebrate fauna include Arthropods and animals with jointed legs. Lesotho (1999) stated that, one hundred and fifty years ago, the country had many kinds of wild animals that have disappeared in this time and age. Wild animals were including: Quaggas (*Eguus guagga*), black and blue wildebeests (*Cannochaetus gnou and Taurinus*), ostriches (*Struthionidae*), lions (*Panthera leo*), hippopotamus (*Hippotamus amphibius*), grey rheboks (*Plea capreolus*), reedbucks (*Redunca fulvorufula*), silver jackals (*Vulpes chama*), baboons (*Papio ursimus*), brown hyenas (*Hyena brunnea*) and leopards (*Panthera pardus*). However, pilot country study conducted in 2012 by FAO Corporate repository concluded that, days are gone where Lesotho used to be a haven of wild animals of all types because today only a few can be found in various parts of the country.

2.3. The Formation of the Kingdom of Lesotho

2.3.1. The History of the Kingdom of Lesotho

The Kingdom of Lesotho also known as Basutoland was founded in the 1820s by King Moshoeshoe I uniting various Basotho groups who had fled by the Zulu. According to Ellenberger (1997), this was far back as 1780 after Dingiswayo, the chief of the Umtetwa had engaged in a scheme of subjugating all the independent people of the surrounding country on the east of the Drakensberg and uniting them under his sole authority. Having escaped the Zulu, Moshoeshoe brought his people to the stronghold of Butha-Buthe and then the mountain of Thaba-Bosiu (about 20 miles from what is now the capital of Lesotho, Maseru). At this stronghold Moshoeshoe built up a great nation extending his rule and founded what we today know as the Basotho nation (Schapera, 1946). This is indicative of the philosophy of Moshoeshoe ‘Peace is the mother of nations’ (Sanders, 1975). Moshoeshoe's territory was being conquered by the trekboers and he approached the British for aid. In 1884 Basutoland became a British Crown Colony (Murray, 2001).

2.3.2. Lesotho Environmental and Biodiversity Related Legislations

In Lesotho there are over 50 pieces of legislations dealing directly or indirectly with various aspects of the environment. These laws are administrated by different institutions. Lack of coordination between these institutions makes it difficult to enforce these laws. Most of these laws overlap while others are inconsistent and contradict each other. Similar sentiments are shared by Chakela (1997) stating that, these rules and regulations are scattered, characterised by a considerable degree of overlap, inconsistency and in certain instances are conflicting. The overlapping laws were passed during the colonial era; and others dealing indirectly with the environment and as such many areas of environmental conservation and management are not covered in these laws. List of laws dealing directly with the environment and biodiversity are attached in Appendix C, but there are three key legislations that include the Constitution of Lesotho adopted in 1993, Environmental Act and Conservation Act.

Section 36 of the new Constitution of Lesotho which was adopted in 1993 requires Lesotho to adopt policies which protect the environment and states that:

> "*Lesotho shall adopt policies designed to protect and enhance the natural and cultural environment of Lesotho for the benefit of both present and future generations and shall endeavour to assure all citizens a sound and safe environment adequate for their health and well-being" (Constitution of Lesotho, 1993).*

In addition, the constitution of Lesotho based on Environmental Management Principles tried to promote the conservation of biological diversity. Environmental Act of 2008; Part II *Section 3* states that:

> "*The constitution tries to use and conserve the environment and natural resources of the Basotho Nation for the benefit of both present and future generations taking into account the rate of population growth and the productivity of available resources, also to maintain stable and functioning relations between the living and non-living parts of the environment through preserving biological diversity and respecting the principle of optimum sustainable yields in the use of natural resources. The constitution points that, its aim is to reclaim lost ecosystems*

where possible and reverse the degradation of natural resources" (Constitution of Lesotho, 1993).

Lesotho is also a party to agreements in relation to environmental matters which relate to biodiversity. These include international, regional and bilateral conventions. Those relate to this thesis are as follows: 1933 Geneva conventions on the protection of fauna and flora in their natural state, 1949 London convention on international trade in endangered species of wild fauna and flora, 1992 Rio de Janeiro convention on biological diversity and 1994 Lusaka agreement on co-operative enforcement operation directed at illegal trade in wild fauna and flora.

2.3.3. Management of Natural Resources in Lesotho

Traditionally, Basotho have managed their natural resources through the chieftainship, their indigenous system of local government. Their Natural Resource Management System (NRMS) focused on rotational grazing and ensured that each area of pasture received sufficient rest in the course of the year. These arrangements included cattle posts in high mountain areas used only in summer months (Lesotho, 1998). The summer cattle posts were managed by the Principal Chiefs. NRMS through the chieftainship covered other resources such as thatching grass, reeds and tress that could only be used at times and places approved by the local chiefs. From early 1980's, the Government of Lesotho promoted the concept of Range Management Areas (RMAs) for which Grazing Associations (GAs) drew up management plans with technical support from the Range Management Division of the Ministry of Agriculture. Most recently, the Local Government Act of 1997 has transferred NRMS authority from the chiefs to the Community Councils (CCs).

2.3.4. Projects engaged to conserve biodiversity in Lesotho

Lesotho has entered into bilateral agreement with the Republic of South Africa to jointly manage the Drakensberg or Maloti regional biodiversity (Lesotho, 2000b). Two conservation measures were introduced, namely; the Maloti Drankesberg Transfontier Project and the Lesotho Biodiversity Trust. The Lesotho Biodiversity Trust was launched in

2004 to prevent extinction of more of Lesotho's wild animals and plants. The initiatives of this Trust are based on sound scientific principles in order to bring about well managed biological diversity (www.lhwp.org.ls, accessed 28 March 2013). The Maloti Drakensberg Transfontier Project seeks to foster biodiversity growth and sustainability (www.maloti.org.ls, retrieved 28 March, 2013).

Lesotho has also been engaged in other projects to conserve biodiversity namely:

- Government administration of conservation.
- Soil and Water conservation project (SWCP).

2.3.5. Government Administration of Conservation

There are two nature reserves in Lesotho that are legally established specifically to protect biodiversity *in situ.* These are the Sehlabathebe National Park and Masitise Nature Reserve. Sehlabathebe National Park is situated in the Afromontane grassland in Qacha´s Nek District (Kopij, 2002). Four other reserves are currently being established in the north of Lesotho within the LHWP Phase 1A and those include; Bokong, Ts'ehlanyane, Muela and Liphofung Nature Reserve. In addition, the Roma campus of the National University of Lesotho is declared as bird sanctuary and includes a Botanic Garden established 30 years ago for teaching purposes (Lesotho, 2000a). Figure 2.1 shows the Lesotho Protected areas.

Figure 2.1: Map of the Lesotho Showing Protected Areas and Major Rivers: ***Source, www.mapsofworld.com, Accessed 2nd April 2014.***

2.4. Social-activities contributing to bio-degradation.

Observation from ecological perspective shows that spatial and temporal faunal and floral changes have been continuing to occur at a broad scale around the world (Landres *et al.*, 1999). Pearce and Moran (1994), have estimated a biodiversity loss of up to 50% for the next century on Earth. Social-activities taking place in Lesotho can be categorised as follows:

2.4.1. Unsustainable harvesting and hunting

During the arrival of the missionaries at Morija in 1833, churches and houses were erected to house them and offer places of worship for Casalis and his party. Wood found in the mountains was used for framework. If the stubble and rushes for the roofing had been cut at some distance from the station the women and the girls took upon themselves the duty of conveying it. They might be seen every morning following one another bearing on their heads large bundles which they deposited in the yard (Casalis, 1861).

It was customary to stitch the materials to the lath of the roof by means of thongs and for this purpose a number of skins were required. All the hunters of the place set off immediately and soon returned with a large wagon of skins of the gnus (*Connochaetes*) and zebra's (*Eguus quagga*) neighbourhood (Casalis, 1861). Never had war been waged against these animals with such good conscience. The hunting cry was, "God wills it and God commands it!" According to Casalis (1861), in the evening the hunters assembled to the number of several hundred under the starlit heavens to sing a hymn to the creator before retiring to rest. During this time the local people would therefore bring their efforts together to help as much as they could and one of the activities they would engage in was to go hunting. They would gather as many hides from wildlife as possible.

Lesotho's plants are over harvested for commercial markets, especially to use them for medicine. Looking at the case study of the Republic of South Africa, Dold and Cocks (2002) argue that the intensive harvesting of medicinal plants for commercial trade poses a threat to many species. As a result, when human populations grow, demand for traditional medicines increases and the pressure on natural resources become greater than ever.

2.4.2. Population increase versus Settlement

Human population on Earth is growing, resulting in the expansion of human settlements and an increase in a wide range of problems, mostly in urban areas (Miller and Spoolman, 2012). Lesotho has been subjected to tremendous biodiversity changes over the last two centuries, primarily due to an ever increasing pressure on land settlement and the extraction

of natural resources (Taylor and Atkison, 2012). Human overpopulation has played a crucial role in habitat decline and is regarded as an ultimate factor causing habitat loss (Miller, 1994). In the case of Lesotho, when the population grows in towns, it requires vegetation to be cleared for housing. Thereby, impacting negatively on species population and diversity which was dependent on the same vegetation (Lesotho, 1999).

2.5. Economic activities contributing to bio-degradation.

Biodiversity is fast depleting. All types of ecosystems are showing rapid changes due to economic activities. Economic-activities referred to are the following:

2.5.1. Cultivation

As settlements expand, people tend to plough crops to support their subsistence requirements, thus, diminishes the rangeland associated with flora and fauna species. In Lesotho the cultivated land is largely confined to the lowlands and foothills on the western border and Senqu river valley on the south. Much of the rest of the land area is utilised for extensive livestock farming. Clearing the land primarily for agriculture is perhaps the single most important cause of environmental degradation, loss of species and depletion of ecological communities' worldwide (Schur, 1990). According to Miller (2002), the exponential human population growth in the last few centuries had influenced massive alteration of habitats and associated biological changes continue to threaten the existence of millions of species and basic ecosystem processes.

2.5.2. Generation of Hydro-Electricity Power (HEP) in Lesotho

Dams are built worldwide to store water, to generate electricity and for flood control. The production of electricity in Lesotho is generated from waterfalls with the help of dams, some of which are built by the Lesotho Highlands Water Project. In the production of H.E.P water fall from a vertical descent, serves as the force that turns the turbines (Figure 2.2). Electricity is then transmitted from the plant via power cables to the National Grid and it is then distributed to some towns and villages in Lesotho.

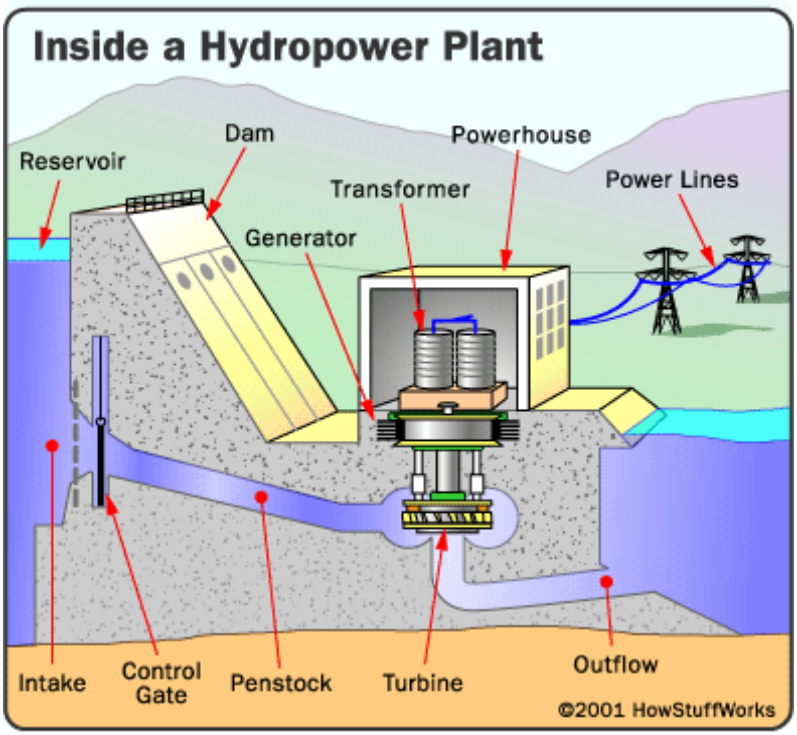

Figure 2.2: Schematic of a power plant and all of its components parts. ***Source: HowStuffWorks, 2001.***

There are some power stations in Lesotho which are sufficient for supplying the country's needs in summer. However, in winter there is an electricity shortage. Therefore, Lesotho has to import additional electricity from the Republic of South Africa. The consequences of operating hydroelectric power plants are quite varied and have significant effects on the physical, biological and human environment in and near the site (Lichaba *et al.*, 2006).

2.5.2.1. Physical environment

The physical environment is affected by the construction of a H.E.P. station in the manner that both the river and ecosystem of the surrounding land area will be altered as soon as the dam construction begins. Once the power house is put in place, the free flow of water stops and water will begin to accumulate behind the dam in the new reservoir. This land may have been used for other things such as agriculture, forestry and even houses but it is now unusable. Biswat (1981) as cited on Castaldi *et al.* (2003) stated that, the loss of habitat may not seem severe but if this area was home to the threatened or endangered species, the dam construction now could threaten their risk of extinction further. Some of the most severe

environmental impacts occur during the construction phase. Since dams tend to be built on underdeveloped areas, they require infrastructure such as roads, electricity which can only be installed or constructed on land which has been cleared of vegetation.

2.5.2.2. Biological environment

Animal and plants life are impacted significantly during the dam construction. Humans are also affected by the building of the H.E.P. plant as they have to be relocated. According to Hoover (2001), there were plants and animals affected in Lesotho due to Lesotho Highlands Water Project Phase 1A and 1B.

2.6. Case study of a country experienced biodiversity loss

2.6.1. Case study of Zimbabwe

The majority of the Zimbabwe population depend directly on a range of biological resources for subsistence and income generation. According to Taylor (2009), poor people living in rural areas tend to depend directly or indirectly on natural system for income-generation. The same author added that, the very poor people are landless labourers who depend on various natural resources such as soil and fisheries for subsistence and income-generation. On a commercial scale such as in forestry, agriculture, fishing and tourism; people rely on a healthy diversity of genes, species and ecosystems. According to Sola (2005), Tombo community of Nyanga have harvested thatch grass (*Hyparrheima hirta*) for both subsistence and commercial purposes for centuries. To date, this community is harvesting and marketing grass to both local and international markets. On the other hand, Curtis (2005) mentioned that Zimbabwe's forestry is over-harvested. The same author added that, Murraya tree *(Murraya paniculata)* which grows in Mashonaland East has some medical properties and is at the risk of extinction whilst other tree species are disappearing due to over-harvesting.

A number of positive steps have being taken to conserve biodiversity and to use it sustainably in Zimbabwe. According to Curtis (2005), 13% of Zimbabwe land space has been set aside as the national parks and wildlife estate under the Parks and Wildlife Act.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Research Methodology

Research methodology is an approach in research used to gather data which is to be used as a basis for inferences, interpretation, explanation and prediction (Cohen and Manion, 1994). Qualitative and quantitative methodologies were utilised in this thesis. Qualitative research method was used in interviews, semi-structured interviews and focus group discussions to collect data. According to Straus and Corbin (1990), qualitative research is any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification. This shows that this method does not use statistical information like quantitative method does; it is rather interested in how people make sense of their lives, experiences and their structure of the world. It therefore, provides information about the human side of issues such as behaviours, beliefs, emotions and their relationships as individuals. There is a reference to Ary *et al.* (1990) that, qualitative inquiry seeks to understand human social behaviour from the "insiders" perspectives, as it is lived by participants on social setting. For example, a cultural schools, community, groups or institutions.

However, qualitative research method has some disadvantages as well. Some of its disadvantages are mentioned by Smith (2008) when he contends that, subjectivity in this research design leads to problems of reliability and validity of the information gathered. He goes further to show that, *"it is difficult to prevent researcher induced bias''*. Other problems that are indicated include its inability to study a big number of subjects and its data collection methods are known to be labour intensive. Hancock (1998) gave the disadvantage that qualitative research method and its findings cannot be generalised.

Quantitative research method was used in pre-post tests to collect data on socio-economic activities that relate to biodiversity loss in Lesotho. When using quantitative method the researcher approached subjects from an objectivist point of view and seeks to provide essentially rational explanations on the assumption that social interaction form an integrated set of relationships best understood by inductive procedures (Creswell, 1994 and Oliver,

2004). In addition, Creswell (1994) stated that, quantitative researchers view reality as objective and independent of the researcher. Similar sentiments were given by different authors; Cohen, Manion and Marrison (2000); Denzin and Lincoln (2005) and Oliver (2004) emphasising that, the researcher should remain distant and independent from what is being researched. The strengths of quantitative paradigm are that, the method produces quantifiable and reliable data that are usually generalisable to some larger population (Weinreich, 2006).

3.1.1. Research designs

The design of research details the researcher's overall approach to the research study. Research design is a plan or a blueprint of how a researcher intends to conduct a study (Babbie and Mouton, 2001). It is a general blueprint for the collection, measurement and analysis of data with the central goal of solving research problem. Focus group discussions, interviews and semi-structured interviews were used to gather qualitative research data whilst pre-post tests were used to gather quantitative research data.

3.1.2. Importance of combined methodologies

The present study used pre-post tests, interviews and focus group discussions with a combination of both qualitative and quantitative methods of data collection. However, the two methods are not opposing each other in this research. As such, they were used in conjunction to fit the questions under study. Creswell and Clark (2007) explained the use of both quantitative and qualitative approaches, providing a better understanding of the research problem than either approach alone been used. Mixed method research provides strength that offset the weaknesses of both quantitative and qualitative research. The use of both paradigms in this research was carefully designed due to financial and time constrains, as advised by Creswell (1994).

3.2. Data collection

Data collection is the process of gathering the information which is needed to address the research problem (Polit and Hunger, 1999). Several studies do exist on biological diversity, however, most of them are representative of the time of their publication and do not account for the state of biodiversity at the present time. Data was gathered from pre-post tests, interviews, semi-structured interviews and focus group discussions.

3.2.1. Pre-post tests

The researcher used set questions of pre-test to find data on socio-economic activities that relate to biodiversity loss in Lesotho. These set questions were given to different participants within groups respectively. According to Cohen, Manion and Morrison (2007), the pre-test study may have questions which differ in form or wording to post-test study though the two studies test the same content. Participants in pre-post tests were from areas A and B. Both areas had 43 and 46 participants in total respectively, with males and female described in Table 3.1 and 3.2.

Table 3.1: Name of groups, number of participants and male-female ratio in area A

AREA A		
Names of groups	**Number of Participants**	**Male: Female ratio within groups**
Group A	12	6:6
Group B	8	3:5
Group C	6	3:3
Group D	7	3:4
Group E	6	3:3
Group F	7	4:3
Total Participants	**46**	**22:24**

Table 3.2: Name of groups, number of participants and male-female ratio in area B

AREA B		
Names of groups	**Number of Participants**	**Male: Female ratio within groups**
Group G	12	6:6
Group H	6	3:3
Group I	5	2:3
Group J	7	2:5
Group K	6	2:4
Group L	7	3:4
Total Participants	**43**	**18:25**

During the first session of pre-tests the researcher asked the participants to think of the activities that could result into decrease in number of plants and animals without having presenting any information. The researcher gave the participants time to think so that some will be able to recognise the activities and organise their thoughts. The researcher intervened where necessary and stimulated brain storming activities about the causes and possible direct causes of decrease in numbers of fauna and flora species and participant's response were evaluated. The researcher made participants to concentrate in all questions that were asked. At the end, the post-test questions were conducted with the group's participants and were repeated more often for validity and reliability of data.

3.2.2. Interviews schedules

A research interview involves verbal administration of the interview guide. The purpose of interviewing was defined by Patton (2002), as the means to find out what is on someone's mind. Interviews are defined as face-to-face encounters between the researcher and the

participants, for specific purpose of obtaining research-relevant information (Kothari, 2004; Mugenda and Mugenda, 2003 and Neuman, 2006). The interview method is considered to be one of the most common and effective way of understanding human beings (Denzin and Lincoln, 2005).

According to Cohen, Manion and Morrison (2000) the number of types of interviews given is frequently a function of the source one reads. Kvale (1996) extended the line of thought and cautioned that, interviews differ in the openness of their purpose. The same author added that, they differ in their degree of structure, the extent to which they are exploratory or hypothesis-testing. Furthermore, there is reference to Cohen, Manion and Morrison (2000), Denzin and Lincoln (2005), Leedy and Ormrod (2005) and Robson (2002) explaining that the major difference between interviews lies in the degree of structure in the interview which to some extent links to the "depth" of response sought. Forty-six participants from area A and forty-three participants from area B were part of the interviews.

3.2.3. Semi-structured interviews

On the basis of the degree of the structure, interviews can be categorised as being structured (where questions are pre-set) or unstructured (where there are no set questions) and where the participant, rather than the interviewer, may even set the agenda. According to Hannabuss (1996), each of these approaches to interviewing has strengths and weaknesses and each may be more or less suitable for particular types and areas of research. For instance, the highly-structured approach may be good for information about large numbers of people using a particular service, while unstructured interviews tend to be preferable when complex, personal or sensitive issues are being discussed.

Unstructured interviews provide more breadth than the other types due to their qualitative nature. A non-structured interview is an open situation with greater flexibility and freedom. Although the research purpose governs the questions to be asked, their content, sequence and wording, they are entirely in the hands of the interviewer (Cohen, Manion and

Morrison, 2000; Leedy and Ormrod, 2005 and Robson, 2002). In this kind of interview, the researcher has a general area of interest and concern but lets the conversation develop within the area. The researcher had controlled the process of interviewing and allowed freedom for participants to express their thoughts as perceived by O'Leary, (2004) that it should be. Forty-six participants from area A and forty-three participants from area B were part of the semi-structured interviews.

3.2.4. Focus groups discussions

Focus group discussions are a means of obtaining information from people in a group. Instead of asking questions of each person in turn, focus group researchers encourage participants to talk to one another, asking questions, exchanging ideas and commenting on each other's experiences and points of view. Focus groups are group discussions exploring a specific set of issues. It involves a narrowly focused topic discussed by group of equal status (Payne and Payne, 2004). According to Barbour and Kitzinger (1999), focus group discussions are better for exploring how points of view are constructed and expressed. The aim of focus group discussion is mainly to gain rich and often exploratory information (Tacchi *et al.*, 2003). Focus group discussions are important because the group develops its own conversation, raising issues and ideas that might not emerge in a discussion with the interviewer alone (Cohen, Manion and Morrison, 2000).

In conducting focus group discussions, the researcher considered a number of factors. These included deciding on the size and composition of the groups, deciding on the number of focus groups to be conducted and deciding on the criteria to be used to select participants to be included in the discussions as proposed in (Cohen, Manion and Morrison, 2000; Morgan, 1988 and Morgan and Scannell, 1998). In most cases, Fern (2001) and Morgan and Scannell (1998) stated that, all these decisions depended on the purpose of the research. The following section presents overviews of the decisions that the researcher made regarding the focus groups discussions which were used in this study.

3.2.4.1. Group size

Different studies used different group sizes in focus group discussions. Therefore, studies are not agreed on the size of the focus groups to be used (Mosia and Ngulube, 2005). Advice about groups' size and composition in existing guides focus group research is often didactic and this can hamper effective application of focus group methods (Barbour and Kitzinger, 1999). Table 3.3 summarises selected groups sizes found in the literature.

Table 3.3: Focus group size found in literature adopted and modified from Mosia and Ngulube (2005).

Author (s)	Focus Group Size
Morgan (1988)	4-12
McClellard (1994)	8-12
Morgan and Scannell (1998)	6-10
Barbour and Kitzinger (1998)	3-5
Greenbaum (2000)	7-10
Bless and Higson-Smith (2000)	4-8
Bloor *et al.* (2001)	6-8
Sekaran (2003)	8-10
Von Seggarn and Young (2003)	4-12

When deciding the size of groups for focus group discussions, it is recommended that the group should not be so large as to be unwieldy or to prevent adequate participation by most members, nor should it be so small that it fails to provide substantial greater coverage than that of an interview with one individual (Bloor *et al.*, 2001; Merton *et al.*, 1990 and Morgan, 1988). According to Morgan and Scannell (1998), deciding on the right numbers of participants for a focus group means striking a balance between having enough people to

generate a discussion and having so many people that some feel crowded out. Cohen, Manion and Morrison (2007) mentioned that, with a small group the intra-group dynamics will exert a disproportionate effect, while with a too large group; it becomes unwieldy and hard to manage. From area A and area B respectively, focus group discussions had four to twelve participants.

3.2.4.2. Composition of the group

Closely related to the issue of the size of the focus groups is the composition of these groups. Interaction between participants is a key feature of the focus group method and therefore, careful consideration of group composition is vital (Fern, 2001). In determining the composition of the groups, the present study paid attention to the issues of compatibility of the participants. Cohen, Manion and Morrison (2007) cautioned that, extreme care should be taken with composition of focus groups, such that every participant is the bearer of the particular characteristic required or that the group has homogeneity of background in the particular areas, otherwise the discussion will lose focus or become unrepresentative.

According to Morgan and Scannell (1998), when the participants perceive each other as fundamentally similar, they can spend less time explaining themselves to each other and more time discussing the issues at hand. The same authors explained that, generating a productive discussion required good group dynamics that depended on compatibility of the participants. To achieve compatibility the present study paid attention to the issue relating to the background of the participants such as their occupation and age. Taking into consideration all of the above factors, the study used both males and females ageing from 18 to 55 and above (Table 3.4 and 3.5).

Table 3.4: Age of participants at area A

AREA A	
Years of participants	**Number of participants**
18-25 Years	**2**
26-35 Years	**6**
36-45 Years	**12**
40-55 Years	**6**
56 Years and above	**20**
Total	**46**

Table 3.5: Age of participants at area B

AREA B	
Years of participants	**Number of participants**
18-25 Years	**3**
26-35 Years	**8**
36-45 Years	**4**
40-55 Years	**18**
56 Years and above	**10**
Total	**43**

3.2.4.3. Number of groups

Commenting on the number of focus group discussions to be conducted in a study, Morgan (1988) warned that, one group is never enough. Morgan and Scannell (1998) agreed that, using one group is often risky. Cohen, Manion and Morrison (2007) emphasised that, one group is insufficient, as the researcher will be unable to know whether the outcome is unique to the behaviour of the group. According to Bryman (2004), it is unlikely that one group would satisfy the needs of the researcher, since there is always the possibility that the responses are particular to that one group. The number of focus groups in a study may vary from three or four to over fifty (Barbour and Kitzinger, 1999; Bloor *et al.*, 2001 and Morgan and Scannell, 1998). The study used six focus group discussions from area A and six focus group discussions from area B.

However, Morgan and Scannell (1998) said that, there is no hard and fast rule about how many groups are sufficient. Dealing with too few groups may result in one missing something or lead to premature conclusions, but using too many is a waste of time and money. Bloor *et al.* (2001) pointed out that, focus groups are labour intensive in recruitment, transcription and analysis. Therefore, where possible, numbers should be kept down to a bare minimum. The appropriate number of focus groups depends on the research questions, the range of people the researcher wishes to include; time and resource limitations. Morgan and Scannell (1998) stated that, the biggest issue in determining the number of groups is the underlying diversity of what people have to say.

3.2.4.4. Selection of group members

Statistical representation is not the aim of most focus groups research. As with most other qualitative methods, the focus group method relies on purposive samples. In purposive sampling participants are chosen for a particular purpose (Leedy and Ormrod, 2005 and Robson, 2002). A purposive sampling strategy chooses the focus group participants according to research goals. Using purposive sampling, the participants should be selected using well-defined purposive selection criteria, as opposed to convenience samples which emphasized the ease of recruiting the participants (Morgan and Scannell, 1998). In this study, the selection of participants to be involved in focus group discussions was done in

such a way that there was a representation of the participants. This means the participants involved in focus group discussions were people who were involved in various economic activities such as farming, livestock-keeping, artisans, herding animals, hunting wild animals, domestic workers and collectors of firewood.

Groups were structured in such a way that similar related groups were put together. The major attraction of focus group discussions over other data collection techniques are pointed out by Cohen, Manion and Morrison (2000; 2007), Denzin and Lincoln (2005), Leedy and Ormrod (2005), Ratcliffe (2002) and Robson (2002), as the following:

- The potential for discussions to develop, thus yielding a wide range of responses;
- Can generate a wider range of responses than individual interviews;
- Might be useful for gaining insight into what might be pursued in subsequent individual interviews;
- They are often quicker than individual interviews and hence are time-saving and involve minimal disruption;
- They are inexpensive to conduct and often produce rich data that are cumulative and elaborative;
- Can be stimulating for participants and aid recall; and
- Provide natural quality control on data collection because participants tend to provide checks and balances on each other and extreme views tend to be weeded out.

3.3. Empirical study

3.3.1. Research areas

The study was conducted in areas A and B, *see the map below*. Both areas were considered because it is where the study had actually looked at biodiversity loss. These two research

sites had therefore, provided insight on whether biodiversity loss in Lesotho is a result of unsustainable use of natural resources or are related to socio-economic activities.

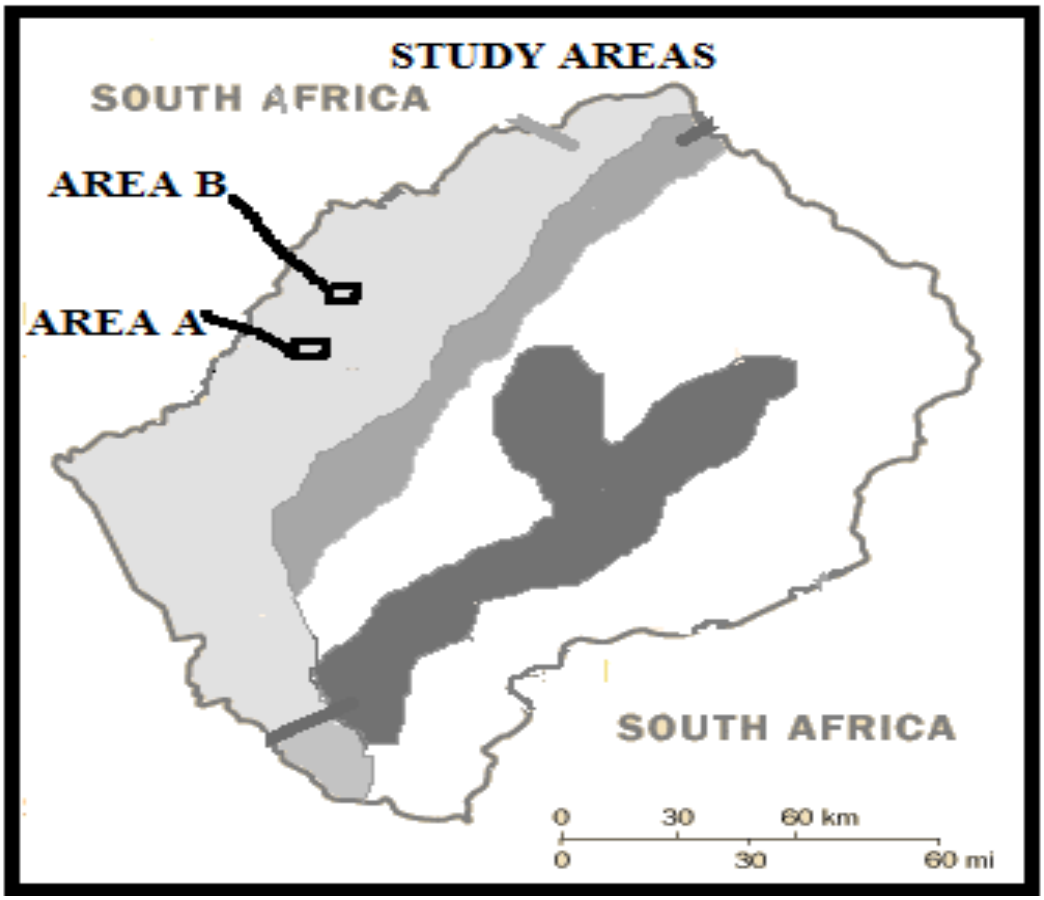

Figure 3.1: Map of Lesotho showing study areas. Source, *Trends in Geography Book 2, 2006:92* and modified by the researcher.

3.3.2. Research Population

A study population can be defined as the entire collection or units about which the researcher wishes to draw conclusions (Kothari, 2004). There is a reference to Babbie (2002) defining study population as the specified aggregation of the elements in the study. According to Ngulube (2005), it is important for the investigator to carefully and completely define the population before collecting samples. One of the major steps in formulating a research design is to define the population according to the objectives of the study. In carrying out this research, the researcher acquired information from participants involved in areas A and B respectively.

3.3.3. Target Sample

The researcher targeted the participants ranging from age 18 to 55 and above; from all categories of occupations they were engaged in from their childhood to adulthood. Those included artisans, sheppards, hunters of wild animals, fetcher of water, collectors of firewood, domestic workers, farmers and livestock keepers.

3.3.4. Sampling Procedures

According to Johnson and Christensen (2000), sampling is defined as selecting representative individual from a population. There are two main methods of sampling used in this research. These are convenience and purposive sampling. Purposive sampling seeks mainly to represent only a particular group or a particular named section of a wider group (Cohen, Manion and Morrison, 2007). Using the research areas described above, selected participants were identified as the part of the purposive sampling group. These particular groups from the population were selected because they are representatives of the community as leaders and well informed about information needed. The researcher has to select the particular elements from the population that will be representatives or informative about the topic. A convenience sample is a group of subject selected because of availability for the study (McMillian and Schumacher, 1992). The participants from areas A and B were available for this study.

3.4. Piloting

The researcher had piloted the interview questions prior to the actual interview meetings. Piloting was done in order to get to grip with some practical aspects of interviewing as well as the types of answers that might be received (De Vos *et al.*, 2005). In addition, piloting was undertaken to ensure that the final set questions of interview schedules are neither deficient nor lacking in any research questions or important aspects. The interviews were tested with three focus groups (group A, B and C) from area A and three focus groups (group G, H and I) from area B in order to rectify errors and check the responses time. According to Glesne (1999), a researcher must gain access to the multiple perspectives of the participants.

Errors were identified regarding the formulation of some questions and were rectified. Participants from area A had difficulties in understanding some of the scientific concepts used in the interviews, for example flora and fauna. The questions which were found to be misleading were rephrased. Remarks obtained from the interviews enabled the researcher to eliminate some items and also to rephrase some of the questions.

3.5. Validity and reliability of the study

According to Morse *et al.* (2002), the concepts of reliability and validity as overarching constructs can be appropriately used in all scientific paradigms, because to validate is to investigate, to check, to question and to theorise. In this regard, Fraenkel and Wallen (1990), view validity as referring to the appropriateness, meaningfulness and usefulness of the inference the researchers make based on the data they collect. Extending the line of thought, Bryman and Burgess (1999), define reliability as typically held to be synonymous with dependability, consistency, stability, predictability and accuracy.

3.5.1. Validity and reliability in quantitative research

In quantitative research, validity refers to the capacity of research techniques to encapsulate the characteristics of the concepts being studied and so properly to measure what the method was intended to measure (Payne and Payne, 2004). Babbie and Mouton (2001) and Leedy and Ormrod (2001) stated that, validity is mainly concerned with the extent to which the measuring devices would yield accurate results and capture the essence of what they are intended to represent. According to Joppe (2000), the following explanation is what validity is in quantitative research:

> *"Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. In other words, does the research instrument allow the researcher to hit "the bull's eye" of the research object? Researchers generally determine validity by asking a series of questions, and will often look for the answers in the research of others".*

In quantitative research**,** reliability is mainly concerned with the extent to which similar results will be obtained if the study were to be repeated (Payne and Payne, 2004).

According to Babbie and Mouton (2001), Cohen, Manion and Morrison (2000), Leedy and Ormrod (2001) and Payne and Payne (2004) research findings are considered to be reliable if they are repeatable to the extent that repeated measures would yield similar results. Kirk and Miller (1986) identified three types of reliability referred to in quantitative research which relate to: (1) the degree to which a measurement, given repeatedly, remains the same (2) the stability of a measurement over time; and (3) the similarity of measurements within a given time period.

3.5.2. Validity and reliability in qualitative research

Since validity and reliability are rooted in quantitative research, there is a need for validity and reliability to be re-defined for their use in qualitative research. Different scholars have provided guidelines on how validity and reliability can be conceptualised. Observation from Golafshani (2003) and Morse *et al.* (2002) are that, validity and reliability in qualitative research are mainly conceptualised as trustworthiness, rigour and quality of the research. According to Cohen, Manion and Morrison (2000), qualitative research validity might be addressed through honesty, depth, richness and scope of the data achieved, the participants approached and the extent of triangulation. According to Guion (2002), validity and reliability relate to whether the findings of the study are true and certain "true" in the sense of the findings accurately reflecting the real situation and “certain" in the sense of the findings being backed by evidence. There should be no good grounds for doubting the results, meaning that the weight of evidence supports the conclusions.

Reliability and validity had been substituted by Lincoln and Guba (1985), with the parallel concept of “trustworthiness” containing four aspects: credibility, transferability, dependability and conformability. The same alternative terms were recommended by Robson (2002). Within these concepts there were specific methodological strategies for demonstrating qualitative rigour, such as the audit trail, member checks when coding, categorising, or confirming results with participants, peer debriefing, negative case analysis, structural corroboration and referential material adequacy.

Ensuring reliability in qualitative research, Seale (1999) stressed the importance of examining the trustworthiness. He explained that; *"trustworthiness of a research report in qualitative research lied at the heart of issues conventionally discussed as validity and reliability"*. On the other hand, Robson (2002) stated that validity in qualitative research had something to do with the research being accurate, correct or true. The same author presented some of the issues which can be considered as threats to validity in qualitative research, which researchers should pay attention to. These threats include inaccuracy or incompleteness of the data, imposition of a framework or meaning on what is happening, rather than this occurring or emerging from what one learnt during his or her involvement with the setting, without considering alternative explanations or understanding of the study. In order to enhance validity, the researcher had drawn conclusion supported by data collected from a number of different instruments whilst the researcher maintained reliability by repeating the same type of question to individual participants groups as possible.

3.6. Ethical Consideration

Ethical considerations represent a moral stance that involves conducting research to achieve not just high professional standards of technical procedures, but also respect and protection for the people actively consenting to be studied (Payne and Payne, 2004). According to Busha and Harter (1981), professional ethical standards should be noted during all phases of the research process. Some of the ethical considerations identified in any research process are the following: protecting the confidentiality of human subjects, following proper procedures to gain access and acceptance to instructions and organisation where research is to be conducted, reporting procedures and findings as accurately as possible, obtaining informed consent from the participants, giving credit to research associates who provided direct evidence and placing a high value on intellectual honesty (Cohen, Manion and Morrison, 2000; Babbie and Mouton, 2001; Busha and Harter, 1981 and Leedy and Ormrod, 2001). Throughout the study the researcher adhered to ethical research considerations and professional guidelines. This involved informed consent, voluntary participation, confidentiality, anonymity and protection from harm and are discussed below.

3.6.1. Informed consent

The researcher requested permission with the letters from areas A and B to conduct research at the selected sites **(Appendices A and B).** This was done to ensure that relevant research permits are obtained before the commencement of data collection. The researcher had first visited areas A and B for formal introduction of research objectives and for conducting the pilot study. The second visit to both places involved pre-post tests, forming focus groups and interviews. The aim and significance of the study was explained by the researcher to the participants when giving out the consent forms.

3.6.2. Voluntary participation

At the interview meeting the following approach was used: letters of consent were given to participants in order for them to read, query and then to sign. Emphasis was placed on the fact that they have the right to refuse and withdraw from the study at any time without penalty, as well as to contact the researcher with any queries at any time during the study. The interview appointments were then scheduled with participants who agreed to participate in the study and the participants were informed a few weeks in advance about the day and time when the interview would be conducted. According to Leedy and Ormrod (2001), research participants should be told the nature of the study to be conducted and be given the choice of either participating or not. If they agree to participate, they must be aware that they have the right to withdraw from the study at any time. According to Sieber (1998), the consent statement should explain the research to be undertaken should be simple and friendly in tone and should translate a scientific proposal into simple everyday language, omitting details that are unimportant to participate but including details that are indeed important to them.

3.6.3. Confidentiality and anonymity

The information that participants shared with the researcher in this study were kept confidential and their identities were not revealed in the interview data and pre-post tests. Supporting the need for confidentiality, Leedy and Ormrod (2001) emphasised that, “under no circumstances should a research report either oral or written, be presented in such a way

that others become aware of how a particular participant has responded or behaved". Pre-post tests and interviews with the participants from area A took place in a hall while with the participants from area B took place at the village gathering "Lebaleng la Lipitso," in order to adhere to the principles of confidentiality and anonymity. In this study, interviews were numbered in the order that they occurred as proposed by Leedy and Ormrod (2001). For example, the groups were numbered with alphabetic numbers A, B, C, D, E, F, G, H, I, J, K and L for the purpose of data analysis.

3.6.4. Protection from harm

There are three principles that Holloway and Jefferson (2000) see as central to research with human beings namely: honesty, sympathy and respect. In this study, these principles were used to protect the participants from harm.

3.7. Data analysis

Data analysis according to Kothari (1990), involves a number of closely related operations which are performed with the purpose of summarising the collected data and organising them in such a manner that they answer the research questions. The operations include editing, classifying and tabulating. It also entails categorising, ordering, manipulating and summarising data to find answers to the research questions (Kerlinger, 1986 and Marshall and Rossman, 1989).

Analysing data is often seen as a demanding, repetitive and arduous task. This is predominantly a mechanical exercise that requires an ability of the researcher to be dynamic, intuitive, creative, reasonable, have the ability to think and theorise (Basit, 2003). Data was analysed using the combination of the template analytical style and an editing analytic style. Before the actual analysis of data, data was edited and checked for accuracy. According to Kothari (2004) and Mugenda and Mugenda (2003), these processes are essential to ensure that the collected data is systematically organised in a manner that facilitates analysis.

3.8. Problems encountered during the collection of data

Several problems were faced by the researcher during data collection. These included participant at area A who was in charge and the participant in charge at area B who were difficult to locate because in few cases, the researcher arrived after they have gone to the meetings or own errands. In area A, the venue set for the interviews was changed because the participants were not easy to locate as some went to the post office to collect their monthly grants from the government. The other problem was time constraints.

CHAPTER 4: DATA ANALYSIS AND INTERPRTATION

4.1. Introduction

This chapter presents the empirical data collected from pre-post tests, interviews and focus group discussions that were conducted with different groups at areas A and B respectively. As stated earlier, group A, B and C at area A were used when piloting the study whilst group D, E and F were used in analysing data. On the other hand, Group G, H and I from area B were used when piloting the study whilst group J, K and L were used in analysing data.

4.1.1. Data collected from group D at area A

This group was pre-post tested and interviewed. The researcher advised the participants to be audible enough when speaking, in order that their voices are clear throughout the discussions. The purpose of the interview was to explore how socio-economic activities related to loss of biodiversity. The questions asked are presented below.

Question 1a: Could participants give the history of this area?

Response: Participants mentioned that, Berea district has an alternative name Teyateyaneng. From history, Lesotho was called Basutoland. In 1910, Basutoland was re-organised where new Berea district was torn apart from old Berea while new Leribe was formed from part of old Berea and Thaba-Bosiu.

Question 1b: In which villages were participants born?

Response: Almost all the participants mentioned that, they were born in area A, except one participant who mentioned that, he was born in one area outside area A.

Question 1c: In which villages did participants grow up as children?

Response: The participants mentioned that they grew up in area A. One study participant mentioned growing up in one area outside the study area which is 10 kilometres away.

Question 1d: For how long did participants live in area A?

Response: The participants mentioned that, for their entire lives have been living in area A. One participant stated has arrived at area A when very young.

Question 1e: In which primary activities did participants engage in during their childhood and adulthood?

Response: Three of the male participants mentioned that they have been engaged in herding animals. This activity occurred since from childhood. Four of the female participants mentioned that they have been engaged in gathering firewood for preparing food and warming the houses especially in winter seasons.

Question 2a: Could participants think about the wild animals they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Almost all the participants mentioned seeing the wild animals around 1950s to 1990s. Some of the wild animals were seen included lions *(Panthera leo)*, baboons *(Papio ursinus)*, elephants *(Loxodonta Africana)* and zebras *(Equus quagga)*.

Question 2b: Do participants think species diversity such as mentioned above may still be present elsewhere in Lesotho?

Response: Participants mentioned yes! Traces of baboons *(Papio ursinus)* can still be seen on the Thaba-Putsoa range as they used to be found in larger numbers in the past there.

Question 2c: Could participants think about natural plants they saw in their areas during their childhood and adulthood. When did they last see them and may they still be present elsewhere in Lesotho?

Response: Participants mentioned that, there used to be various indigenous species that can still be seen in areas such as Quthing but with limited numbers. Such included the wormwood *(Artemisia absinthium),* bitter root *(Lewisia rediviva)* and thatch grass *(Hyparrhenia hirta).*

Question 3: Do participants think that there are socio-economic activities that might have been responsible for the disappearance or reappearance of particular species of wild animals or/and natural plants in the areas they are living recently? If yes, name and elaborate a little how they contributed.

Response: Participants mentioned population increase and habitat destruction might be responsible.

Elaboration of how named socio-economic activities contributed: Increasing population had put greater demands on the finite biological resources. The consequent encroachment of settlement plus the need to increase food production for human consumption had resulted in grazing areas being reduced impacting biodiversity negatively. Population increase also brought changes in settlement patterns. These settlement patterns were adopted during the arrival of the European missionaries in Lesotho. These practices were therefore followed by overgrazing and unfavourable land use practices which altered the habitat and affected the survival habits of wildlife and plants.

Habitat destruction due to overgrazing had caused some habitats being destroyed by overgrazing, trampling by livestock and over-hunting. Poor range management had contributed to grassland being deteriorated due to overgrazing and unsustainable rangeland management practices. Floral species such as merxmuellera *(Monocotyledons)* which is normally used for brooms making and other souvenirs seemed to be extinct due to habitat destruction.

Question 4a: Are there laws or regulations offered by area A to conserve biodiversity?

Response: The legislations given were as follows:

(i) Historical Monuments, Relics, Fauna and Flora Act 1967 that provide for the protection of flora and fauna. It also provides preservation of natural and historical monuments, relics and antiques.

(ii) National Parks Acts of 1975 that is primarily for the establishment and maintenance of national parks for conservation of wild animals, fish life, vegetation, objects of historical or scientific interest for the enjoyment of visitors. The Act puts in place some control measures for non interference with any of species in the park.

(iii) Managed Resource Areas order of 1992 which was established for Basotho to manage their natural resources through the chieftainship.

Question 4b: Are there mitigation measures to enforce compliance with these legislations?

Response: The participants mentioned that there are no mitigation measures in place.

Question 4c: What can participants say about the quality of conservation offered in area A?

Response: Participants mentioned that the quality of conservation offered is very poor.

Question 5: Outreach campaign and awareness campaign programs are they used in promoting the sustainability of biodiversity in area A?

Response: Participants stated that, public outreach and awareness campaigns are offered by the government. These are advertised on television and radio programmes daily and they are trying to adhere with such.

Question 6: Does area A have any previous data that can be used to show that there is a change in biodiversity?

Response: Participants mentioned that previous data on socio-economic activities are documented on a hard copy.

4.1.2. Data collected from group E at area A

Group E was pre-post tested and interviewed with 6 participants with the ratio of 50% of females and 50% of males. The researcher advised the participants to be audible enough when speaking, in order that their voices are clear throughout the discussions. The purpose of the interview was to explore how socio-economic activities related to loss of biodiversity. The questions asked are presented below.

Question 1a: In which primary activities did participants engage in during their childhood and adulthood?

Response: Participants of this group mentioned the following primary activities; hunting for wild animals, collecting firewood, fetching water and herding animals.

Question 1b: Could participants think about the wild animals they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Participants mentioned that some of the wild animals they never saw them. They mentioned that, in the time of their forefathers they were told that the following used to be present in Lesotho. Animals such as leopards (*Panthera pardus*), lions (*Panthera leo*), African wild dogs (*Lycaon pictus*), aardvarks (*Orycteropusafer*), rock elephant-shrews (*Elephantulus myurus*), water mongooses (*Atilux paludinosus*), spotted-necked otter (*Hydrictis maculicollis*) and black-backed jackal (*Canis mesomelas*). Participants believed that some may be present in some parts of Lesotho but not abundant as they used to be. Nobody ever talks of seeing such in this country.

Question 1c: Could participants think about natural plants they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Participants mentioned bitter-bush (*Adriana quadripartita*), cape cudweed (*Graphalium undulatum*) and old wood (*Sequoia sempervivens*) were mentioned seen in abundant. It was mentioned that it was around seventies when they were last seen.

Question 2: Do participants think above mentioned species have any local values to the communities?

Response: Participants mentioned named species having local value to the communities as they are used for firewood especially at homes.

Question 3: Do participants think that there are socio-economic activities that might have been responsible for the disappearance or reappearance of particular species of wild animals or/and natural plants in the areas they are living recently? If yes, name and elaborate a little how they contributed.

Response: Participants mentioned that the rate of increase in socio-economic activities had a relationship to biodiversity loss. Participants mentioned over-utilisation of biological resources within the communities for various reasons. They mentioned that some are utilised for rituals and rites of passage. In addition, the group mentioned that shrub species are over-utilised to meet fuel needs (*see picture 4.2*). The researcher managed to take *picture 4.1* which confirmed what was mentioned in the interview and pre-post tests.

Picture 4.1: Women fetching shrubs to make a meal and warm the family at area A; Picture taken by the researcher.

Picture 4.2: Shrubs harvested and used as fuel for cooking at area A; Picture taken by the researcher.

Moreover, the group mentioned wild plants and animal products are used to treat and cure various ailments. The example given included figwort family (*Scrophulariaceae*), wild garlic (*Allium ursinum*) and sedge (*Cyperaceae*).

Question 4: Are there laws or regulations offered by area A to conserve biodiversity?

Response: Laws are there that include the Lesotho Environmental Act of 2001 and Trade Enterprises order of 1993. The latter provides for the assurance of a Traders' license by the Ministry of Trade, Industry, Cooperation and Marketing before extracting any natural resources.

Question 5: What is it that area A is doing to see that vulnerable species are protected?

Response: Participants mentioned that they ask for permission before their animals can graze on closed areas. Secondly, they ask for permission to harvest wood for any function such as funerals.

Question 6: Outreach campaign and awareness campaign programs are they used in promoting the sustainability of biodiversity in area A?

Response: Participants stated that the community had tried by all means to raise people's consciousness about the value of biodiversity. They increased awareness at non-formal institutions such as education outside the classroom. The participants added that, the government is doing concerted efforts to the entire nation in the efforts for effectively ensuring that awareness of the value of biodiversity is instilled at the earliest educational stages through primary school and right into and throughout adulthood.

Question 7: What are the most challenging factors in implementation of conservation of biodiversity and its sustainability in area A?

Response: Participants mentioned that, lack of local community involvement in preservation and conservation activities is the major challenge. Secondly, there are many gaps in information concerning biodiversity conservation and sustainability. These gaps do not empower teachers and pupils to play a meaningful role in conservation activities.

Question 8: Does area A have any previous data that can be used to show that there is a change in biodiversity?

Response: Participants response was similar to the previous group and was as follows; previous data on socio-economic activities are documented on a hard copy.

4.1.3. Data collected from group F at area A

This group was pre-post tested and interviewed. The researcher advised the participants to be audible enough when speaking, in order that their voices are clear throughout the discussions. The purpose of the interview was to explore how socio-economic activities related to loss of biodiversity. The questions asked are presented below.

Question 1a: In which primary activities did participants engage in during their childhood and adulthood?

Response: Male participants mentioned that they have been engaged in herding animals whilst female participants mentioned that they have been engaged in collecting wood and fetching water.

Question 1b: Could participants think about the wild animals they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Participants mentioned that, it was not too far back when they heard that an African wild dog (*Lycaon pictus*) was in their area. The participants pointed out that, it was towards the area around Phuthiatsane River. The participants added that the following were also seen in their areas: steenbok *(Raphicerus campes)* and klipsringer *(Oreotragus oreotragus)*.

Question 1c: Could participants think about natural plants they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Participants mentioned the following; coxscomb (*Celosia argentea)* and wild nasturtium *(Tropaeolum majus)* were seen in their areas during their childhood and adulthood. It was mentioned that it was around eighties when were last seen.

Question 2: Do participants think above mentioned species have any local values to the communities?

Response: Participants mentioned that, plant such as coxscomb (*Celosia argentea)* is used for medicinal purposes.

Question 3: Do participants think that there are socio-economic activities that might have been responsible for the disappearance or reappearance of particular species of wild animals or/and natural plants in the areas they are living recently? If yes, name and elaborate a little how they contributed.

Response: Participants mentioned overexploitation of resources being responsible for disappearance or reappearance of species. The participants named sweet finger grass *(Digitaria eriantha)* being overexploited as there used to be a lot of it in the older days. They mentioned that, this would grow to the height of an adult waist.

Hunting has been mentioned as another factor that had contributed to disappearance of some species. During the arrival of the European throughout much of the Southern Africa including Lesotho, spreads of the use of the guns were used that made it easier to kill wildlife. These Europeans brought with them hunting campaigns mainly for sports and collecting trophies of their hunting experiences as they went along. Cited example was of the cheetahs (*Acininyx jubatus*) that used to live somewhere around Mangaung place at Ketane known as (cheetahs place). Some places such as Linareng found in Mokhotlong were named after buffalos and Likoeneng found in Mohale's Hoek was named after crocodiles. The participants stated that, people do not even talk about these animals nowadays.

Question 4: Are there laws or regulations offered by area A to conserve biodiversity?

Response: The following laws were mentioned by the participants: Historical Monuments, Relics, Fauna and Flora Act 1967, National Parks Acts of 1975 and Managed Resource Areas order of 1992.

Question 5: What is it that area A is doing to see that vulnerable species are protected?

Response: Participants mentioned that the chiefs are given the responsibility to conserve the natural resources. This is stipulated in Land Husbandry Act no.22 of 1969 that is their responsibility.

Question 6: Outreach campaign and awareness campaign programs are they used in promoting the sustainability of biodiversity in area A?

Response: Participants mentioned that public outreach and awareness campaigns and programs are done to educate people within the village. This is mostly done during village gatherings. The participants recommendation was that, boys at the initiation schools should be given trees to plant while pursuing courses in the mountain in order to ensure sustainable use of biodiversity.

Question 7: What are the most challenging factors in implementation of conservation of biodiversity and its sustainability in area A?

Response: Participants mentioned that herd boys degrade the plants habitats and destroy sign posts control hunting habits. The smuggling and transportation of the legally protected species was raised as the main concern.

Question 8: Does area A have any previous data that can be used to show that there is a change in biodiversity?

Response: Participants response seems to be similar to the previous groups in that, previous data on socio-economic activities had been documented on a hard copy.

4.1.4. Data collected from group J at area B

The same questions as those of the previous groups were asked. Group J comprised of both males and females. This group had seven participants with 71% of females and 29% of males. Group J was pre-post tested and interviewed. The researcher advised the participants to be audible enough when speaking, in order that their voices are clear throughout the discussions. The questions asked are presented below.

Question 1a: In which primary activities did participants engage in during their childhood and adulthood?

Response: The following were mentioned as primary activities: herding animals, hunting of wild animal, fetching water, collecting firewood, construction and carpentry.

Question 1b: Could participants think about the wild animals they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Participants mentioned steenboks *(Raphicerus campes)*, oribis *(Ourebia ourebi)*, buffaloes *(Syncerus caffer)*, brown hyenas *(Hyena brunnea)* and aardwolf *(Proteles cristatus).*

Question 1c: Could participants think about natural plants they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Participants mentioned the following were seen; old wood trees *((Lecanactis abietina)*, blue grass *(Festuca caprina)*, weeping willow *(Salix babylonica)*, *sage wood (Teucrium scorodomia)*, red grass *(Themeda triandra)*, briar *(Rosa rubiginosa)* and zigzag *(Euphorbia tithymaloides).*

Question 2: Do participants think above mentioned species have any local values to the communities?

Response: Participants mentioned species such as weeping willow *(Salix babylonica)* which is used for firewood whilst sweet briar *(Rosa rubiginosa)* is used as food.

Question 3: Do participants think that there are socio-economic activities that might have been responsible for the disappearance or reappearance of particular species of wild animals or/and natural plants in the areas they are living recently? If yes, name and elaborate a little how they contributed.

Response: Participants mentioned that, the rate of increase in socio-economic activities has a relationship to biodiversity loss. Poor range management with uncontrolled fire, hunting of wildlife and over-harvesting of resources were mentioned as socio-economic activities responsible for disappearance of species. Elaborating poor range management with uncontrolled fire, the group mentioned that, it contributed to the grassland being deteriorated. In addition, poor range management general declines soil, water quality and rangeland.

One member of the group explained how hunting is responsible:

"I think most animals have been over-hunted for food. During the arrival of Europeans in Lesotho, they hunted with the guns mainly for sports and collecting trophies. This still apply during the era we are living. Basotho are still hunting the predators as a way of protection to themselves and their livestock. I think there is no way out for animals than to run away".

Overharvesting of natural resources was explained as follows: Several species are over-harvested commercially for medicinal use and that contributed to decrease in their numbers. The species include; hairy thistle *(Picoides marianum)*, wild mallow *(Malva sylvestis)*, bitter root *(Lewisia rediviva)*, honey thorn *(Acacia dreporalosium)* and spiral aloe *(Aloe polyphylla).*

Question 4: Are there laws or regulations offered by area A to conserve biodiversity?

Response: The group mentioned the following environmental laws: the Constitution of Lesotho that was adopted in 1993 and Environmental Act and Conservation Act.

Question 5: What is it that area A is doing to see that vulnerable species are protected?

Response: Participants mentioned that they are trying by all means to implement all Lesotho environmental and biodiversity related legislations within villages. For example, they want to instil knowledge to all individuals that the constitution requires that anyone who wants to harvest the species and engages in trade should have a permit obtained from preservation commission.

Question 6: Outreach campaign and awareness campaign programs are they used in promoting the sustainability of biodiversity in area A?

Response: Education about the value of biodiversity had to be part of national school's curriculum in order to raise children consciousness.

Question 7: What are the most challenging factors in implementation of conservation of biodiversity and its sustainability in area A?

Response: Participants mentioned that illiteracy of the herd boys and ignorance of local people to read sign posts within the villages are the most challenging factors. For example, sign posts that restrict people from grazing their herd temporarily on closed area.

Question 8: Does area A have any previous data that can be used to show that there is a change in biodiversity?

Response: Participants mentioned that Lesotho Fourth National Report on Implementation of Convention on Biological Diversity of December 2009 contained previous identified and post socio-economic that can be used to confirm that there is a change in biodiversity of Lesotho.

4.1.5. Data collected from group K at area B

This group was pre-post tested and interviewed. The researcher advised the participants to be audible enough when speaking, in order that their voices are clear throughout the discussions. The purpose of the interview was to explore how socio-economic activities related to loss of biodiversity. The questions asked are presented below.

Question 1a: In which primary activities did participants engage in during their childhood and adulthood?

Response: Participants mentioned herding animals, collecting wood and water.

Question 2a: Could participants think about the wild animals they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Participants mentioned seeing various animals like the grey rhebok *(Pelea capreolus).* They mentioned that it is dark in colour and has a white tail. Baboons *(Papio ursinus)* were also seen. It was mentioned that, participants last saw these animals in late eighties.

Question 2b: Do participants think species diversity such as mentioned above may still be present elsewhere in Lesotho?

Response: Participants mentioned grey rhebok *(Pelea capreolus)* can still be seen in the region of the Thaba-Putsoa mountain range.

Question 2c: Could participants think about natural plants they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Participants mentioned natural plant such as old wood trees *(Lecanactis abietina).* These old wood trees used to grow as high as the typical peach trees. They mentioned these old wood trees are extinct. They were last seen in late nineties. Participants

do not think they are present elsewhere because most rivers in Lesotho used to be surrounded by trees of all kinds and trees those are no longer available.

Question 3: Do participants think that there are socio-economic activities that might have been responsible for the disappearance or reappearance of particular species of wild animals or/and natural plants in the areas they are living recently? If yes, name and elaborate a little how they contributed.

Response: Participants mentioned socio-economic activities responsible for species disappearance including generation of hydro-electric Power (H.E.P) from Mohale Dam and certain constructed dams such as Metolong. The construction of these dams had caused involuntary resettlement of people who had to abandon wild species that were indigenous and endemic to them.

Question 4a: Do area B have a strategic plan to address biodiversity?

Response: Yes!

Question 4b: Can participants from area B name the strategic plan.

Response: The National Biodiversity Strategy Action Plan. This was developed and approved as a key for conservation of national resources and mainstreaming of biodiversity into all sectors.

Question 5a: Could participants provide the means of implementing the strategic plan?

Response: Participants mentioned that they are implementing the strategic plan through Community Based Natural Resources Management.

Question 5b: Why is area B implementing the strategic plan in this manner?

Response: Participants mentioned that they are part of the community; as a result, they are managing resources as they are relating to them in their day-to-day life activities.

Question 5c: How far is area B with the implementation of the strategic plan?

Response: Participants mentioned that area B is having a little progress but a level of achievement has been attained through re-orientation of sectoral policies, enactment of legal frameworks and restricting to ensure incorporation of environmental consideration into programs implementation and actual implementation of interventions or projects. For instance, to show progress, the level of achievement had increased because 1.5 millions tree seedlings are planted annually at moderate survival rate.

Question 5d: I heard participants talking about implementation of strategies especially projects; which projects were you talking about?

Response: Range Management Areas (RMAs), Management Resource Areas (MRAs), Protected Areas, SADC Plant Genetic Resource Centre and National Plant Genetic Resource Centre (NPGRC).

Question 5e: Are there problems encountered on the implementations of the strategic plan?

Response: Participants mentioned that, area B had encountered a problem of community resistance associated with exclusion mind-set posing the challenges to biodiversity.

Question 6: Which stakeholders are involved in the strategic plans?

Response: Participants mentioned farmers, medicine-men, educators and conservationists.

Question 7a: Are there environmental laws and biodiversity related legislations used in implementation of the strategic plan?

Response: Yes.

Question 7b: Could you please mention them

Response: The following legislative measures on biodiversity control were mentioned:

(i) Environmental Act of 2008. This act helps to reduce degradation and loss of biodiversity caused by socio-economic activities. In addition, the act is a tool that provides for protection, conservation, management and sustainable use of natural resources

(ii) Local Government Act of 1997. This act is a tool that establishes local authorities with legal powers to manage natural resources through laws.

Question 8: Outreach campaign and awareness campaign programs are they used in promoting the sustainability of biodiversity in area B?

Response: Participants mentioned that, some outreach programs were made by area B to raise people's awareness on biodiversity loss. To cite the example, brochures, newsletters, pamphlets and posters were produced and distributed annually to different communities within Lesotho.

Question 9: Does area B have any previous data that can be used to show that there is a change in biodiversity?

Response: Participants stated Lesotho Fourth National Report on Implementation of Convention on Biological Diversity of December 2009 contained previous identified socio-economic activities that can be used to confirm that there is a change in biodiversity.

4.1.6. Data collected from group L at area B

This group was pre-post tested and interviewed. The researcher advised the participants to be audible enough when speaking, in order that their voices are clear throughout the discussions. The purpose of the interview was to explore how socio-economic activities related to loss of biodiversity. The questions asked are presented below.

Question 1a: In which primary activities did participants engage in during their childhood and adulthood?

Response: Participants of the group mentioned the following activities: hunting for wild animals, herding animals, collecting firewood, fetching water, artisans and construction.

Question 1b: Could participants think about the wild animals they saw in their areas during their childhood and adulthood. When did they last see them?

Response: The participants mentioned seeing the following wild animals: brown hyenas (*Hyena brunnea*), cheetahs (*Acininyx jubatus*), ostrich's (*Sruthionide*) and springboks (*Antidorcas marsupialis*). They mentioned that, it was around eighties when they were last seen.

Question 1c: Could participants think about natural plants they saw in their areas during their childhood and adulthood. When did they last see them?

Response: Participants mentioned zigzag (*Rhododendron*), high mountain sage (*Artemisia tridentate*), thatch grass (*Hyparrheima hirta*), willow trees (*Salix*) and aloe (*Aloe polyphylla).*

Question 2: Do participants think above mentioned species have any local values to the communities?

Response: The group participants mentioned thatch grass (*Hyparrheima hirta*) having a significant value as most houses in their area are roofed with it.

Question 3: Do participants think that there are socio-economic activities that might have been responsible for the disappearance or reappearance of particular species of wild animals or/and natural plants in the areas they are living recently? If yes, name and elaborate a little how they contributed.

Response: Participants mentioned hunting of some of the animals. The group stated that, vervet monkeys (*Chlorocebus pygerythrus*), blue antelopes (*Hippotragus leucophaeus*), cheetahs (*Acininyx jubatus*), aardvark (*Orcteropus afer*) and oribis (*Ourebia ourebi*) had disappeared. Thatch grass (*Hyparrheima hirta)* was mentioned being overharvested. This type of grass is no longer seen in area B. *"It has to be red outside because of the cover of this type of grass"*, said the participants.

Question 4: Are there environmental laws and biodiversity related legislations used in implementation of the strategic plan?

Response: There are legislations and regulations in place to conserve biodiversity. The following were mentioned: Historical Monuments, Relics, Fauna and Flora Act 1967 and National Parks Acts of 1975.

Question 5: What is it that area B is doing to see that vulnerable species are protected?

Response: Participants mentioned that most of the rangelands in area B are under control by traditional chiefs and the local government councils. Their roles are to set aside special areas, applying restriction in their area of jurisdiction regarding who can graze and the periods when it is allowed. In addition, they impound trespassing of livestock to ensure that vulnerable species are protected.

Question 6: Outreach campaign and awareness campaign programs are they used in promoting the sustainability of biodiversity in area B?

Response: Participants mentioned that, area B had tried a lot to raise people consciousness in relation to biodiversity management. The government had increased biodiversity issues

with the printed; electronic materials, also through the radio broadcasts, woman magazines and television programmes.

Question 7: What are the most challenging factors in implementation of conservation of biodiversity and its sustainability in area B?

Response: Laws' depending on the goodwill and motivation of an individual chief was suggested as the most challenging factor.

Question 8: Does area B have any previous data that can be used to show that there is a change in biodiversity?

Response: Participants stated Lesotho Fourth National Report on Implementation of Convention on Biological Diversity of December 2009 contained previous identified socio-economic activities that can be used to confirm that there is a change in biodiversity.

4.2. Conclusion

The analysed data suggested that, large game animals and predators that were once present in Lesotho decreased or disappeared in their numbers due to socio-economic activities. Socio-economic activities included population increase, hunting, habitat change and production of hydroelectric power. The collected data implies that, the loss of large game animals and predators do have a relationship with socio-economic activities. In addition, the analysed data suggested that, indigenous plants that some were endemic in Lesotho were over-harvested, over-utilised and over-exploited for various reasons. In the process many life forms in their territories were endangered. The collected data implies that, the loss of some of Lesotho indigenous plants do have a relationship with socio-economic activities.

CHAPTER 5: DATA DISCUSSION

5.1. Introduction

The chapter provides a detailed discussion of the results analysed and interpreted in chapter four. Interpretation involves searching for the broader meaning of the research findings as well as relating the research findings, objectives and questions. Data analysis involves reducing voluminous amount of information into manageable form without losing the embedded meaning (Daley, 2004 and Silverman *et al.,* 2005). Data was analysed using the combination of the template analytical style and an editing analytic style. Before the actual analysis of data, data was edited and checked for accuracy. The purpose of this chapter is therefore to discuss the findings of the study and answer the research objective and questions.

5.2. Discussion of collected data

Research question: **Could participants think about the wild animals they saw in their areas during their childhood and adulthood. When did they last see them?** This was scrutinised in pre-post tests, focus groups and interviews and were answered as follows in the following sections.

5.2.1. The presence of large game animals and predators

Literature review revealed that large game animals and predators including brown hyaena (*Hyena brunnea*), silver jackal (*Vulpes chama*) and Klipspringer (*Oreotragus oreotragus*) are well known to be present in Lesotho (*section 2.2.2.).* According to Ambrose (2006), some of these large game animals are currently declared as rare in Lesotho whilst some are occasionally sighted in the Sehlabathebe National Park. According to Stuart and Stuart (2001), the distribution of predators was virtually throughout the whole of Southern Africa including Lesotho. However, collected data suggested that, places such as Linareng found in Mokhotlong were named after buffalos; Likoeneng found in Mohale's Hoek was named after crocodiles (*section 4.1.3, question 3*). These names imply that, these animals were

once present in Lesotho as they occur across various districts of Lesotho, but later decreased in numbers due to socio-economic activities.

5.2.2. Indigenous species recorded in areas A and B

Literature review pointed out that, wild species are widely used for food in Lesotho where Basotho used stink grass *(Eragrostis cilianenesis)* to make Potele a Sesotho dish made of traditional vegetables and pap (*section 2.1.3*). According to Lesotho (2000a), plants harvested for food and medicinal purposes are well known to the society (*see Table 5.1*). Collected data pointed out that, many communities utilise biodiversity for various reasons thus over-exploited in the process (*section 4.1.2., question 3 and picture 4.1*). Similar to the reviewed literature, collected data also pointed out that many communities harvest woody and shrub species for their fuel needs (*section 4.1.2., question 3 and picture 4.2*). Moreover, collected data revealed that, many communities derived their medicine from wild plants and animals to treat and cure various ailments (*section 4.1.2., question 3*). From the surveyed areas, it can be assumed that, over-utilization of biodiversity for various reasons can endanger many life forms in their territory.

Table 5.1: Indigenous plants common used as food and medicinal purposes. *Source, Biological Diversity in Lesotho, 2000b.*

Medicinal purposes	**Food purposes**
Allied to hemlock (*Tsuga canadensis*)	Birdseed (*Panicum miliaceum*)
Bitter root (*Lewisia rediviva*)	Coxscomb (*Celosia argentea*)
Bull grass *(Iseilema macratherum)*	Fat hen (*Chenopodium album*)
Everlasting flower *(Helichrysum formosissimum)*	Milkweed family (*Asclepias syriaca*)
Figwort family (*Scrophulariaceae*)	Pepperwort (*Lepidium*)
Honey thorn (*Acacia dreparalosium*)	Stinging nettle (*Urtica dioica*)
Kalmoes *(Lichtensteinia lacera)*	Wild mustard (*Sinapis arvensis*)
Reed *(Phragmites)*	Wild nasturtium (*Tropaeolum majus*)
Sedge (*Cyperaceae*)	Wild salsify (*Tragopogon dubius*)
Thatching grass *(Hyparrhenia hirta)*	
Wild mallow *(Malva sylvestris)*	
Wormwood *(Artemisia absinthium)*	

5.3. Socio-economic activities identified relating to loss of large game animals and indigenous endemic plants in Lesotho.

Research question: **Do participants think that there are socio-economic activities that might have been responsible for the disappearance or reappearance of particular species of wild animals or/and natural plants in the areas they are living recently? If yes, name and elaborate a little how they contributed.** This was scrutinised in pre-post tests, focus groups and interviews and were answered as follows in the following sections.

5.3.1. Population increase

Lesotho has been subjected to tremendous biodiversity changes over the last two centuries primarily due to an ever increasing pressure on land settlement and extraction of natural resources (*section 2.4.2.*). According to Germond (1967), the population of Lesotho increased from 200 000 individuals in 1873 to approximately 429 137 individuals by 1911. Concurring with the preceding stance, Lesotho (2011) stated that, population had grown in an alarming rate due to non-usage of contraceptives making the total population nearly 2.2 million from 0.9 million in 1960. Collected data suggested population increase may have brought about significant changes in the distribution of wildlife and indigenous endemic species in Lesotho (*section 4.1.1, question 3*). The findings indicate that, as population increases, more vegetation is cleared for housing. This process impacts negatively on species population and diversity which was dependent on the same vegetation.

5.3.2. Hunting, habitat change, over-harvesting and over-exploitation of species

Hunting

Literature review pointed out that, during the arrival of the missionaries at Morija in 1833, churches and houses were erected for Casalis and his party (*section 2.4.1.*). It was during this time that the local people had brought their efforts together to help as much as they could. One of the activities they were engaged in was to go hunting to gather as many hides from wildlife as possible (*section 2.4.1.*). Lesotho (2000a) stated that, hunting have brought significant declined in the distribution of wildlife in Lesotho. In Africa, game animals are hunted for ivory, horn, skin products and trophies (Barbier *et al.,* 1990). Collected data suggested that, during the arrival of the European throughout much of the Southern Africa

including Lesotho, spreads of the use of the guns were used that made it easier to kill wildlife (Mackenzie, 1988). The same author added that, these Europeans brought with them hunting campaigns mainly for sports and collecting trophies of their hunting experiences as they went along (*section 4.1.3., question 3*). Analysed data imply that, many hunting campaigns would have great impact positive or negative on the remaining wildlife of the present day Lesotho.

Habitat change

Literature review revealed that, during the arrival of the missionaries at Morija in 1833 all hunters were set off the place for hunting in the process causes habitat changes (*section 2.4.1*). According to Plug (2003), vervet monkeys (*Chlorocebus pygerythrus*) were once common in Lesotho but no longer found due to habitat change. Analysed data suggested that, rangelands on explored areas had been degraded to the level of non-recovery through overgrazing and part of overstocking (*section 4.1.1, question 3*). It can be assumed that some habitats are being destroyed by overgrazing and trampling by livestock.

Over-harvesting and over-exploitation of species

Literature review indicated that, Lesotho plants are over-harvested and over-exploited for commercial purposes especially used for medicinal and other purposes (*section 2.4.1.*). Lesotho (2001) stated that, local people in Lesotho are dependent on terrestrial fauna for food, clothing, medicinal and other purposes. Collected data revealed that, Basotho are over-harvesting hairy thistle *(Picoides marianum)*, wild mallow *(Malva sylvestis)*, bitter root *(Lewisia rediviva)*, honey thorn *(Acacia dreporalosium)* and spiral aloe *(Aloe polyphylla)* in their daily lives for medicinal use (*section 4.1.4., question 3*). It can be concluded that, plants that are over-harvested could be extinct in decades to come.

5.3.3. Production of Hydro-electric power

Section 2.5.2 on literature review showed that, consequences of operating hydroelectric power plant are quite varied and have significant effects on the physical and biological environment in and near the site area. In addition, literature review also revealed that, in

biological environment, it was mentioned that animals and plants life are impacted negatively significantly during the dam construction (*section 2.5.2.2*). Analysed data indicated that, the construction of Mohale dam and Metolong dam in Maseru contributed in loss of certain plants species and their habitats (*section 4.1.5., question 3*). Moreover, the construction of mentioned dams had caused involuntary resettlement of people who had to abandon wild species that were indigenous and endemic to them (*4.1.5., question 3*). According to Devitt and Hitchcock (2009), 37 household in pre-construction stage were relocated within the Mohale Basin, 38 households moved to the foothills and 24 households to Maseru. The findings suggest that, the construction of the hydroelectric power plants have negative impacts on the physical, biological and human environment.

5.3.4. Biodiversity Laws and Legislations

Research question: **Are there laws or regulations offered by areas A and B to conserve biodiversity?** This was scrutinised in pre-post tests, focus groups and interviews and was answered as follows:

Literature review revealed that, in Lesotho there are over 50 pieces of legislations dealing directly or indirectly with various aspects of environment (*section 2.3.2.*). Literature review also indicated that, these laws are administrated by different Institutions (*section 2.3.2*). The purposes of these legislations are to use and conserve the environment and natural resources of the Basotho Nation for the benefit of both present and future generations (Lesotho, 2000b). *Section 4.1.1, question 4a, section 4.1.2 question 4, section 4.1.3, question 4 and section 4.1.4, question 4, section 4.1.5, question 7b* and *section 4.1.6, question 4* respectively from collected data revealed that, the following legislations are implemented in Lesotho to conserve biodiversity: Historical Monuments, Relics, Fauna and Flora Act 1967, National Parks Acts of 1975, the Lesotho Environmental Act of 2001, Trade Enterprises order of 1993, Managed Resource Areas order of 1992 and National Parks Acts of 1975. From surveyed areas, the legislations were stated being in usage, but it can be concluded that there is lack of coordination between the institutions that implement them. This was seen where nothing was done to those who do not adhere to the stated legislations.

5.3.5. Public outreach or awareness campaigns programmes

Research question: **Outreach campaign and awareness campaign programs are they used in promoting the sustainability of biodiversity in areas A and B?** This was scrutinised in pre-post tests, focus groups and interviews and was answered as follows in the following section.

Literature review from *section 2.3.4* showed that, Lesotho is doing public outreach through projects that are engaged to conserve biodiversity in Lesotho. Lesotho (2000a) mentioned the project of bilateral agreement with the Republic of South Africa. The project was intended to manage the Drakensberg or Maloti regional biodiversity. In addition, *section 2.3.4* mentioned other projects engaged to conserve biodiversity in Lesotho such as: Government administration of conservation and SWCP. From analysed and interpreted data in *section 4.1.5, question 5d,* the following projects were mentioned to conserve biodiversity: RAMs, MRAs, Protected Areas, Southern African Development Community Plant Genetic Resource Centre and NPGRC. *Section 4.2.1, question 5 and section 4.2.6, question 6 respectively* indicated that, public outreach and awareness programmes were passed through the radio programmes, television, electronic materials and woman magazines. Moreover, *Section 4.1.2, question 6* indicated that, these were also done through non-formal institutions such as education outside the classroom and earliest educational stages through primary school and right into and throughout adulthood. The discussed data concluded that, public outreach and awareness programmes were used to promoting the sustainability of biodiversity in surveyed areas.

5.4. Conclusion

The discussed data suggests that, large game animals and predators which were once present in Lesotho have decreased or disappeared in their numbers due to socio-economic activities. Socio-economic activities include population increase, hunting, habitat change, overgrazing and production of hydroelectric power. The discussed data implies that, the loss of large game animals and predators do have a relationship with socio-economic activities. In addition, the discussed data suggested that, indigenous plants that some were endemic in Lesotho were over-harvested, over-utilised and over-exploited for various reasons. In the process many life forms in their territories were endangered. As a result, from discussed

data it can be concluded that, the loss of indigenous plants in Lesotho do have a relationship with socio-economic activities which impacted them negatively.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

Chapter six provides a general summary of the findings, conclusions and recommendations of the study. This is done based on the data presented and discussed in the two previous chapters. The chapter begins with the general summary of the findings and conclusions that are drawn in relation to the research questions. These are followed by the recommendations of the research.

6.2. General summary of the findings

The analysed and discussed data from pre-post tests and interviews suggested that, loss of large game animals, predators and indigenous plants in Lesotho do have a relationship with socio-economic activities. The socio-economic activities relating to biodiversity loss included the following; population increase, hunting, habitat change, production of hydroelectric power, over-harvesting, over-utilization and over-exploitation.

6.3. Conclusions

In view of the aims and objectives outlined at the beginning of this thesis, the primary outcome of this project was to investigate the various impacts of socio-economic activities on biodiversity in Maseru and Berea districts of Lesotho. From pre-post tests and interviews it was reported that large game animals and predators such as guaggas (*Eguus guagga*), elands (*Taurotragus oryx*), steenboks (*Raphicerus campes*), oribis (*Ourebia ourebi*), buffaloes (*Syncerus caffer*), hippopotamus (*Hippotamus amphibius*), lions (*Panthera leo*), zebras (*Eguus burchelli*), baboons (*Papio ursinus*), cheetahs (*Acininyx jubatus*), grey rhebok (*Pelea capreolus*) and klipsingers (*Oreotragus oreotragus*) were all present in Lesotho until the ninetieth century mostly in western part of Lesotho. The results suggested that, most of the socio-economic activities do impact negatively large game animals and predators. Lynch and Watson (1990) and Kopij (2006) mentioned that, Sehlabathebe National Park serves as a refugee for several wildlife, plant species and several birds. Moreover, similar to the reviewed literature, the analysed data from pre-post tests,

interviews and focus groups suggested that, natural plants species such as mentioned in *Table 5.1* have decreased or disappeared due to the impacts of socio-economic activities.

6.4. Recommendations

Sustainable re-introduction, relocation and translocation of lost faunal species and indigenous endemic species in Lesotho have to be made in order to restore the ecosystem of Lesotho. The country used to be rich in large game animals, predators and indigenous endemic species. Secondly, the establishment of parks and botanic gardens could offer opportunities for re-introduction of faunal and floral species in Lesotho. These established parks and botanic gardens will add value to the existing parks and nature reserves mentioned in chapter two, *section 2.3.5.*

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Appendix A in area B

Consent letter to collect data at area B

Enq: Sekamane T.

Contact no: +266 58988097

P.O. Box 1635

Khubetsoana III

06 February 2013

The Director

Ministry of Tourism, Environment and Culture

P.O Box 12610, Maseru 100

Dear Sir/Madam

REQUEST TO CONDUCT A RESEARCH AT THE CONSENT MINISTRY.

I hereby request to conduct a research at the Ministry of Tourism, Environment and Culture. I am a student at UNISA (University of South Africa) studying Masters of Science degree in Environmental Management. The title for research is:

"AN EXPLORATION OF THE IMPACTS OF SOCIO-ECONOMIC ACTIVITIES ON THE LOSS OF BIODIVERSITY IN MASERU AND BEREA DISTRICTS OF LESOTHO.

In order for me to attain the objective of my study I need your assistance by permitting me to conduct research at your institution. The research will be conducted through interviews, semi- structured interviews, and pre and post tests.

Here follows the procedure for interviews.

- No employee name or respondent name will be identified.
- The interview will be conducted through open-ended questions in order to guarantee anonymity.
- The employees will not be compelled to give the information and they can withdraw at any time they want to.
- The respondents will include the Minister of Agriculture Director/ Principal Secretary and employees of MoTEC.
- Permission will be requested from the interviewee to use the cell phone recording. Cell phone recording will be used so that at latter time the researcher

will transcribe the information and if code switching is needed, the researcher as an English-Sesotho bilingual will translate where required.

- The interview will take plus or minus 30 minutes per respondent.

I guarantee that all the collected data will be treated with complete confidentiality and the respondents will remain anonymous.

I hope my request will be considered.

Yours Faithfully
Mr. Sekamane T. (Student no. 44944977)
.....

I hereby give permission on behalf of the Ministry of Tourism, Environment and Culture for the above-mentioned research to take place. The period for which permission has been granted is from 20th February, 2013 to 15th June, 2013.

Mr/~~Mrs~~ T. MOLAPO
...../.....
Signature..... Date

Stamp

MINISTRY OF TOURISM
PRINCIPAL SECRETARY'S OFFICE
6 FEB 2013
P. O. BOX 52
MASERU 100 LESOTHO
CULTURE AND ENVIRONMENT

Appendix B in area A

Consent letter to collect data at area A

Enq: Sekamane T.

Contact no: +266 58988097

P.O.Box 1635

Khubetsoana III

06 February 2013

The Chief of Maroala

P.O Box Maqhaka

Dear Sir/Madam

REQUEST TO CONDUCT A RESEARCH AT THE CONSENT DISTRICT.

I hereby request to conduct a research at Maqhaka in Berea district. I am a student at UNISA (University of South Africa) studying Masters of Science degree in Environmental Management. The title for research is:

''AN EXPLORATION OF THE IMPACTS OF SOCIO-ECONOMIC ACTIVITIES ON THE LOSS OF BIODIVERSITY IN MASERU AND BEREA DISTRICTS OF LESOTHO.

In order for me to attain the objective of my study I need your assistance by permitting me to conduct research at your institution. The research will be conducted through interviews, pre and post tests study survey.

Here follows the procedure for interviews.

- No employee name or respondent name will be identified.
- The interview will be conducted through open-ended questions in order to guarantee anonymity.
- The employees will not be compelled to give the information and they can withdraw at any time they want to.
- The respondents will include the Chief of Berea and the community.
- Permission will be requested from the interviewee to use the cell phone recording. Cell phone recording will be used so that at latter time the researcher

will transcribe the information and if code switching is needed, the researcher as an English-Sesotho bilingual will translate where required.

- The interview will take plus or minus 30 minutes per respondent.

I guarantee that all the collected data will be treated with complete confidentiality and the respondents will remain anonymous.

I hope my request will be considered.

Yours Faithfully
Sekamane T. (Student no. 44944977)
.....

I hereby give permission on behalf of the Chief of Berea for the above-mentioned research to take place.

Mr/Mrs act. Mirasenliso Mafaje ...6/2/2013...
Signature....Mafaje..... Date

Stamp

MORENA OA MAQHAKA
Mafaje
6 - FEB 2013
P.O. Maqhaka
BEREA, LESOTHO

NB: The period for which permission has been granted is from 20th February to 15th June, 2013

APPENDIX C

List of laws dealing directly with the environment and biodiversity

1. **Colony of the Cape of Good Hope Bees (Protection) Act No 9 of 1869. Objective**: Its application to Lesotho is doubtful.

2. **Wild Birds Proclamation No 43 of 1914**. **Objectives:** The law prohibits the sale of plumage (skins/body) of wild birds.

3. **A. Sale of Game Proclamation No 33 of 1951**. **Objective:** The law prohibits the sale of wild animals (antelope, buffalo, elephant etc.

   B. Game Preservation Proclamation No 33 of 1951. **Objective:** The law provides for game and royal game which may be hunted during open season provided one has a valid license. A license and a special permit (issued with the concurrence of the King) are needed for hunting royal game whereas a license is required for hunting game animals.

   C. Protection of Fresh Water Fish Proclamation No 45 of 1951. **Objective:** Fresh water fish are protected during closed season and a permit is required for catching during open season but use of explosives, chemicals, poisonous/injurious substances, wire and cane is prohibited.

4. **Historical Monuments, Relics, Fauna and Flora Act No 41 of 1967**. **Objective:** It's an offence to destroy, damage/remove fauna and flora from its origin habitat without the written consent of the Commission under the Act.

5. **Land Husbandry Act 1969**. **Objective:** The law applies to agricultural land. It aims at controlling and improving the use of land, soil conservation, water resources, irrigation and certain practices.

6. **Management of Resource Areas Order 1993**. **Objective**: To manage areas of resources.

7. **National Parks Act 1975**. **Objective**: To provide for the establishment, control and maintenance of national parks for the conservation of wild animals, fish, vegetation, objects of historical or scientific interest and for the enjoyment of visitors to such parks.

8. **Forest Act 1998**. **Objective**: To provide the regulation and control of dealings in forest produce, sustained management of forests and forest reserves. A license is required to cut, take and remove any forest produce and to graze livestock.

9. **Water Resource Act 1978**. **Objective:** To control, protect and conserve water resources.

10. **Mining Rights Act 1967**. **Objective:** To apply for a mining lease in order to mine.

11. **Environmental Act 2001**. **Objective:** To provide for the management of the environment and all natural resource of Lesotho. It is an umbrella law that applies to the management of the environment and all kinds of natural resources.