

**IMPACTS OF SOCIO-ECONOMIC ACTIVITIES IN MANAGING SELOUS-  
NIASSA WILDLIFE CORRIDOR**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE  
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## ABSTRACT

Eastern and Southern African countries' authorities managing protected areas have made an effort to establish wildlife corridors as a respond towards ecological and socioeconomic benefits of connected ecosystems. However these corridors face with various socio-economic activities which degrade and fragment their habitats resulting to malfunction of corridors' management. The study aimed at examining socio-economic activities impacting management of Selous-Niassa wildlife corridor. Data were collected using questionnaire survey, key informants interviews, focus group discussions, direct observation and secondary materials. Collected data were contently and statistically analysed. Field results indicated that 86.7% of respondents claimed that land allocated for settlement, agriculture and livestock keeping is not enough. Poached 'elephants' carcasses from 2010 to 2012 showed increasing poaching by 33.3% per year. Charcoal production, honey gathering, clearance for cultivation and local beliefs resulted to increase wildfires by at least 12% per year from 2010-2015. However, PAs within SNWC have insufficient involvement of local communities (81.7%). Consequently, human population increased by 75% from 1988 to 2012 resulting to acceleration of corridor degradation and fragmentation. Multivariate linear regression analysis reveals that, respondents sex, years lived in a village, and size of land owned are socio-economic factors which are statistically significant and positively influencing encroachment of SNWC at ( $b=0.153$ ,  $p<0.05$ ), ( $b=0.161$ ,  $p<0.05$ ) and ( $b=0.484$ ,  $p<0.05$ ) respectively. The study concludes that, management of SNWC is fairly sustainable. It is recommended that, more understanding on resource use values to local communities is imperative. Furthermore; man power, field gears and financial support to SNWC are vital for effective management of biodiversity and sustenance of ecosystem services.

**DECLARATION**

I, Adili Yohana Zella do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

.....

Adili Yohana Zella  
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.....

Date

The declaration is confirmed by;

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Dr. F. Mombo  
(Supervisor)

.....

Date

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## **DEDICATION**

This work is dedicated to my beloved wife Norah Mdee, my son and daughters Kelvin, Mercy and Agnes respectively, who missed my company and encouraged me during my studies.

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## ABBREVIATIONS

CBC	Community Based Conservation
DC	District Commissioner
FGDs	Focus Group Discussions
FRs	Forest Reserve
GCA	Game Controlled Areas
GRs	Game Reserves
HEC	Human Elephant Conflict
HWC	Human Wildlife Conflict
IRA	Institute of Resource Assessment
ITK	Indigenous Technical Knowledge
LDC	Liwale District Council
LLM	Lukwika-Lumesule and Msanjese GRs
MLHS	Ministry of Land, Housing and Settlements
MNRT	Ministry of Natural Resources and Tourism
MWMA	MAGINGO Wildlife Management Areas
NCA	Ngorongoro Conservation Areas
NDC	Nanyumbu District Council
NPs	National Parks
NRs	Natural reserves
NTHCIU	National and Trans-national High Crimes Intelligence Unit
PAC	Problem Animal Control
PAs	Protected Areas
PLLM	Project Manager of Lukwika-Lumesule and Msanjese GRs
SGR	Selous GR



SNWC	Selous-Niassa Wildlife Corridor
SPSS	Statistical Package for Social Sciences
SWS	Sector Warden of Selous GR
TAWIRI	Tanzania Wildlife Research Institute
TFCAs	Transfrontier Conservation Areas
TLUPC	Tanzania Land Use Planning Commission
TPA	Tanzania Ports Authority
TPDF	Tanzania Peoples' Defense Force
TRA	Tanzania Revenue Authority
UNDP	United Nations Development Programme
URT	United Republic of Tanzania
USAID	United States Aid
VDO	Village Development Officer
VEO	Village Executive Officer
VNRO	Village Natural Resources Officer
WCs	WMA Chairpersons
WMAs	Wildlife Management Areas
WPT	Wildlife Policy of Tanzania
WWF	World Wildlife Fund

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background Information

Wildlife corridors have been widely advocated in conservation planning as a way to help reduce effects of habitat fragmentation (Harris, 1984; Forman and Godron, 1986; Noss, 1987; Bennett, 1990; Saunders and Hobbs, 1991; Laurance and Laurance, 1999; Mpanduji, 2004). Habitat fragmentation can be natural (such as the distribution of alpine habitat) or human-induced, and may occur on many scales (MacDonald, 2003). The major effects of habitat fragmentation may be additional to those that occur from habitat loss, including increased external influences (such as invasion or predation), altered microclimate (e.g. associated with evapotranspiration, wind and hydrological cycles), and increased isolation from other areas of similar habitat (Andren, 1994; Saunders *et al.*, 1991; MacDonald, 2003).

Long-run destruction, reduction or fragmentation of the sizes of corridors around the protected areas threatens the persistence and viability of many protected species due to reduction in mobility (Mpanduji, 2004). Besides, damages or fragmentation and blockage of migratory corridors expose the large bodied migratory species such as elephants, which require large home range to extinction. Thus, appropriate management of wildlife corridors provides various ecological benefits to the wildlife. The benefits include returning the landscape to its natural connected state, allow species to migrate between core areas of biological significance, increase gene flow and reduce rates of inbreeding. All these benefits improve species fitness and survival (Schmitt and Seitz, 2002; Suter *et al.*, 2008). Corridors in particular despite allowing greater mobility (Andreassen *et al.*, 1996 and Suter *et al.*, 2008), are potential for species to escape predation and respond to

stochastic events such as fire. Additionally, corridors allow species to respond more easily to long term climatic changes (McEuen, 1993; Suter *et al.*, 2008).

It is widely recognized that the decisions for allocation of land to protected areas (PAs) are based on three categories of reasons: pragmatic, ecological and socioeconomic. Pragmatic reasons for the establishment of PAs are based on factors such as low productivity and availability; the ecological reasons are based on naturalness, uniqueness, ecosystem diversity, integrity, and size while the socioeconomic reasons are based on social and economic principles (Mpanduji, 2004). The establishment of many PAs including wildlife corridors in eastern and southern Africa followed pragmatic and economic criteria (Sarunday and Ruzika, 2000 cited by Mpanduji 2004). Responding to the ecological and socioeconomic benefits of connected ecosystems, a wide range of corridor projects have been proposed or are currently being implemented. Selous-Niassa Wildlife Protection Corridor (SNWC) Project in Africa which link PAs in Tanzania and Mozambique is one of these projects.

## **1.2 Problem Statement**

Wildlife corridors face various socio-economic activities which degrade their habitats. Some of this activities include uncontrolled wildfires, uncontrolled resource use and unplanned and un-regulated conversion of land for agricultural exacerbated by high human population growth (Baldus and Hann, 2009). Most of these activities linked with encroachment of natural resources and are the main threats to the biodiversity within the corridors. These encroachments disturb the wildlife movements and lead to a dramatic reduction of wildlife populations and local extinction of some species (Baldus and Hann, 2009). Baldus and Hann (2009) and Baldus *et al.* (2003, 2006 and 2009) reported poaching to be extensive in Tanzania's wildlife corridors. Also, ribbon strip

developments within the corridors increase human – wildlife conflicts due to blockage of corridors. Selous-Niassa wildlife corridor is not exempted from this scenario as the current socio-economic activities which impacts the corridor are not well known. Before enactment of Tanzania Wildlife Conservation Act No.5 of 2009, there was no legal ways of protecting the corridors. Selous-Niassa wildlife corridor is endangered to convert its biological intact into cultivation due to uncontrolled, unplanned and un-regulated land uses (Balduz and Hann, 2009). Besides, there is scanty information on the root factors influencing encroachment of this corridor. This situation calls for participatory management strategies of wildlife corridors to attain sustainability and maintain local communities livelihoods as recommended by various scholars (Reid *et al.*, 2004; Reid, 2004; Roe *et al.*, 2007; Harris, 1984; Andren, 1994; Saunders and Hobbs, 1991; MacDonald, 2003; Suter *et al.*, 2008).

The threats mentioned above have complex causes and influenced factors which this study intended to find out and indulge management strategies to reverse the situation. As it is emphasized on obeying conservation rule that, “for protected areas (PAs) to be effective according to established objectives, management must be based on an understanding of the threats the area faces” (USAID, 2005).

### **1.3 Justification of the Study**

#### **1.3.1 Significance of the study findings**

The Study findings will help stakeholders of wildlife corridors especially Selous-Niassa wildlife corridor to reveal problems of habitat destruction resulted from socio-economic activities and factors influencing encroachments of the corridor. These stakeholders include the public, researchers, natural resources extension officers, agriculturalists, policy makers, planners, decision makers, game wardens, park rangers, conservators and all other

environmental related experts. Furthermore, the study findings will be useful to stakeholders for knowledge generation and proposing solutions at local, national and international levels on issues related to management of wildlife corridors and Trans-Frontier Conservation Areas (TFCAs) like Selous-Niassa ecosystem.

### **1.3.2 Why study wildlife corridor of Selous – Niassa ecosystem**

The study were done in wildlife corridor of Selous-Niassa ecosystem due to the following reason: First, scanty information of study area interests which is eastern part of the corridor also known as Selous –Masasi compared to western part; second, huge area coverage in Africa as the largest trans-boundary natural dry forest eco-regions covering approximately 154 000 km<sup>2</sup> with a critical gap between these protected areas that stretches for about 120 – 180 km and extending across southern Tanzania and the Mozambique border. Through a network of protected areas of various categories of protection, an area of 110 000 km<sup>2</sup> of this ecosystem is presently under conservation (Baldus and Hahn, 2009); third, wildlife migration and richness as it constitutes one of the largest elephant ranges in the world and contains half of the world remaining wild dog population, besides, supports a large number of other globally significant, threatened and CITES listed fauna and flora species (Baldus *et al.*, 2003); fourth, there was no legal protection of wildlife corridors before enactment of the Wildlife Act of 2009; fifth, there was no signed memorandum of understanding between Tanzania and Mozambique concerned with protection of the ecosystem before May 2015; and last, established wildlife management areas (WMAs) which act as a buffer zone to core protected areas to help conservation of wildlife corridor by involving local communities. WMAs established are bordering Selous, Msanzesi and Lukwika-Lumesule game reserves (MAGINGO WMA, NDONDA and MCHIMALU proposed WMAs respectively) within Liwale, Nachingwea/Masasi and

Nanyumbu Districts respectively in Tanzania whereas people are living inside Niassa national reserve in Mozambique (Pesambili, 2003).

### **1.3.3 Why study impacts of socio-economic activities**

The study mainly focuses on impacts of socio-economic activities practiced by local communities in wildlife corridors for their livelihoods and developments; because the activities are a key driver to biodiversity loss in wildlife corridors resulted from habitat degradation and loss (Kideghesho *et al.*, 2006). These activities influenced by socioeconomic forces arise at local and international levels which shape the decisions made at local level on the resource use patterns. The socio-economic forces include macro-economic policies, demographic changes, development biases, public policies, poverty and inequality (Wood *et al.*, 1999). The changes of resource use patterns resulted from socioeconomic forces are also associated with infrastructure construction, forest overexploitation, in-migration, pollution and land use changes. These activities together with traditional practices cause habitat destruction and ultimately biodiversity loss in wildlife corridors (Noe, 2003).

## **1.4 Objectives of the Study**

### **1.4.1 Main objective**

The main objective of this study was to examine socio-economic activities impacting management of Selous-Niassa wildlife corridor.

### **1.4.2 Specific objectives**

The specific objectives were to:

- (i) Identify communities' current land uses and their effects to Selous-Niassa wildlife corridor.

- (ii) Examine factors influencing people's encroachment to Selous-Niassa wildlife corridor.
- (iii) Determine effectiveness of existing strategies in managing Selous-Niassa wildlife corridor.

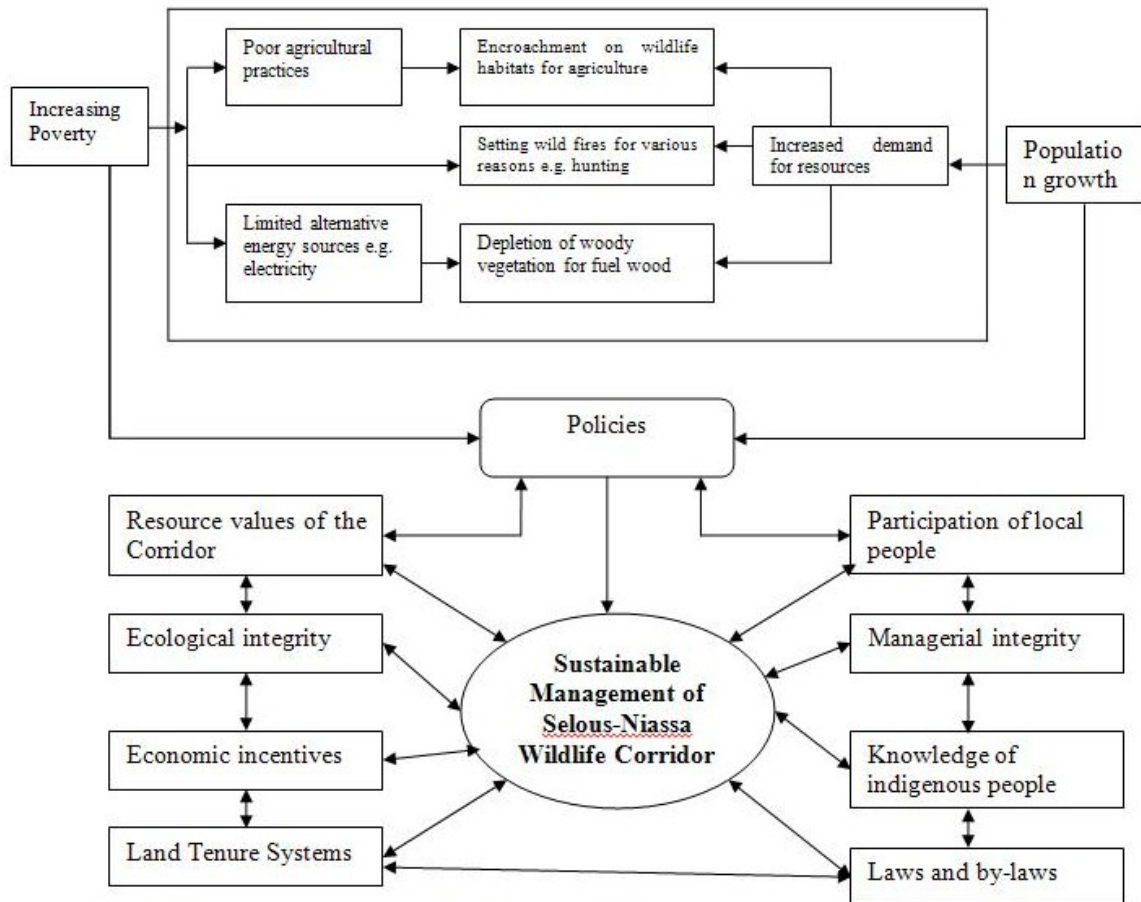
### **1.5 Research Questions**

This study was guided by the following questions:

- (i) What are the major current lands uses directly effecting Selous-Niassa wildlife corridor?
- (ii) To what extent identified socio-economic factors influence encroachment of Selous-Niassa wildlife corridor?
- (iii) Are existing management strategies effective?, if yes, how?, if no, why?

### **1.6 Conceptual Framework**

Figure 1 explains the conceptual framework of the study. It depicts that Population growth increase demand for resources (raw materials, building materials, space for settlement, agriculture and livestock keeping). Poverty also increase demand of domestic energy from natural resources and land for agriculture which lead to wildlife habitat loss as a result of human-wildlife interaction either for good or worse. In order to deal with those problems and enhance sustainable wildlife corridors management, there is a need to develop strategies which ensure outstanding resource values of the wildlife corridors, acknowledge knowledge of indigenous people, awareness creation, increase participation of local people, enhance land tenure systems, provide economic incentives, control population growth and monitor poverty dynamic of local people living within the corridor.



**Figure 1: Conceptual Framework on impacts of socioeconomic activities in managing wildlife corridor of Selous-Niassa ecosystem.**

Source: Adapted from Kideghesho *et al.* (2006)



## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Wildlife Corridors

In general terms, terrestrial wildlife corridors refer to two types of area; (i) an area used by animals to pass from one “habitat patch” to another; or (ii) an area that connects two patches of suitable habitats by passing through a matrix of unsuitable habitat. In Tanzania, wildlife corridors are often identified through their use by large charismatic mammals –so-called “landscape-species”, such as elephant (*Loxodonta africana*) or wild dog (*Lycaon pictus*). However, many smaller animals such as duikers, small carnivores, bats, birds and amphibians will also use these corridors. Thus corridors may be important both for maintenance of populations in protected areas linked by corridors, and for populations moving through or living in corridors (Jones *et al.*, 2009).

The ability of wildlife populations to respond to climate and land-use change depends upon connectivity and migration corridors. Estimating the amount of connectivity among populations at a broad spatial scale is very challenging. Traditional radio tracking and Global Positioning System (GPS) data from captured animals are applicable at the scale of wildlife management units (10-100miles) and statewide or regional scales (100-1000 miles) (Mpanduji, 2003). Host genetics can be used to infer movement patterns at broad spatial scales, but the long generation times of many host species means that recent changes due to land-use change, roads, and climatic factors are undetectable.

Wildlife corridor as an unprotected area (defined as an area with no legally protected status, or an Open area, or a Game controlled area (GCA) between two or more PAs (defined as National parks (NPs), Game reserves (GRs), Forest reserves (FRs), Nature

reserves (NRs) or the Ngorongoro conservation area (NCA)) (i) either through which animals are known to move or are believed to move, (ii) that are connected by (or can potentially be reconnected by) natural vegetation such as forest or grassland, or (iii) both (i) and (ii) together (Jones *et al.*, 2009).

## **2.2 Importance of Wildlife Corridors**

According to Jones *et al.* (2009), wildlife corridors are important for five main reasons:

- (i) If an animal or plant population declines to low levels or become extinct in one area or habitat patch, individuals from another patch can immigrate and rescue that population from local extinction.
- (ii) If a small population is isolated, it will lose genetic variation over the long term and suffer from inbreeding. A corridor allows immigrants to import new genetic variation into isolated populations.
- (iii) A corridor increases the area and diversity of habitats over and above the area of the two habitat patches that it connects.
- (iv) If the habitat of one area becomes unsuitable (e.g. because of climate change), organisms (both plants and animals) can move along corridors to reach more suitable habitat, and thus be 'rescued'.
- (v) Some protected areas do not encompass the range of ecosystem requirements needed by certain flora and fauna. Migrating species, for example, especially large mammalian herbivores and associated carnivores, move outside and/or between protected areas. They may also use corridors as dispersal areas.

## **2.3 Types of Wildlife Corridors in Tanzania**

There are 31 wildlife corridors in Tanzania which fall within five categories as explained much by Jones *et al.* (2009) as follows:

### **2.3.1 Uncontrolled corridors (A)**

These are most poorly documented type of corridor. they consists two sub-categories (i) known historical migration routes of particular species, usually elephants, where is unclear if these routes are still in use or (ii) the shortest distance between two PAs across which animals could travel. Current land use is not taken into account.

### **2.3.2 Uncultivated lands between PAs without documentation on animal movement (B)**

These are usually patches of natural vegetation that lie between two PAs, or sometimes a string of FRs or WMAs between larger PAs. For almost all such corridors, it is known whether any populations use them to move between the PAs. Furthermore, habitat suitability and the population sizes of species living in these corridors are unknown. Such corridors may be needed in the future if habitat in one of the protected area becomes modified and unsuitable, for example through climate change, oil exploration or mining. These areas may also be very important for wildlife already, forest dwelling birds that will not cross open spaces, but still is not documented yet.

### **2.3.3 Continuous or semi-continuous non-agricultural land between PAs with anecdotal information on animal movements (C)**

These consists patches or network of one or two FRs that lie between two larger PAs and additionally across which one or more species are known to move (or assumed to move). These type of corridors often focuses on elephant movements.

### **2.3.4 Known animals' movement routes between two PAs (D)**

Documented movements of large animals, usually elephants, across a habitat that connect two PAs, for example by radio telemetry, satellite tracking or transect studies. The habitat may be legally protected, or agricultural land, or both.

### **2.3.5 Potential connectivity of important habitats (E)**

Proposed or potential corridor areas linking fragmented or threatened habitat patches that contain endangered or other species. These are usually highland forests. Instigation of such corridors may involve forest restoration projects and/or compensation scheme for local people.

The above types makes 31 wildlife corridors in Tanzania to be grouped into three groups namely extreme (denotes probably less than two years remains for extinction: A-2 and D-3), critical (less than five years remaining: A-1, B-1, C-3, D-5 and E-8) and moderate (less than 20 years remaining: A-2, C-1 and D-5).

### **2.4 Land Uses and Their Effects on Wildlife Corridors**

A primary threat to the wildlife corridors is considered to be the uncontrolled and unplanned conversion of land for agricultural purposes (Baldus *et al.*, 2003; Bloesch and Hahn, 2007). The economy of the corridors communities is based on subsistence farming (Baldus, 2009). For example in the western part of Selous-Niassa wildlife corridor, staple crops grown are maize and cassava, with cash crops predominantly of tobacco, sesame, sunflower, rice, groundnuts, beans, cashew nut and occasionally green or red pepper. In the absence of or because of the exorbitant prices of fertilizer shifting cultivation is still practiced. Livestock is mostly restricted to goats, sheep and chicken. Cattle are rare due to the presence of trypanosomiasis transmitted by Tsetse flies in the region.

In the northern half of the Corridor there has been a marked shift from the planting of tobacco to rice due to high input of labor in return for a low crop price, grievances with tobacco cooperatives regarding poor grading and delay in payments, and the practice of loaning money to farmers for fertilizer which then must be paid back by all cooperative

members (Picard, 2008). The availability of wetlands, and not labor, is the limiting factor for rice production in the Corridor (Picard, 2008). Wetlands are critical habitats for wildlife which causing competition between farmers and wildlife, as well as potential for increased human wildlife conflict. Furthermore, an increasing shortage of wetlands for rice production could eventually lead to a conflict over the boundaries of the Corridor as residents demand more fertile land in the future.

## **2.5 Factors Influencing Encroachments of Wildlife Corridors**

Habitat loss and fragmentation are the leading problems for wildlife conservation (Fahrig, 1997 cited by Pinter-Wollman, 2012). Because human encroachment on wildlife habitat leads to inevitable conflict, it seems sensible to make habitat restoration a primary focus of conservation agencies. However, restoration of an animal's entire historic range may not be necessary. Creating wildlife corridors through which animals can safely disperse and migrate between protected areas can lead to a healthy metapopulation (Druce *et al.*, 2008). Factors contributing to habitat destruction or loss entails: poverty, population growth, land tenure systems, development policies, economic incentive and inadequate conservation status.

Poverty is defined as “a state of deprivation associated with lack of incomes and assets, physical weakness, isolation, vulnerability and powerlessness” (Chambers, 1987). It is considered a rural phenomenon in Tanzania, where about 22% and 39% of its population live below the food poverty line and basic needs poverty line, respectively (URT, 2002). The proportions living below US\$1 and US\$2 per day are 19.9% and 59.7%, respectively, thus making 41.6% of the population live below the national poverty line (UNDP, 2003). Liwale and Nanyumbu Districts are not exceptional – and probably the situation is much worse. Poverty and whether the poor are agents or victims of environmental degradation is

explained much by Mwalyosi (1992), Reardon and Vosti (1997), World Bank (2002), Cavendish (1999); and Vedeld *et al.* (2004).

Over the last four decades, areas within wildlife corridors have experienced high population growth which results to growing pressure from local people to open protected lands for community use (Hackel, 1999). For instance western part of Selous-Niassa wildlife corridor, in 2009 had population growth rate of 4.3% (Baldus, 2009). Immigration from within and even from Mozambique appears to be the major factor stimulated by good agricultural land, wildlife (as a source of protein), water bodies (rivers and wetlands for fishing and farming), and mining deposits (Baldus, 2009). One of the problems of high population in the corridor is growing pressure from local people to open other untouched lands for community use.

Over 70% of Selous-Niassa ecosystem has been included into protected areas network. However, some areas, which are critically important for survival of wildlife population, have long remained unprotected or partially protected. Efforts needed to accord adequate conservation status to these areas e.g, eastern and western corridors of Selous-Niassa ecosystem. Though, enforcement has been minimal. Illegal inhabitants continued to remain inside the corridors; despite calls from conservationists to safeguard the corridor. Increased permanent human settlements, infrastructure developments and investment facilities minimize the chances of securing the corridor (Baldus and Hahn, 2009).

The land tenure system, land use policies and market conditions may have detrimental impacts on biodiversity. In Tanzania, the land belongs to the State, although most of it (except PAs) is held in a communal type of tenure often called the deemed right of occupancy while wildlife belongs to State. In contrast to private land tenure, State control

of land has the advantage that the State can restrict the policies and land uses likely to cause detrimental impact on wildlife (Wade *et al.*, 2003).

Like in many other terrestrial ecosystems, in Liwale and Nanyumbu Districts wildlife conservation is pursued along with several other land uses. These uses may be ecologically destructive but economically rewarding (Leader-Williams *et al.*, 1996 cited by Kideghesho, 2006). Therefore local people have less incentive to surrender their current livelihood strategies which can be elaborated through; equity in benefit distribution, failure to compete effectively with alternative land uses, and knowledge of indigenous people as explained much by Emerton (2001), Emery (2000); ICSU (2002b), Martello (2001), Berkes (2002), Zurayk *et al.* (2001), Cox (2000), Singhal (2000), and Fabricus *et al.* (2004).

Uncontrolled resource use and unplanned and un-regulated conversion of land for agricultural and ribbon strip development are the main threats to the biodiversity within the wildlife corridors (UNDP/GEF, 2003), exacerbated by the high human populations growth rate in the corridors areas of over 4.3 %. Therefore, efforts are needed to ensure the integrity of the corridors and associated ecosystems.

## **2.6 Strategies for Managing Wildlife Corridors**

There is no single wildlife resources management policy which stands alone without interfering with other sectoral policies like land, agriculture, forest, mining, energy, environmental policies etc. For example wildlife policy of 2007 is not sufficient in protection of wildlife resources without integrating with other sectoral policies to form a pristine strategy towards management of wildlife resources. The acquisition of lands primarily for wildlife uses can be politically challenging. Land ownership and the cultural

importance attributed to ancestral land are both factors that may prevent the purchase or conversion of land to allow wildlife use. The larger the area to be converted, the more stakeholders need to be consulted, spanning many managerial levels from villages and Districts to countries and governments. The core premise of community conservation is that people who have permanent, exclusive rights to land and resources are more likely to manage resources sustainably in the long term (Hann *et al.*, 1996).

Wildlife management areas (WMAs) in Tanzania were introduced following the wildlife policy of 1998. The aim was to introduce new strategy for managing wildlife by involving local communities in conservation of wildlife through WMAs. WMAs are established on buffer zones of existing national parks or game reserves and along wildlife corridors. There are two objectives for establishing WMAs comprised wildlife conservation and rural economic development (Songorwa, 1999 cited by Sungusia, 2010). The policy acknowledge huge opportunity costs (benefits from alternative land uses such as agriculture) associated with WMAs establishment. Many WMAs are agricultural marginal but others are on highly productive land. However, for WMAs to make economic sense to landholders, its benefits must exceed costs (Sungusia, 2010). The main challenge is that, villagers must be paid to conserve wildlife habitats. Prominently, the amount of payment expected by villagers is unknown.

Yet, rural communities are not fixed, bounded entities; they move in location, change in composition as people move in or move away, and do not necessarily have a clearly defined membership. Whilst these issues are still overlooked in many implementations of community natural resources management projects, which treat the “community” as a “distinct social group in one geographical location, sharing common cultural characteristics, in harmony and consensus”; images that actually may be quite misleading reflections of reality (Kumar, 2005 cited by Newing, 2009).



## CHAPTER THREE

### 3.0 METHODOLOGY

#### 3.1 Description of the Study Area

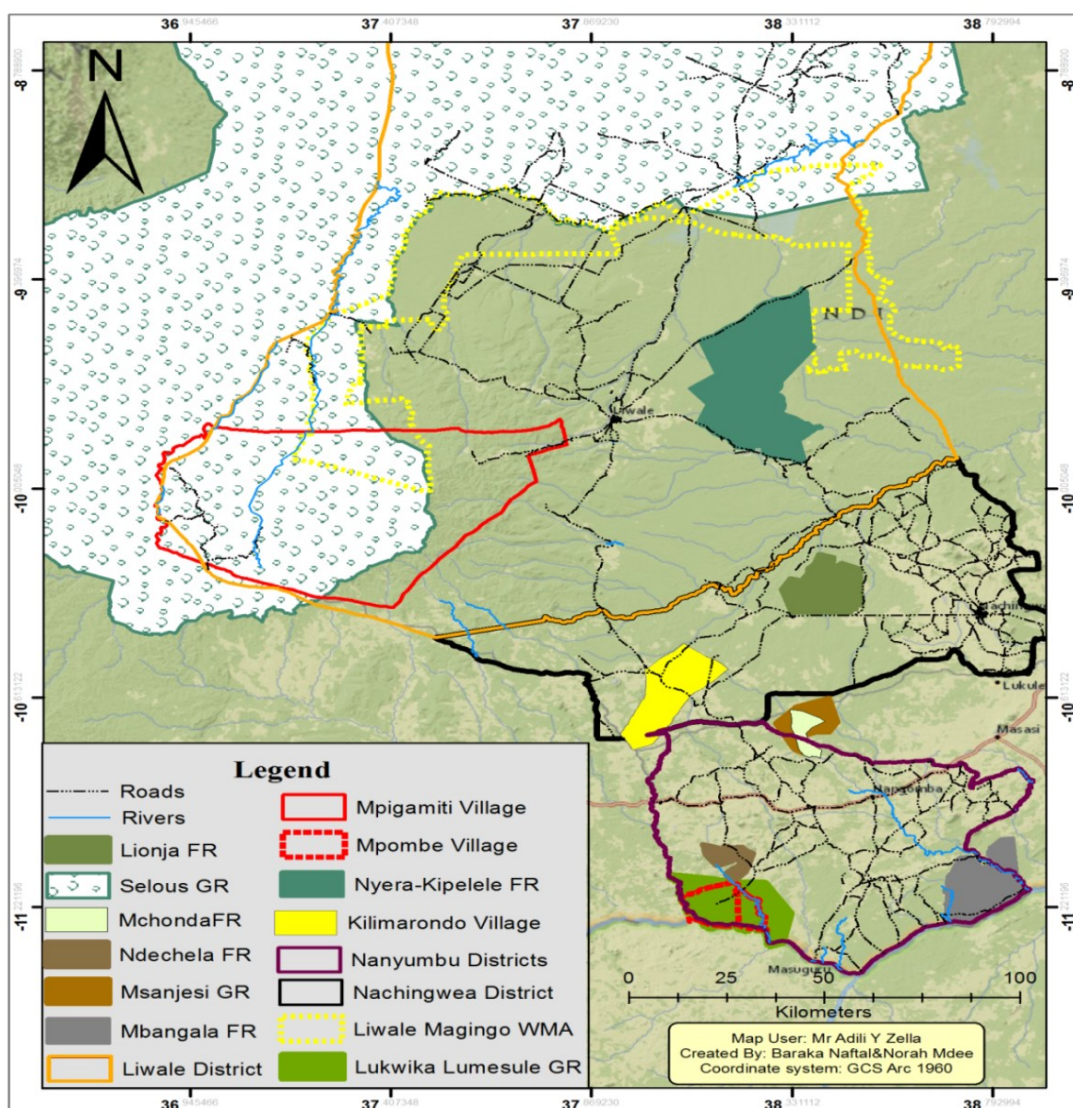
##### 3.1.1 Location

The study were carried out in Selous-Niassa wildlife corridor (SNWC) which extends across southern Tanzania into northern Mozambique between 10<sup>0</sup>S to 11<sup>0</sup> 40'S with north-south length of 160 to 180 km (Figure 2). SNWC comprises of two parts, western part (administratively passes in Namtumbo and Tunduru Districts of Ruvuma regions in southern Tanzania) and eastern part (administratively passes in Liwale, Nachingwea, Masasi, and Nanyumbu Districts). This study will concentrate in eastern part. In eastern SNWC, migration of elephants, buffalos and zebras has been observed (Pesambili, 2003; Ntongani *et al.*, 2007). Two migratory routes have been identified as follows:

- (i) From Selous through Nahimba, Nakalonji, Mbondo, Kilimarondo, Matekwe and Kipindimbi proposed game reserve (GR) in Nachingwea District and then via Msanjesi, Mkumbalu, Sengenya, Nangomba and Nanyumbu in Nanyumbu District to Lukwika-Lumesule GR and then crosses Ruvuma River to the Niassa GR.
  
- (ii) From Selous to Kiegei, Namatumu, Kilimarondo in Nachingwea then along Mbangala and Lumesule rivers to Mchenjeuka and Mitanga in the Lukwika-Lumesule GR, from where they cross the Ruvuma River to the Niassa Reserve.

These routes forms SNWC called Selous-Masasi corridor includes the Msanjesi (2,125 ha) and the Lukwika-Lumesule (44,420 ha) GRs in Masasi and Nanyumbu Districts respectively and areas of Liwale, Nachingwea, Masasi and Tunduru Districts.

The study area comprise wildlife management areas (WMAs) bordering Selous, Msanjesi and Lukwika-Lumesule game reserves (MAGINGO WMA, NDONDA and MCHIMALU proposed WMAs respectively) which are within Liwale, Nachingwea/Masasi and Nanyumbu Districts respectively. In this study 2 villages namely Mpigamiti and Mpombe within MAGINGO WMA and MCHIMALU proposed WMA were purposely selected for the study.



**Figure 2: The Map showing Selous-Niassa Wildlife Corridor (Eastern corridor (Selous-Masasi) the study area)**

**Source:** Map adapted from African Elephant Status Report 2007 (Blanc *et al.*, 2007).

### **3.1.2 Geology**

In general the northern part is hilly while the area towards the Ruvuma River is slightly undulated to flat with isolated hills, some of them having prominent rock outcrops (inselbergs). Mtungwe Mountain (1284m a.s.l.) in the centre of the corridor is the highest elevation. From the North the plateau slightly slopes to the Ruvuma River which reaches its lowest level of about 460m a.s.l. in the southeastern corner of the Corridor. The soils are generally very sandy and washed-out. Two drainage basins exist in the SNWC. North of the watershed, located along the Lake Niassa – Indian Ocean Highway, the rivers drain into the Rufiji River while the area south of the watershed is part of the Ruvuma drainage basin. Some of the major tributaries like Mbarangandu, Lukimwa, Luchulukuru, Luego or Msanjesi are usually permanent watercourses.

### **3.1.3 Climate**

The corridor has the typical unimodal rainfall system of the Miombo woodland ecosystem. The southeast monsoons, bearing moisture from the Indian Ocean, are responsible for the rainy season chiefly occurring from mid-November to mid-May. The rainfall generally decreases from the northern part with about 1200-1300 mm rainfall per year towards the south having a mean annual rainfall of about 800 mm along the Ruvuma River. The mean annual temperature is about 21°C.

### **3.1.4 Vegetation**

The wide variety of its wildlife habitats – Miombo woodland dominated by *Brachystegia spp.*, *Julbernardia spp.* and *Isoberlinia spp.*, wooded grasslands, open savannahs, granite inselbergs, seasonal and permanent wetlands and riverine forests along numerous perennial and seasonal streams - account for globally significant biodiversity. Although vegetation studies are still in progress about 500 plant species including one tree species

(*Xylopia sp. nov.*), which has been never described before, have been identified. A number of these plant species are either CITES listed or are of the IUCN category for threatened species and endemic to Tanzania (Baldus *et al.*, 2009).

### 3.1.5 Wildlife

Several dry season aerial censuses were carried out simultaneously in both countries at intervals of three years - the latest in 2012 (TAWIRI, 2012). Accordingly the total elephant population of the entire Selous – Niassa ecosystem seems to be less than 70,000 as reported in 2006, with the majority in Tanzania. Globally significant populations of Lichtenstein's hartebeest (*Alcelaphalus buselaphus lichtensteinii*), African buffalo (*Syncerus caffer*), Niassa wildebeest (*Connochaetes taurinus cooksoni*), Eland (*Taurotragus oryx*), Greater kudu (*Tragelaphus strepsiceros*), Common waterbuck (*Kobus ellipsiprymnus*), Bushbuck (*Tragelaphus scriptus*), Common Reedbuck (*Redunca arundinum*), Zebra (*Equus burchelli*), Impala (*Aepyceros melampus*) and Klippsspringer (*Oreotragus oreotragus*) are linked by the corridor. Their distribution and occurrence varies substantially depending on the rainy or dry season and their location in the corridor. Large numbers of Roosevelt's sable antelope (*Hippotragus niger roosevelti*) are widespread throughout the corridor. Beside these species both reserves and the corridor are home of a variety of large carnivores including African wild dog (*Lyacon pictus*), Lion (*Panthera leo*) and Leopard (*Panthera pardus*) and Spotted hyaena (*Crocuta crocuta*). Other wildlife includes Crocodile (*Crocodilus niloticus*) and Hippopotamus (*Hippopotamus amphibius*). The highly endangered Black rhino (*Diceros bicornis*) is still found in both reserves and the corridor, but numbers are low. The ecosystem has also a rich diversity of bird life. Migratory birds use the Ruvuma River area as a nesting or resting place on the fly way route from Northern Europe to South Africa.

### **3.1.6 Socio-economic activities**

The economy of the corridor communities in Liwale and Nanyumbu Districts is based on subsistence agriculture (95%). Staple crops grown are maize and cassava, cash crops predominantly cashewnut, sesame, sunflower, rice and groundnuts. Livestock is mostly restricted to goats, sheep and chicken. Cattle are rare due to the presence of Tsetse in the region (Schuerholz and Bossen, 2005). Currently, high immigration of livestock and livestock keepers are experienced in the area.

Dependency on natural resources by corridor dwellers is rated as “very high”. Natural products collected regularly include poles for house construction, grass for thatching, reeds, firewood, wild fruits, mushrooms, traditional medicines and (legally or illegally) fish and bush meat. Firewood is the main source of domestic energy for cooking for over 96 percent of all households with no affordable energy alternatives in the foreseeable future (Smith, 2005).

### **3.1.7 Ethnicity**

Ngindo, Yao, Mwera, Makua and Matambwe tribes are common in eastern part of the corridor. Ngindo are commonly found in Liwale District, Mwera in Nachingwea District, Makua, Yao and Matambwe in Masasi and Nanyumbu Districts. Historically these tribes were hunters and gathers. Thus, living adjacent or within wildlife protected areas for this ethnicity is inexorable (Schuerholz and Bossen, 2005).

## **3.2 Research Design**

A cross sectional survey design was employed. This type of research design utilizes different groups of people who differ in the variable of interest, but share other characteristics such as socioeconomic status, educational background, and ethnicity

(Kothari, 2004). Cross sectional survey design has various merits includes (i) it takes place at a single point in time, (ii) does not involve manipulating variables, (iii) allows researchers to look at numerous things at once (age, income, gender) and (iv) often used to look at the prevalence of something in a given population.

### **3.3 Sampling Procedure and Sample Size Determination**

#### **3.3.1 Sampling procedure**

Mpigamiti and Mpombe villages in Liwale and Nanyumbu Districts respectively were purposively selected as those found within eastern wildlife corridor of Selous-Niassa ecosystem. The study villages selected because (i) both are within the corridor, (ii) both are members of wildlife management areas (Mpigamiti – MAGINGO WMA and Mpombe-MCHIMALU proposed WMA) and (iii) Mpigamiti is within the start of the corridor while Mpombe is within the destination of the corridor in Tanzania.

A list of all households from the updated village register book in the study villages was the sampling frame. Sampling unit for this study was a household. Household was defined as a group of people living together and identifying the authority of one person the household head, who is the decision maker for the household (Katani, 1999). Simple random sampling was used to identify the sample units. In this method every household has an equal chance of being selected. Where a candidate happened to come from the same household, one was dropped (Bouma, 2000; Henn *et al.*, 2006; Veal, 1997; and Kaswamila, 2009).

#### **3.3.2 Sample size determination**

The sample size for each study village was 30 households whereby 10 households were drawn from each income group (low, medium and high) as described in village's fact

sheet. Sample size in socio-economic studies can be decided by the researcher depending on the nature of study but should be at least 30 units as supported by many scholars (Bailey, 1994, Boyd *et al.*, 1981; Kajembe and Luoga, 1996; Mbwambo, 2000; and Kaswamila, 2009). Judgmental/purposive sampling technique was used to obtain 12 key informants. The distributions of sample size are shown in Table 1.

**Table 1: Respondent sample composition**

Category of respondent	District	Villages		Total
		Mpigamiti	Mpombe	
Households	-	30	30	60
Village Executive officers (VEOs)	-	1	1	2
Village Natural Resources Officers(VNROs)	-	1	1	2
Project Manager of LLM (PLLM)	1	-	-	1
District Game officers (DGOs)	2	-	-	2
Sector warden of SGR (SWS)	1	-	-	1
Village Development Officers (VDOs)	-	1	1	2
WMA Chairpersons (WCs)	2			2
<b>Total</b>	<b>6</b>	<b>33</b>	<b>33</b>	<b>72</b>

### 3.4 Pilot Study

Prior before actual data collection pilot study was conducted so as to provide a general picture of the study area and testing of the questionnaire in order to verify if the questions could be understood by the respondents. Questionnaire pilot-testing was done in Majonanga village which is within Selous-Niassa wildlife corridor in Ndonda proposed WMA in Nachingwea District and is adjacent to Msanjesi GR aimed to test questionnaire wording, sequencing and layout; and to estimate response rates and time.

### 3.5 Data Collection

The research consisted two phases of data collection whereby primary and secondary data were collected.

### **3.5.1 Primary data**

Primary data for this study were collected using survey (household questionnaire survey and key informants interview); participatory rural appraisal (focus group discussion and direct observation). Both quantitative and qualitative data were acquired.

#### **3.5.1.1 Household questionnaire survey**

Semi-structured questionnaires were administered to the sampled households (see appendix 1). This type of questionnaires can be used with informants who are illiterate, blind, bedridden or very old and when a respondent does not understand the question the researcher can translate and elaborate to bring the right meaning as explained much by Gillham (2005); Miler & Wilson (1983); and Kaswamila (2009).

The household questionnaire survey were useful in acquisition of quantitative information for statistical analysis, acquiring much social economic information quickly, current community socio-economic activities affecting Selous-Niassa wildlife corridor, factors influencing people's encroachment of wildlife corridors, and effectiveness of existing strategies in managing Selous-Niassa wildlife corridor. Both pre-testing and pilot-testing of questionnaires were exercised. During questionnaires preparation, pre-testing was done to SUA staffs and students. Pre-testing was used to assess whether the questions are clear, specific, answerable, interconnected and substantially relevant (Kaswamila, 2009). Before administering the questionnaires one task was accomplished, this is training of two local research assistants including questionnaire pilot-testing as part of training. The use of local research assistants aiming at reducing researcher or experimental bias effect (Miller & Wilson, 1983; Kaswamila, 2009), to exploit local people's willingness to provide information to a person they know. During research assistants training, questionnaire pilot-testing was done in Majonanga village which is within Selous-Niassa wildlife corridor in Ndonda proposed WMA in Nachingwea District. The instrument was self-administered to 10 respondents following procedures described by White (2002) and Mauch *et al.* (2003).

#### **3.5.1.2 Key informants interview**

Checklist of questions (Appendix 2) was used to guide interview with 12 key informants as shown in Table 1 above. Key informant interviews are advantageous because they often



provide data and insight that cannot be obtained with other methods. They provide flexibility to explore new ideas and issues that is not being anticipated in planning the study but are relevant to its purpose (Pratt and Loizos, 1992 cited by Lusambo, 2002). Type of data to be collected was involved current socio-economic activities that affects Selous-Niassa wildlife corridor, factors influencing people's encroachment of Selous-Niassa wildlife corridor, existing strategies in managing Selous-Niassa wildlife corridor, and related studies done in the area and also recommendations on how management strategies can be improved so as achieving sustainability. At that time researcher recorded the relevant information which relate with the study.

### **3.5.1.3 Focus group discussions (FGDs)**

Two focus group discussions in each study village with villagers were organised. Each discussion group comprised 6-12 people (Mikkelsen, 1995; Charmaz, 2005; and Lusambo, 2009). A checklist of questions (Appendix 3) were used to cover discussion themes, which hinged on major socio-economic activities that destruct Selous-Niassa wildlife corridor, factors influencing encroachment of Selous-Niassa wildlife corridor, and effectiveness of existing strategies in managing Selous-Niassa wildlife corridor. FGDs have an advantage over interviews in that, participants are allowed to give their opinion and talk in detail about their beliefs and feelings and also ensure that views of the minority groups are captured (Cooksey and Lokuji, 1995; Kaswamila 2009, Tribe and Summer, 2004; Denscombe, 2003). In the discussions, the researcher acted as a facilitator, tape recording and ensures that everyone have a say. The age group of discussants were at least 18 years of age as they are familiar with the study area and issues concerning management of wildlife corridor.

### **3.5.1.4 Direct observation**

As the data collection being carried out, direct field observation method was used to supplement data collected from social surveys and focus group discussion. A researcher and assistants together with some villagers and key informants were randomly site

observing major socio-economic activities that destruct wildlife habitat within Selous-Niassa wildlife corridor as identified during focus group discussion. The assistants undergo training on the critical issues of the study to be captured. The obtained information enabled the researcher to discuss with respondents (households, key informants and focus groups) for triangulation purposes. Again, this tool was used for generation of first hand data which is not interfered by other factors standing between researcher and respondent.

This covered the gaps left by other data collection instruments for example cross checking whether what was claimed to be facts and actual facts were compared. A checklist contained issues for cross checked was used in recording the observed data. Also, digital camera was used to take photographs relevant to the study.

### **3.5.2 Secondary data**

Secondary data was collected using literature surveys. Both quantitative and qualitative data were acquired.

#### **Literature surveys**

Archive information for this study was published and unpublished obtained from SGR, LLM, Village, and or District offices, libraries and internet. Data accessed were in the form of reports, manuscripts, books, journal papers and other documents found in office files and other collections. Documented information in related to land uses in Selous-Niassa wildlife corridor; factors influencing encroachments of Selous-Niassa wildlife corridor, and effectiveness of existing management strategies were accessed. Similar information was also sought from Village experts (agriculture, wildlife and community development). This information was used to supplement data collected from interviewed households.

### **3.6 Data Analysis**

Quantitative data from questionnaire was analysed statistically. Qualitative data from focus group discussions (FGDs) and key informants were analysed through content analysis. Content analysis is useful in analyzing details of the components of verbal discussions held with key informants and FGDs (Kajembe, 1996 cited by Kijazi, 2006).

#### **3.6.1 Statistical analysis**

The Statistical Package for Social Sciences (SPSS) and Microsoft Excel were employed. Two types of statistical analysis namely, descriptive and inferential statistical analyses were carried out.

##### **3.6.1.1 Descriptive statistical analysis**

Analysis of quantitative data by descriptive statistics was involved frequencies, percentages, means, and standard deviations of variables such as age, marital status, sex, education level, household size and income. Also examining relationship between two variables by the use of cross tabulation method was employed.

##### **3.6.1.2 Inferential statistical analysis**

Inferential statistical analysis was involved application of multiple regression model used to determine the existence of correlation between socio-economic factors influencing encroachment of wildlife corridor. Multiple regression model has been successfully employed in social sciences, biostatistics and demographic issues (Pallant, 2005). Multivariate regression analysis was run to assess the influence of independent variables on dependent variable. Giliba *et al.* (2011) argued that, applications of multivariate regression analysis depend on the nature of the dependent variable of the

particular study inquiry. Significant value should be less than 0.05 (Pallant, 2005 and Akankali and Chindah., 2011). The model was expressed as follows:

$$Y_i = \beta_0 + \sum_{i=1}^{i=j} \beta_i X_i + e_i$$

Where:

$Y_i$ = encroachment of wildlife corridor (presence of socio-economic activities that have adverse effect on ecosystem)

$\beta$ 's = coefficients to be estimated

$B_0$  = constant coefficient (intercept of the equation)

$X_i$ = independent variables

$i=1,2, 3, \dots, j$

$e_i$ = error term

The hypotheses tested were:

$H_0$ :  $\beta_i = 0$  that is regression coefficients are equal to zero implying that socio-economic factors (independent variables) have no significant influence on encroaching SNWC ( $p < 0.05$ )

$H_a$ :  $\beta_i \neq 0$  that is regression coefficients are not equal to zero meaning that socio-economic factors have significant influence on encroaching SNWC ( $p < 0.05$ )

From the above, the variables included in the regression model were:

**$X_1$ = Age**

It was hypothesized that age of respondents influence encroachment of SNWC. Young respondents ( $\leq 35$  years), middle-aged (36–45 years) and respondents over 60 years old (commensurate with Tanzania's mandatory retirement age of 60) differed in the level of encroachment in SNWC. Young people depended more on natural resources extraction for their survival compared to older people who were more likely to have income from wages,

salaries or pensions, and less income from natural resources. Therefore, age has negative regression coefficient (-).

### **X<sub>2</sub>= Sex**

This could have positive coefficient (+) in the sense that sex influence encroachment in SNWC as male are more destructive compared to women as almost most poachers arrested in SNWC are male.

### **X<sub>3</sub>= Education level**

This could have a negative coefficient (-). It was hypothesized that respondents with higher education has low influence on encroachment of SNWC compared to respondents with low education. The reason behind is that, respondents with higher education can be employed in various private and government sectors operating in Districts where SNWC lies.

### **X<sub>4</sub>= House hold size**

The regression coefficient for household size was expected to be positive (+). The reason behind is that large household size have many mouths to feed resulting in increasing food production and other necessities. This scenario accelerates encroachment of SNWC as ethnicity of the area encourages polygamy.

### **X<sub>5</sub>= Household income**

Household income could have positive coefficient (+) as higher income families mostly employed or business oriented respondents compared to low income families who engage in illegal extracting natural resources to supplement necessities. Furthermore low income families are easier to corode with outsiders of SNWC to encroach valuable natural resources.

**X<sub>6</sub>=Years lived in a village**

This could have positive coefficient (+). It was hypothesized that large number of years ( $\geq 05$  years) lived in a village influence encroachment of SNWC as the respondent familiarity with the area and knows different trading techniques for encroached natural resources. The reason behind is that no one is able to extract any resource within the area without in-depth knowing of its status or using the indigenous people.

**X<sub>7</sub>= Size of land owned by a household**

Size of land owned by a household was expected to have positive regression coefficient (+). The reason behind is that insufficient land for agriculture, settlement and livestock keeping accelerates encroachment of SNWC as people will extend to PAs as a result of destruction and fragmentation of the corridor.

**Table 2: Summary of data collection and analysis in each objective**

<b>Specific objective</b>	<b>Data collection tool</b>	<b>Data to be collected</b>	<b>Data analysis</b>
1	-Semi-structured questionnaire - Checklists for key informants and FGDs - Documents	- Current social economic activities (agriculture, logging, mining, charcoal making, honey mongering, fuelwood collection, hunting etc) - Access to land and land tenure (size of land owned, means of acquiring land, land use plan)- Law enforcement	- Descriptive analysis using SPSS software and MS Excel - Content analysis
2	- Semi-structured questionnaire - Checklist for key informants and FGDs - Documents	- Socio-economic factors - Income (Poverty) - External forces (market and demand forces) - Awareness of resource values - Awareness of ecological integrity	- Descriptive analysis using SPSS software and MS Excel - Content analysis - Multiple regression model
3	- Semi-structured questionnaire - Checklist for key informants and FGDs - Documents	- Involvement of local people in SNWC management - Distribution of benefits accrued from SNWC - Property damage and loss of life - Local beliefs and indigenous knowledge - Control of socio-economic activities in migratory routes	- Descriptive analysis using SPSS software and MS Excel - Content analysis

## **CHAPTER FOUR**

### **4.0 RESULTS AND DISCUSSION**

#### **4.1 Socio-demographic Characteristics of Respondents**

The study population comprised of males and females with different ages, family size and education background (Table 3). Of the household heads interviewed, 83.3% were at least 25 years old. This was important to the management of Selous-Niassa wildlife corridor (SNWC) because they understand the historical trend of their areas as well as existing indigenous technical knowledge (ITK).

The study villages were found to have large household sizes. Results show that 53.3% have 1-5 persons per household and 46.7% have more than 5 persons. This is due to the culture of marrying many wives (polygamy) which results into a lot of dependents to feed and take care of. Education background of the surveyed population was at most primary education (85.0%), very few had at least secondary education (3.3%). This is due to shortages of schools especially primary school resulting into children walking long distances to school. There was no nearby secondary school in Mpigamiti or Mpombe villages. This implies that, low education level provides low payment employment opportunities to tourism industry within SNWC.

The study villages found to have low income per month resulted mostly from small-scale farming compared to standard living cost needed in the study area. Results show that 73.3% have income less than TZS 90 000, and 26.7% above TZS 90 000, whereas 45.0% below TZS 60 000 which means below TZS 2 000 per day (Table 2). This shows that those employed villagers have high income compared to non-employed (Table 3) which shows that 57.1% of employed villagers have income per month above TZS 150 000



compared to unemployed villagers 73.3% have an income per month below TZS 90 000. Moreover, the chi-square test indicated statistical insignificance on all socio-demographic characteristics of respondents in study villages.

**Table 3: Socio-demographic characteristics of respondents**

<b>Information</b>	<b>Study villages Mpigamiti n=30</b>	<b>Mpombe n=30</b>	<b>Overall N=60</b>	<b>Pearson's chi-square Exact Significance: (2-sided)(1-sided)</b>	
<b>Age class:</b>					
18-24 Years	5(16.7) <sup>1</sup>	5(16.7)	10(16.7)	0.420	0.225
25-35 Years	6(20.0)	11(36.7)	17(28.3)		
36-44 Years	9(30.0)	8(26.7)	17(28.3)		
45-65 Years	8(26.7)	3(10.0)	11(18.3)		
> 65 Years	2(6.7)	3(10.0)	5(8.4)		
<b>Sex:</b>					
Male	16(53.3)	13(43.3)	29(48.3)	0.606	0.303
Female	14(46.7)	17(56.7)	31(51.7)		
<b>Education background:</b>					
Informal education	6(20.0)	11(36.7)	17(28.3)	0.491	0.068
Basic adult education	6(20.3)	5(16.7)	11(8.3)		
Primary	12(40.0)	11(36.7)	23(38.4)		
Secondary	4(13.3)	3(10.0)	7(11.7)		
> secondary	2(6.7)	0(0.0)	2(3.3)		
<b>Household size:</b>					
1-5Persons	14(46.7)	18(60.0)	32(53.3)	0.572	0.368
6-10Persons	13(43.3)	9(30.0)	22(36.7)		
11-15Persons	3(10.0)	2(6.7)	5(8.3)		
> 15Persons	0(0.0)	1(3.3)	1(1.7)		
<b>Income per month:</b>					
Below TZS 30 000	5(16.7)	4(13.3)	9(15.0)	1.000	0.206
TZS 30 000-59 000	9(30.0)	9(30.0)	18(30.0)		
TZS 60 000-89 000	9(30.0)	8(26.7)	17(28.3)		
TZS 90 000-119 000	3(10.0)	3(10.0)	6(10.0)		
TZS 120 000-149 000	3(10.0)	3(10.0)	6(10.0)		
TZS 150 000-179 000	1(3.3)	1(3.3)	2(3.3)		
TZS 180 000-209 000	0(0.0)	1(3.3)	1(1.7)		
>TZS209000	0(0.0)	1(3.3)	1(1.7)		

<sup>1</sup> Figures outside and inside the parentheses are frequencies and percentages respectively.

Also the results show that the study population has 11.7% of employed villagers while 88.3% are unemployed. Mostly those villagers who are employed work in Tourism industry, and those who are not employed are likely to engage themselves in other socio-economic activities including encroachment of wildlife and forest resources. Those unemployed people are the one who are poor compared to employed villagers.

**Table 4: Income level of respondent per month**

<b>Income per month:</b>	<b>Employed</b> n=7	<b>Unemployed</b> n=53	<b>Overall</b> N=60
Below TZS 30 000	0(0.0) <sup>1</sup>	9(17.0)	9(15.0)
TZS 30 000-59,000	0(0.0)	18(34.0)	18(30.0)
TZS 60 000-89 000	0(0.0)	17(32.1)	17(28.3)
TZS 90 000-119,000	0(14.3)	6(11.3)	6(10.0)
TZS 120 000-149,000	3(42.9)	3(5.7)	6(10.0)
TZS 150 000-179,000	2(28.6)	0(0.0)	2(3.3)
TZS180 000-209,000	1(14.3)	0(0.0)	1(1.7)
>TZS 209 000	1(14.3)	0(0.0)	1(1.7)

$\chi^2 = 45.445, P < 0.001$

Statistically significant at 0.001 level of significance

<sup>1</sup> Figures outside and inside the parentheses are frequencies and percentages respectively.

The study villages observed to have large household size with low income of her people as a result concentrates on utilizing wildlife and forest resources in the protected areas. Alternatively, if considers employments in tourism industry, it has seen foreigners paid much compared to locals and this is common in many tourism companies includes Tanganyika Wildlife Safaris (TAWISA), Bushman Hunting Safaris and Tanganyika Wildlife company Ltd (TAWICO) which have invested in Selous Game Reserve. Furthermore, the chi-square test indicated statistical significance ( $P < 0.001$ , i.e  $\chi^2 = 45.445$ ) on monthly income of employed and unemployed households (Table 4). This

implies that, affirmative action policies may need to be adopted for a period of time to improve the conditions of the excluded and to enhance equitable access to job opportunities.

## **4.2 Communities' Current Land Uses and Their Effects to the Management of Selous-Niassa Wildlife Corridor**

### **4.2.1 Access to land and land tenure in the study area**

The land tenure system in the study area is given in Table 5. The dominant land ownership system is individual land obtained through inheritance (83.3%). This is followed by rent land (16.7%) where the majorities are females who were either divorced or widowed because the traditional rules for accessing land did not favor them. The minimum farm size owned by an individual farmer was one hectare, while the maximum farm land was 15hectares. Average farm land per farmer was 1.2 ha. Regarding land area, 80% of the respondents have land parcels between 1-3hectares and 20% had more than three hectares. However, 86.7% of the respondents claimed that land was not enough.

For possibilities to get more land for cultivation, 78.3% claimed that it was possible either through formal application to the village government (81.7%), buying from those with big farms (10.0%) and renting on temporary basis (8.3%) (Table5). Even though, the majority of respondents (85%) indicated the possibility of getting additional piece of land (Table 4). During the focus group discussions it was found that there is a problem of fertile land for rice farming in Mpigamiti village resulted to land use conflicts. The conflict arose in 2010 after MAGINGO WMA getting user right for the area while immigrants invaded the area and cultivated protected land and uses water from the source of Liwale River (Mpigamiti spring) without prior consultation and permission from the village, MAGINGO leaders and District authority as the river is only source of water to Liwale District. This is due

to divisions of former village of Mpigamiti into three villages (Mpigamiti, Namakololo and Mitawa) while during formation of the WMA it was one village. Thereof, distribution of income from WMA goes to only one village (Mpigamiti) and other two remaining villages get nothing contrary to sharing their land to WMA.

**Table 5: Land ownership in study villages**

Information	Villages		
	Mpigamiti n=30	Mpombe n=30	Overall N=60
(a) Land ownership:			
Individual	27(90.0) <sup>1</sup>	23(76.9)	50(83.3)
Rent	3(10.0)	7(23.3)	10(16.7)
(b) Size of land owned hectares:			
1 - 3 ha	24(80.0)	24(80.0)	48(80.0)
4 – 6 ha	6(20.0)	5(16.7)	11(18.3)
7 - 10 ha	0(0.0)	1(3.3)	1(1.7)
11-15 ha	0(0.0)	0(0.0)	0(0.0)
> 15 ha	0(0.0)	0(0.0)	0(0.0)
(c) Land available:			
Enough	2(6.7)	6(20.0)	8(13.3)
Not enough	28(93.3)	24(80.0)	52(86.7)
(d) Possibility to get more land:			
Yes	23(76.7)	28(93.3)	51(85.0)
No	6(23.3)	2(6.7%)	9(15.0)
(d) Location of owned land:			
Within migratory routes	2(6.7)	1(3.3)	3(5.0)
Five km from core PA	2(6.7)	1(3.3)	3(5.0)
Within the WMA	0(0.0)	10(33.3)	10(16.7)
In the planned area	23(76.7)	18(60.0)	41(68.3)
In wetland area	3(10.0)	0(0.0)	3(5.0)

<sup>1</sup> Figures outside and inside the parentheses are frequencies and percentages respectively.

**Table 6: t-test for possibility to get more land for cultivation by households in study villages**

T	df	Sig. (2-tailed)	Mean Difference	95% CI of the Difference:	
				Lower	Upper
-1.067E3	59	.000	-58.767	-58.88	-58.66

CI=confidence interval

t-test in Table 6 indicated statistical significance ( $p=0.05$ ) on possibility to get more land for cultivation by households in study villages through various means includes application to the village government, buying or rent.

Findings from the analysis of variance (ANOVA) in Table 7 shows that there was a significant variation ( $p<0.05$ ) of means to acquire land for cultivation by households in study villages.

**Table 7: One-Way ANOVA for means to acquire land for cultivation by households in study villages**

Source of variations	Sum of Squares	Df	Mean Square	F	Sig. Level
Between villages	1.067	1	1.067	2.994	< 0.05
Within villages (error)	20.667	58	.356		
<b>Total</b>	<b>21.733</b>	<b>59</b>			

\*Statistically significant at 0.05 level of significance

Furthermore, information obtained from MAGINGO and MCHIMALU WMAs offices and DLOs shows that, study villages bordering Selous and Lukwika-Lumesule GRs have land use plans made by Tanzania Land Use Plan Commission (TLUPC) in collaboration with Ministry of Land, Housing and Settlement (MLHS); and Liwale and Namyumbu

District Councils (LDC and NDC) in 2008 and 2010 respectively. The planning process was funded by WWF however excluded SGR and LGR which in one way or another is among of the cause of border conflict between adjacent villages and PAs. It was explored that, study villages land use plans maps don't have "buffer zones" as suggested by Wildlife Conservation Act No. 12 of 1974 and its successor No.5 of 2009.

Therefore, this shows that, all professionals were only listening to villagers without considering other laws and policies like Wildlife, Environmental, Forest and others. For instance, during 2015 boundary conflict resolution between MAGINGO WMA and SGR done by the committee made by then Minister of MNRT which involved professionals from TLUPC, LDC, MLHS, MNRT and SGR also Village elders of nine villages forming WMA includes Mpigamiti, Ndapata, Barikiwa, Chimbuko, Kikulyungu, Kimambi, Mirui and Naujombo (MWMA and SGR office reports, 2016). At the end of resolution, all villages except Kikulyungu agreed with the Government Notice No. 275 of 1974 which declares the boundaries of SGR. The zoned land area for WMA in Kikulyungu village is no more favourable for wildlife conservation as it was converted to agriculture activities. Summary for land uses of Liwale and Nanyumbu Districts were study villages located area are as follows:

**Table 8: Land uses in Nanyumbu District**

<b>Land use</b>	<b>Area in hectares</b>	<b>Percent</b>
Arable land / Land for Cultivation	340 369 ha	67.1
Grazing Land / Pasture	1 690 ha	0.3
Natural Forest	100 072 ha	19.7
Reserve Forest and Game	64 200 ha	12.7
Agro-forest	519 ha	0.1
Covered with water	300 ha	0.1
<b>Total Land Area</b>	<b>507 150 ha</b>	<b>100</b>

**Source:** NDC Report (2016)

**Table 9: Land uses in Liwale District**

<b>Land use</b>	<b>Area in hectares</b>	<b>Percent</b>
Selous Game Reserves	2 558600 ha	66.7
Angai Forest Reserves	139 420 ha	3.6
Nyera Kipelele Forest Reserves	98 420ha	2.6
Wildlife Management Authority (WMA)	426700 ha	11.1
Arable land, area under cultivation, settlement and grazing land	614860 ha	16.0
<b>Total Land Area</b>	<b>3 838 000 ha</b>	<b>100</b>

**Source:** LDC Report (2016)

#### **4.2.2 Agriculture**

Agriculture is a major economic activity and source of income in Selous-Niassa wildlife corridor. Many villagers in Liwale and Nanyumbu Districts practice shifting cultivation associated with destroying Miombo forests which are also habitat for wild animals thereafter causing human-wildlife or wildlife-crops interactions/conflicts. Specifically, this behavior depends on population of the Districts; for instance 2012 census show Liwale District to have a population of 91 380 people with average of one person per 6.7 hectares suitable for agriculture and outside protected areas; while Nanyumbu District have 150 857 people with average of one person per 2.3 hectares. This shows that, Nanyumbu District will extend to protected land for agriculture activities if shifting cultivation is not reversed.

**Table 10: Food and cash crops areas**

<b>Information:</b>	<b>Area (in hectares)</b>	
(a)Food crops:	Liwale District	Nanyumbu District
Cassava	12 809	27 558
Maize	14 464	16 450
Rice	5 998	2 154
Sorghum	11 741	10 280
<b>Total</b>	<b>33 492</b>	<b>56 442</b>
(b)Cash crops:		
Cashew nuts	13943	105 820
Sesame	6 800	5 400
Cowpea	1 400	3500
Pigeon	1 220	14 000
Gram	4 340	9 811
Groundnuts	870	15 120
<b>Total</b>	<b>28 573</b>	<b>153 651</b>

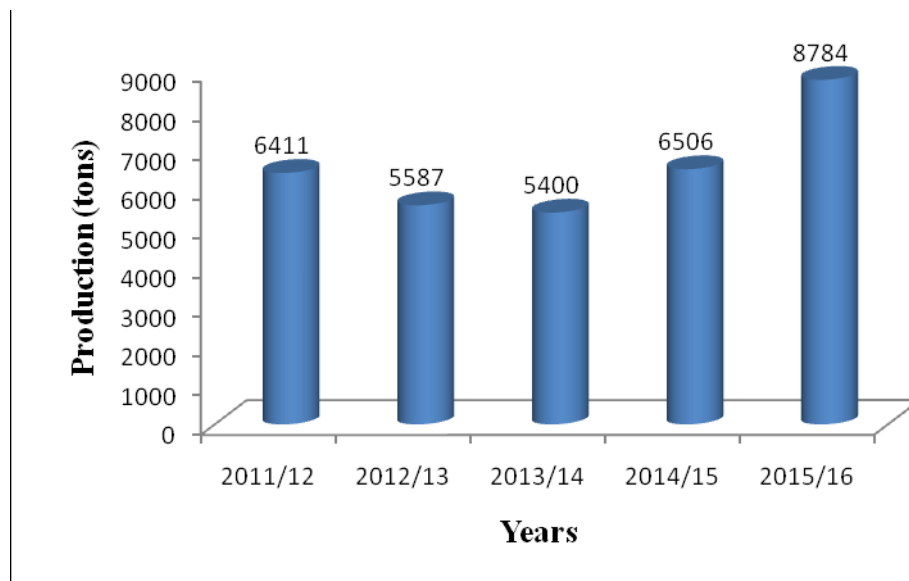
**Source:** LDC and NDC Reports, 2016

Liwale District uses only 62 065 ha (10.1%) of its arable land suitable for agriculture, settlement and grazing; and Nanyumbu District uses 210 093 ha (61.7%) (Table 8, 9 and 10).

Cultivated crops in the study area can be categorized into three main groups namely annual, semi perennial and perennial crops. Major annual cultivated crops include maize (*Zea mays*); rice (*Oryza sativa*) and sorghum (*Sorghum vulgare*). Semi perennial cultivated plant species are cassava (*Manihot esculenta*), sugar cane (*Saccharum officinarum*), simsim (*Sesamum sp*), and banana (*Musa esente*, *Musa cavendishii*, and *Musa sp*). Perennial cultivated plant species are cashewnut (*Anacardium occidentale*) and coconut (*Cocos nucifera*). Other minor cultivated plant species are groundnuts (*Arachis hypogea*), melon (*Cucurbita mero*) and Pigeon beans (*Cajanus cajan*). Fruits plant species cultivated in study area include mango (*Mangifera indica*), orange (*Citrus sp*) and pawpaw (*Carica papaya*). However, perennial and semi perennial crops are grown on small scale

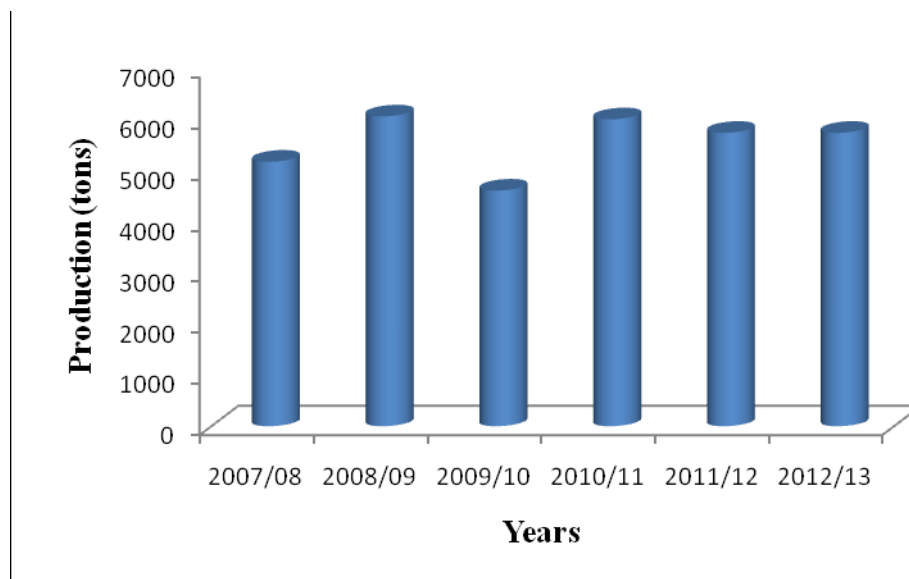


level but all crops are grown for subsistence and trade, but cashew nuts remains the principal cash crop and sesame emerged as short term cash crop involve highly forests destructions. Production trend varies in different years depending on input and equipments supplied. The following figures (Figures3 and 4) show some of the existing production for Liwale and Nanyumbu Districts in years:



**Figure 3: Liwale cashewnut production (Tons) for the years 2011/12 up to 2015/16**

Source: LDC report, 2016



**Figure 4: Nanyumbu cashewnut production (Tons) for the years 2007/08 up to 2012/13**

Source: NDC report, 2016

During in-depth interview with Districts agriculture officers, it was seen that the production trend are not actual due to the presence of illegal buyers (Chomachoma) where quantity bought are unknown and increase loss of Districts income. Therefore, out of other factors, production variation in years depends on strength of District security on exit routes of that particular year.

The emergence of highly production of simsim (*Sesamum* sp) seems to overtake cashewnut and becomes the leading source of Districts revenues and households' income. For instance, simsim production in Liwale District for the year 2015/16 was 7 925 157 kg compared to 7 483 874 kg of cashewnut amounted TZS15 850 314 000 and TZS 8 980 648 800 respectively. This shows that, simsim production in terms of revenues accrued almost double cashewnut production. However, most of cashewnut are at least fifty years of age and are owned through inheritance, thus accelerates conservation efforts compared to simsim production which is environmental destructive but short time income rewarding activity. There is no actual figure for the land size used for simsim production as most of producers invade and clear public Miombo forests for establishment of farms. This statement evidenced by a large number of "Makonde" from Newala, Tandahimba and Mahuta claimed during focus group discussions to invade the corridor.

Also, these food and cash crops attract wild animals which are the source of conflict of interests between conservation and agriculture. The study villages show that 88.6% of respondents suffered from wildlife related problems while only 11.4% had not experienced the problem (Table 11).

**Table 11: Problem animals destroying crops and human life**

Information:	Villages		
	Mpigamiti n=30	Mpombe n=30	Overall N=60
(a) Availability of problem animals:			
Yes	26(86.7) <sup>1</sup>	26(86.7)	52(86.7)
No	4(13.3)	4(13.3)	8(13.3)
(b) Common problem animals:			
Elephant ( <i>Loxodonta africana</i> )	26(86.7)	4(13.3)	30(50.0)
Bushpig ( <i>Potamochoerus porcus</i> )	20(66.7)	11(36.7)	31(51.7)
Vervet monkeys ( <i>Chlorocebus aethiops</i> )	9(30.0)	24(80.0)	33(55.0)
Hippos ( <i>Hippopotamus amphibius</i> )	6(20.0)	3(10.0)	9(30.0)
Olive baboon ( <i>Papio anubis anubis</i> )	16(53.3)	12(40.0)	28(46.7)

For (b) Multiple responses answers were obtained

<sup>1</sup> Figures outside and inside the parentheses are frequencies and percentages respectively.

The study found the animals that damage crops in the field include elephants (50%), bushpigs (51.7%), velvet monkeys (55%), hippos (30%) and olive baboon (46.7%) (Table 9). Elephants seem to damage mostly in Mpigamiti village (86.7%) compared to Mpombe where vervet monkey take chances (80%). This indicates that elephant poaching is at alarming rate in Mpombe village compared to Mpigamiti village within the Selous-Niassa wildlife corridor.

Furthermore, rats were reported by many respondents that they cause great damage on stored cereal crops at home compared to fields' crops. During field observation and focus group discussions it was found that, damage to crops varied from one village to another and from one plot to another within the study area. The most preferred crops by animals were maize, cassava, sugarcane, melon and cashew nuts.

During focus group discussions, community categorized the wild animals that damage crops into three main groups:

- (a) All wild animals' species which damage crops during the day. These include Vervet monkey (*Cercopithecus aethiops arenarius*), Rufiji blue monkey (*Cercopithecus mitis monoides*) and yellow baboon (*Papio cynocephalus*).
- (b) All wild animals' species which damage crops at night. These include African elephant (*Loxodonta africana*), bushpig (*Potamochoerus porcus*), buffalo (*Cyncerus caffer*) and hippopotamus (*Hippopotamus amphibius*).
- (c) All animals' species that cause minor damage of crops at night. These include warthog (*Phacochoerus aethiopicus*), eland (*Taurotragus oryx*), greater kudu (*Strepsiceros strepsiceros*), bushbuck (*Tragelaphus scriptus*), impala (*Aepyceros melampus*), black backed jackal (*Canis mesomelas*), Reed buck (*Redunca redunca*), porcupine (*Hyrix africae astralis*) and cane rat (*Thyromomys swinderianus*).

Elephants, bushpigs and baboons are animals that cause greater damage to maize farm plots both in wet and dry season. Baboons start to destroy maize seedling immediately after germination. They jab germinated maize seedlings and continue to damage crops in the growing season until they are harvested. Elephant start to feed on maize seedlings between 3 - 4 weeks after germination and continue to damage the crops until they are harvested. The relative ranking of damage caused by elephant varies in the study area. Elephants were found to enter crops most in both wet and dry season depending on the location of the field from the feeding or migratory routes to or from core protected areas. Bushpigs were reported to use stems of maize and sorghum at early stage.

The measures taken by farmers to control include non lethal deterrents applied by farmers include oil chilled ropes and chilled elephant dung blocks. The farmers who applied oil chilled ropes and chilled dungs around their farm plots in the study area had less crops loss or raided by animals especially elephants. These measures experienced in Mpigamiti village were peasants who applied the deterrents of elephants in their farm plots yielded much and had large farms plots compared to those who do not apply (See plates 1-4). Therefore, as suggested by Kagaruki (2004) crop production in the study villages would be increased if more efforts toward preventing crop damage will be focused on the control of weeds, crop diseases, and smaller species such as bush pigs, baboons, rodents or birds because elephants in many areas within the corridor are deteriorating.



**Plate 1: Oil chilled ropes around farm Plot.**



**Plate 2: Chill-elephant dung bricks**



**Plate 3: Harvested chilies used in HEC/HWC**



**Plate 4: Cultivation of non - palatable crops (Sesame, Sunflower e.t.c)**

However, wildlife not only represent problems for people living around them but there is also an overall great deal of respect, affection and positive culture associate with the populations of wild animals. Wild animals are part of people's lives, their identity and attachment to the land. There might be a considerable faith in the manager's capability to alleviate problems around communities while protecting natural resources. Nevertheless, major threat hinder sustainable conservation of wildlife is a limited range of opportunities and alternatives in a situation characterized by wide spread poverty and increased population pressure within the wildlife corridors. Therefore, the need to facilitate community mobilization seems to be the pre-requisite for sustainable wildlife management (Pinter-Wollman, 2012).

Population growth of people and ghastry land uses in study villages brings pressure on resources available as results of habitat destruction and environmental degradation. During field observation, it was seen that, many farms are within the wildlife corridor and out of planned areas which implies that, people are not only interested with growing crops only but their eyes are on wild animals.

The existence of conflicts within the corridor is based on the differing term-utilization attached to the available resources. The objectives behind the conservation scheme is to conserve natural resources for long-term benefits, while the concern of the inhabitants of the corridor is the need to have a means of livelihood for survival. The different functional interpretations given to the corridor have generated the varying degrees of conflicts experienced.

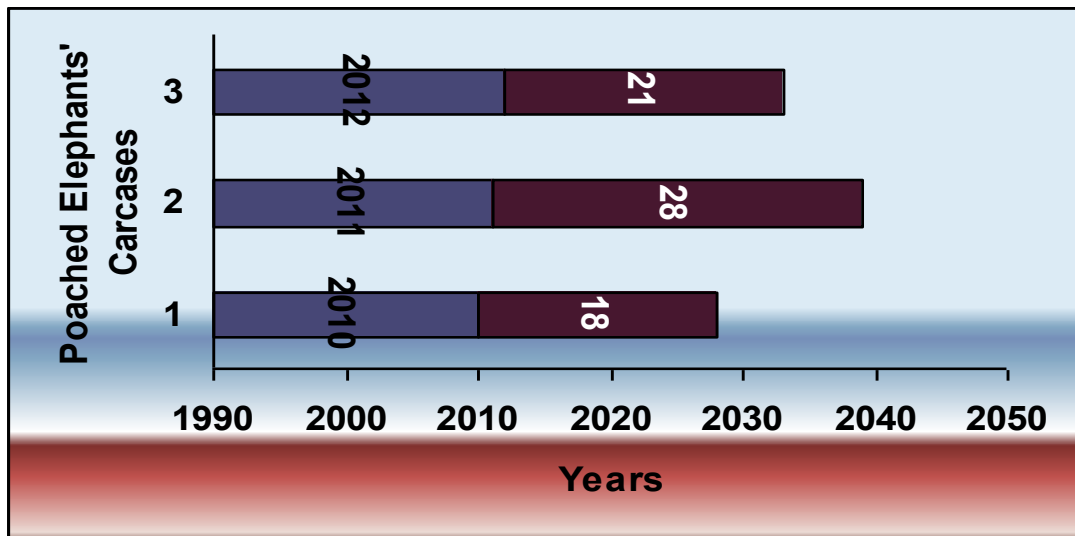
#### **4.2.3 Poaching and law enforcement in the study area**

Hunting of wildlife has already resulted in reduced populations of several resident herbivore species (Campbell and Hofer, 1995; Campbell and Loibooki, 2000; Ngowe,

2004; TRAFFIC, 2012, TAWIRI, 2013; and WWF, 2016). Table 12 shows number of arrested poachers and exhibits from 2009 up to 2015 and actions taken. The results shows that, out 67 poachers arrested from 2009 to 2014 only 10 poachers were taken to court of law while 54 poachers compounded and paid a sum of TZS 3 230 000.

Moreover, poaching remains a chronic problem in wildlife corridors conservation and protected areas. In Selous-Niassa wildlife corridor and within core protected areas, the poachers mainly use guns for killing elephants whose price of the tusks rise everyday in black market due to the need of the trophies in Asian markets. Elephants trophy poaching in the study area was rampant in the year 2011-2013 after rise of black market where one kilogram of elephant tusk in Liwale and Nanyumbu Districts sold up to TZS 300 000. This is evidenced by having a total of 67 poached elephants' carcasses in SGR-Southeastern sector, MWMA and Liwale open area in the year 2010 to 2012 (Figure 5).

Additionally, evidence comes from seizing a lot of elephant ivory tones in Asia especially China and Vietnam and claimed coming from Tanzania (Interpol reports, 2014). Killing of other species include hartebeest, buffalo, eland, impala and others mostly using wire snares are for subsistence and selling almost within the Districts. Poached elephants ivory are transported mainly using blind ports along shores of Indian Ocean in Lindi and Mtwara regions. Recent data available shows that until September 2014 there are 16 blind ports for smuggling elephant tusks which transported to Zanzibar and Dar es Salaam ready for overseas transportation (Interpol reports, 2014).



**Figure 5: Poached elephants' carcasses from 2010 – 2012**

**Source:** SGR – South Eastern Sector office (2016)



**Table 12: Poachers arrested within Selous-Niassa wildlife corridor in Liwale District from 2008 to 2013**

	2008	2009	2010	2011	2012	2013	Total
Number of Poachers arrested	14	7	5	10	16	15	<b>67</b>
Number of poachers taken to court of law	1	-	1	3	3	2	<b>10</b>
Number of cases in court of law	1	-	-	2	3	1	<b>7</b>
Number of cases convicted in court of law	-	-	-	1 null proscue	1 jailed 30 years,	1 jailed 10 years	<b>3</b>
Number of cases continues in court of law	-	-	-	2	2	1	<b>5</b>
Number of poachers fined	13	7	4	7	13	10	<b>54</b>
Total fines collected	630 000	660 000	220000	520000	500 000	700 000	<b>3 230 000</b>
Guns and other exhibits	.375, dikdik meat	Buffalo meat	Hartebeest meat	6 elephants tusks, 2 hippo tusks, dikdik meat	25 elephants tusks, dikdik meat, 1700 timbers	.375, 517 timbers, insya meat	2 guns, 31 elephant tusks, 2 hippo tusks, 2217 timbers, Dikdik, Buffalo, Hartebeest and Insya meat.

**Source:** SGR south eastern sector office (2016)

**Table 13: Poachers arrested within Selous-Niassa wildlife corridor in Nachingwea and Nanyumbu Districts from 2010 to 2015**

	2010	2011	2012	2013	2014	2015	Total
Number of Poachers arrested	58	11	14	32	59	23	<b>197</b>
Number of poachers taken to court of law	47	10	14	27	51	13	<b>162</b>
Number of cases in court of law	31	5	11	10	24	9	<b>90</b>
Number of cases convicted in court of law	31	5	11	2	3	-	<b>52</b>
Number of cases continues in court of law	-	-	-	8	21	9	<b>38</b>
Number of poachers fined	11	1	-	19	3	9	<b>43</b>
Total fines collected	200000/=	180000/=	-	2 390 000/=	800 000/=	2 000 000/=	<b>5570 000/=</b>
Guns and other exhibits	487 elephant tusks, 03 bicycle, .375 + 10 bullets, .458(04) + 72 bullets, .404 + 04 bullets, 02 shotgun, .375 bullets (06) + 01 magazine, elephant killing poison, 1953 timbers, 01 SMG + 02 magazine + 45 bullets, 30 axes, 33 knives, 368 snares, 02 warthog tusks, 12 arrows, 02 bow, 02 elephants trumps, .303(03) + 51 bullets, 01 hyena skin, 01 litre of python oil, 15 elephant tail, 31 spade, 01 sable horn, 09 motorbike, elephant meat, hippo meat, duiker meat, insya meat, dikdik meat, warthog meat, fishes, buffalo meat, kudu meat, insya skin (02), leopard skin (16), lion skin (01), cheater skin (01), warthog skin (01), serval cat skin (04), baboon skin (01), wildcat skin (03), 05 saws, 01 lorry, 02 tractors, 14 “gunia”, 05 chainsaw, 36 buckets, and 16 pick axes.						

**Source:** LLM GR office (2016)

Despite being included in the environmental crimes, poaching and other illegal harvesting of wild resources are on increase. For instance in Nachingwea and Nanyumbu Districts 487 elephants tusks arrested between 2010 to 2015 equivalent to 244 elephants killed within Selous – Niassa wildlife corridor amounted to \$366 000 (TZS 732 000 000) (Table 11). Comparing ratio of staffs and anti-poaching equipment to the area and status of conservation regime implies that more than 80% of illegal trophies exported from the corridor (personal observation). In discussion with the focus groups, the reported reasons for poaching mostly were traditional of local people being preferring wildlife meat to that of livestock due to historical aspects of animated hunters and gatherers. The local people conduct wildlife hunting using traditional weapons includes snares, arrows, tradition poisons, local guns (gobore) etc. evidenced by arrested 368 snares. The wire snares reduce the risk of poachers being arrested by wildlife authorities since a normal hunting involves a lot of chasing for the wounded animals. It is only a romantic myth that bush meat originated from small-scale consumptive poaching which is less destructive than commercial trophy poaching.

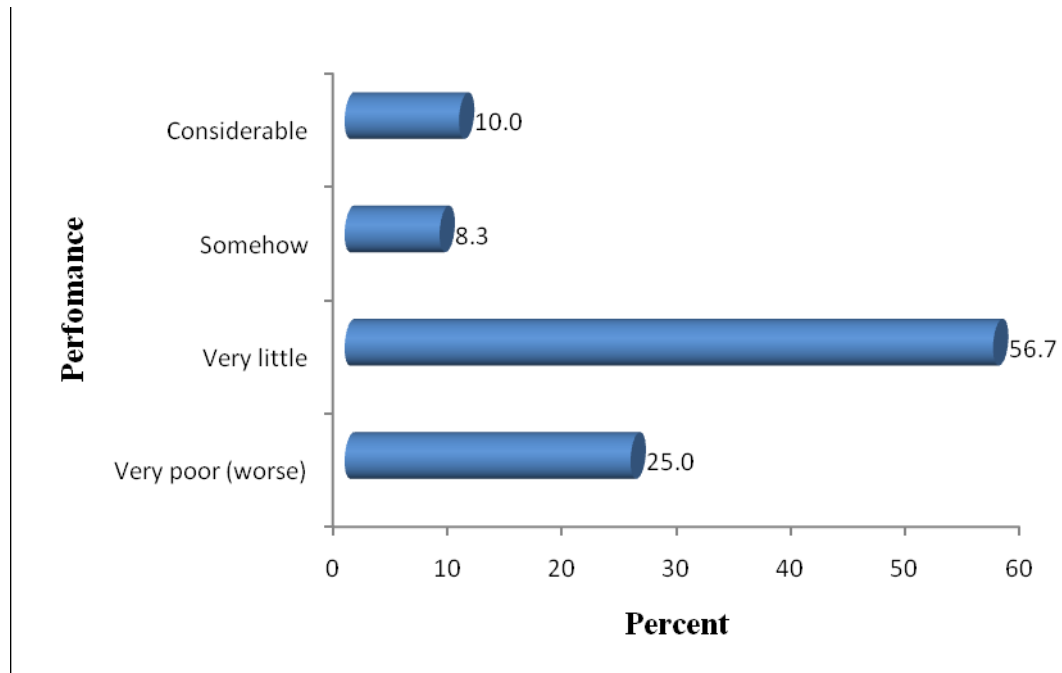
Even though, villagers are involved in the management of wildlife, illegal hunting is still observed in the WMAs which covers 4 267 square kilometres and 234 square kilometres for MAGINGO and MCHIMALU in Liwale and Nanyumbu Districts respectively. The reason behind is that the villages governments and WMAs have low capacity to invest in anti-poaching activities regarding the huge area. For instance, patrol budget for MAGINGO WMA was TZS59M and 60 M for 2013/14 and 2014/15, respectively. Meanwhile, the income from their hunting quota and share from the department of Wildlife was TZS 50 Million and 63 Million for 2013/14 and 2014/15, respectively.

However, anti-poaching operations conducted by Taskforce (National and Trans – National High Crimes Intelligence Unit - NTHCIU) managed to withdraw 147 guns and at least 600ammunitions used in illegal killing of wild animals from Liwale District in September 2012. Nonetheless, poaching still continues as evidenced by seizing of 61 pieces of elephants tusks equivalent to 34 complete tusks accounted to 17 live elephants killed in October 2012. Anti-poaching activities are priotised to SGR, LLM, District authorities and WMAs. For example each game scout/warden/officer is supposed to patrol at least 20 days per month in order to make sure everywhere inside core protected areas and within the corridor are reached. Due to this it is easy to succeed in all identified management strategies of natural resources.

The number of poachers arrested in the study area has been decreasing with time. But this does not mean that poaching is also decreasing, due to the fact that those cases available are for poachers' arrested outside core protected areas (within SNWC) whereby inside core PAs there is a big war between poachers and game scouts. For instance until November 2013 there were eleven (11) different poaching cases in Liwale District court and ten (10) of them have given decision whereby majority were sentenced to jailed for 20 years or 5 years (SGR – South eastern sector office, 2016). Personal observation and experience in the area show these cases results in court do not bring security to available wildlife resources for future generation. Thus, more actions are needed to make sure every individual have a sense of ownership to these resources and foregone any other factors contributing to encroachment of the available resources.

Conversely, the study population found to have low trust on the management of LLM and SGR. Results (Figure 6) show that 56.7% of study population rank very little, 25% rank very poor, 10% rank considerable and the remaining percentage rank somehow. This

shows that LLM and SGR management should uplift its management strategies for the future generation.



**Figure 6: LLM and SGR Performance on Protection of Wildlife Resources**

**Source:** Research findings, 2016

#### **4.2.4 Encroachment for fuelwood, logging and mining**

Encroachment for fuelwood, logging and mining is increasing daily in the study area as alternative source of income for their livelihoods. During direct field observation and focus groups discussions in study area, mining tunnels observed and most of mining practiced within rivers (Liwale, Lumesule, Mbwemkuru, Lukwika and Ruvuma rivers) inside wildlife and forest protected areas found in SNMWC. Focus groups discussants claimed that, minerals found in the study area are such as white sapphire, green sapphire, blue sapphire, green tourmaline and gold. This is evidenced by arrested of 14 “gunia”, 36 buckets and 16 pick axes (Table 12) which are used for mining purposes. During in-depth interview with DGOs and passing through District revenues collections records for five years 2010 to 2015, the quantity of mines and revenues accrued by Districts authorities are still a myth.

Illegal logging increased in study area especially in forest reserves, WMAs, and SGR, LLM GRs as these are the only areas in Liwale, Nachingwea and Nanyumbu districts concentrated with valuable trees for logging and timbering. For year 2010 to 2015, LLM arrested 1953 timbers from SNWC in Nachingwea and Nanyumbu Districts while SGR arrested 2217 in Liwale District (Table 12 and 13). Encroachments of forests for valuable trees increased due to emerged application of chainsaws in illegal and legal harvesting contrary to Forest Act of 2002. For instance, the year 2014, twenty six (26) people and more than 4000 timbers which were illegally harvested were arrested inside MAGINGO WMA, Nyera/Kipele forest reserve and open areas by Tanzania forest service (TFS) in collaboration with SGR. The growing number of people, farms and wildlife in the study area are leading to increased conflict between the needs of conservation and development as explained much by World Bank (2008), Nelson (2009 and 2010) and Wilfred (2010).

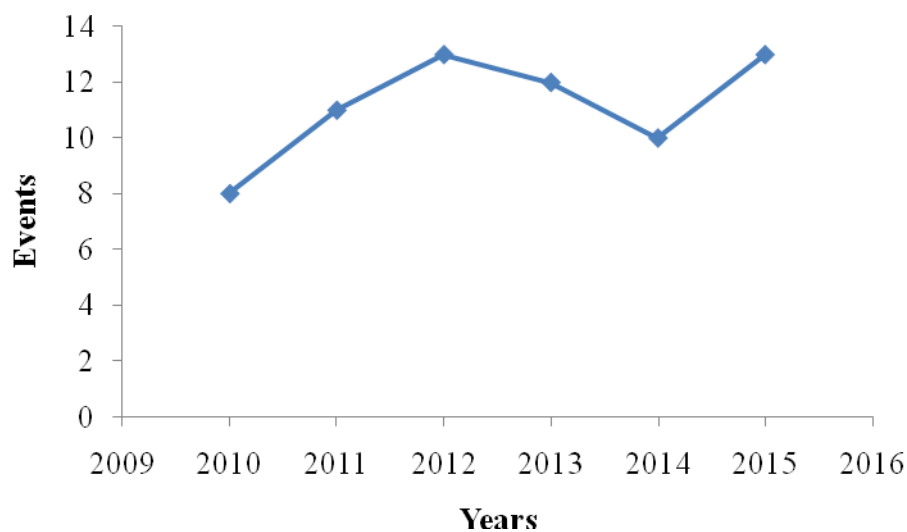
Tree planting help to reduce shortage of fuelwood and logging which are important for households' consumption. The study villages found to have high concentration of people who do not adopt trees planting strategy contrary to the national agenda (DGO, 2016). Most households in study villages depend on natural regeneration of trees to tackle fuelwood shortage and few infrequent practiced private tree planting, agro-forest and communal tree planting (personal observation). This scenario implies more encroachment in study area.

#### **4.2.5 Wildfires**

Control of wildfires is one among the strategies for conservation of biodiversity and other wildlife. During focus group discussion in study villages, it was found to have very few people adopt strategies/practices to control loss of wildlife resources. The area is the migratory route for migrating elephants and other animals. Wildfires occur frequently in

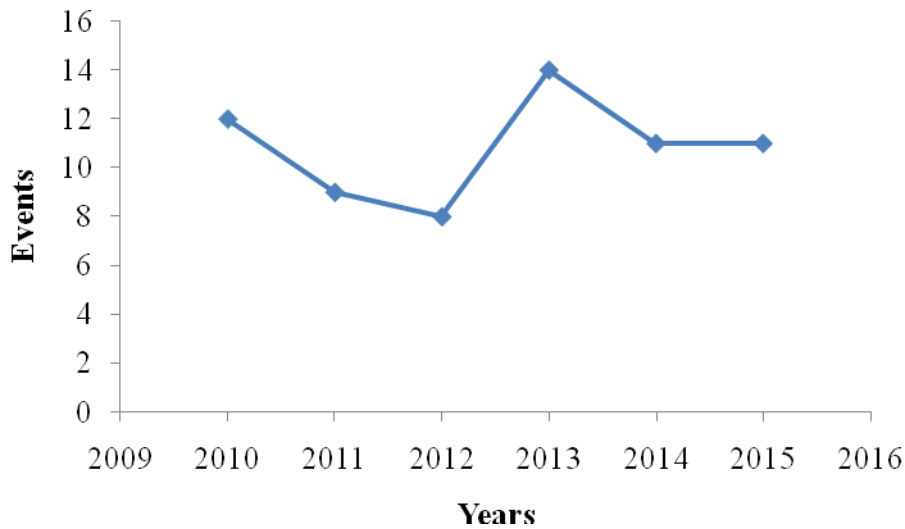
the area. The major causes of these fires are honey mongering, charcoal production, clearance for cultivation and local beliefs. Wildfires have overwhelming effects on the biodiversity and ecology of the SNWC ecosystem thereof calls for efficiency and effective management especially when occurred at the wrong season.

In Nanyumbu and Liwale districts more than eight wildfires reported each year in different villages within SNWC. Figure 7 and 8 shows reported incidences of wildfires from 2010-2015. The extent of damage to SNWC is immeasurable but core PAs of Selous GR, Msanjesi GR, Lukwika-Lumsule GR, and some of forest reserves have natural firebreaks which are rivers(Matandu, Liwale, Mbwemkulu, Lumesule, Lukwika, Ruvuma etc) and man-made breaks includes roads. Availability of by-laws for preventing wildfires were aware to many villagers but traditional ways of starting the fire is unavoidable as mostly done at night hours.



**Figure 7: Incidence of Wildfires from the Year 2010 to 2015**

**Source:** LDC office (2016)



**Figure 8: Incidence of Wildfires from the Year 2010 to 2015**

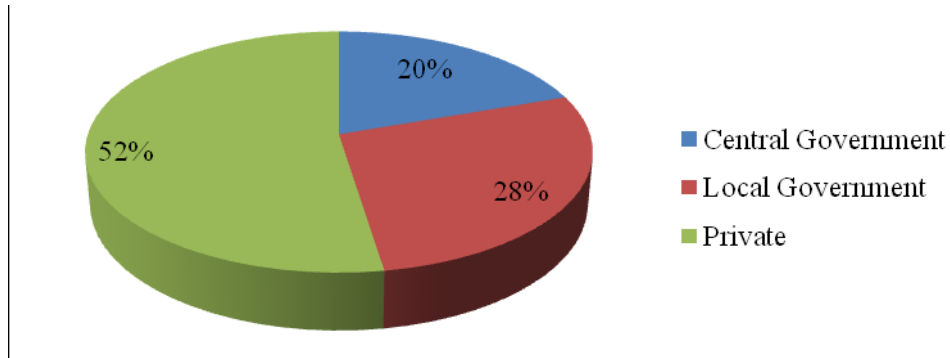
**Source:** NDC office (2016)

### **4.3 Factors Influencing People to Encroach Protected Areas**

#### **4.3.1 Poverty**

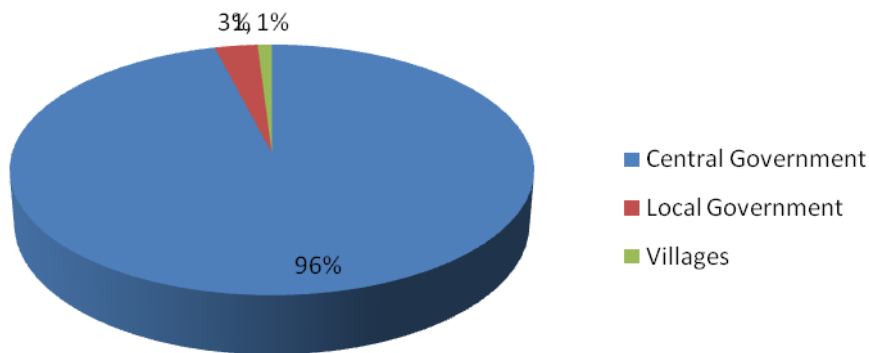
Eastern Selous-Niassa wildlife corridor in Lindi and Mtwara regions endowed with abundant natural resources in terms of forestry and wildlife. The Liwale and Nanyumbu Districts have about 639782 hectares and 164 772 hectares of natural forests respectively, which serves as habitat for wild animals. These forests are mainly Miombo woodland consisting of species such as *Pterocypas anglensis*, *Afzelia quanzenis*, *Dalbegia melanoxylone*, *Euphorbia candelabrum*, and *Brachstegia speciformis*. The distribution of forests ownership is shown in Figure 9 and 10. Timber, charcoal, poles, and fire- wood are the chief products extracted for commercial and local consumptions. The products are harvested from Open Village Lands though some of them; especially timber is illegally obtained from the Reserves. No legal harvesting takes place in the reserves at this time. Other products from the Reserves and Open Village Lands are roots for traditional treatments, withes, fruits, grass and mushroom.





**Figure 9: Liwale District forest by ownership**

**Source:** LDC office, 2016



**Figure 10: Nanyumbu District forest by ownership**

**Source:** NDC office, 2016

Therefore cutting down trees for lumbering is a huge activity for businessmen from outside the District but are using village members and leaders to allow engaging in illegal timber harvesting and thereof destroying wildlife habitats. The prime income of the villagers is farming for both food and commerce as explained much in part 4.2.2 and 4.1 and the average income per month of the residents of study villages is almost TZS 48 000.

During focus group discussions in both study villages reported outsiders to be engaging in lumbering and timber business. However, locals and leaders show the outsiders the areas with valuable wood trees mainly “Mninga” and “Mkongo” scientifically known as *Pterocarpus angolensis* and *Pseudolachnostylis maprouneifolia*, respectively. In both Mpigamiti and Mpombe villages lumbering or timber harvesting was not allowed for years (2012 to 2016). Yet illegal harvesting experienced in the areas as evidenced by confiscation of 581 timbers in Mpigamiti village in the year 2014 by Selous GR staffs in collaboration with Village game scouts and District forest officer. Also, confiscated of 500 timbers by PCCB (Prevention and Combating Corruption Bureau) in collaboration with Selous GR staffs in the year 2014 within Selous-Niassa wildlife corridor.



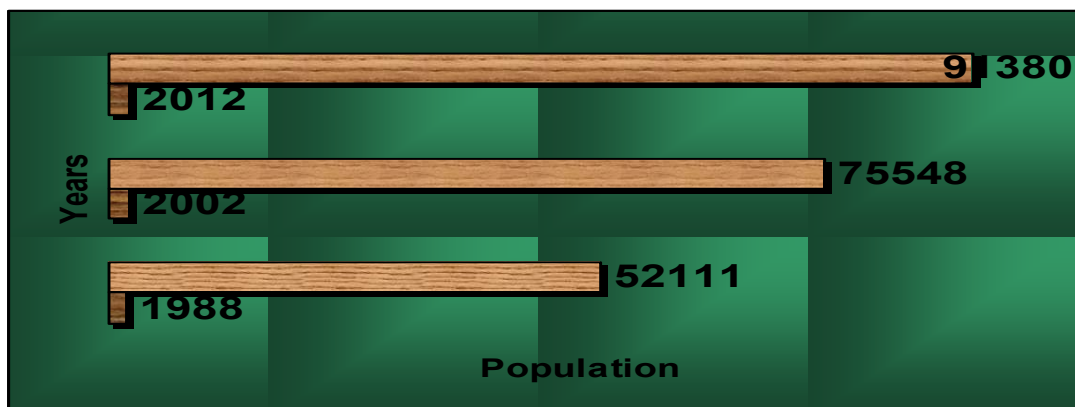
**Plate 5: Illegal timber harvesting within Msanjese GRIs one of the main drivers of habitat destruction in SNWC**

**Source:** LLM office (2016)

#### **4.3.2 Demographic factors**

According to 2012 National population census, Liwale had a population of 91380 people and Nanyumbu 150 857 people. Population density is 02 people and 30 people per square

kilometer in Liwale and Nanyumbu districts respectively. The sustainability of SNWC and its associated PAs must go perpendicular with human population density whereby the intercensal (1988 -2012) shown in Figure 7 found Liwale District to had the annual growth rate of 2.8%, compared to the total Tanzania growth rate of 2.9%. While in Nanyumbu District the situation is worse due to her population density and residents dependence on natural resources for their livelihoods since her establishment in 2005. The population growth rate increases in study area due to immigrations of pastoralists and other land users seeking livelihood opportunities such as mining, business, agriculture and timber makers. Thus, like other areas within and adjacent to PAs, Liwale and Nanyumbu are confronted with various resource use conflicts, which are partly due to high population density (IRA, 2007). However, the unreserved land of Liwale and Nanyumbu Districts which are 6 148.6 km<sup>2</sup> and 1 667.81km<sup>2</sup> found to have population density (population/km<sup>2</sup>) of 14.9 and 90.5 respectively.



**Figure 11: Population growth in Liwale District**

**Source:** Census 1988, 2002 and 2012

#### 4.3.3 Inadequate conservation status of some critical habitats

About 83.9% of Liwale District land (32231.4 km<sup>2</sup>) and 67.1% of Nanyumbu District land (3403.7 km<sup>2</sup>) has been included into protected areas network of Selous-Niassa wildlife

corridor ecosystem. However, some areas, which are critically important for survival of wildlife population and are within the PAs network of SNWC like wetlands, riverine forests, dispersal areas etc, have long remained unprotected or partially protected. Recently, there have been some efforts to accord adequate conservation status to these areas made by WWF to recognize the area and plan for management strategies suitable for adoption. Also, forest reserves like Angai and Nyera/Kipelele which are within the SNWC ecosystem have a good living habitat for wildlife and have abundant number of wildlife but living at risk because there is no any protection in the area whereas timber harvesting and poaching is evidenced (Personal observation, 2016).

The critical habitats found in study villages are Miombo woodlands. These woodlands are at risk due to increase in lumbering and loggings especially inside WMA for Mpigamiti village. In Mpombe village, lumbering is practiced in area proposed for WMA. This happens because of little security to the area resulted from understaffed, underfunded and unequipped of WMAs and respective Districts councils as whole disdain protection of natural resources.

#### **4.3.4 Failure to compete effectively with alternative land uses**

Unreserved land of study area can be used for productions that are economic rewarding and environmental friendly to offset reserved areas for conservation of wildlife and forest resources. The study villages found to have alternative livelihood strategies to be adopted in unreserved land area. Among the strategies is conservation agriculture which is the new concept to villagers and seemed practiced in Mpigamiti village. If this strategy accepted as the Districts agenda towards protection of biodiversity and land degradation will answer the problem of deforestation and wildlife destruction. Additionally, Mpigamiti village in collaboration with WWF and SGR have constructed three fish dams/ponds for fish

farming. Every villager interested in fish farming should construct their own dams and take fish seedlings to those three dams following the established procedures. These farming supplement proteins hence reduce pressure on bush meat (Plate 6 and 7).



**Plate 6: Fish dam in Mpigamiti  
village**



**Plate 7: Fishes found in the dam**

As Emerton (2001, cited by Kideghesho, 2006) observes, “if there is no domestic economic gain associated with wildlife, then there will be insufficient arguments – as well as insufficient local incentives – either for conserving it or for communities becoming involved in conservation activities”. The choice made by villagers living adjacent to forest reserves and wildlife management area within SNWC shows that, people continue encroaching into these areas for wildlife and forest resources specifically bushmeat and timber harvesting because they get the tangible benefits. For example in Mpigamiti village is a good conservator of elephants for applying non-lethal deterrents to their farms but the SGR game scouts arrests 509 timbers harvested in WMA land between July to October, 2015 (SGR-South eastern sector office reports, 2016). Owing to inadequate staffs in forest sector in Districts councils to support conservation of forests for instance there are four forest staffs with insufficient field gears serve for Liwale District council. Additionally,

there is weak law enforcement in WMAs, open areas and core protected areas (Game reserves) because of insufficient staff, field gears and limited fund.

Moreover, many people invade in WMAs land and engage themselves in rice farming nearby the source and along rivers; for instance Liwale River which is the only source of water in the Liwale District (VEO office report, 2016). This implies that, benefits accrued from conservation of wildlife habitat and environment as whole is not tangible to individuals a results force them to engage in activities that are environmental destructive but economic rewarding for short term without considering long term impacts which is more detrimental to their livelihoods.

#### **4.3.5 Socio-economic factors influencing people encroaching SNWC**

In this study, socio-economic factors influencing people encroaching of SNWC were strived to reveal their significance statistically. Towards revealing the statistically significance of socio-economic factors influencing encroachment of SNWC, a multiple regression model was employed. The socio-economic factors revealed in the study area were entered sequentially in the multiple regression model, checked and the insignificant factors were removed from the prediction model. The explanatory variables that were accommodated in multiple linear regression model were; age, sex, education level, household size, household income, years lived in a village and land size owned by a household. The model was purposely employed to assess the significant socio-economic factors influencing encroachment of natural resources in the study area.

##### **4.3.5.1 Results of the multiple regression model**

The multiple regression model was used to determine the effects of explanatory variables on encroachment of natural resources in the study area. The model summary in Table 14 shows that the independent variables fit well in the regression model in that R square was

0.537. This means that the fit explains 53.7% of the total socio-economic factors influencing people encroaching wildlife corridor were explained by the tested factors. The R and adjusted R square of 0.773 and 0.475 respectively show that there is correlation between encroachment and explanatory variables.

**Table 14: Model summary for socio-economic factors influencing encroachment of SNWC**

<b>Model</b>	<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>SE</b>
	0.773	0.537	0.475	0.226

The model revealed ANOVA results as follows, with F value of 8.621 estimated at 7 and 52 degrees of freedom and a standard error of 0.226, gave a p value of 0.000 (Table 15). This implies that at a significance level of 5% the explanatory variables are statistically significant in explaining the involvement in encroachment of wildlife corridor.

**Table 15: ANOVA for socio-economic factors influencing encroachment of SNWC**

<b>Model</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Regression	3.080	7	.440	8.621	.000
Residual	2.654	52	.051		
<b>Total</b>	<b>5.733</b>	<b>59</b>			

Table 16 summarizes the socio-economic factors influencing encroachment of SNWC. The result shows that, some explanatory variables influence encroachment of SNWC significantly. Of the seven independent variables used in the model only three variables are significant at 5% significance level ( $\alpha$ ).

**Table 16: Multiple regression results for socio-economic factors influencing encroachment of SNWC**

Model	B	Std. Error	Beta	t	Sig
(Constant)	.827	.254		3.251	.002
Age	-.010	.028	-.038	-.359	.721NS
Sex	.153	.068	.247	2.250	.029*
Education level	-.026	.031	-.095	-.863	.392NS
Household size	.061	.043	.140	1.409	.165NS
Household income	.000	.021	.002	.017	.986NS
Years lived in a village	.161	.059	.275	2.719	.009*
Size of land owned	.484	.070	.706	6.894	.000*

\* = Statistically significant at  $\alpha = 0.05$ ; NS = statistically not significant at  $\alpha = 0.05$

#### 4.3.5.1.1 Sex

The results in Table 16 suggest that sex of household head influence encroachment of SNWC positively and significantly ( $b=0.153$ ,  $p<0.05$ ). This implies that males are exponentially engaged with encroachment activities like commercial poaching, logging, mining, charcoal making, extensive crop farming, livestock keeping and others compared to females who concentrates with subsistence farming, fuelwood collection. The results are consistent with Ntongan *et al.* (2007) and Noe (2003).

#### 4.3.5.1.2 Years lived in a village

Respondents' years lived in a study village influence encroachment of SNWC positively and significantly ( $b=0.161$ ,  $p<0.05$ ) (Table 16). This implies that, those respondents' stays longer in a village equipped with indigenous technical knowledge and experience in wildlife migrations seasons, routes used, species involved and different valued Miombo trees species location and concentrations. The situations accelerates sabotage of the



respondents with poachers and businessmen comes outside the District for illegal harvesting of natural resources within SNWC as explained much by Pimbert, and Pretty (1995), Mbwambo (2000), and Pesambili (2003).

#### **4.3.5.1.3 Size of land owned**

Findings also revealed that size of land owned by a household influence encroachment of SNWC positively and significantly ( $b=0.484$ ,  $p<0.05$ ) (Table 16). This implies that as household size increases also size of land owned by a household need to be increased so as to supplement the need of increased members as a result of encroaching SNWC. An explanation behind the observed relationship is that the encroaching land within SNWC for livelihood is violating village land use plan and extended area for food production, building materials, settlement area and other socio-economic activities which hamper biodiversity conservation and ecosystem services of fauna and flora as supported much by Pinter-Wollman (2012).

### **4.4 Effectiveness of Existing Wildlife Management Strategies**

#### **4.4.1 Involvement of local people in SNWC management**

During focus group discussions, it was claimed that PAs management within SNWC do not involve villagers in different management activities of wildlife resources and solving their problems. These show that PAs (Game and Forest reserves) within SNWC has poor communication with adjacent community in study villages. This implies that, Community Based Conservation (CBC) section is not well equipped in making good relationship with its adjacent community. Due to limited fund, LLM and SGR – CBCs sections fail to mobilize information and knowledge usable for communities in time instead of available capacity to do so.

Local community involvement in natural resources management within and adjacent to PAs is vital as it help in extraction of indigenous technical knowledge (ITK) used by local community in conservation of fauna and flora. This evidenced by group discussants that, most of Ngindo tribe living within SNWC has ITK which restrict cutting down some tree species or killing some animal species. For example “Msolo” is the type of hard wood tree used for rituals. The implication of this ITK is protection of those feared fauna and flora as explained much by Pimbert and Pretty (1995).

#### **4.4.2 Equitable sharing by villages of benefits accrued from SNWC**

Liwale District has six (6) hunting blocks (MT1, MH1, MB2, MA1, N2 and U3) within SGR and Liwale open area has two hunting blocks (Liwale north and Liwale south) which have been taken by MAGINGO WMA and thereof resource management zone plan followed effective from 2013. The plan shows three tourist hunting blocks (Nachengo (854.33 km<sup>2</sup>), Hokololo (914.60 km<sup>2</sup>) and Naimba Plain (400.86 km<sup>2</sup>). All hunting blocks within SGR have investors and two blocks within MAGINGO WMA have investors. In Nanyumbu District there is one hunting block in LLM and one block in MCHIMALU proposed WMA and there is no investor in these blocks due to insufficient wildlife richness in these blocks. For instance, Kilombero North hunting company surrendered LLM block to the MNRT in 2014. Meanwhile, income generated from tourist hunting is not enough to show tangible benefits to community. For example 25% obtained by District council in the year 2014/2015 was TZS 23551143.33 and within it 15% was given to MWMA equivalent to TZS 14130686.46. If this income is divided for each village where MWMA has eight (8) member villages, each village will get TZS 1766335.81. The amount is meagre compared with efforts they used to fight for survival of those wild animals.

However, the 2012/2013 hunting season, MAGINGO WMA sold their Quota to Barlete hunting Safaris for TZS 24 100 000 which add to their income. But, the move is beneficiary to conservation because the buyer did not hunt for the said year so allow regeneration of wild animals while discouraging poaching. During interview with the government leaders in Mpigamiti village there were a concern of uncomfortable with the share of money they get from MAGINGO WMA. They asserted that, the money is not enough to offset the cost incurred from conservation of wild animals. The money obtained was used for antipoaching or contribution in building a classroom. For instance, the year 2014 Mpigamiti village uses their share for anti-poaching activities.

In addition to that, the investors in wildlife richness areas such as hoteliers, tour operators and professional hunters obtain benefits from wildlife whose survival is dangerous to rural communities. The foreigners are among the top beneficiaries of Tanzania's wildlife resources. Foreigners collude with corrupt Ministry officials to obtain the benefits (Kideghesho, 2009). Some Legislators in Tanzanian National Assembly decried the lack of transparency in the allocation of hunting blocks (Kideghesho, 2009). They revealed that foreign-owned hunting companies are given licenses on lucrative hunting areas, in the process leaving indigenous Tanzanians on the wayside. Twelve foreign companies were given 57 prime hunting blocks out of the total 147 blocks allocated in 2006, with each company owning on average five blocks (Kideghesho, 2009). This scenario of 2006 is not far from that one of 2012. Under that circumstance, all wildlife management strategies will be difficult to implement as result of bureaucracy and corruption in all wildlife management system in the country.

#### **4.4.3 Minimisations of property damage and human life caused by wild animals**

Protected areas in Tanzania are not fenced thus wildlife freedom of movement is almost boundless. District Councils have a duty to combat dangerous animals and assist farmers

in crop protection. Many Districts are understaffed and not adequately equipped to perform this duty (Kideghesho, 2006). People who share the immediate boundaries with protected areas incur costs inflicted by wildlife conservation. Such costs include; loss of access to legitimate and traditional rights, damage to crops and other properties, livestock depredation, and risk posed to people's lives through disease transmission and attacks by wild animals.

Out of the strategy used to minimize property damage and loss of life is the use of game scouts. Liwale District has seventy six (76) villages and Nanyumbu District have 93 villages. Over 50% of these villages experience human wildlife conflict (HWC). This is due to the fact that there are few game scouts distributed whereby only seven game scouts are in Liwale and distributed in seven villages include Lilombe, Mkutano, Liwale Mjini, Mirui, Mpigamiti, Nangano and Mlembwe (LDC, 2016) while Nanyumbu have only one game scout (NDC, 2016).

During interview with Liwale DGO on 24<sup>th</sup> February, 2016; it was found that, low knowledge of District game scouts on non-lethal deterrents needed to be used for controlling problematic animals accelerate shooting of animals. These game scouts undergo short courses in wildlife management before they resume their duties. However these courses are inadequate. In the financial year 2013/2014, twelve (12) elephants were killed and other one hundred twenty nine (129) injured. Most of the injured died of injury to increase the mortality to seventy seven (77) (Table 16). Also, three people were injured in Liwale and 64 in Nanyumbu; and 42 people killed from 2008 – 2015 in Nanyumbu District and mostly by elephant and crocodile; a total of 296 acres and 26.5 acres of different crops were destroyed in Liwale and Nanyumbu as shown in Tables 17,18, 19,20, 21 and 22, respectively. Furthermore, a total of 63 livestock killed by wild animals in Nanyumbu from 2011 – 2014 (Table 23).

**Table 17: Problem animals killed or injured by game scouts in Liwale District****2013/2014**

S/N	Type of Animal	Killed	Injured
1.	Elephant ( <i>Loxodonta Africana</i> )	12	129
2.	Hippo ( <i>Hippopotamus amphibius</i> )	2	5
<b>Total</b>		<b>14</b>	<b>134</b>

Source: LDC office (2016)

**Table 18: People injured by dangerous animals in Liwale District 2013/2014**

S/N	Date	Village	Type of Animal
1.	28.05.2013	Kipule	Leopard ( <i>Panthera pardus</i> )
2.	24.07.2013	Ndapata	Lion ( <i>Panthera leo</i> )
3.	30.12.2013	Namalingo	Lion ( <i>Panthera leo</i> )

Source: LDC office (2016)

**Table 19: People injured by dangerous animals in Nanyumbu District 2008 - 2015**

Year	2008	2009	2010	2011	2012	2013	2014	2015
Number of injured people	2	14	29	11	2	0	3	3

Source: LLM office (2016)

**Table 20: People killed by dangerous animals in Nanyumbu District 2008 - 2015**

Year	2008	2009	2010	2011	2012	2013	2014	2015
Number of injured people	2	9	14	7	3	1	4	2

Source: LLM office (2016)

**Table 21: Extent of crops damaged by wild animals 2013/2014 in Liwale District**

S/N	Type of Crop	Type of Animal	Acreage
1.	Cashewnuts ( <i>Anacardium occidentale</i> )	Elephant	48
2.	Maize ( <i>Zea mays</i> )	Elephant	56
3.	Sorghum ( <i>Sorghum vulgare</i> )	Elephant	70
4.	Rice ( <i>Oryza sativa</i> )	Elephant and Hippo	30
5.	Cassava ( <i>Manihot esculenta</i> )	Elephant	49
6.	Sesame	Elephant	18
7.	Banana ( <i>Musa sp</i> )	Elephant	20
8.	Sweet potatoes	Elephant	5
<b>Total</b>			<b>296</b>

Source: LDC office (2016)

**Table 22: Extent of crops damaged by wild animals 2008 - 2015 in Nanyumbu**

<b>District</b>			
<b>S/N</b>	<b>Type of Crop</b>	<b>Type of Animal</b>	<b>Acreage</b>
1.	Maize ( <i>Zea mays</i> )	Elephant	19.5
2.	Rice ( <i>Oryza sativa</i> )	Elephant	4
3.	Banana ( <i>Musa sp</i> )	Elephant	1
4.	Sugarcane	Elephant	2
<b>Total</b>			<b>26.5</b>

**Source:** NDC office (2016)

**Table 23: Livestock killed by wild animals 2011 - 2014 in Nanyumbu District**

<b>S/N</b>	<b>Type of Livestock</b>	<b>Quantity</b>	<b>Type Of Animal</b>
1.	Cattle	1	Lion
2.	Goat	53	Lion and Hyena
3.	Pig	9	Lion
<b>Total</b>		<b>63</b>	

**Source:** NDC office (2016)

The wildlife policy of 2007 statement unlike the previous one (of 1998) has failed even to give short-term and long-term strategies to address the human-wildlife conflict and instead the government is now trying to assign the responsibility to CBC institutions (Kaswamila, 2009). Tanzanian government has introduced a compensation scheme for crop damage not exceeding five acres and consolation for human injured/killed by wildlife whereby the consolation does not exceed one million Tanzania shillings. The Government will devolve progressively the responsibility for Problem Animal Control (PAC) to operating Community Based Conservation (CBC) programmes and continue to give assistance where village communities have not developed this capacity (WPT, 2007).

The government shifts wildlife management from Decentralisation (according to WPT, 1998) to Recentralisation (according to WPT, 2007). Liwale and Nanyumbu Districts are

not distinguished from this scenario as it has eight (8) villages out of seventy six (76) and nine (9) out of ninety three (93) in Liwale and Nanyumbu respectively forming CBC (MWMA). Thereof this approach is likely to exacerbate the problem for two reasons. First, there are few CBCs in areas where humans live with wildlife countrywide and where these institutions exist they are still in futile and/or ineffective. Second, the institutions lack both human and finance capacity to deal with this sensitive and long-standing problem (*ibid*).

Furthermore, Sections 71 of Wildlife Conservation Act No. 5 of 2009 gives power to the Minister of MNRT make regulations specifying the amount of money to be paid as consolation to a person or groups of persons who have suffered loss of life, livestock, crops or injury caused by dangerous animals as stipulated much in Wildlife Conservation of Tanzania (Dangerous Animals Damage Consolation) Regulations (2011). Likewise, the Act considered only dangerous animals such as lion, buffalo, elephant and other animals categorized in fourth schedule for consolation of life, crops or injury while problems animals are not considered for this while contribute to crops destruction, injury or loss of life (URT, 2009).

#### **4.4.4 Access to ritual sites inside PAs within SNWC**

According to URT (2005), many protected areas in Tanzania were used by communities for their livelihood before independence in 1961. This scenario is not exceptional to PAs (Game and Forest reserve) where most of the study populations living within SNWC used to live in these reserves before repatriation of 1968 after outbreak of sleep sickness caused by tsetse infested, and others during volatilisation of 1974. For instance, after the official gazette of SGR with its boundaries in government gazette No. 275 of 1974 those people remained inside SGR were relocated. Their cultural and ritual areas remained

within or adjacent the present SGR. The law governing game reserves prohibits entry except by the prior permission of the Director of Wildlife. Ever since then, access of local communities into the reserve to perform ritual worships has been denied. This situation is a cause to the prevailing bad relationships between the management and local people.

During focus group discussion, it was found that local communities have two season each year August and October to go for ritual worships they call “Ngende”. The worshipers register their names to DC (District Commissioner) who passes them to Sector manager of SGR-South eastern sector who provide two game scouts for security and escorting the group which normally consist three hundreds (300) to five hundreds (500) people. The journey took fifteen days. The annual routine and general system of “Ngende” were formulated and given blessings by the Director of wildlife since then. For the case of good relationship with local community, no any bureaucracy taken to allow local people unless there is some information showing individuals with other businesses which bring negative impact to natural resources.

Environmentally this exercise is unfriendly due to fact that, these group took three to four days from Liwale to Ilonga (Mahenge) passing inside SGR, and they are using the same sleeping camps each year (Njenje, Mbarang’andu, Luwegu, Ligugu and Luwea) where they cut down trees for cooking and fire for security. Their camps are made adjacently to water bodies and consequently fishing activities for subsistence exercised. Under that circumstance, in the long run, environmental degradation especially deforestation in these areas will be experienced. Furthermore, differing cultural value systems between protected area managers and their support communities have frequently resulted in incidences of conflicts particularly as many of the native societies within protected areas believe that the natural environments within these areas are sacred habitats which connect them to their religious inclinations. Hence, such areas are consciously protected from any form of intrusion.



Similar findings is reported by Ryan (1992) about farmers of the south East Asian region who traditionally honour sacred groves- patches of wilderness amidst agricultural fields and rural landscapes as abodes of their powerful deities. Also, Essien and Bisong (2009) reports that, the indigenous Indians of Panama, patches of forests are regarded as super natural parks for the refuse of wildlife and spirits, while the Tukano Indians of Brazil guard forests and waterways for spiritual recourse. The indirect effect of this is the protection of over 60% of the streams within the locality as sanctuaries for fishes and other aquatic life. Similarly, the taboo and religious traditional value placed on orange-utang population in the upper reaches of Butang-Ai river in southern Sarawak has resulted in the preservation of the animal population (James, 1991).

#### **4.4.5 Controls of settlements and agriculture in migratory routes**

Settlements and agriculture are amongst the wildlife-human interaction which causes stress on natural resources in Selous-Niassa ecosystem. In the study villages (Table 23), the respondents don't see these as great sources of stress on wildlife resources because their effects are seen in a long term basis, instead they rank interaction of wildlife and human/livestock is Very high (56.7%). The villages forgetting that, when make settlement or agriculture in migratory routes automatically interaction with wildlife will be great and the ecosystem will be disturbed as a result affect wildlife range area, genes distribution and migration of wild animals. Whatsoever, agriculture ranked High (65%) and Settlement ranked Medium (63.3%). Furthermore, statistical tests shows that, settlement has a significant mean as a source of stress in SNWC compared to other sources as indicated in Table 24. This shows that the wildlife population is at risk. Therefore, unless strategies to alleviate the situation are in place, environmental degradation including loss of wildlife habitat will not continue. This negative interaction between human and wildlife is also caused by other sources of stresses on natural resources in PAs as stipulated much by Hackel (1999); URT (2002); Johansen (2002); UNDP (2003) and Kideghesho (2005).

**Table 24: Sources of stress on natural resources in SNWC**

Sources of stress	Strength of stress				Overall	Mean±Sd
	Very high	High	Medium	Low		
(a)Poverty/Low income	34(56.7) <sup>1</sup>	26(43.3)	0(0.0)	0(0.0)	60(100)	1.65± 1.02
(b)Ignorance	2(3.3)	35(58.3)	12(20.0)	11(18.3)	60(100)	2.75± 0.88
(c)Income generation from natural products	12(20.0)	34(56.7)	14(23.3)	0(0.0)	60(100)	1.55± 1.00
(d)Population increase	1(1.7)	37(61.7)	21(35.0)	1(1.7)	60(100)	1.50± 0.91
(e)Sabotage	0(0.0)	10(16.7)	21(35.0)	29(48.3)	60(100)	2.58± 1.20
(f)Uncontrolled burning	3(5.0)	23(38.3)	20(33.3)	14(23.3)	60(100)	1.25± 0.82
(g)Interaction between wildlife and human/livestock	34(56.7)	22(36.6)	3(5.0)	1(1.7)	60(100)	2.52± 1.31
(h)Drought/Floods	5(8.3)	35(58.3)	13(21.7)	7(11.7)	60(100)	1.58± 1.94
(i)Agriculture	18(30.0)	39(65.0)	3(5.0)	0(0.0)	60(100)	1.58± 1.00
(j)Settlements	6(10.0)	13(21.7)	38(63.3)	3(5.0)	60(100)	3.03± 1.21
(k)Banditry	0(0.0)	37(61.7)	11(18.3)	12(20.0)	60(100)	2.13± 0.85
(l)Lack of land use plans	2(3.3)	0(0.0)	18(30.0)	40(66.7)	60(100)	2.97± 1.25

<sup>1</sup> Figures outside and inside the parentheses are frequencies and percentages respectively.

## CHAPTER FIVE

### 5.0 CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Conclusions

The study demonstrated that impacts of socio-economic activities in managing Selous-Niassa wildlife corridor (SNWC) was prejudiced by looking on status of community land uses that affect management of SNWC, factors influencing people encroaching SNWC, and effectiveness of existing wildlife management strategies as follows:

Communities' land use is major determinant for management of natural resources in SNWC. Access to land in study area is possible and unreserved land is fairly not enough compared to population available. However, gender inequality experienced especially to women who are continued to be discriminated and denied direct access to land and insecure. Though, the land in the study villages under go land use plan, thereof land accessed by the community is mainly the one that planned for agriculture. Shifting cultivation is still practiced in the study area and need to be reversed so as communities adopt best agriculture practices that will use small farm plots which will be well mechanized in terms of pesticides, insecticides and fertilizers application.

The study area suffered from wild animals that destroy crops but adoption of application of non-lethal deterrents has become the best control measure. Also, conservation agriculture which is the new phenomenon in the study area needs to be emphasised to be adopted quickly so as to protect biodiversity and land degradation resulting from deforestation. This will also lower pressure to wildlife destruction. Poaching, encroachment for fuelwood and wildfires cause wildlife habitat destruction and decrease of wildlife population as a result those direct and indirect benefits of wildlife resources in

the ecosystem will be destroyed. Therefore, integrative participatory approach of local people and other stakeholders in relation to wildlife resources management and environment as a whole is vital in order to come up with collaborative sustainable wildlife management network in the ecosystem.

Factors that influencing people encroaching SNWC includes poverty, population growth, inadequate conservation status of some critical habitats, and failure to compete effectively with alternative land uses. There is a myth says, poor people are agents of environmental degradation or wildlife resources destruction. Actually, human survival is critical if forces threatening the protected areas ecosystem are to be halted. It is illogical for anyone to accept a scenario where preservation of wildlife resources implies starvation. To reduce the pressures on wildlife and its habitats, alternative strategies capable of reducing the necessity of encroaching into wildlife habitats should be adopted. The exponential growth of human population reduces the benefits per capita accrued from SNWC. Further reduction of the benefits may corrode local support for conservation on the basis of 'no profit, no conservation' scenario.

Generally, benefit-based approaches is a fundamentally inconsistent due to the fact that, their design and implementation can hardly enhance the value of the wildlife to local people but cannot ensure equity access and cannot guarantee sustainability of the benefits to local communities. Therefore, the current benefits are less effective in inspiring sustainable conservation behaviors. This, however, does not mean that the PAs in SNWC should abandon the benefit-based approaches and return to the 'fences and fines' approach. More comprehensive and integrated study that will offer more innovative and effective options in view of making the initiatives more conceivable is vital. The options

should seek to increase more opportunities that will divert the communities from heavy reliance on wildlife species and habitats for survival.

Nevertheless, effectiveness of existing wildlife resources management strategies is vital for sustainability of our wildlife in all protected areas (PAs). Strategies and measures adopted to counter the degradation of wildlife so far have not succeeded in providing sufficient incentives and motivation to communities living adjacent to these PAs. Programmes such as command and control by government and linking development to conservation have failed to stimulate conservation and increase the income of the local populations. Although the local people benefit from hunting of wildlife roaming outside the PAs, they are unlikely to tolerate loss of crops and domestic animals without grievance.

The study demonstrates that the value of wildlife-induced damage to crops and life is considerable higher than the wildlife-related benefits. Illegal hunting does not reduce the costs related to damage. Problematic animals control is a controversial issue in the communities, especially for elephants and carnivores like lions, which cause damage to livestock and can be an issue of fear and safety to humans. Similarly, in communities where the risk of property damage and loss of life by wildlife is perceived to be significant, local communities may be hostile to wildlife and oppose conservation programs.

## **5.2 Recommendations**

Based on these findings, this study recommends the following:

- (i) Land tenure system should be gendered accessed by both groups including divorced or widowed who customary laws does not favored them. Invaded reserved land for

MAGINGO and MCHIMALU WMAs should be taken into account by making sure the present land use plans are followed. These will guarantee the longrun survival of wildlife. Poor agricultural practices especially shifting cultivation should be reversed because it involves destroying Miombo forests and other vegetation which used as the living habitats for wildlife as result of human-wildlife conflict (HWC). Therefore cultivation on permanent farm plots which are well mechanized in terms of pesticides, herbicides and fertilizers application is vital. Importantly, rampant elephant poaching should be reversed by improving working facilities, number of staffs, new techniques training and participation of other stakeholders such as Tanzania Revenue Authority (TRA), Tanzania Ports Authority (TPA), Tanzania forces (Police, Military and Migration) and communities. The communities should fling those unimportant beliefs for increasing wildfires in order to assure their future life which lies on ecosystem services of SNWC.

- (ii) Control of income and non-income poverty by improving economic incentives of communities which will help production of beneficial farming activities that are environmental friendly such as vegetables and fruits farming, fish farming etc are important so as to avoid dependence of natural resources available in protected areas. Population control is crucial so as to reduce number of dependence and pressure on available natural resources. Protection of forest reserves within SNWC like Nyera/Kipelele and Angai forest reserves should be enhanced by increasing forest staffs and working facilities. Enhance awareness to communities on importance of protecting forest reserves. Exercise inventory of Miombo woodlands in District villages so as to ensure effectiveness before granting license/permit for harvesting forest products. Promoting alternative land uses of unreserved land to reduce encroachment in SNWC.

(iii) Involvement of local people in SNWC management is vital. Communities that excluded in management of protected areas are the one bring hazards. Recognize and employ indigenous technical knowledge (ITK) that enhances conservation of wildlife resources. Furthermore, transparent on benefits accrued from protection of wildlife in PAs within SNWC. The 25% of the income accrued from hunting blocks residing in Liwale and Nanyumbu Districts should be known to communities. Also hunting companies invested in these blocks should help the adjacent communities according to Tourist hunting regulations of 2010. The companies should help communities in the area of social services and job opportunities. Additionally, control of HWC should be prioritised by Liwale and Nanyumbu Districts councils. Enhance knowledge and practice on application of non-lethal deterrents to all communities adjacent to protected areas especially oil chilled ropes and chilled dung blocks which proved to be effective to elephants and other problem animals. Also, Ministry of Natural Resources and Tourism (MNRT) should compensate/consolate those people injured/killed and damaged/destroyed crops by problem animals. Since 2010 no compensation/consolation has been made. However, the present routine of access to ritual sites (Ngende) should be enhanced. The location of camping sites used by 'Ngende' groups should be changed at the same rivers to allow regenerations of destroyed vegetations. The fishing exercise in camping sites should be halted according to Wildlife Conservation act No. 5 of 2009.

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## APPENDICES

### Appendix 1: Questionnaire for Households

This is the questionnaire of a final year student of Sokoine University of Agriculture pursuing Master of Science in environmental and natural resource economics undertaking research on the topic “Impact of socio-economic activities in managing Selous-Niassa wildlife corridor”.

The goal of this survey is to gather information that will enable researcher to examine socio-economic activities impacting management of Selous-Niassa wildlife corridor. The answers are strictly for academic use and therefore, the confidentiality of your answers is highly guaranteed. Thanks for your understanding and cooperation.

Date.....Questionnaire number.....Village.....Hamlet.....

#### A: Household particulars

- A1. Name (not necessary).....
- A2. Age (years) i)18-24.....ii)25-35.....iii) 36-44..... iv)45-65.....v)Above 65
- A3. Sex: Male.....Female.....
- A4.What highest level of education has you attained? (Tick required)
- i) No education (informal).....ii) Basic adult education.....
- iii) Primary education.....iv) Secondary education.....
- v) Above secondary education.....
- A5.What is marital status of household head? (tick required)
- i) Married.....ii) Unmarried.....
- iii) Widow/widower.....iv) Separated.....v) Divorced.....
- A6. What is your household size? (tick required)
- (i) 1-5Persons..... (ii) 6-10Persons.....
- (iii) 11-15Persons..... (iv) Above 16Persons.....
- A7. What is your household income per month? (tick required):
- (i) Below TZS30,000 .....
- (ii) TZS30,000-59,000 .....
- (iii) TZS60,000-89,000 .....
- (iv) TZS90,000-119,000 .....
- (v) TZS120,000-149,000 .....
- (vi) TZS150,000-179,000 .....
- (vii) TZS180,000-209,000 .....
- (viii) Above TZS209,000.....
- A8. What is your Occupation? (tick required):
- (i) Employed .....
- (ii) Unemployed.....

A9. What is number of meals per day? (tick required):

- (i) One (ii) Two (iii) Three

A10. For how long have you lived here? (tick required):

- (i) 0 – 5yrs.....
- (ii) 6 – 12 yrs.....
- (iii) more than 12 yrs.....

A11. Where did you come from? (tick required):

- (i) Born here.....
- (ii) Outside the ward.....
- (iii) Outside the division.....
- (iv) Outside the District.....

If the answer is outside the District – then which District did you come from? .....

A12. What type of land ownership? (tick required):

- (i) Individual .....
- (ii) Rent.....

If the answer is individual,

S/n	How many parcels	Size	Location	Remarks

If the answer is rent,

S/n	How many parcels	Size	Location	Remarks

A13. Do you consider your land adequate? (tick required):

- (i) Yes .....
- (ii) No .....

If the answer is No, how much would be adequate and why?

.....  
 .....

A14. Which crops do you cultivate and how big is the area?

S/n	Type of crop	Farm size (acres)

Production per Acre

S/n	Type of crop	Production(tins/bags)

**B: Existing Strategies for natural resources management**

B1. Is there any strategies used for natural resources management in your area?(tick appropriate)

(i) Yes.....(ii) No.....

B2. If yes, what are they?

- (i) .....
- (ii) .....
- (iii) .....
- (iv) .....
- (v) .....
- (vi) .....
- (vii) .....

B3. Is SGR Management involve local community in management of natural resources?(tick appropriate)

(viii) Yes.....(ii) No.....

B4. If yes, how?

- (i) .....
- ...
- (ii) .....
- ...
- (iii) .....
- ...
- (iv) .....
- ...
- (v) .....
- ...
- (vi) .....
- ...
- (vii) .....
- ...

B5. Are there any national and international agencies which deal with problem of loss of natural resources?

Yes....., No.....

B6. If yes what are those among the following? (Put  $\checkmark$  if it exist)

- (i) SGR.....
- (ii) LLM -----
- (iii) LIMAS.....
- (iv) FZS -----
- (v) TAWIRI-----
- (vi) WWF. -----
- (vii) AWF-----
- (viii) CARE-----
- (ix) CONCERN.....
- (x) (Other (Specify) -----

B7. What are the roles of these agencies (stakeholders) in combating loss of natural resources?

- (i)-----
- (ii)-----
- (iii)-----
- (iv)-----

B8. Have you received any education for management of natural resources? (Put  $\checkmark$  where appropriate)

- (i) Yes....., (ii) No.....

B9. If yes in which kind have you received education among the following? (Put  $\checkmark$  if it exist)

- (i) training-----
- (ii) Seminar-----
- (iii) Meetings-----
- (iv) Short courses-----
- (v) Workshops-----

B10. How many times was this natural resource management education delivered to the community?(Put  $\checkmark$  if it exist)

- Often-----
- Sometimes-----

B11. Is there any community based organizations which deals with natural resources conservation in your area? (Put  $\checkmark$  where appropriate) Yes----- No-----

B12. Is there any community Capacity Building Programmes in preserving natural resources in your area? (Put  $\checkmark$  where appropriate) Yes----- No-----

B13. If yes what are those programmes?

- i.-----
- ii.-----
- iii.-----

B14. Are there any by-laws against loss of natural resources in your area? (Put  $\checkmark$  where appropriate)

Yes----- No-----

B15. If yes what are they?

- i.-----
- ii.-----
- iii.-----
- iv.-----

B16. Does this by-laws efficiency and effective? (Put  $\checkmark$  where appropriate) Yes---- No---

B17. If yes how are they efficiency and effective?

- i.-----
- ii.-----
- iii.-----

B18. If No, why are they not efficiency and effective?

- i.-----
- ii.-----
- iii.-----



B19. What do you think are causes of Wildlife-Human interaction which make stress on natural resources in the Selous-Niassa wildlife corridor? (Put  $\checkmark$  where appropriate)

- i. Agriculture
- ii. Banditry
- iii. Drought/Floods
- iv. Ignorance
- v. Income generation from natural products
- vi. Interaction between wildlife and livestock
- vii. Lack of Land use Plans
- viii. Population increase
- ix. Poverty/low income
- x. Sabotage
- xi. Settlements
- xii. Uncontrolled burning

B20. Rank the following as Sources of stress on natural resources in SNWC (Put  $\checkmark$  where appropriate and comments)

Sources of Stress	Very High	High	Medium	Low	Comments
Poverty/low income					
Ignorance					
Income generation from natural products					
Population increase					
Sabotage					
Uncontrolled burning					
Interaction between wildlife and livestock					
Drought/Floods					
Agriculture					
Settlements					
Banditry					
Lack of Land use Plans					

B21. Do you use any kind of strategies or practices to control loss of natural resources? (Put  $\checkmark$  where appropriate) Yes..... No.....

B22. If yes which of the following strategies do you practices? (Put  $\checkmark$  where appropriate)

Practices	Frequency of use		
	Often	infrequency	Not used at all
Minimization of Wildfire			
Use of alternative Source of Energy			
Stay away from Protected area			
Change agricultural practices			
Destocking			
Active Participation in SNWC Management			
Wind breakers			
Land use planning			

B23. Assess the following management effectiveness of SNWC in natural resource management

No	Question	Mpigamiti	Mpombe
1	How does SNWC management performing on protection of natural resources? Will SNWC keep our wildlife for the future generation? Or success in reducing poaching?		
2	Does SNWC management played a good role in informing surround communities' conservation education?		
3	How do you assess the status of SNWC management to the relationship with its local communities?		
4	Does SNWC accomplish its planned objectives? How does you assess general working status of its staff?		

**Key for Scores:** 0 – Very poor (worse); 1 – Very little; 2 – Somehow; 3 – Considerable; 4 – Good; 5 – Excellent

B20. For your own opinion suggest measures to be undertaken in order to overcome problem of loss of natural resources in SNWC?

- i.-----
- ii. -----
- iii. -----

**C: Effectiveness of the identified existing strategies for natural resource management**

C1. Is there any wild animals damage/destroy your crops or your life? (tick appropriate)

(i) Yes....., (ii) No.....

C2 If yes, mentions the wild animals that always damage/destroy you crops and life:

- i. ....
- ii. ....
- iii. ....
- iv. ....
- v. ....
- vi. ....

C3 Are you getting any Compensation from Life and Crops damaged from Government? (tick appropriate), (i)Yes....., (ii)No.....

C4. If yes. How much for: (i)Crops....., (ii) Life.....

C5. Do you think the money compensated is correlating with the loss caused by wild animal? (tick appropriate) , (i)Yes....., (ii)No.....

C6. If No, what do you think is the proper way for solving the problem?

.....  
 .....

C7. Is there any other social economic activities undertaken in the study area?

Yes.....,No.....

C8. If yes which of the following socio-economic activities do you undertake?

Practices	Frequency of use		
	Often	infrequent	Not used at all
Agriculture(AG)			
Livestock(LS)			
Charcoal making(CM)			
Fire wood collection (FW)			
Businesses(BS)			
Lumbering/Timbering(LM)			
Honey mongering(HM)			
Hunting(HT)			
Others(specify)			

C9. Do you use fire during honey mongering? Yes..... No.....

C10. Is there any timber business in your area? Yes..... No.....

C11. Where do you get building materials?

- i.....
- ii.....
- iii.....

C12. Do these economic activities raise the household income? Yes.....No.....

C13. If yes how much per month?

C14. Do you grow trees on your farms? Yes..... No.....

C15. If yes, for what purpose do you grow trees?

- i. Fuel wood.....
- ii. Building material.....
- iii. Soil fertility maintenance.....
- iv. Wind breakers.....
- v. Shades.....
- vi. Others (specify).....

C16. Which of the following measures are you taking to deal with fuel wood shortage in your area?

Practices	Frequency of use		
	Often	infrequent	Not use at all
Agro forest			
Private tree planting			
Communal tree planting			
Natural regeneration			

C17. What is the main source of water? (Put  $\checkmark$  where appropriate)

- i) Pipe water
- ii) Borehole
- iii) River
- iv) Shallow wells
- v) Spring water
- vi) Rain harvesting
- vii) Others (Please specify) .....

C18. Where is the location of water sources? (Tick those located in Protected Area)

- i) Pipe water
- ii) Borehole
- iii) River
- iv) Shallow wells
- v) Spring water
- vi) Rain harvesting
- vii) Others (Please specify) .....

C19. Is there any bureaucracy in access to ritual sites inside SNWC? Yes..... No.....

C20. Have you taken any of the following strategies because of soil erosion? (Put  $\checkmark$  where appropriate)

- i. Abandon your farming plots? Yes..... No.....
- ii. Expanded to marginal land? Yes..... No.....
- iii. Off-farm employment? Yes..... No.....
- iv. Others (specify).....

C21. Do you use any kind of practices to maintain or enrich soil fertility of your farming land? (Put  $\checkmark$  where appropriate) Yes..... No .....

C22. If yes which of the following practices do you use?

Practices	Frequency of use		
	Often	Infrequency	Not used at all
Use of fertilizers			
Use of farm yard manure			
Inter cropping			
Agro forest			
Mulching			
Alley farming			
Green manure			
Composite manure			
A forestation			

**Appendix 2: Guiding Questions for Focus Group Discussion**

Name of the village.....

Date.....

1. What is the historical profile of your village?
2. Is the village have land use plan? If yes, is the land use plan followed?, and if not followed what are the causes?
3. What are major socio-economic activities performed within the corridor?
4. Is there any factors influencing people encroaching the corridor?, if yes, what are they?
5. Is there any bureaucracy access to ritual sites in the corridor? If Yes or No what can be done to improve the current situation?
6. What is the performance of SNWC hunting companies in natural resource management and relationship with local community? Suggest ways to be followed so as to improve the relationship situation
7. What are indigenous technical knowledge for natural resource management in this area?
8. Is there any conflict existing between the people and wild animals in your village? If yes, what are the causes?
9. What kind of intervention mechanisms have you been using to improve management of natural resources?
10. What weaknesses do you think the conflict intervention mechanisms had and need some modification?
11. What do you think should be done as intervention measures for management strategies of SNWC?

**Appendix 3: Checklist for Key Informants**

**1.1 Background Information**

Date.....  
 Respondent No. -----  
 Full Name-----  
 Age-----  
 Sex----- (1, Male 2, Female)  
 Education level-----  
 Designation-----

**1.2 Official Information**

1. What are the major socio-economic activities effecting SNWC?

- i. ....
- ii. ....
- iii. ....
- iv. ....
- v. ....
- vi. ....
- vii. ....

2. What are strategies used in mobilizing the community to undertake sustainable natural resources Management in SNWC?

No.	Strategies used

3. What are the effectiveness of various strategies used in natural resources management in SNWC?

No.	Strategies used

4. What is the trend of poachers' cases since 2005?

Year	Number of Poachers
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	

5. How many people killed by wild animals since 2005?

Year	Number of people killed
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	

6. What is the total amount of money (Tsh) were compensated since 2005?

Year	Total Amount(TZS)
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	

7. What is the trend of income from Tourism since 2005?

Year	Total Amount(USD)
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	

8. What are the performances of strategies used in management of SNWC?

- i. ....
- ii. ....
- iii. ....
- iv. ....
- v. ....
- vi. ....

9. What are the methods for scaling up the most successful strategy/strategies in SNWC?

- i. ....
- ii. ....
- iii. ....
- iv. ....
- v. ....

