IMPACTS OF WILDLIFE MIGRATORY CORRIDORS' BLOCKAGE ON LIVELIHOODS OF COMMUNITIES LIVING ADJACENT TO ARUSHA NATIONAL PARK, TANZANIA

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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance to the Open University of Tanzania **a** dissertation entitled "**Impact of Wildlife Migratory Corridors' Blockage on livelihood of Communities Living Adjacent to Arusha National Park"** in partial fulfillment of the requirement of the award of Degree of Masters in Tourism Planning and Management.

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Dr. Reguli Baltazar Mushy

(Supervisor)

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Date

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DECLARATION

I, **Mary Clement Mtenga**, declare that, this is my original work and has not been submitted or published for any award of a degree or diploma in this University or any other University and that where material could be construed as the work of others, it is fully cited and referenced, and/or with the appropriate acknowledgement given.

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Signature

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Date

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ABSTRACT

The Kisimiri-Lendoiya wildlife corridor (connecting Arusha National Park and Kilimanjaro National Park) is highly threatened by anthropogenic activities, mainly cultivation, settlements, changes in land use and land cover. This study aimed to assess the impacts of blockage of wildlife migratory on livelihood of the communities residing in Kisimiri and Olkung'wado villages adjacent to Arusha National Park. Random Forest Classification was used to analyse changes in land use and land cover (2010-2020), as an indication of the habitat condition. Questionnaires were administered to ascertain existing anthropogenic related activities and effects of wildlife to local communities in the corridor, whereby, a total of 97 households were randomly selected. Linkage Mapper was used to analyze delineation of the corridor, whereas quantitative data were analysed using the Statistical Package for Social Sciences (SPSS). Qualitative data from the Key Informants were analysed in content wise. Findings revealed dramatic land use changes and these changes impacted the natural habitats, causing negative impacts to both wildlife and people's livelihood. The delineated corridor has a width of 10 Km, and a length of 26.3 Km. Crop production (55.7%) and livestock keeping (23.7%) were reported as the main socio-economic activities. It was further revealed that; crop raiding (97.9%) is the major form of human-wildlife conflict in the area, mostly affecting farmlands close to park boundaries. Different preventive measures; active deterrent (25.7%) and farm guiding (23.7%) are used. The findings of our study suggest that food security is threatened by crop-raiding incidences. Despite negative effects of wildlife to livelihood, still majority of local communities' benefit from wildlife conservation (84.5%). Conservation education and land use planning are recommended in the corridor.

Key words: Anthropogenic activities, conflicts, food security, Land use changes, Livelihood activities and Wildlife corridors

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ANAPA	Arusha National Park
ETM	Enhanced Thematic Mapper
GIS	Geographical Information System
GPS	Global Positioning System
HWC	Human Wildlife Conflicts
KIA	Kappa Index of Agreement
KINAPA	Kilimanjaro National Park
LULC	Land use and land cover change
MNRT	Ministry of Natural Resources and Tourism
SCIP	Support for Conservation Initiated Projects
SPSS	Statistical Package for Social Science
TANAPA	Tanzania National Parks
TAWA	Tanzania Wildlife Management Authority
TAWIRI	Tanzania Wildlife Research Institute
URT	United Republic of Tanzania
USAID	United States Agency for International Development
WMA	Wildlife Management Area
WWF	World Wildlife Fund for Nature

CHAPTER ONE

INTRODUCTION

1.1 Background to the Research Problem

The concept of wildlife corridor has been on use among conservation management circles for quite a time now. Nonetheless, this concept differs greatly among scholars. Wildlife corridor is defined as an area of land used by wild animal species to move seasonally from one protected ecosystem to another in search of basic requirements, such as water, food and breeding (Caro *et al.*, 2009; Njamasi *et al.*, 2022). Importance of wildlife corridors to biodiversity conservation and sustainability of livelihoods cannot be overemphasized. Wildlife corridors are critical in providing habitats, and they serve to secure the integrity of physical environmental processes that are vital to the requirements of certain species (Bennett & Mulongoy, 2006), enhance connectivity and increase genetic flow between small and fragmented populations (Burkart *et al.*, 2016). Wildlife corridors maintain biodiversity through conservation of potentially at risk local wild populations and have proven to greatly improve species richness and reduce the risk of local species extinction (Wilcove, Chen, 1998) and the ability of individual wildlife species to respond to environmental and climate change (Massawe, 2010).

Wildlife corridors are crucial for providing landscape connectivity and in sustaining the livelihood of communities living around. For example, in Pench and Kenha National Parks-India wildlife corridors provides habitat connectivity for tiger species, before realization of such corridor, the area was threatened by habitat fragmentation due to human activities such as agricultural expansion, human

settlement and development of infrastructures (Ramesh *et al.*, 2020). In Africa, study of seasonal home ranges of elephants between Kruger National Park and Sabi Sand reserve have revealed the importance of connectivity, and the same provide resources of both parks, and insight of their seasonal-movements within and between the protected areas (Thomas *et al.*, 2012; Thomas *et al.*, 2008). The Nairobi National Park-Kitengela dispersal area is used by wildlife to migrate between the two areas during wet season, leading to increase of human wildlife conflict in communities living adjacent to the migratory corridor (Rodriguez *et al.*, 2012; Wandaka, Francis, 2019). In Tanzania, several studies have documented importance of wildlife corridors in sustenance of wildlife species elephant in particular (Eakin, 2017). According to the 2009 nationwide assessment, there were a total of 31 wildlife corridors. Of the 31 corridors, 77% were categorized as 'extremely' or 'critically' threatened, indicating that in the do-nothing situation, can likely to cease being functional in five years (TAWIRI, 2009).

Due to high rate of wildlife corridors disappearance in the country, in 2012, the Tanzania Wildlife Research Institute (TAWIRI), recommended priority areas for research to various key national conservation authorities including TANAPA (TAWIRI, 2012). The status of the Arusha National Park (ANAPA) wildlife migratory corridors emerged among the high priority target area for research, however, until now studies to informing management options are inadequate. Arusha National Park (ANAPA) and Kilimanjaro National Park (KINAPA) General Management Plans (GMPs) indicate existence of highly threaten wildlife migratory corridors which limit the movement of animals and emphasized on the adequate

measures to protect the wildlife migratory corridors. TAWIRI alert two research areas to informing ANAPA's conservation management, including the assessment of impact of anthropogenic factors on the status of the two main corridors namely, Ngasurai and Kisimiri. The two corridors are vital for connecting ANAPA with KINAPA and Amboseli National Parks in Tanzania and Kenya respectively (TAWIRI, 2012).

1.2 Statement of the Problem

Wildlife migratory corridors are varnishing at alarming rates in most parts of the world, including Tanzania (Sitati, 2021). In the early 1980s, there were more than 31 wildlife migratory corridors in Tanzania though not well researched. These corridors were not 'legally' protected as most of them occur in communal lands. In late 1990's some of the corridors were partially protected as open game-controlled areas and recently some have been put into Wildlife Management Areas (WMAs) and some are just no mans' land. Despite the level of protection, these corridors have been facing many challenges of agricultural expansion, unplanned land use plan, and development of infrastructure that are being evidenced in the various wildlife migratory corridors around the country (Kremen and Merenlender, 2018; Martin *et al.*, 2019).

Wildlife corridor connecting the Arusha National Park (ANAPA) with Longido WMA has ceased to exist due to gross interferences through varied anthropogenic activities such as settlement, livestock grazing, agricultural expansion taking place in the area and its vicinity (Massawe, 2010). The status of the remaining two corridors, namely, Ngasurai and Kisimiri that connect ANAPA to the other protected areas in

the wider ecosystem including Kilimanjaro and the neighboring Kenya's Amboseli National Parks, remains unclear despite knowledge that they are also being defiled. TAWIRI (2012) identified into the status of these corridors as a research agenda of high priority. This implies that despite their being critically important, very little is known about threats and conservation status of the corridors.

Understanding the effects of wildlife corridors' blockage in livelihoods of surrounding communities is of utmost importance. Lack of legal protection and increased anthropogenic pressure, corridors are increasingly in-line with human-wildlife-conflicts (Shauri, Hitchcock, 1999). Consequently, reports on wildlife-human killings, crop raiding, livestock killings and poaching are increasingly reported as well. For example, recent reports in Tanzania on wildlife-human killings indicates people are killed annually in wildlife corridors blockage, as well as increased incidence of crop raiding, and livestock depredation (Idd, 2020; Suratissa, 2021; Zella, 2016).

Virtually, consequences of blockage of corridors due to interferences from varied human activities can be two sided. On one hand, blockages of corridors can a result into undesired conservation outcomes where the health of ecosystem is jeopardized. On the other hand, blockage creates an assortment of undesired effects to local communities living in or around the corridor area. While many studies focus on the effects of wildlife corridors blockage on conservation, the novel of this study seeks to explore the impacts of corridors' blockage to communities' adjacent protected areas.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of the study is to assess the impact of wildlife migratory corridors' blockage on livelihoods of communities living adjacent to Arusha National Park (ANAPA).

1.3.2 Specific Objectives

Specifically, the study aims to:

1. Assess the current state of wildlife migratory corridors adjacent Arusha National Park,
2. Examine the nature of human activities in wildlife migratory corridors adjacent ANAPA.
3. Determine the effects of wildlife to livelihoods of communities in migratory corridors adjacent ANAPA.

1.4 Research Questions

1. What is the current state of wildlife migratory corridors adjacent to ANAPA?
2. What is the nature of human activities in wildlife migratory corridors adjacent to ANAPA?
3. What are the effects of wildlife to livelihoods of communities in migratory corridors adjacent to ANAPA?

1.5 Significance of the Study

This study is expected to contribute to information that will help to enrich the existing literature on the impact of the growing challenges facing wildlife corridors and how blockage of these corridors is impacting on communities residing adjacent

to protected areas. Regionally, this study will open avenues for further research on salient aspects of the subject matter which pertains to blockage of wildlife corridors and its impacts.

Specifically, in Tanzania, this study is anticipated to serve as a useful focal point or reference tool as they endeavor to come up with sustainable solutions to the ever-growing challenges facing wildlife corridors throughout the country while also ensuring conservation. The study is novel as its informing findings on the nature and scope of impact of wildlife corridors blockage will be grounded and spatially mapped for informed decision making for conservation and management strategies as 77% corridors are highly threatened in the country. Similarly, the study will serve to expose the nature and scope of impact due to corridors blockage. Such exposure shall facilitate informed decision making for conservation and management strategies for the area's entire ecosystem along with other wildlife corridors in the country.

1.6 Limitation and Delimitations

Orotho (2008) maintains that limitation of a given study pertains to an aspect of the study that a researcher knows may adversely affect the results or generalizability of results of that study but over which he /she has no direct control.

As far as this study is concerned, the researcher foresees several areas that may pose as limitations to the study. In the fore, the sheer geographical distribution and set of the various areas' wildlife migratory corridors may present a limitation to reckon with. While some migratory corridors join the ANAPA to Kilimanjaro national park to the east and the neighboring Kenya's Amboseli National Park to the northeast,

other corridor routes join the park with Longido WMA to the north. This geographical distribution is more likely to create limitations as it means data sources are spatially distributed over a fragmentally wide geographical area. This means reachability and follow-up of respondents are directly affected in terms of time and financial resources required to accomplish the task of data collection.

The situation may be even more exacerbated by the fact that to have a truer picture of the situation, this researcher intends to delve to even further remotely locations to access data sources. Financial constraints and time limitations may hinder effective execution of tasks pertaining to this study. If not well addressed, these may factor in and end up limiting prospects of a successful study.

Uncooperative and indifferent respondents may pose as yet another potential limitation to the study. It is expected that pockets of respondents may opt to non response on a number of reasons.

Further, it may prove difficult to secure audience with some key respondents or informants. For instance, highly placed officials who in most of cases may cite tight schedules as one of reasons for being unable to grant an audience with a researcher. This researcher will also need to remain on guard at all the time against biasness and lack of objectivity which in themselves may pose limitations in terms of usability of study findings.

1.7 Delimitation of the Study

Researcher deliberates to undertake several measures to mitigate or overcome the foreseeable limitations. Foremost, the researcher intends to undertake thorough

identification of data sources and dissects the study area into constituent sections closely considering their geographical access convenience. This will render data sources amenable to systematic reachability.

Again, the researcher intends to exploit all possible avenues in a bid to ensure that adequate financial resources are floated to meet travel (both with research assistants) and related upkeep expenses around the area during course of this study. The researcher intends to employ cheap but efficient means of transport in particular motorcycle to ease access.

To elicit and win cooperation of respondents, this researcher intends to use a portfolio of techniques. One such technique considers talking sense to indifferent respondents on the importance of this study to the communities concerned and the way it may serve to promote awareness on the challenges which is a right step towards obtaining lasting solutions to pertinent problems. Every precaution will be taken to avoid bias and maintain objectivity with research instruments being checked and rechecked to ensure reasonable levels of usability and reliability of study results. In specific, the approach will be the use of mixed methods in data collection which, according to Cohen (2000) constitute an important strategy in avoiding bias and distortion of reality.

1.8 Organization of the Work

This dissertation is organized into five chapters. Chapter One introduces an overview of the study; including background to the research problem, statement of the problem, research objectives, research question and significance of the study.

Chapter two is about the literature review of the key concept of the study as well as the empirical review, what has remained as a gap in relation the past studies, and the conceptual framework which guides the study. Chapter three is about the research methodology, which entails description of the study area, the approach for the design and sampling, and how the collated data and information were analyzed. The same chapter cover as well the validity and reliability of the study as well as the ethical considerations. Chapter four is articulated to present results and discussion, touching base on the study objectives. Chapter five discusses the study conclusions and put forward key recommendations to policy and decision makers.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is a review of literature in relation to the study topic. It particularly deals with key concepts and review of theories as well as empirical studies. The chapter also presents conceptual framework as well as the research gap.

2.2 Definition of Key terms and Concepts

2.2.1 Wildlife corridor

Wildlife corridor refers to an area used by wild animals in their movements from one part to another, at any given time in search of basic requirements such as water, pastures, space and habitat. It functions as passageway for the purpose of providing connectivity between wild species by means of dispersal or migration of individuals (Horskins, 2005). Wildlife corridor can either be described as functional connectivity (e.g. active use of wildlife) and structural connectivity which consist of vegetation that can allow species use and passage

2.2.2 Ecosystem

Ecosystem has been defined as a community of living organisms interacting with living (biotic) and non-living (abiotic) components of the environment. In this study, the biotic components are the living things including human being, who are mostly forgotten in many literatures. The abiotic components include non-living environment that provides habitats and material flow for the ecosystem integrity and functions (Eakin, 2017). This includes water, soil, climate, etc., form abiotic

component of the ecosystem. In this study the two components are made clear because their monitored interactions reduce the adverse impacts of wildlife corridors blockages to communities and conservation.

2.2.3 Protected Area

According to IUCN, (1994) protected area defined as an area of land/ or sea especially dedicated to the protection of biological diversity and of natural and associated cultural resources, and managed through legal or other effective means. There are several kinds of protected areas, which vary by level of protection depending on the enabling laws of each country or the regulations of the international organizations involved. For example, in Tanzania, protected areas fall under (i) National parks, (ii) Game Reserves, (iii) Game Controlled Areas, (iv) Forest Reserves, and (v) Nature Reserves. On the other hand, protected areas are defined as a geographical space, recognized, dedicated and managed, through legal and other effective means to achieve the long-term conservation of nature with associated ecosystem services and cultural services (Dudley, 2008). Based on the World Conservation Union (IUCN), protected areas are categorized into six categories, all of equal importance, and geared towards biodiversity conservation (Ravenel, Redford, 2009). Furthermore, they are essential for conserving biodiversity, and for delivering vital ecosystem services, such as protecting watersheds and soils and shielding human communities from natural disasters.

2.2.4 National Park

National Park refers to an area set aside by a national government for the preservation of the natural environment, with different purposes such as being set aside for public recreation and enjoyment or for its historical or scientific interest while keeping most landscapes and their accompanying plants and animals in their natural state (IUCN, 1996). National park protects large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for the environmentally and culturally compatible spiritual, scientific, educational, recreational and visitors opportunities (Dudley, 2008). There are 22 national parks in Tanzania, the largest being Nyerere National Park and the smallest being Saanane Islands National Park where by National parks in Tanzania constitute about 15% of the total conserved area (MNRT, 2022).

2.2.5 Wildlife Management Area (WMA)

Wildlife Management Area (WMA) means an area declared by the Minister of Natural Resources and Tourism under section 32 of the Wildlife Act No 5 (2009). WMAs is a form of community-based conservation which ensures villagers or communities rich in wildlife resources sets aside land to sustainability conserve, utilize and benefits from wildlife. WMAs are formed within village land from which villagers set aside a piece of land purposely for sustainable conservation and utilization of wildlife resources(Lee, 2018). The establishment of Wildlife Management Areas (WMAs) has been adopted as intervention to safeguard the wildlife and their habitats outside the core protected areas in Tanzania.

2.2.6 Human-Wildlife Conflict

Human-Wildlife Conflict has been defined as any interaction between humans and wildlife that results in negative impacts on social, economic or cultural life, on the conservation of wildlife population, or on the environment (WWF, 2005). Human-wildlife conflicts occur when wildlife requirements extend beyond those of human population and create costs to residents as well as wild animals.

2.3 Theoretical Review

Blockage of wildlife migratory corridors is attributed to many factors. Some of the factors are related to poverty, ever increasing human population, demand for wildlife resources, climate change related droughts, energy, technology (Kideghesho *et al*., 2006). However, poverty has been singled out as the most important cause of global environmental problems as all the other factors mentioned are dependent on it in a cause-and-effect relationship (Bhalla, 1992).

On this reasoning, it will be logical to mostly premise this review of theoretical literature on Needs-based motivational theories and the way they can be used to guide this study. In this context, needs-based theories will be employed to address the various factors pushing people to act in a destructive manner towards the environment including engaging in various anthropogenic activities that eventually result in corridor blockage.

Basically, the assumption is that since people are poor and their means to fulfill basic survival needs are limited, they are unrelentingly pushed to rely entirely on exploitation of environmental resources to make the ends meet. In this regard,

biodiversity resources are exploited unsustainably through anthropogenic activities the end result of which is environment destruction in its various forms including blockage of wildlife migratory corridors. However, the issue happens to be two-sided. In one side, local people fulfill their pressing survivalist needs through unsustainable exploitation of environmental resources which consequently leads to inevitable destruction of biodiversity. In the other, the same people become impacted negatively as the outcome of this destruction.

Another source of theoretical guidance for this study shall emanate from a social psychology construct known as the Value-Belief-Norm (VBN) theory. The theory explains how environmentally friendly behavior can be adopted basing on personal norms, values and perceptions (Stern 2000). This theory shall be used to understand local peoples' ecological worldview in the study area. It shall also help to explain why such people may be acting in ways that contradict conservation in case they hold a worldview that is supportive to conservation efforts. The Value-Belief-Norm theory abbreviated as VBN is a social psychology theory whose development is credited to Stern & Dietz (1994) and traces its roots in the need to explain social movements including environmentalism. The theory postulates a causal chain of five variables that include Values, the New Ecological (Environmental) Paradigm (NEP) and Awareness of Consequences (AC). Others are Self-beliefs and finally Personal Norms (PN).

While extensive research has documented clear link between an individual's values and their behavioral intent and actual behavior (Schultz *et al.,* 2005), studies have

also empirically validated the finding that values are a key component in explaining beliefs, attitudes and behavioral intentions (Stern and Dietz, 1994; Stern, 2000). Therefore, it is foreseen that investigating and understanding the values of local people in the study area will go a long way to enable predicting and explaining their behavioral intent and actual behavior in terms of whether it is pro-environmental or otherwise. This is regarded as significant in so far as explaining the environmental situation and status of conservation of biophysical resources in the study area including the related blockage of wildlife corridors and its impact on the local communities.

The VBN theory originators Stern and Dietz (1994) developed the theory to help explain the activation of personal environmental norms that influence environmental behavior and intentions. The researchers' work was based upon Schwartz's (1977) moral norm activation theory which posited that an individual's level of altruistic value type would influence their "awareness of undesirable consequences (AC)" from events occurring to other people which would then influence the individual's personal norm (PN) activation due to one's own ascription of responsibility (AR) for harm occurring to another person. Stern (2000) defined personal norm (PN) as a perception of moral responsibility to engage in pro-environmental behaviors or actions to remedy an environmental problem. PN was found to be the forerunner to behavioral action taken to rectify the negative consequences of the event. The VBN theory was adapted from Schwartz' theory in order to specifically describe environmental intentions and behavioral activation and not just selfless behaviors as was described in Schwartz' original work. In particular, Stern and Dietz (1994)

explained that personal norms can be explained by other values as well as altruism such as egoistic and biospheric values. They then described how an individual's level of endorsement among any of these values would influence their awareness of consequences (AC) from events for other individuals, other species and the biosphere which would then influence the individual's environmental intentions and behavioral actions taken to alleviate threats to others, non-human species and the biosphere.

In much previous research, the VBN theory has proven effective in explaining behavioral intentions with regard to environmental issues. A few examples are such as Sibley and Duekitt (2010), Schultz *et al*., (2005), Nordlund and Garvill, (2002) and Stern *et. al*., (1999), to mention but a few.

However, despite its strengths, the VBN theory is not free from being criticized. According to Akintunde (2017), one major weakness of the theory is that it doesn't provide a better understanding that good intentions towards the environment alone are not enough in themselves to propel an action. Notwithstanding criticism leveled against the VBN theory, it still can be applied to guide this study due to its fundamental attributes and strengths. The theory has done very well in articulating its key variables of values, beliefs and norms and the way these play influential role in explaining and even predicting individual's behavior and intentions towards environmental issues and concerns. The fact that the theory can be used to understand one's personality and its interaction with the environment to help predictability of behavior is undoubtedly a major strength of this theory.

In the same ilk, the theory's variables will be of use to explain why the study area's inhabitants/people have been acting the way they do towards the environment and its resources. Under the guidance of this theory it will be captivating to investigation into, and understand the specificities regarding their values and the way these have influenced and shaped environmental related beliefs. By so doing it will be possible to come up with a broader picture of how personal norms are being activated and consequently pro or anti-environmental behaviors and intentions. Even with such a picture, it will still be feasible to be sensitive of other possibilities leading to degradation of the environment especially economic factors including poverty. This is because even if people were harboring pro-environmental intentions, expecting such intentions to remain durable will be deceiving oneself if these very people are deprived and thus hard pressed to fulfill their survival needs under circumstances where the surrounding environment and its resources offer the major means of making the ends meet.

Thus, it may be possible to find that under such circumstances pro-environmental behaviors are being relegated in favor of what may appear to be anti-environmental intentions simply because the pressure to satisfy needs reigns supreme over and above the care for the environment. As Loibook *et al*., (2002) observes, even if the law that prohibits certain practices and activities exists, the need to survive may prompt violation of this law because poor people are compelled to adopt coping strategies, set priorities and make economic choices that are ecologically destructive because they lack viable coping alternatives. This is where the dual theories of

Maslow and VBN shall come to work in conjunction to guide and provide direction for this study.

2.4 Empirical Review

2.4.1 Current State of Wildlife Migratory Corridors adjacent Arusha National Park

The impacts of wildlife migratory corridors' blockages on conservation have been on top of international conservation agenda in recent years (Massawe, 2010). The international day of conservation raised awareness on the importance of the ecological system and the protection of the environmental through prevention of the socio-economic impact while addressing the importance of sustainable management, conservation and uses. This is because meeting human demands coupled with climate change put wildlife conservation at high risk and wildlife corridors are seen as the ultimate solution to lessen the risk. Nevertheless, Jones *et al.,* (2009) argue that blockage of wildlife corridor in Sub-Saharan Africa put conservation in a critical condition as it changes local communities' attitude towards conservation due to increasingly human-wildlife conflicts.

Addressing these impacts from a community perspective is timely to device appropriate conservation measures as now Macha, (2015) argues that communities have negative perception on conservation. The impacts of wildlife migratory corridors' blockage have been well document contrary to its effects on adjacent communities. This could be likely due to conservation policies that exclude communities or lack of approaches to assess the impacts from a community perspective. The impacts of wildlife corridors blockage are many. The key impacts

ranges from human-wildlife conflict that are attributed to crop riding, human killing, livestock killing, zoonotic diseases to encroachment that are attributed agriculture, settlement and other developmental activities. Sometimes, these impacts end in livestock confiscation and jail sentences. Without informing findings, these unresolved impacts add pressure towards negative attitude towards conservation.

In Tanzania, just as in most Sub-Saharan countries, adverse impacts of wildlife corridors blockage to local communities have been encapsulated in terms of wildlife-related costs to humans and the resultant human-wildlife conflicts (Noe, 2003). These impacts are more pronounced in local communities living in or adjacent protected areas.

2.4.2 The Nature of Human Activities in Wildlife Migratory Corridors

Noe (2003) in a study of Kilimanjaro-Amboseli wildlife migratory corridor, a cross border corridor linking two National Parks namely, Tanzania's Kilimanjaro and Kenya's Amboseli. In this study, the immediate causes of land use changes that led to blockage of routes and ultimately shrinkage of the corridor's size from its former 21 km^2 of 1952 to a paltry 5km^2 in 2003 were mentioned as changes in Maasai livelihood strategies, settlements, expansion of agriculture, availability of markets for agricultural products and encroachment. Root causes for the land use changes that affected the corridor were mentioned as demographic factors particularly exponential growth in human population, economic factors as well as government policies and legislation. Others were environmental factors, institutional factors and changes in resource management responsibilities.

In turn these if not well integrated in land-use plan, blockage of wildlife migratory corridors is the ultimate results. Land-use planning involves allocation of land to different uses across a landscape in a way that balances economic, social and environmental values. Most developing countries lack LU-plans as a result, conservation is at risk due to increase of pressure towards natural resources (Kilungu *et al.,* 2019). Land use-planning help to minimize conflicts and bring more effective and efficient use of land and its natural resources. Well-organized land use plan will help to solve the problem since it provides fair participation in preparation of LU-Plan among land users.

2.4.3. Effects of Wild Animals on Livelihood in Wildlife Corridors

Human-wildlife conflicts are among the effects of wildlife-migratory corridor blockage in Sub-Saharan Africa (Lamarque, 2008). In these countries livestock holdings and agricultural activities are the major economic livelihoods. It originates in the activities that are implemented nearby or within the corridor; these are threaten by the existing conflict of human wildlife conflict. The ability to access water for domestic animals, pasture, farm land and even the crop destruction is the source of conflict. Uses of corridor in terms of combination between human and wild animals are the source of challenges. The study by Matseketsa *et al.*, (2019) in southern Zimbabwe found that competition between local communities and wild animals for natural resources use and space is particularly intense and direct because of the rapid human population increase and expansion of areas for cultivation.

In the study of Mollel (2017) about Human-Wildlife Conflict in Burunge Wildlife Management Area, found that livestock predation, crop raiding, human killing and injury as the major causes of human wildlife conflict which affect livelihoods of local community. Nyahongo (2007) conducted a study about depredation of livestock by wild carnivores and illegal utilization of natural resources by humans in western Serengeti, He found that encroachments in wildlife corridors fragmenting the corridors and creating small patches of habitats for large predators such as lions and spotted hyenas that would normally require large home ranges.

Kideghesho (2010) conducted research about wildlife conservation and local land use conflict in western Serengeti. He established economic losses due to crop damage by problem animals led by elephants to have stood at a whopping $516 per household annually. Holmern *et al.*, (2007) conducted a study about livestock loss caused by predators outside Serengeti National Park found that livestock depredations causing an average loss $97.7 to households in the area. Livestock mostly affected were cattle, goats and sheep. Predators blamed for most of depredatory incidences were lions, spotted hyenas and leopard.

Hariohay (2013) in his study of human settlements and land use changes in Kwakuchinja, a wildlife corridor found in Tarangire-Manyara ecosystem in northern Tanzania that links Tarangire National Park (TNP) and Lake Manyara National Park (LMNP). He found that number of wildlife related costs that were more or less reflecting the above shown Kideghesho's function and which were blamed as fueling the associated human-wildlife conflicts in the area. That, besides harming wildlife, blockage of the corridor resulted in negative impacts to the local people living within

the corridor in terms of crop damage and livestock depredations, disease transmission from wildlife to livestock, human injuries and killings by wild animals and damage to infrastructure especially water systems.

Other adverse impacts were blocked access to pastures, crop farms and social centers including schools, dispensaries and shopping outlets. Also people were denied access to firewood collection and traditional medicinal plants for fear of attacks by wild animals. As a case to illustrate the magnitude of the impacts, school children were reportedly missing classes, at times, over prolonged periods for the same fear of attacks by wild animals' while in route to or from school especially during wet season when herds of elephant's roam in affected areas. Wasted time guiding crops from destructive animals as well as livestock from depredations was again pinpointed as among the wildlife related costs incurred by local people in the study area.

2.5 Policy and Legal Related Issues on Wildlife Corridors

The Wildlife Policy of United Republic of Tanzania calls for better management of protected areas, sustainable use of wildlife, devolution of wildlife user rights to communities and sharing of benefits derived from wildlife uses (Nelson *et al.*, 2007). The Wildlife Policy (1998) and Wildlife Conservation Act, 2018 promote conservation of wildlife and its habitats outside core areas by protecting wildlife corridors, dispersal areas, buffer zones and migratory routes. The wildlife policy demands of establishing Wildlife Management Areas, preventing illegal use of wildlife and transferring of Wildlife Management Areas to local communities.

This is to help local communities to attain substantial tangible benefits from conservation which allow communities to take care of buffer zones, wildlife migratory corridors and also involve local communities in safeguarding the integrity of the wildlife areas and their habitat. However, the implementation of these policies requires observation of relevant policies or laws governing resources on village lands. This is because conservation of wildlife by establishing wildlife corridors, dispersal areas, buffer zones and migratory routes involve taking lands that belong to the village land (Nelson *et al.*, 2007), which may cause conflicts with local communities. Hence, local communities need to be sensitized to make informed consent in allocating land for wildlife conservation, and ensure fully and willful participation of local communities in wildlife conservation activities.

2.6 Research Gap

Addressing the effect of wildlife migratory corridors blockage to Tanzanian communities is timey especially now when conservation strive to meet human needs while protecting ecosystem integrity. Nevertheless, studies that address this topic are inadequate when compared with similar studies on conservation. This could be due to the inadequate studies that address the current state of wildlife migratory corridors in Tanzania to informing land-use planning.

Noe (2003) argues that addressing the impacts of wildlife migratory corridors blockage is difficulty as it involves numerous factors that are interlinked thus many approaches must be deployed. While addressing this complexity one need to understand the nature and the extent of the impacts in a broad sense, study by Macha (2015)focused on perceptions of local communities in conservation. Perception

studies are informing but not appropriate in undemanding the nature of the impacts to informing policy. To handle this, studies need to map the extent of the corridors and assess the nature of changes in wildlife corridors.

The previous studies such as that of Mollel, (2017) who studied the impact of wildlife corridors' blockage in many parts of Tanzania without a quantitative assessment, the study by Debonnet and Nindi, (2017) addressed the land use and tenure options and status of wildlife corridors in Tanzania: an input to the preparation of corridor, while Riggio and Caro, (2017) addressed the structural connectivity at a national scale: wildlife corridors in Tanzania. The previous experiences have highlighted the need for a more detailed study on the impact of wildlife migratory corridors' blockage on the livelihoods of communities. This gap in understanding the consequences of blocking wildlife migration routes emphasizes the importance of conducting comprehensive research to assess the specific impacts on local communities. By delving deeper into this aspect, we can gain and contribute valuable insights into the direct and indirect effects of blocking migratory corridors on people's livelihoods. Overall, by addressing the existing gap in knowledge regarding the impacts of wildlife migratory corridors' blockage on community livelihoods, we can foster a better understanding of the interconnectedness between conservation efforts and human well-being, leading to more informed decision-making and sustainable management practices.

2.7 Conceptual Framework

The conceptual framework (CF) guiding this study is presented in Figure 2.1. The CF provided a working strategy as it presents key components and depicts relationship

and feedbacks. The CF is framed to provide an understanding of the processes and impacts of wildlife corridors blockage on livelihood, drivers of habitat (LULC) change, and conservation attitude of local communities. Blockage of wildlife migratory corridors can be attributed to changes in LULC and associated anthropogenic activities.

Basically, there is a complex interaction between anthropogenic activities and drivers of change. Drivers of change (e.g. LULC) can influence wildlife corridors either through reduced habitat patch sizes or degrading the quality of habitat patches or altering wildlife populations and distribution in the area. Anthropogenic activities which influence livelihoods can cause expansion of agriculture and settlement, and increasing livestock number, consequently reducing habitat patches and narrowing connectivity (migratory corridor) as lands will be cleared for settlement and cultivation to sustain the growing population (Nduati *et al.*, 2013) especially in the two study villages.

Wildlife corridor are very important in providing linkages in terrestrial ecosystems, and any anthropogenic activities influence both LULC as it determines the status/state of wildlife corridor. Increased human population is related with increased demand for agriculture land and settlement. For example, agriculture/farming can affect LULC and wildlife habitats in a way that it opens vegetated area. Livestock can degrade the quality of habitat, and can be an agent for wildlife-livestock-human diseases. These factors can exert deleterious impacts on wildlife corridors leading to crop damage, livestock depredation, disease transmission, human injury/killed,

destruction of infrastructure, and in other side causing species decline or loss as wildlife population and distribution. Therefore, it is important to ascertain the effects of wildlife corridor blockage to livelihoods and conservation at large to set strategies (Policies and Regulations) to intervene deleterious impacts of the blockage.

Therefore, to this end, the study is guided by the questions; what is the current state of wildlife migratory corridors adjacent to ANAPA? What is the nature of human activities in wildlife migratory corridors adjacent to ANAPA? and what are the effects of wildlife to livelihoods of communities in migratory corridors adjacent to ANAPA. This conceptual framework is designed to address the independent, intermediate and dependent variable of this study.

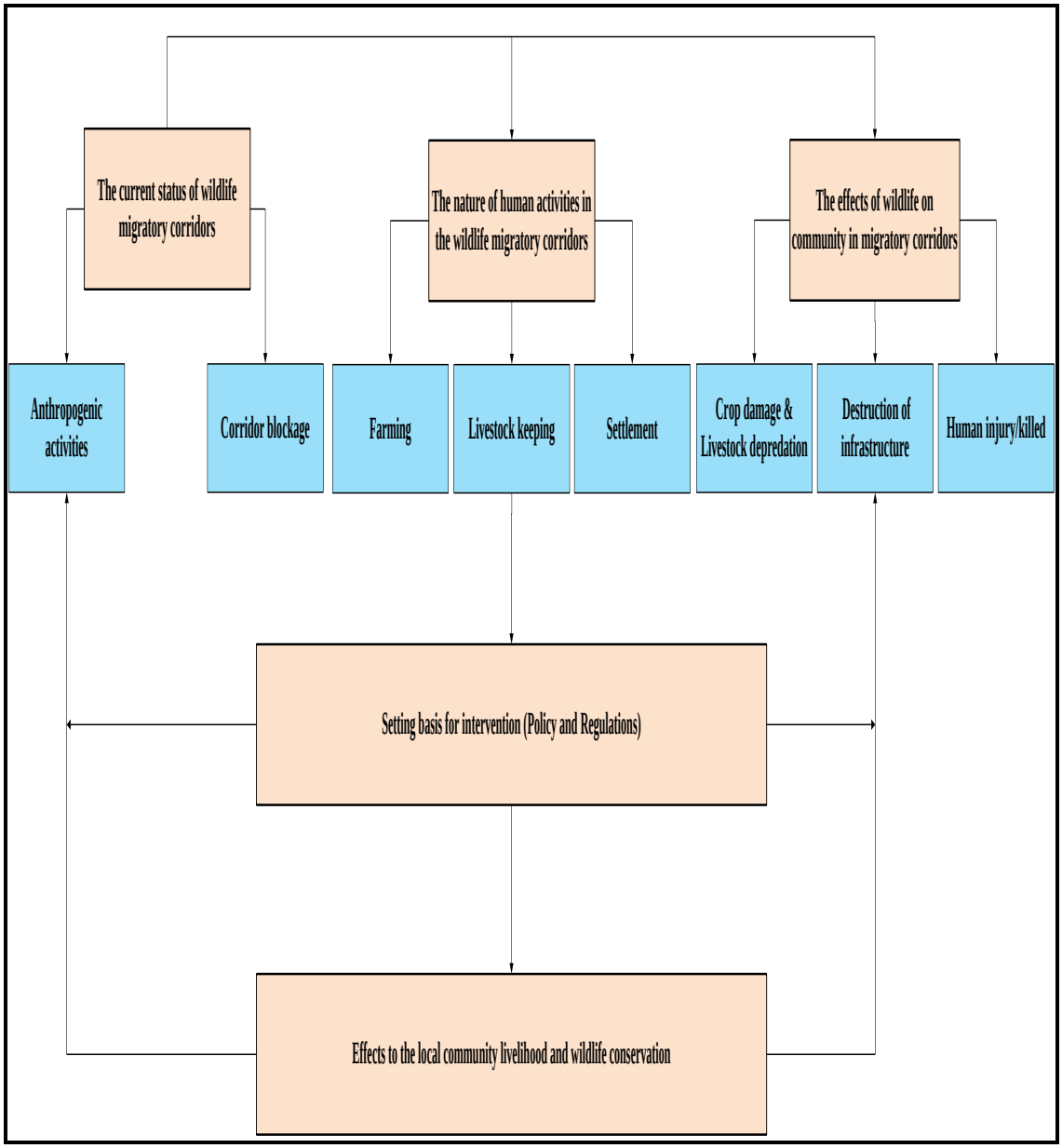

Figure 2.1: Relationship between Wildlife Corridors Blockage and Surrounding Communities

Source: Modified from Liu, 2018

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter deals with a description of the study area, research approach as well as research design, target population, sampling procedure and sample size. Further, the chapter elucidates on data collection methods and data analysis.

3.2 Study area

Kisimiri-Lendoiya corridor connecting Arusha National Park (ANAPA) and Kilimanjaro National Park (KINAPA) is located in Arusha region, northern Tanzania. ANAPA lies between latitude 03’12’ to 03’18’South and longitude 36’45’to 36’56’East, covering 552 Km^2. ANAPA is connected to KINAPA in Tanzania and Amboseli in Kenya. The Kisimiri-Lendoiya in east-south, West Kilimanjaro ranch east-north, Olkungw’ado in east, Longido plains in west, Lake Natron and Uwiro to Ngabobo in north are among the corridors and dispersal areas connecting ANAPA, KINAPA and Amboseli National Park. The study focused on the Kisimiri-Lendoiya corridor (Figure 3.1). The corridor is closely surrounded by two villages Kisimiri chini (817 households) and Olkungw’ado (2441 households), with Meru and Arusha as the main ethics groups (NBS, 2022). The popular in-migrant groups include the Maasai and Chagga. The main economic activities in this area are livestock keeping and agricultural activities.

The study area has bimodal type of rainfall i.e. Short rains (*Vuli*) which falls between November and January and long rains (*Masika*) which falls between March and June,

thus have two agricultural seasons. The average annual rainfall ranging between 500m and 1200 mm, and normally rains starts between mid – October and December, February and ends in May. It experiences the average temperatures of about 25^0C (January – February) and 22^0C (June-August). Generally, the soils are well drained dark sandy loams with favorable moisture holding properties of volcanic origin.

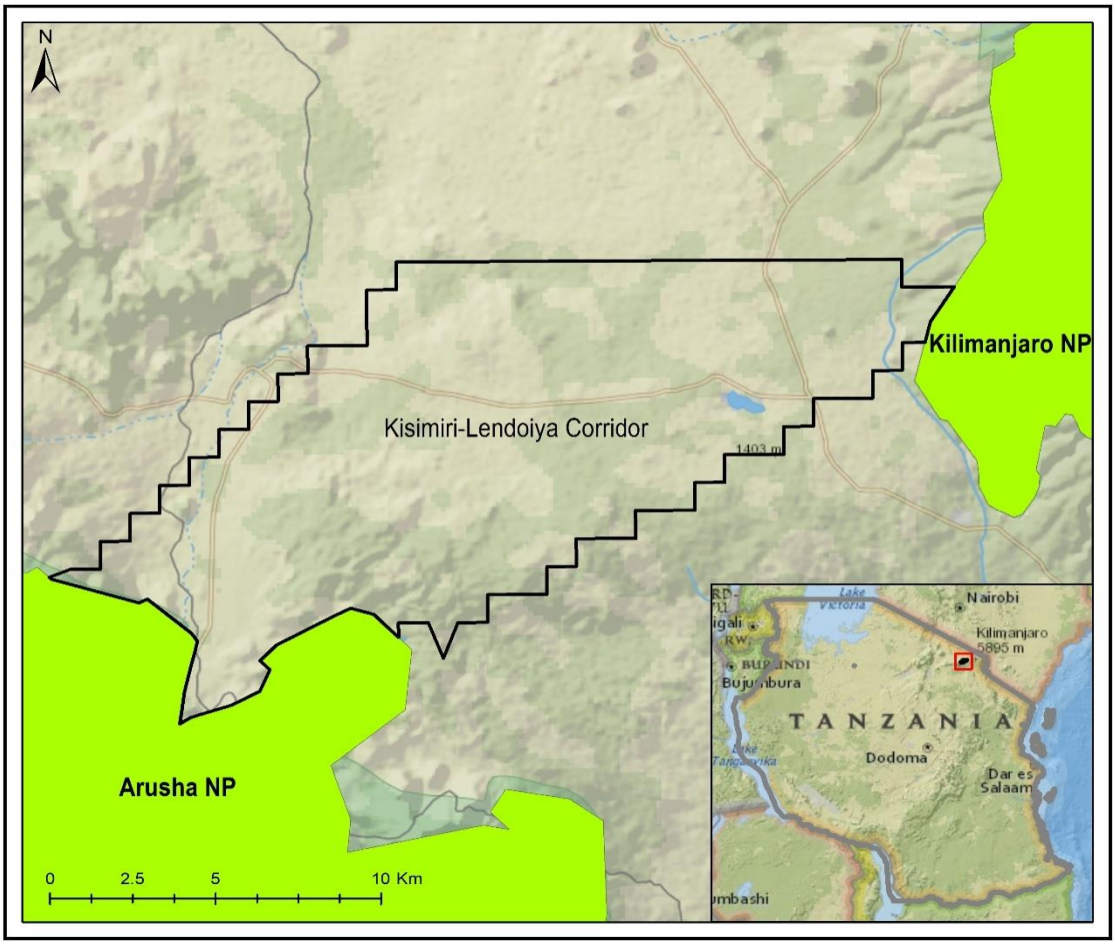

Figure 3.1: Location of the study area

Source: (TAWIRI, 2022)

3.3 Research Design

Sarantakos, (2005) defined a research design as a research strategy that translates ontological and epistemological principles into guidelines that express how the research is undertaken. Kothari (2004) views a research design as a conceptual structure within which research is conducted. Descriptive research design was used in this study. Descriptive research design narrates the facts and characteristics concerning individual, group or situation in the field.

3.4 Research Approach

Both simple quantitative and qualitative approaches were used. Quantitative approach was used collate data, which involved collecting information from households via questionnaires and other socio-economic data collection tools. On the other hand, Qualitative refers to collecting non-numerical data such as text, video, photographs, or audio recordings via open-ended and conversational discussions. The data can be collected using in-depth interviews and analyzed using grounded theory or thematic analysis (Bhattacherjee, 2012; Neuendorf, 2017).Despite existence of different types of methods, we employed key informant interviews and content analysis. Content analysis in this manner is referred to as the systematic analysis of the content of a text (e.g., extraction of information such as who says what, to whom, why, and with what effect) in a quantitative or qualitative manner, without losing its original meaning (Bhattacherjee, 2012; Neuendorf, 2017). The choice of the two approaches was driven by the fact that quantitative approach is very well suited to establishing cause-and-effect relationships, to testing hypotheses and to determining the opinions, attitudes and practices of a population under study (Bhattacherjee,

2012; Verhoef, Casebeer, 1997). Further, it relies on concrete numbers and fewer variables, thus can assist in removing biases from the research and make the findings more accurate (Krippendorff, 2018).

3.5 Sample and Sampling Techniques

3.5.1 Sample Size

The local community in the Kisimiri and Olkungw'ado villages was considered as the study population. The two villages were selected because they are within the Kisimiri-Lendoiya corridor, and reports from the local authorities show that they are the most affected villages for human wildlife related conflicts compared to other adjacent villages (Personal communication between the Student and the Village Executive Officers, Kisimiri and Olkung'wado). Based on the fact that they are the two specific group or target population for data collection, 97households selected as a sample size, quiet enough for our study area (Louangrath, 2017)delivered from a total of 3258 households, computed based on the Slovin formula as follows;

$$n = \frac{N}{1 + Ne^2}$$

Whereby; N= targeted population = 3258

n= Sample size

e= the level of precision (confidence level 10%) for provision of adequate respondents 'number.

$$n=3258/1+3258\ (0.1)^2 = 97$$

The sample size was 97 respondents

3.5.2 Sampling Techniques

Sampling is defined as the selection of some part of an aggregate or totality on basis of which judgment or inference about the aggregate or totality is made (Kothari, CR, Garg, Gaurav, 2014). Further, Cooper *et al.,* (2003) define sampling techniques as a systematic procedure of forming a manageable sample size that will be investigated to answer research questions (Dworkin, 2012). As of this specific study, sampling techniques that were used to enable its objectives being achieved include random sampling as well as purposive or deliberate sampling.

3.5.2.1 Random Sampling

Random sampling is a probability or chance sampling procedure in which every item has an equal chance of inclusion in the sample (Kothari and Garg, 2014). This sampling technique was specifically employed to obtain household from local the community. A list of entire households in the study area was obtained from the respective village government office and forms the basis for selecting sample size who then responded to the questionnaires. However, in order to obtain an unbiased study sample, the one which ensure representativeness that all member within the population have an equal chance of being included in the study sample, the approach of selecting respondents was basically similar to the one used by (Tosun, 2006) in his study about the expected nature of community participation in tourism development in Turkey. A random number generator was used to make a number of responds who were then selected from the corresponding village registers. This sampling was used as it is believed to avoid biases in sampling. To achieve this, each household was given a unique code written on a piece of paper and mixed in a box and randomly

drawn from the box. The same procedure was applied in the study area to obtain 97 respondents. Each house was given a unique code written on a piece of paper and mixed in the box where by 97 pieces were picked randomly from the box. Only heads of household were included in the study from selected households.

3.5.2.2 Purposive Sampling Technique

This is a non-probability sampling technique which considers selecting subjects because of some characteristics whereby respondents were also be known and were specifically chosen because they were providing important information for a given research study. This sampling technique was particularly applied to Managers from ANAPA and KINAPA, Meru District Game officer and Enduiment WMA manager. Also, this technique was used to select local leaders and elders from the study area.

3.6 Sources of Data and Collection Methods

The primary data were collected using questionnaire surveys, Key Informants Interview and spatial data (GIS and Remote sensing) specifically for land cover and land use characterization and delineation of the wildlife corridor. To complement the primary data; secondary data were also used.

3.6.1 Spatial Data (GIS and Remote sensing)

Assessment of the historical and current state of wildlife migratory corridor adjacent Arusha National Park was achieved by conducting spatial analysis through analysis of land use and land cover changes over a span of 10 years (2010-2020) and corridor spatial analyses. The year 2010 closely aligned with the first National Wildlife Corridor Assessment that was carried in the year 2009, and the second assessment

year 2020 was considered as it aligned with the second National Wildlife Corridor Prioritization and Action Plan (2020). The nature of human activities in wildlife migratory corridors and the effects of wildlife to livelihoods of communities in migratory corridor were examined by questionnaires with local communities and interviews with government officials. The interviews and observations were used to obtain information about the state of wildlife migratory corridors, the nature of anthropogenic activities in the wildlife migratory corridors, the effects of wild animals on community adjacent ANAPA.

3.6.2 Questionnaires

Questionnaires were administered to heads of households in the selected villages. 97 respondents selected using a random sampling approach after determining a number of persons were given the questionnaires. Generally, the questionnaires were clearly designed and piloted before administered to respondents, and respondents were treated as key stakeholders in the study. Therefore, both open ended and closed ended questions were used to collect data from heads of household, specifically on the effects of wildlife corridors' blockage to their livelihoods and or how their socio-economic activities contributed to the changing status of wildlife migratory corridors in the study villages. Researcher and research assistants in collaboration with local authority administer questionnaires door to door to respondents.

3.6.3 Interview

Through interview, information about the current state of wildlife migratory corridors compare to the past, trends, impacts and source of human-wildlife conflicts

due to wildlife migratory corridors blockage were collected. A total of 26 respondents (Meru District Game Officer, Conservation Managers from KINAPA, ANAPA, TAWA and Enduiment WMA (5) villages government leaders (12) whereby 7 were from Olkung`wado and 5 from Kisimiri, villages elders from Olkung`wado (5) and Kisimiri (4) villages were interviewed. The selection of respondents for interview considered their knowledge of wildlife corridors development and changes have had happened overtime for the past ten years.

3.6.4 Direct Observation

Direct observation method was employed to obtain information through investigator's own direct observation without direct contact with respondents. This method or technique made use of observational guide or checklist to assist the researcher to observe respondents' and current situation in the study area. Direct observation by using a checklist guideline was used to obtain information relating to human activities in the wildlife corridor such as mitigation measures applied in human wildlife conflict, farming, grazing livestock, firewood collection, settlement, cutting down trees and collection of firewood and how these are likely to impact the wildlife corridor.

3.6.5 Land Cover and Land Use Characterization

Random points spaced at least 500 meters apart (overlaid in Landsat images for the year 2010 and 2020), were generated and traced on ground using hand-held GPS (Congalton, 1991). Following this, 2225 sample points were generated shown in Table 3.1. Sample points falling in inaccessible areas were replaced with samples

from nearby similar reflectance pixels overlaid in high resolution images and the corresponding land cover identified (van Vliet *et al.*, 2011). Image classification procedures followed the steps outline in figure 3.2.

Table 3.1: Sample Points for Image Classification and Accuracy Assessment

Land use and land cover type	Training set		Validation set		Total samples
	2010	2020	2010	2020	
Bare-land	111	103	47	44	305
Cultivated land	57	117	25	50	249
Grassland	115	207	49	89	460
Settlement	71	111	31	48	261
Shrub-land	86	106	37	45	274
Water bodies	97	96	42	41	276
Woodland	181	98	78	43	400
Total samples	718	838	309	360	2225

Source: Field data, 2022

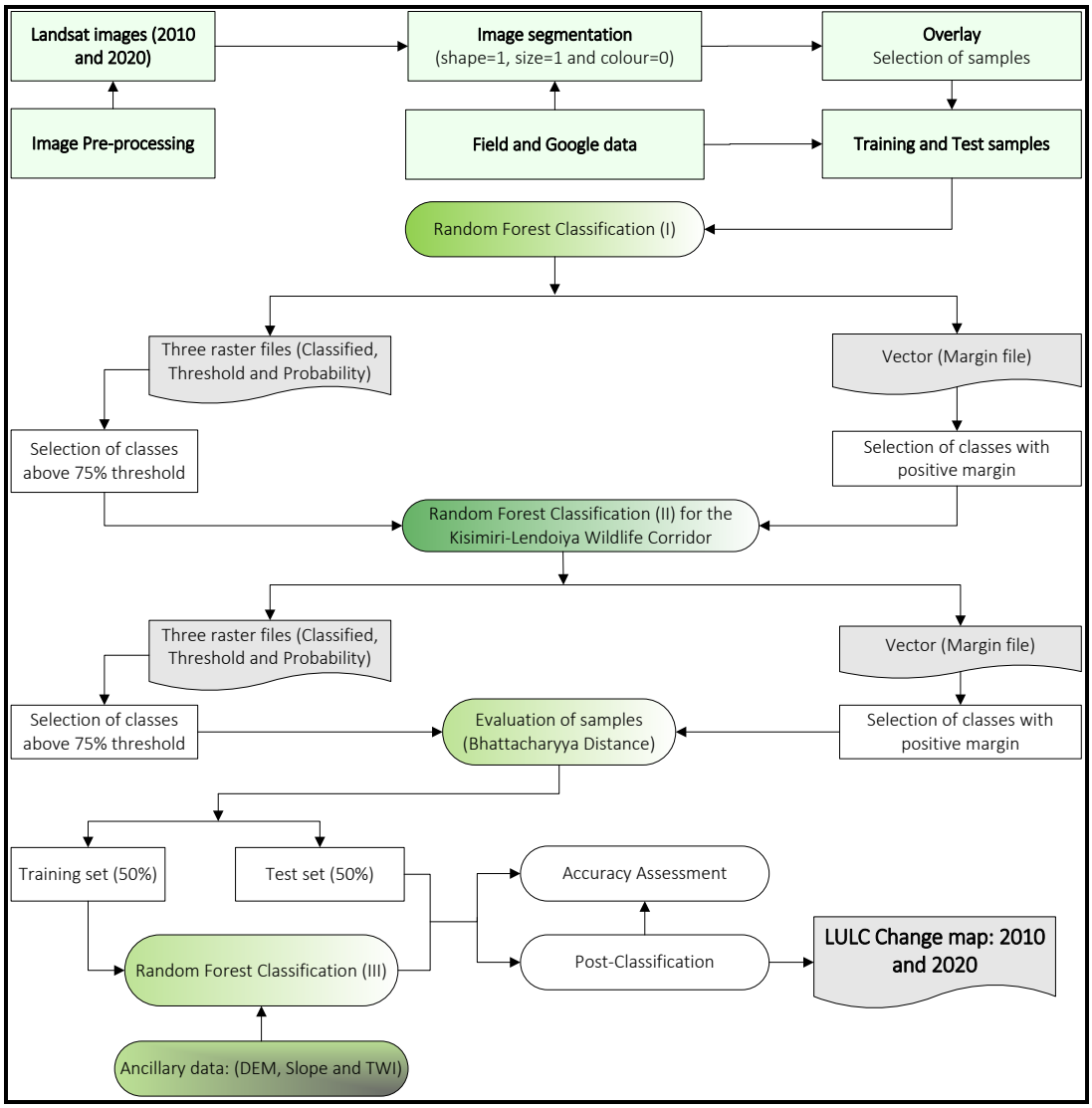

Figure 3.2: Methodological Flow Chart For Land Use and Land Cover Characterization

Source: Field data, 2022

3.7 Data Analysis, Interpretation and Presentation

3.7.1Qualitative Data

Qualitative data and information from the discussion with key informants were analyzed through Content analysis. Content analysis is a scientific study of content of

communication or a set of methods for analyzing what is contained in a message to reduce the total content of communication to some sets of categories that represent some characteristics of research interests (Singleton, 1993). It is considered as a non-reactive method of social science research, utilizes a set of procedures to make valid inferences from text or content. Therefore, information collected through verbal discussions (observation and document) with the key informants' interviews was broken down into the smallest meaningful units of information on the two study villages.

3.7.2 Quantitative Data

Simple Descriptive Quantitative data from household surveys were processed and analyzed in the Statistical Package for Social Sciences (SPSS) version 26.0 (SPSS Inc., Chicago, IL, USA). Most of the quantitative analyses portray descriptive statistics, resulting in ascertaining frequencies, percentages and cross-tabulation of responses to test response about community awareness on wildlife conservation in the corridor and their contribution to biodiversity conservation. Results are presented using pie charts, tables and graphs.

3.7.3 Remote Sensing Data

Random Forest (RF) in R software (Breiman, 2001)was used for 2010 and 2020 image classification. RF is a powerful machine learning classifier that has received wider acceptance in land-based remote sensing, with advantages such as; high classification accuracy, robust to noise compared to other classifiers and a non-parametric classifier (Cutler *et al.*, 2007; Frakes *et al.*, 2015).

3.8 Validity and Reliability

Validity refers to the extent to which data collection method or methods accurately measure what they were intended to measure or the extent to which research findings are really about what they profess to be about (Saunders *et al.*, 2007). In order to ensure validity of the study, a pilot study was conducted in the study area to test the accuracy of information in the questionnaires. Land use and land cover change accuracy was measured through the application of satellite image.

Reliability refers to the extent to which data collection technique or techniques yield consistent findings (Saunders *et al.*, 2007). Reliability was measured through checking the questionnaires in advance. Also, feedback and field notes were taken to clear doubts on the collected data. Bias was reduced through use of semi structure questionnaire of both open-ended and closed-ended questionnaires.

3.9 Ethical Considerations

Participants were fully informed in advance and freely agreed to give their views and it was expressed that data collection is mainly meant for the stated purposes and just in case third part need the same data for different study, they will be informed. During and post-data collection, issues of confidentiality and anonymity was taken care.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the study findings. Findings are presented according to research objectives and respond to the research questions that guided the study. Findings responds to demographic characteristics of the study area, and the state of land use and land cover changes, structure and configuration of the study's corridor, including the negative effects of blockage. This section presents as well the effects of wildlife to livelihoods and lastly it draws conclusions and recommendations.

4.2 Demographic Characteristics of Respondents

Descriptive social-economic characteristics of the interviewed respondents (97) include respondent's demographic related characteristics such as; age composition, gender, education, marital status and occupations. Other descriptive results include human-wildlife conflicts (crop raiding and livestock depredation). These data were important in order to provide a quick background of the study's respondents.

4.2.1 Distribution of Respondents by Gender

Results are only limited to two sampled villages within the Lendoiya-Kisimiri corridor, namely; Kisimiri (N=24) and Olkung'wado (N=73%). Regarding gender, majority of sampled population were male (75.3%), and female constituted only 24.7% (Figure 4.1). Olkung'wado village represented most of both male and female sampled population (Male - 56.7% and female – 18.6%) than in Kisimiri village (Male - 18.6% and female - 6.2%).

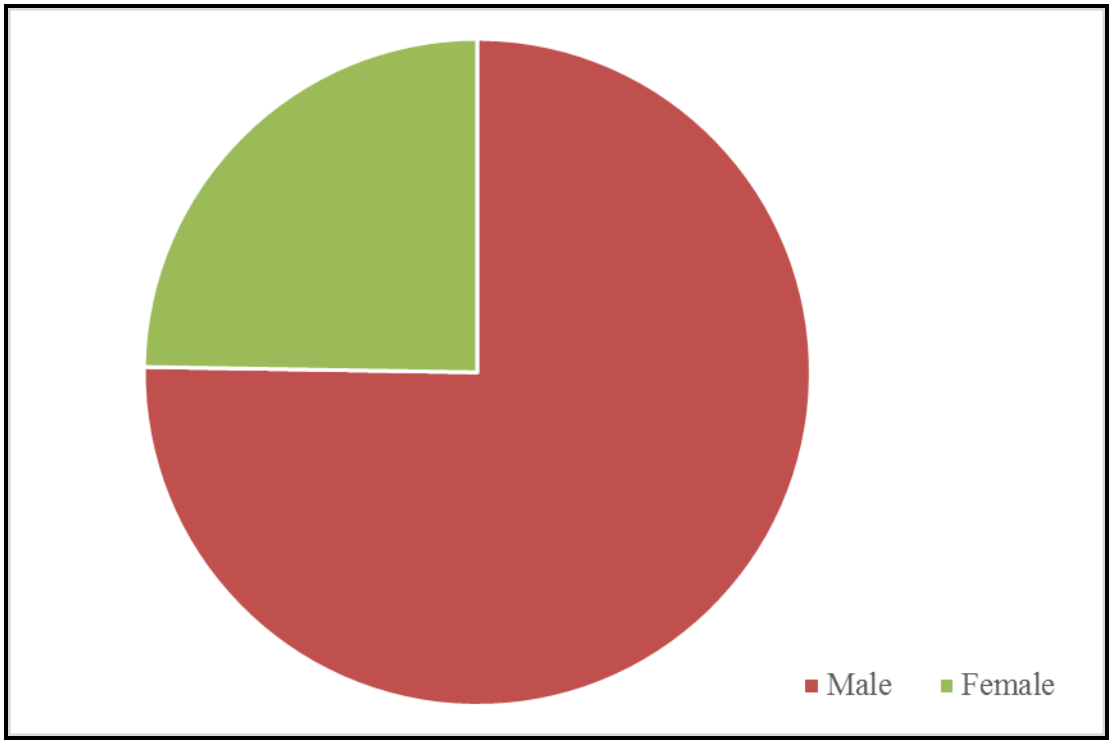

Figure 4.1: Gender of respondents

Source: Field data, 2022

This ratio suggests presence of low level of participation of women in various socio-economic responsibilities. Looking at the return of respondents, indicates that the sampled population and responses are adequate and acceptable for scientific analysis (Babbie, 2020; Mugenda, Mugenda, 2003). Looking at the results, a conspicuous gender imbalance as a result of strong cultural background biased against women is observed. Only few women were interviewed compared to male, and this could be associated with the patriarch system in Tanzania and other African countries where women are less involved in decision making because culture dictates women being subordinate to male (Chami, 2016; Dutt *et al.*, 2016; Michael, 1998; Songorwa, 1999).

The low number of female respondents could also be explained by the fact that most of the interviewed households were male. Low number of women participations in socio-economic interviews, including associated factors has also been reported elsewhere (Homewood *et al.*, 2022; Michael *et al.*, 2013; Van Aelst, Holvoet, 2018). Normally, male dominance affects household's decision-making, and is considered as an impediment to poverty reduction strategies at national level.

These respondents were born in the study villages 66% (Kisimiri – 14.4% and Olkung'wado – 51.5%); however, high population of those who were born from outside the study villages indicates Olkung'wado had more 23.7% compared to Kisimiri 10.3%. The leading driving factor to reside in the study villages includes employment (30.3%) and fertile lands (27.3%). Other reasons for migration in both villages are shown in figure 4.2 below.

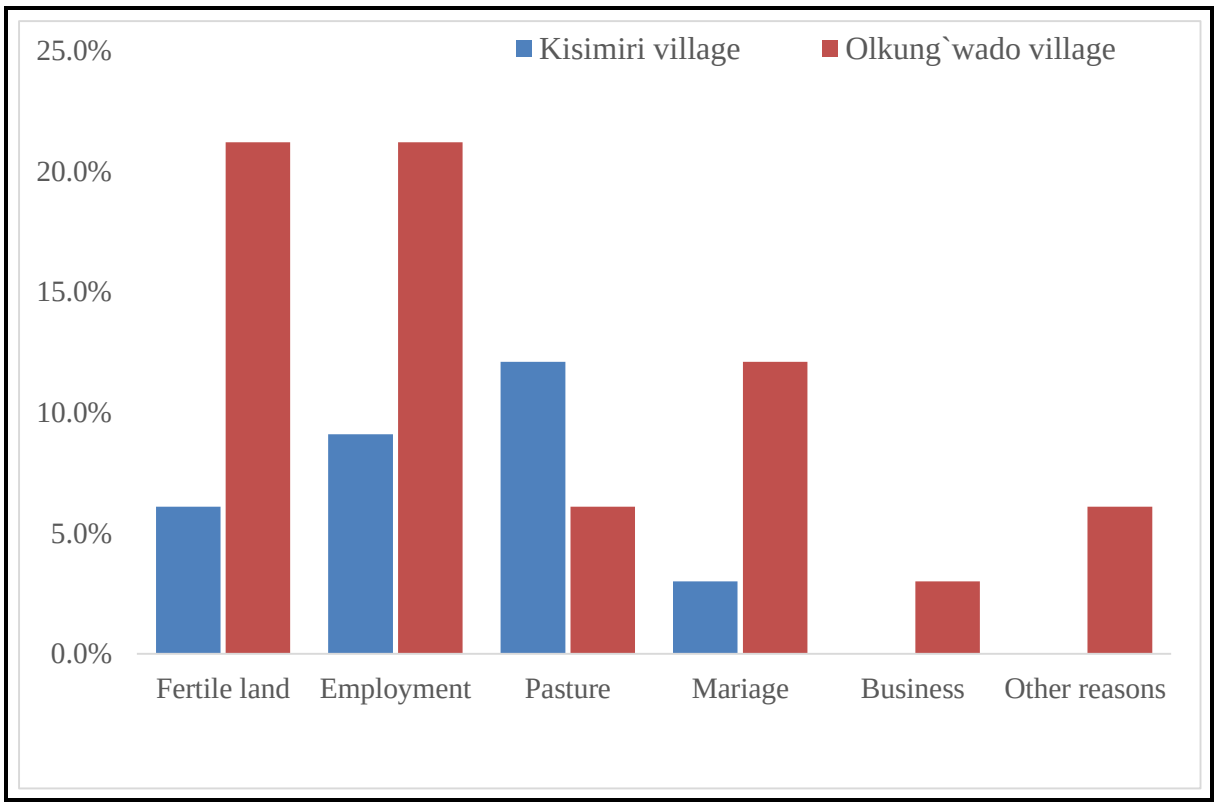

Figure 4.2: Reasons for Migration to the Study Villages

Source: Field data, 2022

Majority of the study's respondents were married (86.6%), followed by single (8.2%) and divorced which constitute 5.2% as shown in table 4.1. Education level among respondents show that, 11.3% had no formal education, 69% had primary level of education level, 19.6% had a secondary level of education and very few (3.1%) had a tertiary level of education (Table 4.1).

Table 4.1: Marital Status and Education Level of Respondents

Marital status/Education level	No formal education	Primary education	Secondary education	University level of education	Total
Married	10 (11.0%)	58 (69.0%)	13 (15.5%)	3 (3.6%)	84
Single	1 (12.5%)	1 (12.5%)	6 (75.0%)	0 (0%)	8
Divorced	0 (0%)	5 (100%)	0 (0%)	0 (0%)	5

Source: Field Survey, 2022

Both for marital status and education level Olkung'wado village had more proportion compared to Kisimiri village. The study findings revealed that majority of the interviewed respondents were married, implying presence of families with a good number of family members and children available to undertake socio-economic activities in the community. This distribution implies that most respondents are basic education level or a high number of people with formal schooling (76.6%), in all categories from primary to tertiary level, entailing members of population with indigenous knowledge and with basic life skills including environmental conservation. Study elsewhere reported that high level of formal education place the community at stake in a better understanding and provides and understanding to undertake better decision making (Kessy, 1998; Njana, 2008). Having most of respondents with low level of formal education was due to traditions of the resident's societies like Meru who do not encourage their children to attend schools; instead many of them remain at home taking care of other duties according to their age class.

4.2.2 Age Distribution of Respondents

Most of the respondents were of age between 41-50 (35.1%) and 31-40 (34%) years compared to other age categories (20.6% for the age between 51-60 years), and 10.3% for the age category of 18-30 years. Kisimiri village have more people of the age class 41-50 (32.9%) against 32.9% in Olkung'wado village, whereas for the age class 31-40 Olkung'wado have more people (26.8%) than Kisimiri village (7.2%). Other age group categories are shown in figure 4.3. The dominant age category was between 31-40 and 41-50, comprised > 75% of the respondents, indicating maturity age class within the society, economically most active and productive groups, fully assuming responsibilities for their households and the age category that is legally allowed according to the Constitution of Tanzania and the Law of Marriage Act, 1971 (URT, 1977; URT, 1971). Involvement of different age groups in the study was very important because different age groups had different experiences on the past situation of the study's area.

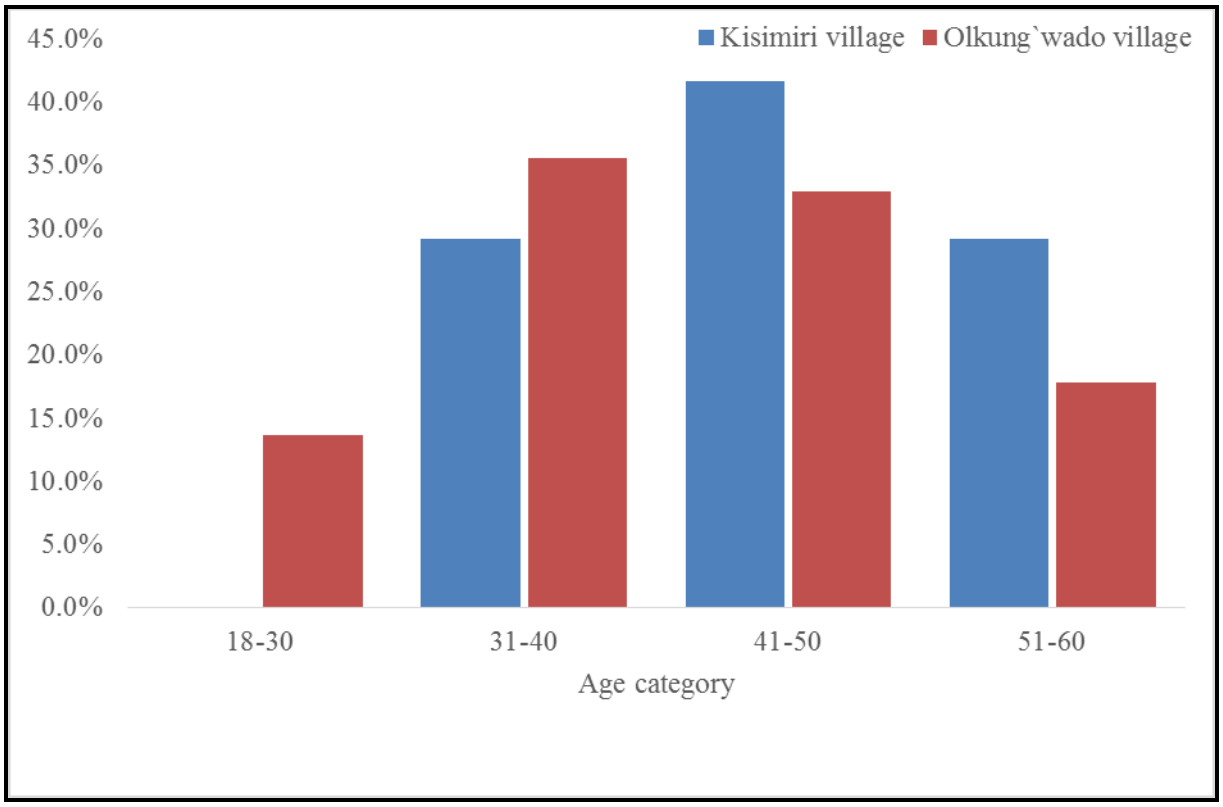

Figure 4.3: Age Class Distribution in the Study Villages

Source: Field Data, 2022

The study findings corresponds with results from the previous studies (Chami, 2016; Giliba *et al.*, 2011) who reported age class of 31-50 as the most dominant and available productive age category in rural settings who participate in economic and environmental conservation and is in line as well with Njana (2008) study in the Miombo woodlands of Western Tanzania and the report by the National Bureau of Statistics (URT, 2012) which indicates the same age as the most available and supportive national work-force for engagement household economic activities.

4.2.3 Land Ownership

Land possessions in the study villages stand at 89.7% (Kisimiri – 22.7% and Olkung'wado village – 67%). The acreage ownership is at 77.3% for plots with a size of 1-5 acres (Kisimiri – 12.4%, and Olkung'wado village – 64.9%), and the acreage size of greater than 5-10 is at 22.7%. Land ownership is mainly through purchase (44.3%) and inheritance (37.1%), whereas acquisition through village land procedure constitutes 18.6% (Figure 4.4 and Table 4.2).

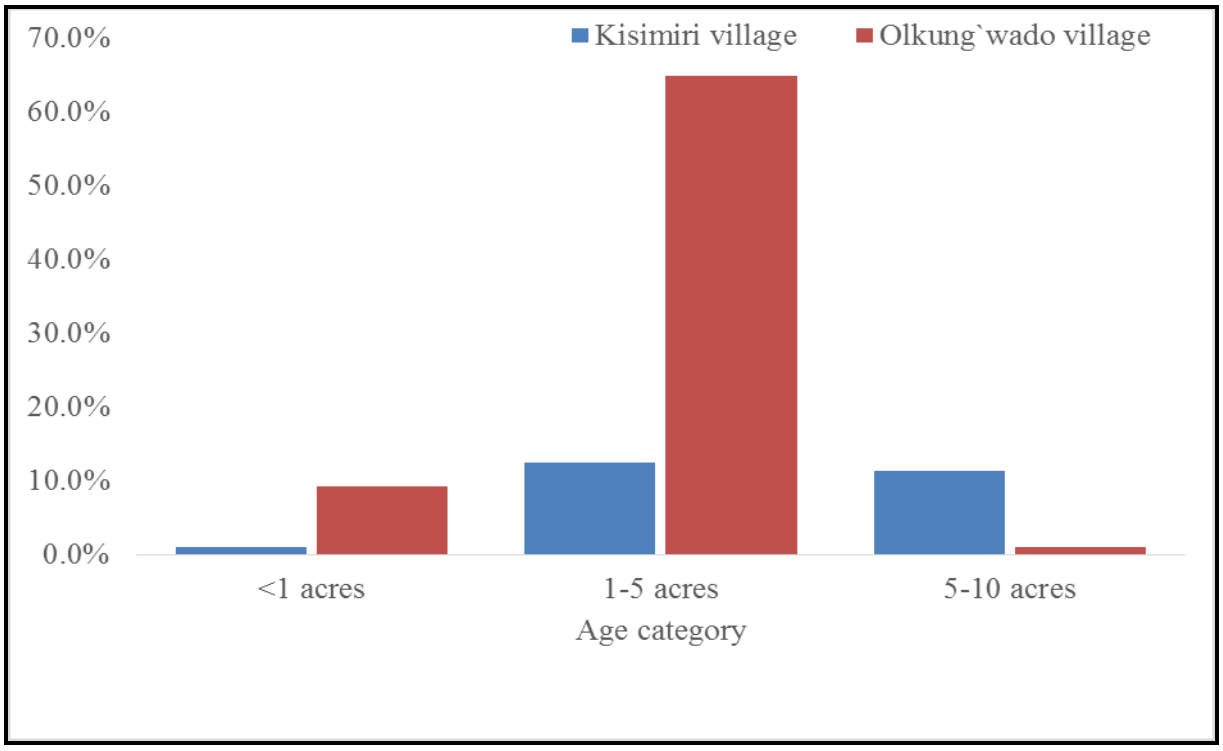

Figure 4.4: Proportions of Land Ownership in the Study Villages

Source: Field data, 2022

Table 4.2: Land Ownership in the Study Village

Village	Purchased land	Inherited land	Land acquisition	Total
Kisimiri	14 (58.3%)	5 (20.8%)	5 (20.8%)	24
Olkung`wado	29 (39.72%)	31 (42.5%)	13 (17.8%)	73
Total	43 (44.3%)	36 (37.1%)	18 (18.6%)	97
Percentage	44.3%	37.1%	18.6%	100.0%

Distribution of land acquisition in relation to study villages indicates that, land purchase is highly practiced in Olkung'wado village (29.9%) than in Kisimiri village (14.4%). Inheritance is more dominant in Olkung'wado village (32%) than in Kisimiri village (5.2%). Acquisition through village procedures accounts for 13.4% in Olkung'wado, and 5.2% in Kisimiri village. The majority (86.2%) of respondents owned land of 1-5 ha, of which they considered it not to be enough for farming activities, and only 13.8% do own 5-10 ha of land for cultivation. Similar arguments were reported in the previous study by Uliwa and Fischer (2004)whereby 70% of the respondents were reported to own and cultivate in less than or around 1 ha.

Land acquisition in Tanzania especially village land is governed under the Village Land Act (1999) and the Land Act (1999). The Village Land Act, number 5 of 1999, refers to governance and administration of village land, which constitutes 70 per cent of the whole land mass of Tanzania Mainland. The same act provides for the customary rights to occupancy, whereby villages are granted Certificates of Customary Right of Occupancy (CCROs). In Tanzania, most of local people acquire lands through inheritance from their parents.

4.3 State of the Kisimiri-Lendoiya Wildlife Corridor

4.3.1 Assessment of land Use and Land Cover Changes

Interpretation of thematic maps for the year 2010 indicates that grassland cover type dominated the area by 53.01%, followed by shrubland 20.24%, cultivated land 15.04%, woody cover 9.52%, and least for bareland 1.85% and water at 0.34%. On the other hand, in 2020 grassland cover continued to occupy the highest proportion 41.40%, followed by shrubland 41.40%, cultivated land 20.68%, and less than 1% was recorded for bareland and water bodies (Table 4.3, Figure 4.5 and 4.6). During the study slice (2010 – 2020) cultivated area, shrubland and water bodies cover increased, whereas, bareland, grassland and woodland cover types declined in size.

Table 4.3: Proportions of Different Land Use and Land Cover in the Study Area

Land use and land cover type	Areal coverage (Ha)		Proportional (%)	
	2010	2020	2010	2020
Bare-land	356	142	1.85	0.74
Cultivated land	2888	3972	15.04	20.68
Water bodies	66	90	0.34	0.47
Grassland	10182	7952	53.01	41.40
Shrub-land	3887	5293	20.24	27.56
Woodland	1829	1759	9.52	9.16

Source: Field data, 2022

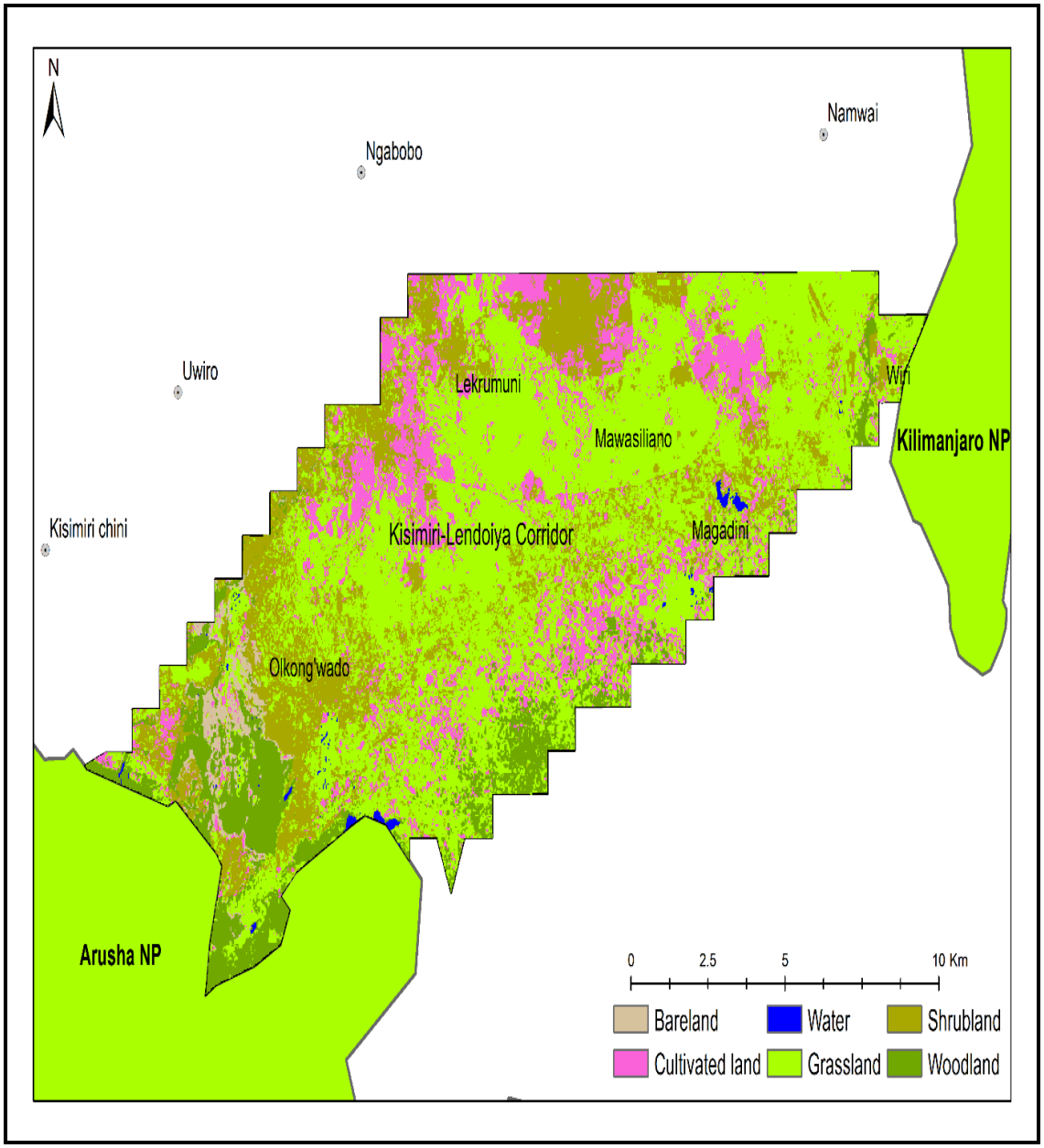

Figure 4.5: Land Use and Land Cover for the Year 2010

Source: Field Data, 2022

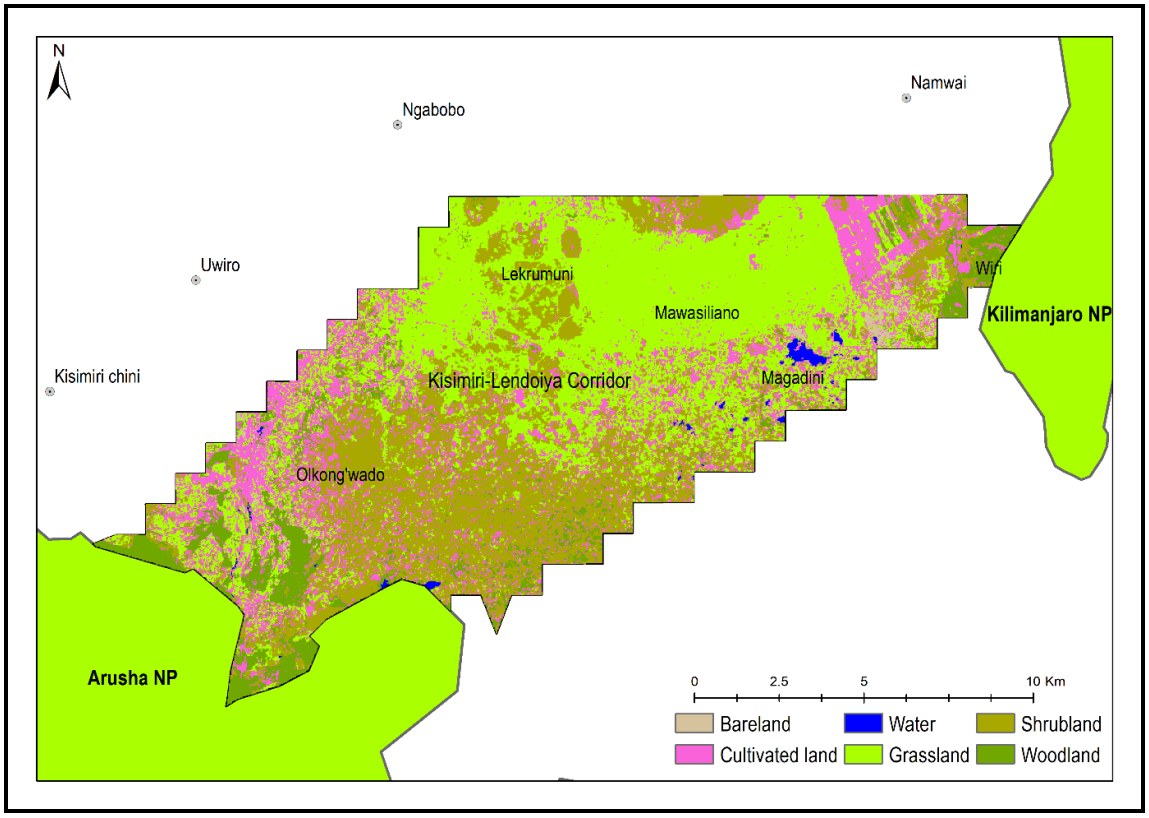

Figure 4.6: Land Use and Land Cover For The Year 2020

Source: Field Data, 2022

Based on the content analysis, it was reported by one key informant that:

> *"Land fertility could be the pull reason the increase in human population in the area, where people open areas for agriculture practises and associated settlements".*

Large proportion of grassland and scrubland cover types is a good indication for available cover type that can provide forage to grazers and browsing species, and can provide hiding grounds as well. However, decline in grassland between 2010 and 2020 is a bad sign in ecological integrity of the area, indicating a reduced cover type for grazing species. Decline in bare land area, suggests an improved condition of the landscape, and signals for the increased vegetated cover. Increase in water bodies

denotes available water for domestic use, irrigation and for livestock and wildlife use. Low proportions of anthropogenic disturbed habitat through conversion of natural vegetation to cultivated and settled area as noted from the decline of bare-land area provides a picture of reduced threat level to habitat conditions (reduced risk for erosion, degradation, etc). Decline in woodland cover type indicates reduced habitat for mixed feeders (e.g. elephant) and large sized browsing ungulates (e.g. giraffe).

The overall accuracy for the years 2010 and 2020 is 88.76% and 91.62% with Kappa Index of Agreement (KIA) of 0.87 and 0.90 respectively. In thematic classification, an overall accuracy of ≥ 85 is considered acceptable, given the per-class accuracy is ≥ 70 (Thomlinson *et al.*, 1999). Accuracy assessment is accompanied by KIA, a measure of how well the classified map and reference data match-up. According to Tateishi *et al.*, (2007), KIA values > 0.8 reflect perfect classification and between 0.6 and 0.8 indicate a good classification. Therefore, the KIA were considered acceptable for classification and are presented along the confusion matrix (Foody, 2002; Tateishi et al., 2007). Information on land use and land cover changes are providing critical understanding of ecological processes that influence the ecological integrity of wildlife dispersal areas or corridors and an indication of spatio-temporal patterns of human-wildlife conflicts in human dominated landscapes. Expansion of anthropogenic related activities such as cultivation and settlement can significantly reduce wildlife habitats. Land use and cover changes can inform ecological interventions by restricting further expanse of timely conservation of remnant or

fragmented habitats, and can be a baseline point for proper land use planning and an alert to future state.

The current obtained results are in consistency with study by Kija *et al.,* (2020) in a savannah dominated landscape who reported that grassland and shrub-land had high proportions amongst other vegetation and/or habitat types. The same study recorded decline in woodland cover as well. Decline in woodland cover in tropical countries is a common phenomenon, the same scenario has been reported as well by Kideghesho (2015). The decline was associated with increased human population and poverty. In contrast, our results differ to a study conducted in a woodland dominated area of the eastern arm of the Selous-Niassa Wildlife Corridor (Nachingwea District), whereby shrub-land and woodland cover dominated the area. This could be probably due to the fact that, the two areas are in two different ecologically dominated landscapes.

4.3.2 Determination of the Kisimiri-Lendoiya Wildlife Corridor

Spatial analysis indicates that currently the Kisimiri – Lendoiya wildlife corridor has a length of 26.3 Km, and an average width of 10 Km and a perimeter of 192 Km (Figure 4.7a). The corridor traverses through village lands (Olkung'wado, Lekrumuni, Mawasiliano, Magadini and Wiri), with a variety of anthropogenic activities including farming, human settlement and other livelihoods activities. Previously (2010), the corridor has a length of 26.3(same as the current because it connects the two areas, whose distance has not changed), average width of 14.3 and a perimeter of 273.28 Km (Figure 4.7b). Some wild species such as elephant, buffalo, zebra and primates were sparsely observed. Wildlife corridors provide areas for

wildlife to move from one point to another in search of basic resources such as forage and breeding sites. Wildlife corridors maintains landscape connectivity, thus assist in developing effective conservation strategy for wide-ranging mammals such as the African elephant (*Loxodonta africana*), and reduce fragmented landscapes and isolated metapopulations. Using the Linkage mapper, Kisimiri-Lendoiya wildlife corridor. The possible reasons for shrinkage of the corridor could be due to conversion of natural habitats into agricultural land, urban areas, or infrastructure development. Deforestation, land clearance, and expansion of human settlements can all contribute to habitat loss and the narrowing of corridors.

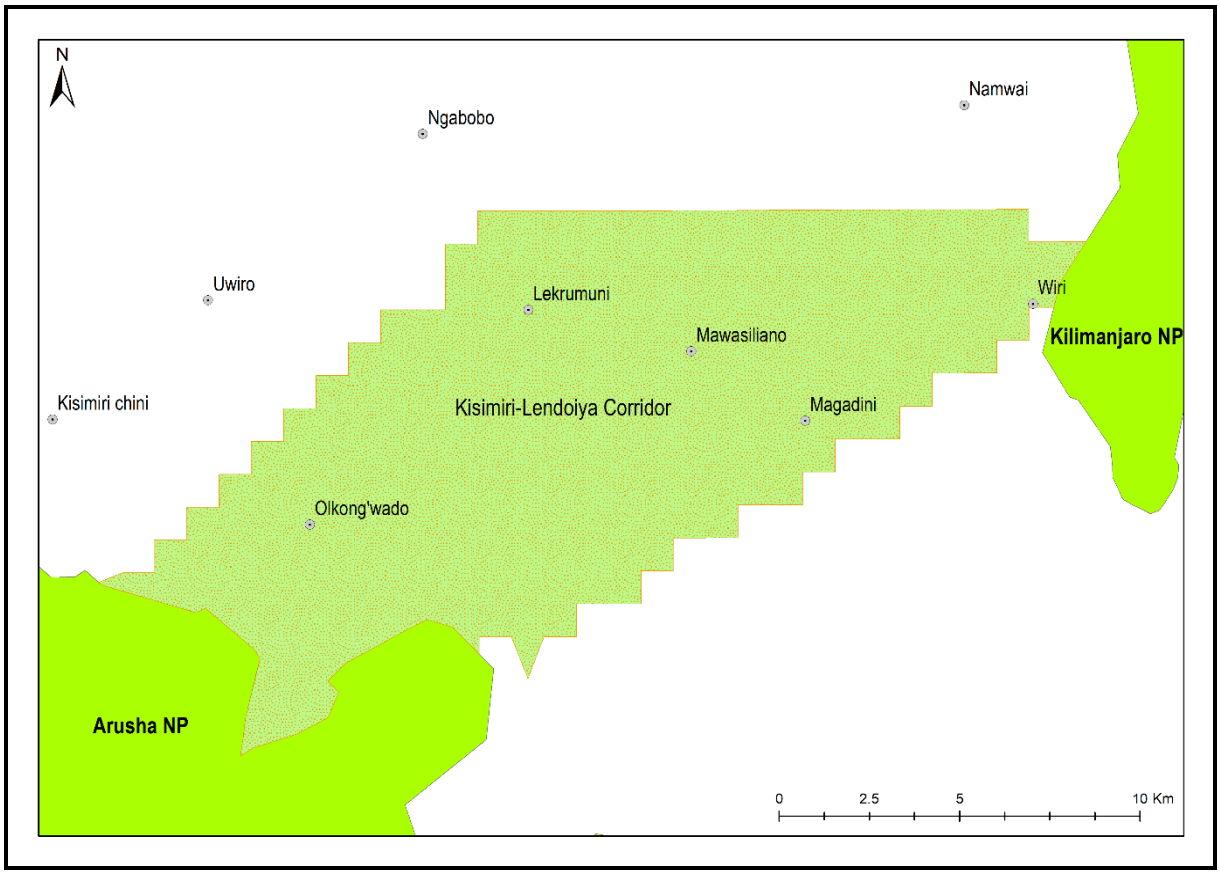

Figure 4.7a: Kisimiri – Lendoiya Wildlife Corridor in 2020

Source: Field Data, 2022

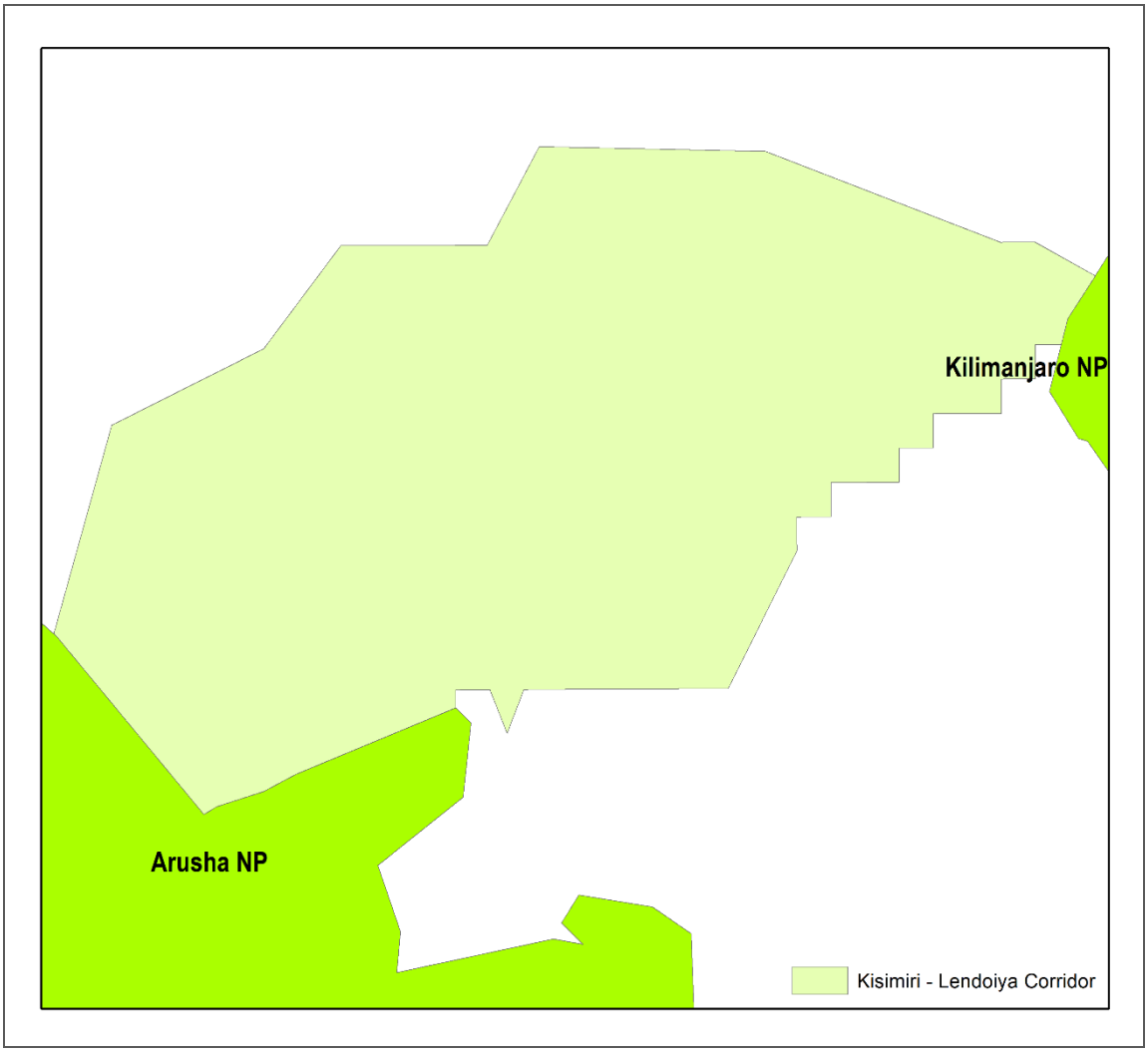

Figure 4.7b: Kisimiri – Lendoiya Wildlife Corridor in 2010

Source: Analysis of 2010 Landsat Image

4.3.3 Effects of Blockage to the Kisimiri-Lendoiya Wildlife Corridor

Anthropogenic related activities such as cultivation, settlement, and grazing are impacting wildlife corridors. Results indicates that, majority of respondents reported that blockage of the corridor has resulted into increased conflicts between wildlife and humans, particularly crop raiding (N=43 ~ 44.3%) followed by restricted wildlife movements (N=36 ~ 37.1%). Other impacts reported were reduced chances for finding mates or getting hiding places and birth (N=11 ~ 11.3%) and 7.2% didn't have an idea of what are the impacts for blockage of these areas (Figure 4.8).

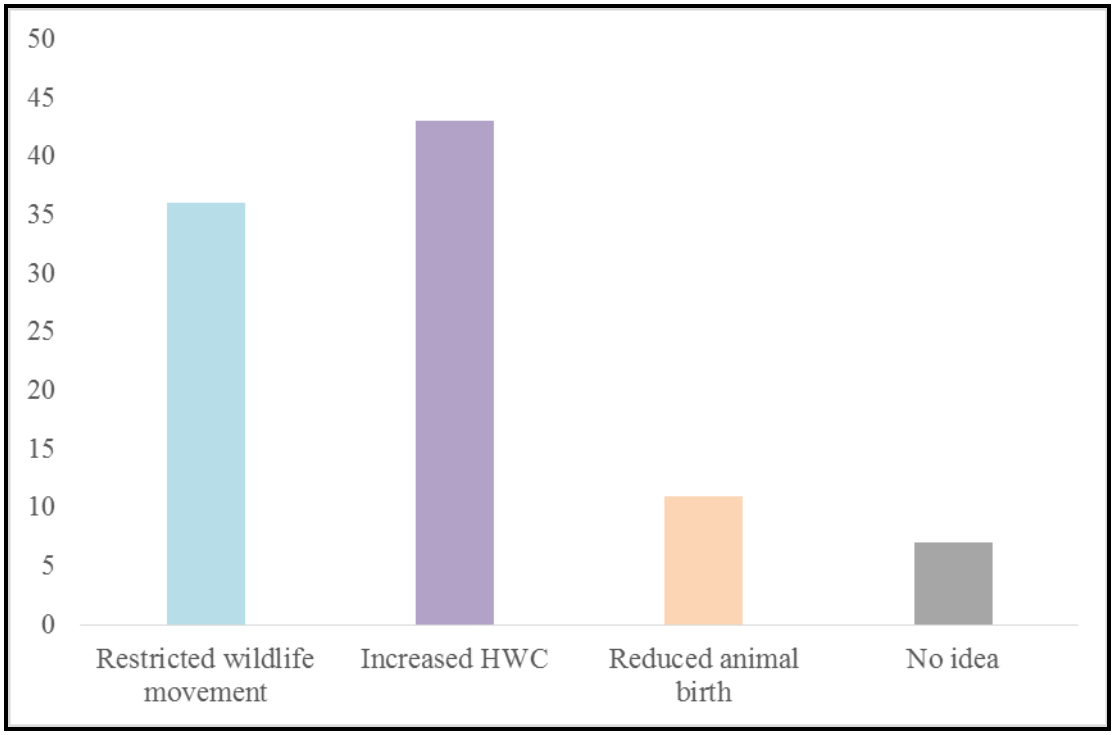

Figure 4.8: Impacts of Blockage of the Kisimiri-Lendoiya Wildlife Ccorridor

Source: Field Survey, 2023

Species such as wildebeests and zebra are migratory in nature and usually have permanent routes when traversing in search of basic needs. Once their routes are blocked as a result of anthropogenic activities particularly; settlements, cultivation and livestock keeping they come into contact with domestic animals or might enter into crop raiding incidences. For example, the Kisimiri-Lendoiya wildlife corridor has been blocked by human activities including the West Kilimanjaro livestock ranch as it was reported by one respondent that:

> *"Migratory species e.g. zebra and wildebeest move to the study corridor on the way between ANAPA and Kilimanjaro NP or during dispersal in adjacent communal lands, however, we have been observing reduction of these incidences over the past 10 years".*

This has facilitated wildlife and livestock contacts when wildlife is trekking through this corridor in search of life necessities such as pasture, water and mineral licks. There has been immigration of people from other areas to the study area for cultivation, animal grazing, and employment. This is perceived as a pull factor for habitat degradation to areas which were previously used by wildlife. Further, some areas in the corridor are fenced (Plate 4.1), to protect crops, thus negatively impacting food resources for wildlife as animals are unable to access wild food and appropriate gene flow.

Plate 4.9: Fencing to Protect Elephant from Crop Raiding in West Kilimanjaro

Photo Source: Tanzanian Elephant Foundation, 2022

Anthropogenic driven land use changes continuously reduces the buffer zones which act as shock absorption and therefore increasing edge effect. It was observed that ANAPA lacks buffer zones. According to Beier and Noss (1998) habitat connectivity and buffer zones are important for wildlife to surviving stressful conditions and ensuring health population. Content analysis result indicates that the corridor is largely threatened by settlements, agriculture, cattle grazing, illegal tree cutting and charcoal making. Human-wildlife conflict and wildlife crimes are other threats to the corridor. Poor implementation of the village land use plans and poor understanding

importance of the corridor in sustainable biodiversity conservation are also a major threat.

4.4 Nature of Human Activities in the Kisimiri-Lendoiya Wildlife Corridor

The main socio-economic activity in the study villages are; crop production (55.7%), followed by livestock keeping (23.7%), formal employment (15.5%), and other activities (5.1%). Crop production is mostly practiced in Olkung'wado village than in Kisimiri village. For livestock keeping, Kisimiri village accounts more livestock than Olkung'wado village (Table 4.4). Employment account 16.5% (Formal employment – 15.5% and non-formal – 1%) of the main socio-economic activities. Business account 1%, and mainly involve kiosks, retail shops, and food vendors (mama lishe), commercial business of maize, beans, banana and beef. Olkung'wado village has more employed people than Kisimiri. Other activities include business and casual labour (Table 4.4).

Among the livestock kept, goats constitute 48.5% (12.4% in Kisimiri village and 36.1% in Olkung'wado). Sheep constitutes 12.4% (2.1% in Kisimiri and 10.3% in Olkung'wado). Majority of livestock are goats, this could be due to their price, i.e. it is easy to buy goats than cattle, and goats are preferred to sheep.

Table 4.4: Main Socio-Economic Activities in the Study Villages

Village Name	Source of Income				
	Employed	Crop production	Livestock keeping	Business	Casual labour
Kisimiri	4.1%	5.2%	13.4%	1.0%	1.0%
Olkung`wado	11.3%	50.5%	10.3%	3.1%	
Total	**15.5%**	**55.7%**	**23.7%**	**4.1%**	**1.0%**

Source: Field data, 2022

High proportion of farmers could also be linked to the fact that agriculture is the key economic activity in rural areas (the main activity in rural settings) and is a backbone of the national economy, i.e., thus contributing to the economic growth as agriculture sector in Tanzania, accounts approximately 65.5% of employment, 29% of Gross Domestic Product and 65% of industrial raw materials(URT, 2019). The nature of the economic activities is more or less the same as in other areas around protected areas or in wildlife corridors (Runyoro *et al.*, 2018).

In the study villages, results indicate major cash and staple crops cultivated include maize (the main staple food) and beans. Others crops are sweet potatoes, banana, sunflower, cowpeas, and vegetables. The agriculture system is found to be a subsistence kind of farming system, supporting other similar studies in other rural area in Tanzania (Giliba *et al.*, 2011; Kessy, 1998; Njana, 2008). Crop production in the study villages face some challenges such as; climatic variability, especially un-predicted or unreliable rainfall, and crop raiding by wildlife species. Other challenges include low prices offered during harvesting time, and un-predicted markets for their

harvest. Crop farming and livestock keeping altogether accounts for about 80% of the local community main activities, implying that these activities engage many people in the study area.

4.5 Effects of Wildlife to Livelihood's in the Kisimiri-Lendoiya Wildlife Corridor

4.5.1 Nature of Human-Wildlife Conflicts

There are different forms of human wildlife conflicts in (Runyoro *et al.*, 2018). In the study area, most of the conflicts were related to crop raiding. Livestock depredation as well as human injury and/or death are very minor incidences. The two forms of conflicts are discussed below.

4.5.2 Crop Raiding

Crop raiding is a major form of human-wildlife conflicts in human-modified landscapes. Given this, the two study villages are not exempted to human – wildlife conflicts. Our results show that crop raiding occurred more frequently than other types of wildlife damage (97.9%). Damages are more pronounced in Olkung'wado (75.4%) than in Kisimiri (24.7%), as shown in table 4.5. These incidences mostly happen in the evening time (41.2%), compared to morning (38.1%) and the rest of the day accounts for 20.6% (Afternoon – 16.5% and throughout the day 4.1%). Damage occurs more in the Olkung'wado village because the village has more people who cultivate (farm) as compared to Kisimiri, and the reasons for more crop damage compared to livestock depredation is probably due to a higher number of famers in the two study areas. High probability of farmers could be positively associated with crop-raiding incidences (Buchholtz *et al.*, 2020). The pronounced

damage in evening and night time could be associated by the fact that farmers have left their farms or anthropogenic activities are reduced after those times.

Table 4.5: Problems Caused by Wildlife in the Study Area

Village name	Crop raiding (N)	Livestock killings/Depredations (N)	Total
Kisimiri	24	0	24
Olkung`wado	71	2	73
Total	95	2	97

Source: Field Survey, 2022

These conflicts are mostly related to crops raiding (97.9%) than livestock depredation (2.1%). Olkung'wado village is more raided (75.4%) than Kisimiri village (24.7%), whereas, livestock depredations were only reported in the Olkung'wado village (2.7%), and non in Kisimiri village. The conflicts in Olkung'wado village are related to crop raiding (97.3%) than depredation (2.7%). This could be attributed to the fact that farming is the main economic activity in the two study villages.

Species-wise, results show that buffaloes and elephant (72.2%) are more involved in crops raiding incidences that other species (27.8%). Specie's specific incidences are shown in table 4.6. High crop foraging by elephants could be related to the fact that elephant crop raiding is predominantly a nocturnal activity, and it is believed that in night they cannot be detected easily due to reduced visibility. Our findings are in line with a study by Chiyo *et al.,* (2005) and Barnes *et al.,* (2007) who reported that, most

of elephant crop raiding incidences happens in the evening and night time as a strategy for reducing possibility of spotted or encountering humans.

Table 4.6: Wildlife Species Involved in Conflicts, Especially Crop Raiding

Specie (s)	No of incidences	Percent (%)
Buffaloes	36	37.1
Elephant	34	35.1
Giraffe	17	17.5
Hyena	6	6.2
Other species	4	4.1
Total	97	100

Source: Field Data, 2022

Distribution of crop raiding incidences show Olkung'wado suffers more from buffalo related incidences (33%) compared to elephant (19.6%) and other species (Figure 4.9). In Kisimiri, elephant related crop raiding incidences are more pronounced (15.5%) as compared to buffalo (4.1%) and other species as shown in figure 4.9. High incidences of damage in Olkung'wado are associated with high number of farmers. Crop raiding mainly occurs in wet (52.2%) than in the dry season (47.4%), and incidences are reported frequently at any time (63.9%), at least twice per week (22.7%), and less per one week (7.2%) and occasionally (6.2%). Our findings are similar to Angela *et al.,* (2014) and (Mlay, 2014) who reported that crop raiding occurs towards the end of wet/harvest season, especially when crops are ripening. However, our results contradicts to Chiyo *et al.,* (2005) who found that, in Uganda, elephant crop raiding incidences happens in the dry season when crops are at the

peak. Generally, human-wildlife conflicts especially crop-raiding in Tanzania is primarily associated with the growing human population and increasing transformation of natural land to cultivated village land, leading to into closer contact between human and wildlife and increased competition for access to existing resources.

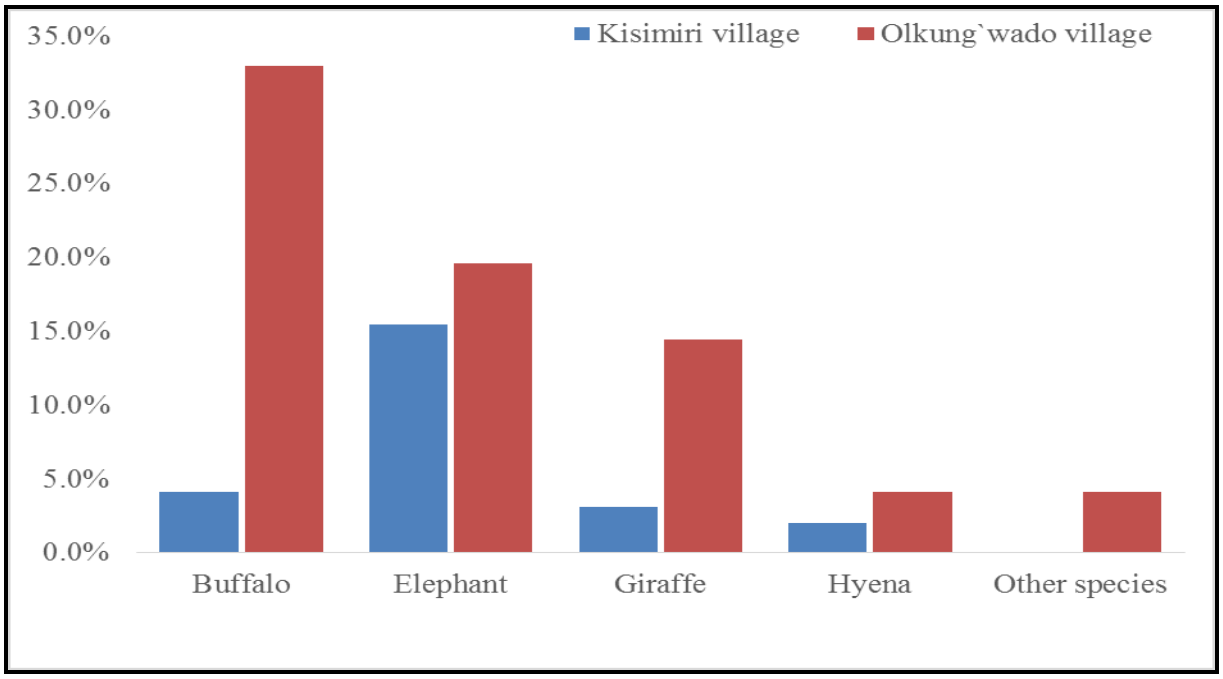

Figure 4.10: Extent of Human Wildlife Conflicts in the Study Villages

Source: Field Data, 2022

Farm crops damage incidences are common in all villages that border or overlap with the protected area, and are perceived to reduce tolerance. Being close to Arusha and Kilimanjaro NPs, and traversed with the Kisimiri-Lendoiya wildlife corridor the villages are facing human-wildlife conflicts. Elephant and buffalo conflicts with human are rampant, as lamented by the interviewed respondents. These species are reportedly very destructive when they invade farms, together with zebra and giraffe.

Our result agrees with the fact that areas close to park boundaries experience more wildlife related conflicts (Franco *et al.*, 2021; Hariohay *et al.*, 2017; Mfunda, Røskaft, 2011; Munuo, 2016; Vedeld *et al.*, 2012).

Crop raiding is a prevalent form of human–wildlife conflict along protected area boundaries. For example, in a study conducted in Siha District, Kilimanjaro Region showed that crop raiding due to elephant was a kind of repeatedly incidences in the area, claimed to raid about 370 Ha of various crops in the year 2009 (Mariki, 2015; Mariki *et al.*, 2015). Crop damage has also been reported by other studies elsewhere (Andrea, 2015). For example, in Rombo District approximately 90% of crop raiding incidences were attributed to elephants (Kideghesho, 2008). In the western Serengeti, elephants and other wildlife species are reportedly to cause crop raiding (Eustace *et al.*, 2018). Increasing wildlife population in almost all ecosystems in the country could be the reason for the increased crop raiding (TAWIRI, 2018), proximity of farms to protected area boundaries, as well as increase in human population. Crop raiding incidences as a form of human-wildlife conflict can undermine conservation efforts even when the conservation programs provide substantial economic benefits to local communities (Ajayi *et al.*, 2019), and can affect food security and cash income adjacent to protected areas (Kaswamila *et al.*, 2007; Mukeka *et al.*, 2019).

4.5.3 Livestock Depredation and Human Injuries or Killing

These wildlife species were also reported to cause human injuries or killings and these incidences were reported to increase (86.6%), compared to same impact (11.3%). Only 2.1% of the interviewed respondents reported the incidences to decline, over the past 20 years. According to respondents, hyenas are more involved

to cause livestock depredation than any other carnivores. Livestock predation and poultry by carnivores are common phenomenon in areas where livestock keepers are (Mkonyi *et al.*, 2017). Livestock depredation by spotted hyenas and retaliatory killings of the same specie has is a growing concern in Tanzania (Kideghesho, 2008; Kissui, 2008). Similar accounts of elephants as problem animals have been reported in other parts of Tanzania, Selous-Niassa in particular. Of all the depredated livestock, sheep (47.6%) and goats (34.4%) are leading, and fewer attacks are attributed to cattle (18%), all these incidences were reported in both study villages. Most of these attacks occur in the night time (87.4%) than in the day-time (12.6%).

Our results are supported by a study in Eastern and Western Serengeti whereby hyena were reportedly the main predator for livestock depredation (Franco *et al.*, 2018; Holmern *et al.*, 2007). In another study in Southern Tigray, Ethiopia, hyena were also reported as the main predator responsible for livestock depredation (Yirga, Bauer, 2010). Since they affect the local people, hyena are likely to be killed as well, as a result of their predation, hence a risk for species to be persecuted. Livestock predation is elevated by existence of poorly built livestock enclosures (bomas) that protect livestock from carnivores' attack at night time. Only one child was reported to be injured in Olkungw'ado village.

4.5.4 Measures Taken to Control Human-Wildlife Conflicts and Challenges Faced

Different preventive measures such as; a) presence of a guides/watchmen; b) use of various active deterrents (such as shouting, using torches and banging drums, and smoke from chili), and c) barbed wire fences and vegetation/ropes fences are

employed by local farmers in the study villages. The preventive measures are mainly taken in Olkung`wado village (75.3%) than in Kisimiri village (24.7%). Of all the preventive measures, active deterrent mostly used (25.7%), followed by guiding the farms (23.7%), and only 13.4% of respondents use a combination of more than one method in curbing the crop raiding problem (Table 4.7 and 4.8).

Table 4.7: Preventive Measures Undertaken to Curb Crop Raiding

Preventive measure undertaken	Village name	
	Kisimiri	Olkung`wado
Guides and/or Watchmen	7.2%	16.5%
Active deterrents	4.1%	21.6%
Fences (Traditional and modern)	3.1%	13.4%
Combination of more than one measure	3.1%	10.3%
Do not use any preventive method	7.2%	13.4%

Source: Field data, 2022

Table 4.8: Suggestive Measures for Reducing HWC

Suggestions for reducing HWC	Village	
	Kisimiri	Olkung`wado
Providing more conservation education	12.4%	34.0%
Cultivating good relationship with communities	2.1%	16.5%
Revision of the compensation scheme	2.1%	13.4%
Recruiting more rangers	4.1%	6.2%
Strengthening/Establishing rapid response units	5.2%	4.1%

Source: Field data, 2022

Problem animal control is mainly undertaken by game wardens (67%) from TANAPA and the District Council (sometimes with support from Enduimet WMA) accounting 13.4%, and local farmers (16.5%). The rest (3.1%) do not use any preventive measure in controlling crop raiding and livestock depredation incidences. Extent of control per village is shown in figure 4.10.

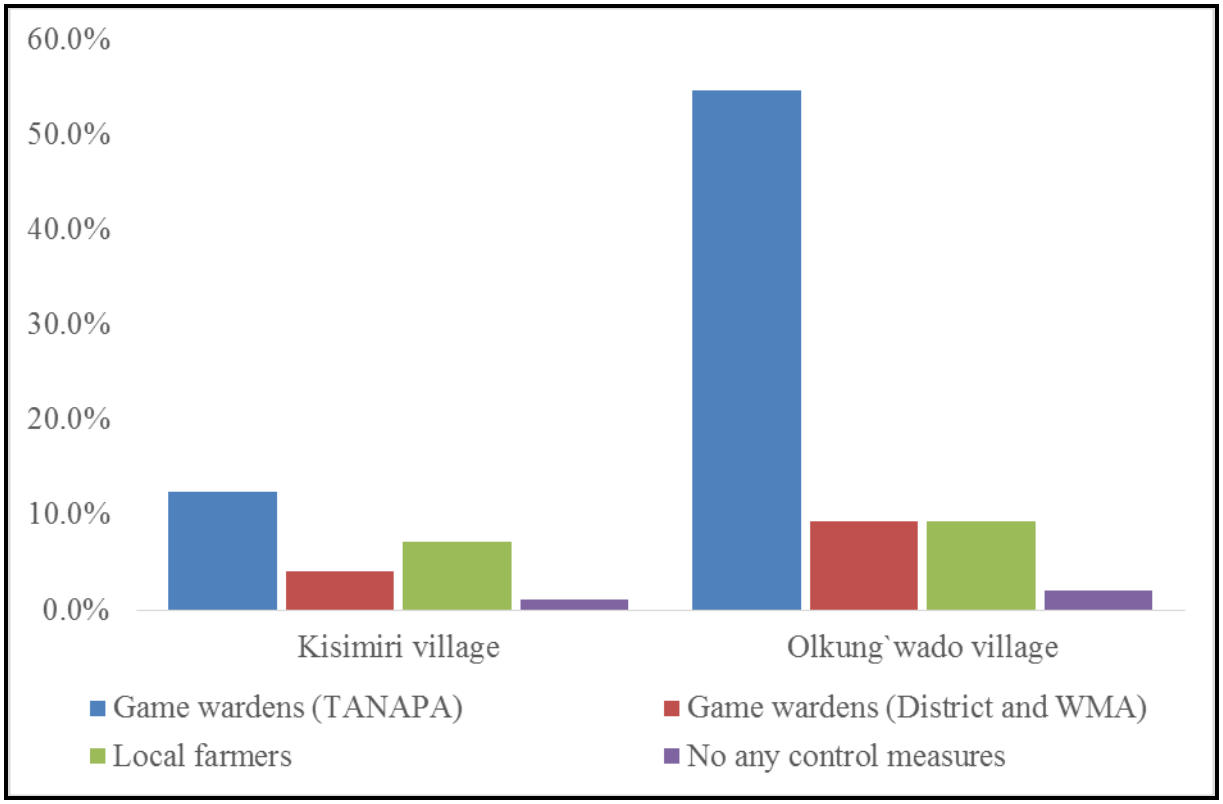

Figure 4.11: Common Interventions to Crop Raiding in the Study Villages

Source: Field Data, 2022

TANAPA is taking more preventive measure or roles in Olkung'wado village than in Kisimiri because the corridor to a greater extent is within the former village land and is closer to ANAPA, thus, most of the impacts are realized in the Olkungw'ado village than in Kisimiri. Our findings collaborate with study by Mashalla and Ringo

(2015) who reported active deterrent as an effective means for lessening crop raiding and livestock depredation. In a study in Western Serengeti, Angela *et al.,* (2014) found that a combination of methods were also effective in controlling crop-raiding animals. Kiffner *et al.* (2021) found that, a combination of method (effectiveness of chili and beehive fences) was found to be effective in controlling elephant crop-raiding in the Ngorongoro Conservation Area, Tanzania. Elsewhere, a combination of methods in deterring crop raiding and livestock depredation (fencing, scares, repellents, barriers, translocation, and use of guard animal) have been proved to work effectively (Landry *et al.*, 2005; Matseketsa *et al.*, 2019; Megaze *et al.*, 2017; Mukeka *et al.*, 2019).

Respondents reported that, of all challenges encountered, delays to arrive at the raiding scene is the most cited challenge (50.5%), followed by the notion that crop raiding species are getting used to raid crops (30.9%). Inadequate resources (mainly financial) were also reported (18.6%). Distribution of responses in individual villages is shown in figure 4.11.

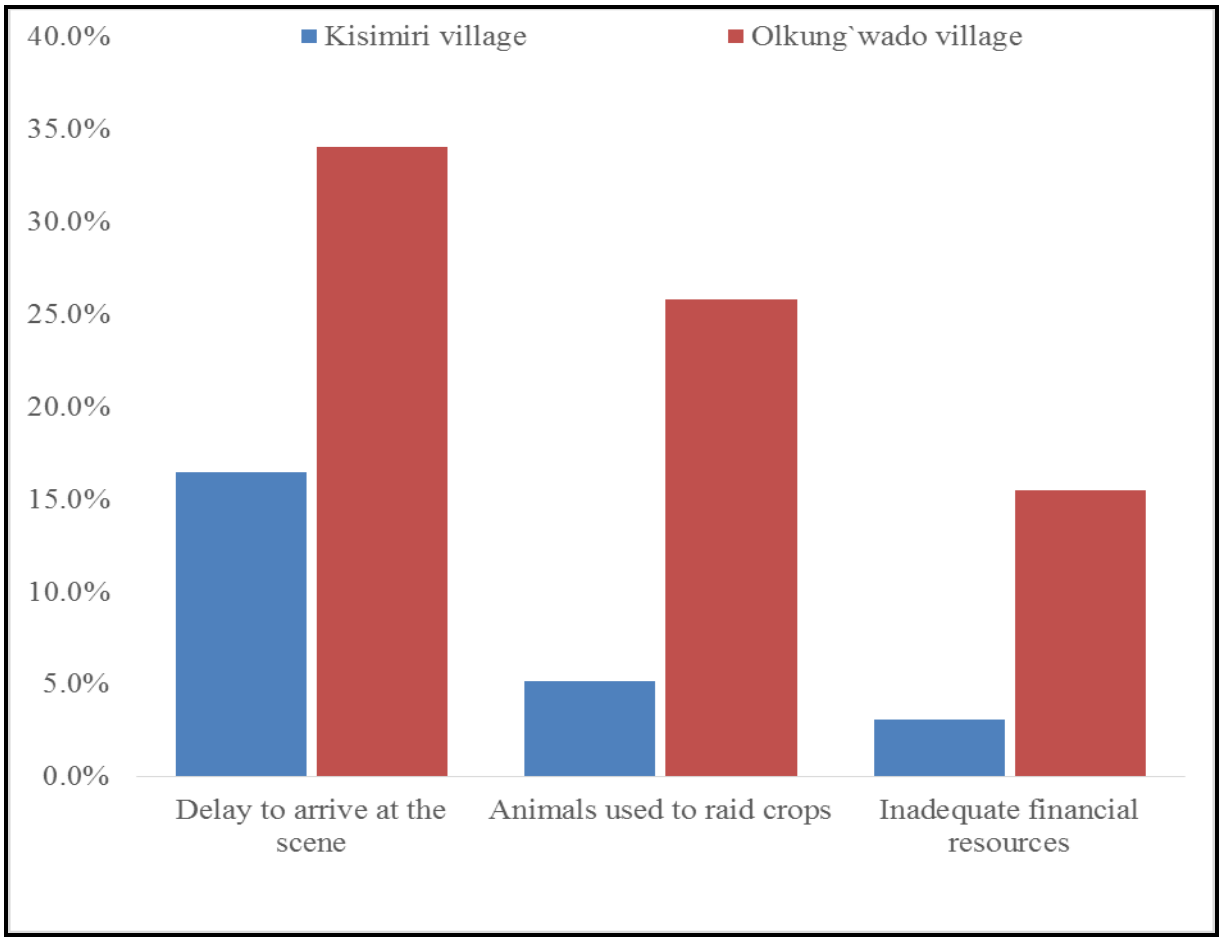

Figure 4.12: Challenges to Preventive Control Measures in the Study Villages

Source: Field Data, 2022

4.5.5 Associated Conservation Benefits of Wildlife to Local Communities

Wildlife conservation is often viewed as a trade-off between the development of short-term benefits and protection for long-term benefits. Local communities in the study villages reported to benefit from conservation education in relation to wildlife corridor. Villagers from Olkung'wado benefit more from wildlife conservation (75.3%) than those from Kisimiri (24.7%), specifically on employment (83.3%) and

tourism income (62.2%). Villagers from Kisimiri benefit from employment by 16.7% and by 37.8% from Tourism Income (Table 4.9).

Table 4.9: Conservation Benefits

Benefit from conservation	Village Name		Total
	Kisimiri	Olkung`wado	
Employment	16.7%	83.3%	61.9%
Tourism income	37.8%	62.2%	38.1%
Total (Village-wise)	**24.7%**	**75.3%**	**100.0%**

Source: Field Data, 2022

Results indicate that Olkung'wado benefits more than Kisimiri could be due to fact that the village is very close to Arusha national park than Kisimiri. Other benefits include improvement of infrastructure (frequent rehabilitation of roads) and social services due to TANAPA Support for Conservation Initiated Projects (SCIP). Among others, the SCIP aimed at improving the relationship between individual parks and local communities, to ensure that the interests of TANAPA regarding natural resources conservation and community welfare are represented at all levels, to facilitate the planned benefit sharing schemes to target communities through SCIP. Our results are in-line with other several studies which reported tourism associated conservation benefits. Studies indicate that communities adjacent protected areas, mainly national parks benefit from several supports such as education, water services, health services, and many more (Kaltenborn *et al.*, 2008; Mlay, 2014).

4.5.6 Perception of Local Communities to Wildlife Conservation

Seventy-two percent (72.2%) of respondents in the study area reported to perceive conservation in a positive way (56.7%) from Olkung'wado and 15.5% in Kisimiri) as opposed to those with negative attitude to conservation (16.5%). Most of those who support conservation are from Olkung'wado village (Figure 4.10). The positive perception of local people to wildlife conservation could be because they benefit from conservation related socio-economic benefits through TANAPA Support for Conservation Initiated Projects (SCIP).The SCIP related benefits are considered as motivational factors for local people to change their attitudes, support conservation efforts, and align their behaviors with conservation goals, and can assist conservation practitioners and decision-makers to prioritise resources, on the assumption that high-scoring individuals are more likely to participate in conservation initiatives.

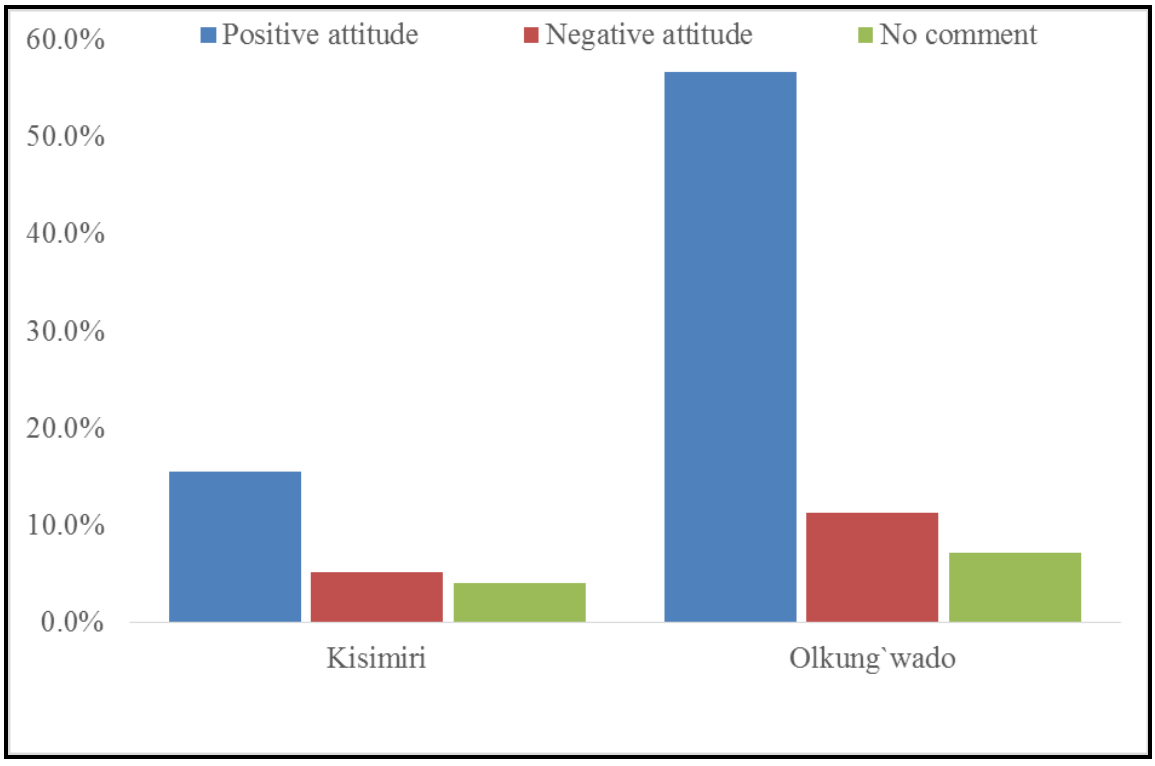

Figure 4.13: Perception of Local Communities on Wildlife Conservation

Source: Field Data, 2022

Despite the fact that human-wildlife conflicts can jeopardize conservation efforts (Kiffner *et al.*, 2021), on the contrary perception of communities towards conservation of wild animals in the park showed that majority of the respondents' in the study area still perceive conservation in a positive side. The same situation has been also reported in Kenya and Indonesia, whereby it was reported that conservation perceptions and attitude can be still positive despite crop raiding incidences by wildlife (Abdullah *et al.*, 2019; Siljander *et al.*, 2020). The local communities suggested for more conservation education to balance conservation and livelihoods, together with other suggested measures.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter presents the summary, conclusion and recommendations. The conclusions and recommendations are based on the objectives of the study and have been carefully analyzed to guide policy makers, on how to restore the status of the Kisimiri-Lendoiya corridor maintain positive attitudes towards conservation of natural resources and local communities adjacent Arusha and Kilimanjaro National Parks and turn negative attitudes impacts into positivity.

5.2 Summary of the Findings

This section provides summary of this study. The study sought to assess the impact of wildlife migratory corridors' blockage on livelihoods of communities living adjacent to Arusha National Park (ANAPA). The study was guided by three specific objectives; (i) Assess the current state of wildlife migratory corridors adjacent Arusha National Park, (ii) Examine the nature of human activities in wildlife migratory corridors adjacent ANAPA, and (iii) Determine the effects of wildlife to livelihoods of communities in migratory corridors adjacent ANAPA. Different methodology was employed, namely qualitative and quantitative assessment, remote sensing and GIS. The sample size was 97 (households), and supplemented by local leaders, ANAPA, DGO and WMAs staff members. Primary data were collected using questionnaires, interviews and observations. Data were analyzed descriptively using SPSS and qualitative data analyzed using Content analysis.

Results indicates that, land use and cover have been changing over the past 10 years, mainly the woodland and grassland cover types and this is probably associated with increased human population and associated activities. Corridor modelling reveals that, the size and length is decreasing compared to the one reported in past study, and this could be associated with human increase and activities such as farming, livestock grazing and human settlements. Increased conflicts between wildlife and humans, particularly crop raiding, restricted wildlife movements, reduced chances for finding mates are the negative impacts of corridor blockage. The identified nature of human-wildlife conflicts is related to crop raiding (greater extent) and livestock depredation to a smaller extent. Different preventive measures such as use of guides/watchmen; use of active deterrents and barbed wire fences and vegetation ropes/fences are employed. Despite all, the local community in the study area perceives wildlife in a positive way as it improves infrastructures and other social services, such as education services and tourism related employments.

Generally, the Kisimiri-Lendoiya wildlife corridor is currently under threat due to on-going anthropogenic activities, such as land use and land cover changes (changes in habitat conditions), settlement and cultivation, leading to reduced size and increased human-wildlife conflicts. Besides this, local people still perceive wildlife conservation in a positive way.

5.3 Conclusion

Looking at the one-decade changes in land use and land cover and its association with habitat it is evident that the Kisimiri-Lendoiya wildlife corridor is currently

under threat due to on-going anthropogenic activities. Cultivated land is expanding in space and time, encroaching areas that historically used as natural habitat in the corridor, thus decreasing the shape and configuration of the corridor with time. The expanse of cultivated lands at expense of woodland and shrubland cover type is an indication of decreasing habitat quality. If the corridor is reduced in shape and size, it is likely that animals will be expanding their range in community owned area. Buffalo and elephant are the most frequently cited species responsible for crop raiding. As a response to this, local communities are offering to deterring the crop raiding species, and guiding the farms. The game rangers from both TANAPA and District Council or WMA are reported to chase the crop raiding animals. With all the negative consequences faced, still local have a good attitude with conservations.

For the nature of human activities in the corridor, the main challenges include increase of human population that lead to intensification of human pressures on the natural resources and the corridor as a whole. With the growing population, illegal settlements, illegal cattle grazing, illegal tree cutting and charcoal making, human-wildlife conflict and wildlife crime become major issues affecting the corridor(s). Human-wildlife conflict and wildlife crimes are currently affecting the corridor(s). Poor implementation of the village land use plans and poor understanding of the values of the corridor and its role in sustainable biodiversity conservation are also a major threat. For the negative effects of wildlife conservation to livelihoods of communities in migratory corridors adjacent ANAPA reveals increased conflicts between wildlife and humans, particularly crop raiding, restricted wildlife movements.

5.4 Recommendations

Formulation of practical land use plans that take into consideration wildlife corridors around their areas or village lands. This can be done by collaboration of the President's Office – Regional Administration and Local Government (PO-RALG) with Ministry of Natural Resources and Tourism (MNRT) and the Ministry of Lands and Human Settlement to ensure land use planning around villages that surround protected areas be carried out, and the resulting planning be properly enforced.

Policy implementation are required to ensure further expansion of human settlement and crop cultivation in wildlife movement corridors are controlled or curbed. This will include development of specific by-laws by villages or respective District Council that will regulate unauthorized activities or environmental hazardous activities. This can also be done through collaborations of all stakeholders including MNRT, TANAPA, TAWIRI, WMA, PO-RALG and local people ensure all detrimental activities to the existence of the wildlife corridor are halted, e.g. cultivation, tree cutting and un-planned settlement. Further, provisions of conservation knowledge are imperative to the conservation of wildlife and the environment in general, thus, MNRT through Wildlife Division (WD) in collaboration with other stakeholders are urged to conducting seminars for sensitization on wildlife migratory corridors in communities adjacent the park and undertake ground verification and delineation of the corridor, including gazettement and installation of beacons of the Lendoiya-Kisimiri corridor. The enhanced conservation education to local people (i.e. from young people to elders) should focus on positive attitude to wildlife and opportunities available for local people.

Crop raiding activities affect farmlands that are very close to park boundaries. Therefore, farmers are advised to cultivate away from park boundaries or cultivate un-palatable crops. Our research suggests that alternative mitigation strategies for crop raiding need to be trialed/sought to identify their effectiveness in the study villages.The Ministry of Natural Resources and Tourism (MNRT) through WD improve Regulations on Wildlife Migratory Corridors to ensure local people benefits through income generating projects such as beekeeping and community-based tourism, and design mechanism that will make community benefiting more from conservation. Further, National parks (e.g. KINAPA and ANAPA) should work closely with WMAs as national parks are important in conservation of corridors and dispersal areas.

5.6 Areas for Further Research

The following are the suggested areas for further research as emanated from this study;

1. Continued research and extension be carried out and effectively applied in resolving human-wildlife conflicts so as to increase social acceptability in lieu of wildlife conservation.
2. To conduct social research to understand current perception of the local communities in relation to wildlife conservation. The same should be done to assess human properties.

3. Conduct research on zoonotic diseases due to interaction between wildlife, livestock and humans. It is likely some diseases are likely to be transmitted between the three.

REFERENCES

Abdullah, A., Sayuti, A., Hasanuddin, H., Affan, M., & Wilson, G. (2019). People's perceptions of elephant conservation and the human-elephant conflict in Aceh Jaya, Sumatra, Indonesia. *European Journal of Wildlife Research, 65*(5), 1-8.

Ajayi, S., Osaguona, P., Elekhizor, B., Oyeleye, D., Meduna, P., & Habib, A. (2019). Assessment of crop raiding activities of wild animal species in Kainji Lake National Park, Nigeria. *Journal of Research in Forestry, Wildlife and Environment, 11*(1), 132-140.

Andrea, J.J. (2015). *Park-people Relations and their Contribution to Community Livelihoods: A Case of Kilimanjaro National Park in Tanzania.* The University of Dodoma,

Angela, M., Julius, N., Janemary, N., & Eivin, R. (2014). The impact of crop raiding by wild animals in communities surrounding the Serengeti National Park, Tanzania. *International Journal of Biodiversity and Conservation, 6*(9), 637-646.

Babbie, E.R. (2020). *The practice of social research*: Cengage learning.

Barnes, R., Dubiure, U., Danquah, E., Boafo, Y., Nandjui, A., Hema, E., & Manford, M. (2007). Crop-raiding elephants and the moon. *African Journal of Ecology, 45*(1), 112-115.

Beier, P., & Noss, R.F. (1998). Do habitat corridors provide connectivity? *Conservation Biology, 12*(6), 1241-1252.

Bennett, G., & Mulongoy, K.J. (2006). *Review of experience with ecological networks, corridors and buffer zones.* Paper presented at the Secretariat of the Convention on Biological Diversity, Montreal, Technical Series.

Bhattacherjee, A. (2012). Social science research: Principles, methods, and practices.

Breiman, L. (2001). Random forests. *Machine learning, 45*(1), 5-32.

Buchholtz, E.K., Stronza, A., Songhurst, A., McCulloch, G., & Fitzgerald, L.A. (2020). Using landscape connectivity to predict human-wildlife conflict. *Biological conservation, 248*, 108677.

Burkart, S., Gugerli, F., Senn, J., Kuehn, R., & Bolliger, J. (2016). Evaluating the functionality of expert-assessed wildlife corridors with genetic data from roe deer. *Basic and Applied Ecology, 17*(1), 52-60.

Caro, T., Jones, T., & Davenport, T.R. (2009). Realities of documenting wildlife corridors in tropical countries. *Biological conservation, 142*(11), 2807-2811.

Chami, A. (2016). Roles of socio-economic incentives towards sustainable environmental conservation of kondoa rehabilitated rural areas, Dodoma. *Tanzania. J Ecosys Ecograph, 6*(210), 2.

Chiyo, P.I., Cochrane, E.P., Naughton, L., & Basuta, G.I. (2005). Temporal patterns of crop raiding by elephants: a response to changes in forage quality or crop availability? *African Journal of Ecology, 43*(1), 48-55.

Congalton, R.G. (1991). A review of assessing the accuracy of classifications of remotely sensed data. *Remote sensing of environment, 37*(1), 35-46.

Cooper, D.R., Schindler, P.S., Cooper, D.R., & Schindler, P.S. (2003). Business research methods.

Cutler, D.R., Edwards, T.C., Beard, K.H., Cutler, A., Hess, K.T., Gibson, J., & Lawler, J.J. (2007). Random forests for classification in ecology. *Ecology, 88*(11), 2783-2792.

Debonnet, G., & Nindi, S. (2017). Technical study on land use and tenure options and status of wildlife corridors in Tanzania: an input to the preparation of corridor. *USAID: Washington, DC, USA*.

Dudley, N. (2008). *Guidelines for applying protected area management categories*: IUCN.

Dutt, A., Grabe, S., & Castro, M. (2016). Exploring links between women's business ownership and empowerment among Maasai women in Tanzania. *Analyses of Social Issues and Public Policy, 16*(1), 363-386.

Dworkin, S.L. (2012). Sample size policy for qualitative studies using in-depth interviews. In (Vol. 41, pp. 1319-1320): Springer.

Eakin, E. (2017). The effectiveness of wildlife corridors in biological conservation, a case study of the African elephant (Loxodonta africana) in Tanzania. *England: University of Bristol*.

Eustace, A., Kisingo, A.W., & Mbwiliza, J.S. (2018). Wildlife damage in villages surrounding the Serengeti ecosystem. *Parks, 24*, 107.

Foody, G.M. (2002). Status of land cover classification accuracy assessment. *Remote sensing of environment, 80*(1), 185-201.

Frakes, R.A., Belden, R.C., Wood, B.E., & James, F.E. (2015). Landscape Analysis of Adult Florida Panther Habitat. *PloS one, 10*(7). doi:10.1371/journal.pone.0133044

Franco, P.M., Beatrice, M., & Eivin, R. (2021). Impact of protected areas on the livelihood of locals: A case study in Saadani National Park, Tanzania. *International Journal of Biodiversity and Conservation, 13*(3), 98-108.

Franco, P.M., Gine, R.S., Richard, D.L., Robert, D.F., Craig, J., Tomas, H., & Eivin, R. (2018). Livestock depredation by wild carnivores in the Eastern Serengeti Ecosystem, Tanzania. *International Journal of Biodiversity and Conservation, 10*(3), 122-130.

Giliba, R.A., Boon, E.K., Kayombo, C.J., Chirenje, L.I., & Musamba, E.B. (2011). The influence of socio-economic factors on deforestation: a case study of the Bereku Forest Reserve in Tanzania. *Journal of Biodiversity, 2*(1), 31-39.

Hariohay, K.M., Fyumagwa, R.D., Kideghesho, J.R., & Røskaft, E. (2017). Assessing crop and livestock losses along the Rungwa-Katavi wildlife corridor, South-Western Tanzania.

Holmern, T., Nyahongo, J., & Røskaft, E. (2007). Livestock loss caused by predators outside the Serengeti National Park, Tanzania. *Biological conservation, 135*(4), 518-526.

Homewood, K., Nielsen, M.R., & Keane, A. (2022). Women, wellbeing and wildlife management areas in Tanzania. *The Journal of Peasant Studies, 49*(2), 335-362.

Horskins, K. (2005). *The effectiveness of wildlife corridors in facilitating connectivity: assessment of a model system from the Australian wet tropics.* Queensland University of Technology,

Idd, L.A. (2020). *The effectiveness of consolation scheme in reducing human-wildlife conflict to the communities neighbouring Rungwa-Muhesi-Kizigo game reserve in Singida region, Tanzania.* The University of Dodoma,

Jones, T., Caro, T., & Davenport, T. (2009). Wildlife corridors in Tanzania. *Unpublished report. Tanzania Wildlife Research Institute (TAWIRI), Arusha*, *6*.

Kaltenborn, B.P., Nyahongo, J.W., Kidegesho, J.R., & Haaland, H. (2008). Serengeti National Park and its neighbours–Do they interact? *Journal for Nature Conservation, 16*(2), 96-108.

Kaswamila, A., Russell, S., & McGibbon, M. (2007). Impacts of wildlife on household food security and income in northeastern Tanzania. *Human Dimensions of Wildlife, 12*(6), 391-404.

Kessy, J.F. (1998). *Conservation and utilization of natural resources in the East Usambara forest reserves: conventional views and local perspectives*: Wageningen University and Research.

Kideghesho, J.R. (2015). Realities on deforestation in Tanzania—trends, drivers, implications and the way forward. *Precious Forests-Precious Earth*, 21-47.

Kideghesho, J.R. (2008). *Who pays for wildlife conservation in Tanzania and who benefits? In: Papier présenté à la 12eme Conférence Biennale de*

International Association for the Study of Commons (IASC) "Governing shared resources: ConnecƟng local experience to global challenges, pp. 14–18.

Kideghesho, J.R. (2008). *Who pays for wildlife conservation inTanzania and who benefits? In: Papier présenté à la 12eme Conférence Biennale de International Association for the Studyof Commons (IASC) "Governing shared resources: ConnecƟnglocal experience to global challenges, pp. 14–18.*

Kiffner, C., Schaal, I., Cass, L., Peirce, K., Sussman, O., Grueser, A., Wachtel, E., Adams, H., Clark, K., & König, H.J. (2021). Perceptions and realities of elephant crop raiding and mitigation methods. *Conservation Science and Practice, 3*(3), e372.

Kija, H.K., Ogutu, J.O., Mangewa, L.J., Bukombe, J., Verones, F., Graae, B.J., Kideghesho, J.R., Said, M.Y., & Nzunda, E.F. (2020). Land use and land cover change within and around the greater Serengeti ecosystem, Tanzania. *Am J Remote Sens. 2020b, 8*(1), 1-9.

Kilungu, H., Leemans, R., Munishi, P.K., Nicholls, S., & Amelung, B. (2019). Forty years of climate and land-cover change and its effects on tourism resources in Kilimanjaro National Park. *Tourism Planning & Development, 16*(2), 235-253.

Kissui, B.M. (2008). Livestock predation by lions, leopards, spotted hyenas, and their vulnerability to retaliatory killing in the Maasai steppe, Tanzania. *Animal conservation, 11*(5), 422-432.

Kothari, C., & Garg, G. (2014). Research methodology Methods and Techniques. 2014-New Age International (P) Ltd. *New Delhi*.

Kothari, C., & Garg, G. (2014). Research methodology: Methods and techniques (pp. 129-135) New age international (P) limited. *Publishers, New Delhi*.

Kremen, C., & Merenlender, A.M. (2018). Landscapes that work for biodiversity and people. *Science, 362*(6412).

Krippendorff, K. (2018). *Content analysis: An introduction to its methodology*: Sage publications.

Lamarque, P. (2008). *The philosophy of literature*: John Wiley & Sons.

Landry, C., Rsten, W., Linnell, J., & Weber, J. (2005). Non-lethal techniques for reducing depredation. *People and wildlife, conflict or co-existence, 49*.

Lee, D.E. (2018). Evaluating conservation effectiveness in a Tanzanian community wildlife management area. *The Journal of Wildlife Management*, *82*(8), 1767-1774.

Louangrath, P. (2017). Minimum sample size method based on survey scales. *Int. J. Res. Methodol. Soc. Sci*, *3*, 45.

Macha, R.R. (2015). Community based health insurance schemes and protection of the rural poor: empirical evidence from Tanzania. *African Journal of Economic Review, 3*(2), 38-56.

Mariki, S. (2015). Communities and conservation in West Kilimanjaro. *Tanzania: Participation, costs and benefits Lokalsamfunn og naturvern I Vest-Kilimanjaro, Tanzania: Deltakelse, kostnaderognytte Department of*

International Environment and Development (Noragric) Norwegian University of Life Sciences. 99pp.

Mariki, S.B., Svarstad, H., & Benjaminsen, T.A. (2015). Elephants over the cliff: explaining wildlife killings in Tanzania. *Land Use Policy, 44*, 19-30.

Martin, E.H., Jensen, R.R., Hardin, P.J., Kisingo, A.W., Shoo, R.A., & Eustace, A. (2019). Assessing changes in Tanzania's Kwakuchinja Wildlife Corridor using multitemporal satellite imagery and open source tools. *Applied Geography, 110*, 102051.

Mashalla, A., & Ringo, J. (2015). Status of human-wildlife conflicts in mpanga/kipengere game reserve, Tanzania. *International journal of environment and bioenergy, 10*(1), 26-40.

Massawe, G.M. (2010). *Impacts of human activities on the conservation of igando-igawa wildlife corridor in Njombe and Mbarali districts, Tanzania*. Sokoine University of Agriculture,

Matseketsa, G., Muboko, N., Gandiwa, E., Kombora, D.M., & Chibememe, G. (2019). An assessment of human-wildlife conflicts in local communities bordering the western part of Save Valley Conservancy, Zimbabwe. *Global Ecology and Conservation, 20*, e00737.

Megaze, A., Balakrishnan, M., & Belay, G. (2017). Human–wildlife conflict and attitude of local people towards conservation of wildlife in Chebera Churchura National Park, Ethiopia. *African Zoology, 52*(1), 1-8.

Mfunda, I.M., & Røskaft, E. (2011). Wildlife or crop production: the dilemma of conservation and human livelihoods in Serengeti, Tanzania. *International*

Journal of Biodiversity Science, Ecosystem Services & Management, 7(1), 39-49.

Michael, B. (1998). The role of women in water resources management: the Tanzania case. *International Journal of Water Resources Development, 14*(4), 499-504.

Michael, M., Mgonja, J.T., & Backman, K.F. (2013). Desires of community participation in tourism development decision making process: A case study of Barabarani, Mto Wa Mbu, Tanzania. *American Journal of Tourism Research, 2*(1), 84-94.

Mkonyi, F.J., Estes, A.B., Msuha, M.J., Lichtenfeld, L.L., & Durant, S.M. (2017). Socio-economic correlates and management implications of livestock depredation by large carnivores in the Tarangire ecosystem, northern Tanzania. *International Journal of Biodiversity Science, Ecosystem Services & Management, 13*(1), 248-263.

Mlay, G.F. (2014). *The impact of protected areas on the livelihoods of local communities at Mikumi National Park, Tanzania".* The Open University of Tanzania,

Mollel, T.L. (2017). *Assessment of Human-Wildlife Conflicts in Wildlife Management Areas: A Case of Burunge WMA.* The Open University of Tanzania,

Mugenda, O., & Mugenda, A. (2003). Research Methods; Quantitative and Qualitative Approaches. Nairobi: African Centre for Technology Studies

(ACTS) Press. Mujis, D.(2004). Doing Quantitative Research in. In: Sage Publications.

Mukeka, J.M., Ogutu, J.O., Kanga, E., & Røskaft, E. (2019). Human-wildlife conflicts and their correlates in Narok County, Kenya. *Global Ecology and Conservation, 18*.

Munuo, W. (2016). *Distribution Patterns of Human Elephant Conflict in Areas Adjacent to Rungwa Game Reserve, Tanzania.* NTNU,

Musiba, C., & Mabulla, A. (2011). East African tourism primarily features wildlife, local customs, historical sites, and spectacular landscapes. Like many other developing nations, Tanzania has created national parks and other forms of protected areas (reserves and conservation areas) to boost the country's economy and pro-tect these areas for future generations. In Tanzania, most national parks, game. *East African Archaeology: Foragers, Potters, Smiths, and Traders*, 133.

NBS. (2022). *Tanzania Human Population and Settlement, Dar es Salaam*.

Nduati, E.W., Mundia, C.N., & Ngigi, M.M. (2013). Effects of vegetation change and land use/land cover change on land surface temperature in the mara ecosystem. *International Journal of Science and Research, 2*, 22-28.

Nelson, F., Nshala, R., & Rodgers, W. (2007). The evolution and reform of Tanzanian wildlife management. *Conservation and Society, 5*(2), 232-261.

Neuendorf, K.A. (2017). *The content analysis guidebook*: sage.

Njamasi, Y.R., Ndibalema, V.G., & Kioko, J. (2022). The influence of human activities on wildlife in Kwakuchinja migratory corridor,

Tarangire/Manyara Ecosystem, Northern Tanzania. *International Journal of Tropical Drylands*, *6*(1).

Njana, M. (2008). *Arborescent species diversity and stocking in Miombo woodland of Urumwa Forest Reserve and their contribution to livelihoods, Tabora, Tanzania. MSc Dissertation, Sokoine University of Agriculture, Morogoro, Tanzania.*

Noe, C. (2003). The Dynamics of land use changes and their impacts on the wildlife corridor between Mt. Kilimanjaro and Amboseli National Parks. *LUCID Working Paper*.

Ramesh, T., Kalle, R., Milda, D., Gayathri, V., Thanikodi, M., Ashish, K., & Giordano, A.J. (2020). Patterns of livestock predation risk by large carnivores in India's Eastern and Western Ghats. *Global Ecology and Conservation, 24*, e01366.

Ravenel, R.M., & Redford, K.H. (2009). Understanding IUCN protected area categories.

Riggio, J., & Caro, T. (2017). Structural connectivity at a national scale: Wildlife corridors in Tanzania. *PLoS One, 12*(11), e0187407.

Rodriguez, L.C., Henson, D., Herrero, M., Nkedianye, D., & Reid, R. (2012). Private farmers' compensation and viability of protected areas: the case of Nairobi National Park and Kitengela dispersal corridor. *International Journal of Sustainable Development & World Ecology, 19*(1), 34-43.

Runyoro, V., Msuha, M., & Mduma, S. (2018). Human Wildlife Conflict in Tanzania with a Focus on Elephant and Lion. *Archiv Zool Stud*, *1*(007).

Saunders, M., Lewis, P., & Thornhill, A. (2007). Research methods. *Business Students 4th edition Pearson Education Limited, England, 6*(3), 1-268.

Shauri, V., & Hitchcock, L. (1999). Wildlife Corridors and Buffer Zones in Tanzania. *LEAT: Dar Es Salaam, Tanzania, 7*, 583-596.

Siljander, M., Kuronen, T., Johansson, T., Munyao, M.N., & Pellikka, P.K. (2020). Primates on the farm–spatial patterns of human–wildlife conflict in forest-agricultural landscape mosaic in Taita Hills, Kenya. *Applied Geography, 117*, 102185.

Singleton, R.I., Straits, B. C. & Straits, M. M. . (1993). Approaches to social research. Second Edition. New York: Oxford University Press. In.

Songorwa, A.N. (1999). Is Community-based wildlife management gender sensitive? Experiences from Selous conservation programme in Tanzania. *Uongozi Journal of Management and Development Dynamics, 11*(2), 145-166.

Suratissa, D. (2021). The falling out man and the wild-a review of influential factors, causes, impacts, and strategies for minimizing human-wildlife conflict. *Tropical Agricultural Research and Extension, 24*(2).

Tateishi, R., Tsend-Ayush, J., Ghar, M.A., Al-Bilbisi, H., & Okatani, T. (2007). Sampling Methods for Validation of Large Area Land Cover Mapping. *Journal of The Remote Sensing Society of Japan, 27*(3), 195-204.

Tateishi, R., Tsend-Ayush, J., Ghar, M.A., Hussam, A.-B., & Okatani, T. (2007). Sampling methods for validation of large area land cover mapping. *Journal of The Remote Sensing Society of Japan, 27*(3), 195-204.

TAWIRI. (2009). *Assessment of Wildlife Corridors in Tanzania. Tanzania Wildlife Research Institute, Arusha, Tanzania*. Retrieved from

Thomas, B., Holland, J., & Minot, E. (2012). Seasonal home ranges of elephants (Loxodonta africana) and their movements between Sabi Sand Reserve and Kruger National Park. *African Journal of Ecology*, *50*(2), 131-139.

Thomas, B., Holland, J.D., & Minot, E.O. (2008). Elephant (Loxodonta africana) home ranges in Sabi Sand Reserve and Kruger National Park: a five-year satellite tracking study. *PLoS One*, *3*(12), e3902.

Thomlinson, J.R., Bolstad, P.V., & Cohen, W.B. (1999). Coordinating methodologies for scaling landcover classifications from site-specific to global: Steps toward validating global map products. *Remote sensing of environment, 70*(1), 16-28.

Tosun, C. (2006). Expected nature of community participation in tourism development. *Tourism management, 27*(3), 493-504.

Uliwa, P., & Fischer, D. (2004). Assessment of Tanzania's Producer Organizations: Experience and environment. *USAID Tanzania Economic Growth Office*.

URT. (1977). *The Constitution of Tanzania. Government of Tanzania, Dar es Salaam, Tanzania*.

URT. (1971). *United Republic of Tanzania (URT). The Law of Marriage Act. Government of Tanzania, Dar es Salaam, Tanzania*.

URT. (2019). *The United Republic of Tanzania, Ministry of Agriculture. Budget Speech, Ministry of Agriculture. 2019. Available online:*

https://www.kilimo.go.tz/index.php/en/resources/view/hotuba-ya-waziri-wa-kilimo-mheshimiwa-japhet-ngailonga-hasunga-mb.

URT. (2012). *The United Republic of Tanzania. National Population Census 2012. National Bureau of Statistics, Ministry of Finance, Dar es Salaam, Tanzania. p: 133.*

Van Aelst, K., & Holvoet, N. (2018). Climate change adaptation in the Morogoro Region of Tanzania: women's decision-making participation in small-scale farm households. *Climate and Development, 10*(6), 495-508.

van Vliet, J., Bregt, A.K., & Hagen-Zanker, A. (2011). Revisiting Kappa to account for change in the accuracy assessment of land-use change models. *Ecological modelling, 222*(8), 1367-1375.

Vedeld, P., Jumane, A., Wapalila, G., & Songorwa, A. (2012). Protected areas, poverty and conflicts: A livelihood case study of Mikumi National Park, Tanzania. *Forest policy and economics, 21*, 20-31.

Verhoef, M.J., & Casebeer, A.L. (1997). Broadening horizons: integrating quantitative and qualitative research. In (Vol. 8, pp. 65-66): Hindawi.

Wandaka, J.K., & Francis, K.M. (2019). Analysis of Impacts of Land Use Changes in Kitengela Conservation Area on Migratory Wildlife of Nairobi National Park, Kenya. *International Journal of Applied Science, 2*(2), p41-p41.

Wilcove, D.S., & Chen, L.Y. (1998). Management costs for endangered species. *Conservation Biology, 12*(6), 1405-1407.

Yirga, G., & Bauer, H. (2010). Livestock depredation of the spotted hyena (Crocuta crocuta) in Southern Tigray, Northern Ethiopia. *International Journal of Ecology and Environmental Sciences, 36*(1), 67-73.

Zella, A.Y. (2016). *Impacts of socio-economic activities in managing Selous-Niassa Wildlife Corridor.* Sokoine University of Agriculture,

APPENDICES

6.1: QUESTIONNAIRE FOR HEADS OF HOUSEHOLD

The intended goal of this questionnaire is to elicit information that is vital in completing this study on impacts of wildlife migratory corridors' blockage on communities living adjacent to Arusha National Park. This information is specifically sought for the purpose of academic research. The study is intended to enable acquisition of a Master of Tourism planning and Management conferred by The Open University of Tanzania.

1. Your village …….
2. Gender (Please tick as appropriate in the bracket)Male ( ) Female ( )
3. Age:
   i) 18-30 ( )
   ii) 31-40 ( )
   iii) 41-50 ( )
   iv) 51-60 ( )
   v) Above 60 years old ( )
4. What is your marital status?
   i. Married ( )
   ii. Single ( )
   iii. Divorced ( )

5. What is your education level?

   i. No formal education ( )

   ii. Primary education ( )

   iii. Secondary education ( )

   iv. University level of education ( )

6. What is the main source of income?

   i) Employed ( )

   ii) Crop production ( )

   iii) Livestock keeping ( )

   iv) Business ( )

   v) Casual labor ( )

   vi) Other ( )

7. Do you own land? i. Yes ( ) ii. No ( )

   i. If yes how many acres.....

   ii. How did you get it? ……

8. Place of born (a) Within the village ( ) b. Outside the village ( )

9. If outside the village, what are the reasons for migration?

i. Fertile land ( )

ii. Employment ( )

iii. Pasture ( )

iv. Marriage ( )

v. Business ( )

vi. Other ( )

10. (a) If you practice agriculture, mention crops cultivated

…… …… …….

(b) Type of livestock you own …….

11. Have you ever encountered with the wild animals in your area or village?

i. Yes ( )

ii. No ( )

12. A) If yes, which wild animals …… …… …… ……. B) How often do they visit?

i. Daily ( )

ii. Once per week ( )

iii. Twice a week ( )

iv. Any time ( )

13. Which time of a day and season of the year? …….. ……..

……. ……. ……..

……

14. a) Is there human-wildlife conflict in this village? Yes ( ) No ( )

If yes which problems caused by wild animal?

…… .. ……..

b) Which crops mostly raided by wild animals in your farm?…….

……

c) Which livestock mostly attacked by wild animals in this village

…….……..……

…….……..……d)

Is there any cases of human injury or killed by wildlife? Yes ( ) No ( ) if yes state …… …….

…….……..……

…….……..……e)

In your observation, do you think human-wildlife conflicts increasing, decreasing or the same?

Explain why?

…….……..……

…….……..……

15. Do you know any wildlife corridor in or near to your village? Yes ( )

No ( ) if yes mention at least two wildlife corridors

……..……..……

……..……

In your opinion why wild animal comes frequently in this village?……

……..……..……

……..……..……As a local people living adjacent ANAPA, how do you benefited from wildlife……..……..……

……..……..……

…

Have you ever received education about wildlife corridor or conservation? Yes ( ) No ( ). If yes when and by who?

……..……..……

……..……

16. What is your perception and/or attitude to wildlife despite the negative effects posing to local communities?
    i. Still perceive conservation in a positive way
    ii. Negatively support conservation
    iii. No comment
17. What are the effects of blocking the wildlife corridor?
    i. Restricted wildlife movements
    ii. Increased HWC
    iii. Reduced animal birth

iv. No idea

18. What is your suggestion for reducing HWC in your village?

i. Providing more conservation education

ii. Cultivating good relationship with local communities

iii. Revision of the compensation scheme

iv. Recruiting more rangers

v. Strengthening/Establishing rapid response units

Thank you

6.2: INTERVIEW GUIDE FOR CONSERVATION MANAGERS

1. What are the current states of the corridors connecting your protected area?
2. To what extent wildlife migratory corridors connecting your protected area is important?
3. What measures have been taken to ensure sustainability of wildlife corridors in this area?
4. What are the main challenges facing this corridor?
5. How do you cooperate with local people to solve those challenges?

6.3 INTERVIEW GUIDE FOR ELDERS IN THE STUDY AREA

Assess the current state of wildlife migratory corridors adjacent Arusha National Park.

1. Did wildlife habit or use the wildlife corridor in the past? How frequent wildlife seen in the wildlife corridor? Were they plenty of wildlife or how large were the herds of wildlife? Did wildlife corridor manage to accommodate all wildlife? or wildlife spilled in the village land?
2. How can you explain the presence of wildlife currently in the wildlife corridors? Does wildlife rely on wildlife corridors only or spill-over on village lands for water and pastures? What types of species of wildlife (animals and key plants (trees) that were common in the wildlife corridors have disappeared or decreased?
3. To what extent wildlife corridor areas/lands have increased or decreased?

II. Examine the nature of human activities in wildlife migratory corridors.

1. What human-activities have expanded into wildlife corridors? (In each activity explain type of activity and how regularly is undertaken throughout the year, who is involved, and extent of its land-use). How have these activities affected wildlife corridors? How are human-wildlife conflicts presently compared to past? If increased or decreased, why and how have these conflicts affected both people and wildlife?

III. To determine the effects of wild animals on livelihoods in wildlife migratory corridors

1. How do you benefit from wildlife migratory corridors?
2. How do wildlife corridors have negatively impacted you? (Is there limited access to former farming land? grazing land? ritual sites? Timber and Non-timber forest products? Water? Wild meat? Human-wildlife conflicts (injuries and deaths, Predation (lost livestock because of predators, crops damage)? Livestock diseases? Increased number of non-residents and related violations of local cultural values.

6.4: INTERVIEW GUIDE FOR LOCAL LEADERS

1. When was this village established?
2. Are the majority of villagers indigenous or immigrants? If immigrants, why did they migrate to this village?
3. Is there any conservation area and activity in this village? If yes, when established or started?
4. What are the main economic activities in the village? Is there enough land to accommodate these activities? If no, do villagers extend into the conservation areas?
5. Are there any conflict between villagers' activities and conservation activities? If yes, how many cases are reported annually in the past five years (cases of land conflicts, crops damage, human injuries and deaths in case human-wildlife conflicts)?

6. Have conservation activities affected livelihoods of villagers?
7. How have conservation activities benefited villagers? (Have you received any environmental education, outreach program aids – community projects, employment).
8. In case of human-wildlife conflicts/challenges who help you to address them?

6.5: OBSERVATION CHECKLIST

No	Observing objects	Responses		Notes
		Yes	No	
i	Is wildlife corridors neatly conserved (presence of trees/grasses and security)?			
ii	Availability of wild animals			
iii	Presences of anthropogenic activities			
iv	Presence of community projects (school, dispensary, and other social infrastructure) supported by conservation activities?			
v	Presence of people who have been injured by wildlife?			

RESEARCH CLEARANCE

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

THE OPEN UNIVERSITY OF TANZANIA

Ref. No OUT/ PG201900460 **18th October, 2022**

Regional Administrative Secretary,
Arusha Region,
P.O Box 3050,
ARUSHA.

Dear Regional Administrative Secretary,

RE: RESEARCH CLEARANCE FOR MS MARY C MTENGA, REG NO: PG201900460

2. The Open University of Tanzania was established by an Act of Parliament No. 17 of 1992, which became operational on the 1st March 1993 by public notice No.55 in the official Gazette. The Act was however replaced by the Open University of Tanzania Charter of 2005, which became operational on 1st January 2007.In line with the Charter, the Open University of Tanzania mission is to generate and apply knowledge through research.

3. To facilitate and to simplify research process therefore, the act empowers the Vice Chancellor of the Open University of Tanzania to issue research clearance, on behalf of the Government of Tanzania and Tanzania Commission for Science and Technology, to both its staff and students who are doing research in Tanzania. With this brief background, the purpose of this letter is to introduce to you **Ms. Mary C Mtenga, Reg. No: PG201900460)** pursuing **Master in Tourism Planning and Management (MTPM)**. We here by grant this clearance to conduct a research titled **"Impacts of Wildlife Migratory Corridors' Blockage on Livelihoods of Communities Living Adjacent to Arusha National Park, Tanzania"**. She will collect her data at Communities adjacent Arusha National Park in Arusha Region from 19th October to 19th November, 2022.

4. In case you need any further information, kindly do not hesitate to contact the Deputy Vice Chancellor (Academic) of the Open University of Tanzania, P.O.Box 23409, Dar es Salaam. Tel: 022-2-2668820.We lastly thank you in advance for your assumed cooperation and facilitation of this research academic activity.

Yours sincerely,

THE OPEN UNIVERSITY OF TANZANIA

Prof. Magreth S.Bushesha

For: VICE CHANCELLOR

JAMHURI YA MUUNGANO WA TANZANIA
OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA
HALMASHAURI YA WILAYA YA MERU

Unapojibu tafadhali taja:

Kumb Na. N.10/5 VOL VIII/46 18/10/2022

Mtendaji Kata
Kata ya Ngarenanyuki
HALMASHAURI YA WILAYA YA MERU

Kuh: KUMTAMBULISHA KWAKO MWANAFUNZI MERY MTENGA MWENYE NAMBA YA USAJILI PG201900460 TOKA CHUO KIKUU HURIA CHA TANZANIA (OUT)

Tafadhali husika na kichwa cha habari hapo juu.

2. Ofisi ya Mkurugenzi Mtendaji Halmashauri ya (W) ya Meru inamtambulisha kwako Mwanafunzi **Mery Mtenga** toka chuo tajwa ambaye anachukulia masomo ya Utalii ili aweze kufanya utafiti ndani ya Halmashauri ya Meru Kijiji cha Olkong'wado juu ya **IMPACT OF WILDLIFE MIGRATORY CORRIDOR BLOCKAGE ON LIVELIHOOD OF COMMUNITIES ADJACENT TO ARUSHA NATIONAL PARK.**

3. Aidha utafiti huo utaanza tarehe 19/10/2022 hadi tarehe 19/11/2022 hivyo ukiwa kama Mtendaji wa Kata unatakiwa kumpa ushirikiano mtajwa ili aweze kufanikisha Utafiti huo ambao pia utakuwa na tija kwa Halmashauri ya Meru.

Charles R. Mungure
Kny; Mkurugenzi Mtendaji
HALMASHAURI YA WILAYA YA MERU

Nakala ;-
1. Mkurugenzi Mtendaji - Aione kwenye Jalada