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COMPARATION OF HUMAN-WILDLIFE CONFLICTS IN TANZANIA AND KENYA

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1. INTRODUCTION

Conflict is a significant concept in human-animal interactions, and it is defined as unpleasant interactions that occur when humans and wildlife engage and compete for shared resources (Anand & Radhakrishna 2017). These conflicts can manifest themselves in a variety of ways, including competition for food, water, and territorial space (Ogutu et al. 2016), as well as disagreements over access to resources such as land and natural resources. The issue of human-wildlife conflict is a growing global concern (although it is an area that has received very little attention over the years), as human populations continue to expand and encroach upon areas previously inhabited by wildlife (Anand & Radhakrishna 2017) (Acharya et al. 2016). This conflict can have adverse impacts on both humans and wildlife, hence the need to find ways to mitigate these conflicts to ensure the sustainability and well-being of both groups.

The relationship between humans and wildlife, especially in developing countries, has gradually turned into what Charles Darwin once defined as a survival of the fittest and the struggle for existence. In both phrases, organisms, whether humans or animals, that best adjust to their environment will survive and continue to reproduce successfully. This implies that all species will struggle to get basic needs to remain alive, even if it means causing harm to another breed. As both species increase in number, the ecosystem is unable to contain them to their satisfaction (especially during severe droughts), causing competition for space and resources. Notably, larger mammals like elephants and rhinos are most known for engaging in conflict with humans, which has made them to be an endangered species; the conflict renders many of them distinct. According to research carried out by the Kenya Wildlife Service (KWS) within a period of 17 years, from 2001 to 2017, wildlife contributed to the conflict at different rates (Ogutu et al, 2019). Notably, as established by Ogutu and his peers, the elephant contributed to about 50% of the conflicts, followed by the buffalo (10.6%). Other animals that paused as a threat include Burchell's zebra, leopard, spotted hyena, and lion.

The aggregate contribution of these animals to the unpleasant relationship with humans is about 80%. Reports indicate that these animals mostly destroyed crops like maize and wheat and attacked both livestock and human beings. According to Ogutu et al, (2019), human-wildlife conflicts were highest between 2008 and 2009, where rain was lowest in Narok County. They also note that during the late wet season, crop raiding was highest because it is when crops mature, and livestock depredation is highest in this season because it is when natural prey density is lowest (Ogutu et al, 2019). It is when animals like gazelles and wildebeests are scarce and carnivores like lions have to find food elsewhere. Researchers like Linuma and his peers, in the article, *Drivers of Human–wildlife interactions in a coexistence area: a case study of the Ngorongoro conservation area, Tanzania* assert that efforts to curb the conflict between humans and wildlife, for instance through establishment of protected areas and alternative forms of land use like wildlife tourism have proved difficult because wildlife still roams

outside protected areas (Linuma et al, 2022). They note that humans must unavoidably interact with wildlife, for instance in the Ngorongoro conservation area, Tanzania, where the land is for multiple purposes and pastoralists like Maasai and Dagota reside with wildlife. Consequently, human-wildlife conflict becomes inevitable.

Despite the inconsistency in record keeping, past research reveals that between 2015 and 2020 (a period of five years), human-wildlife interactions resulted in conflicts in Ngorongoro conservation area where over 150 people were attacked buffalos, elephants, lions, leopards, hyenas, cheetahs, hippopotamus, wild dogs, and snakes (Linuma et al, 2022).

Within this period, 21 people, corresponding to about 13% of those attacked by wildlife died because of elephant attacks. Linuma and his peers note with concern that this information was obtained only from one hospital and, therefore, might be a representation of a very little percentage of the actual attacks and effects within the period of study.

The reported increase in human-wildlife interactions and consequent conflicts has sparked interest among scholars seeking to understand the causes of this conflict. Researchers hope that by establishing the root cause of the problem, they might find a permanent or long-term solution. The main aim of this research is to establish how various factors in the ecosystem contribute to human-wildlife conflict in Maasai Mara National Reserve and Ngorongoro conservation area.

The research is divided into two studies: study one and study two, all falling under methods of studies. After the literature review, study one is a case that focuses on Maasai Mara National Reserve, Narok County, Kenya. The first part provides the research design employed and further articulates the target population of the study. It also presents the sampling technique and sample size for the study in addition to the research instrument used for data collection. The study also discusses pilot testing, validity test and the reliability of the instruments used, as well as the data analysis technique. Study two is an assessment of the effect of the effect of human-wildlife conflicts in Ngorongoro conservation area, Tanzania. It presents the research design, followed by the research strategy. It also discusses sample size and sampling techniques, and data validity and reliability.

The next section is a comparison between the two studies in terms of research approaches, research instruments, and sampling techniques and sample sizes. The data analysis section is also divided into study one and study two. Study one focuses on Masai mara national reserve (MMNR) in Narok County, Kenya. It presents the objectives of the study, their statements, and responses from the sample population. The data is provided in tables. Study two focuses on Ngorongoro conservation area, Tanzania. The section also provides objectives and data in tables, capturing statements and responses from respondents.

The results section presents the results of both studies, detailing the data established from the objectives, and is followed by a comparison of the data from Kenya and Tanzania. The last bit is a discussion of the results from where conclusions and recommendations are drawn.

1.2. Objectives

The general objective of the study is to establish the existence of human-wildlife conflict in Maasai Mara National Reserve, Kenya and Ngorongoro conservation area, Tanzania. The specific objectives for study one are as follows:

- To assess the influence of resources competition (food, water, and fodder) on Human-wildlife conflict.
- To determine the influence of human migration settlement (urban centers emergence, migration, and agricultural expansion) on human-wildlife conflict.
- To establish the extent to which human intrusion (fence vandalism, deforestation, and poaching) to protected areas influences human-wildlife conflict.

2. LITERATURE REVIEW

2.1. What is conflict?

Conflict is a significant concept in human-animal interactions, and it is defined as unpleasant interactions that occur when humans and wildlife engage and compete for shared resources (Anand & Radhakrishna, 2017). These conflicts can manifest themselves in a variety of ways, including competition for food, water, and territorial space (Ogutu et al., 2016), as well as disagreements over access to resources such as land and natural resources.

Human-wildlife conflict is not a new issue; rather, it dates to the first examples of human and animal collaboration (Anand & Radhakrishna, 2017). Early hominids were preyed upon by the creatures that shared their homes and shelters with them, according to the fossil record. For example, forensic evidence recently revealed that the "Taung skull," a remarkable hominid fossil discovered in South Africa in 1924, belonged to a child killed by an eagle approximately two million years ago ((Seoraj-Pillai & Pillay, 2016)). This indicates the persistence of human-wildlife conflict and the difficulties people encountered while navigating the complexities of sharing resources with wild creatures.

The issue of human-wildlife conflict is a growing global concern, as human populations continue to expand and encroach upon areas previously inhabited by wildlife (Anand & Radhakrishna, 2017) (Acharya et al. 2016). This conflict can have adverse impacts on both humans and wildlife, hence the need to find ways to ameliorate these conflicts to ensure the sustainability and well-being of both groups.

2.1.1. Perpetuators of Conflict

Taking a deeper observation, conflict goes both ways, in that both parties get adversely affected (Ogutu et al. 2016). Human beings, having a higher consciousness than wildlife, need to ensure critical thinking prevails when confronted with adversity involving wildlife (Anand & Radhakrishna, 2017). In that, the general human population cannot be selfish nor myopic to the fact that we need a robust and balanced ecosystem that promotes sustenance of wildlife (Seoraj-Pillai & Pillay, 2016). Such a utopic society is crucial for the betterment of both species, humans, and wildlife (Acharya et al., 2016). Wildlife in this case refers to both flora and fauna. This standpoint necessitates a clear understanding on how both parties foster and/ or are on the receiving end of conflict.

Human-wildlife conflict has a long history in Tanzania, especially in areas with a high agricultural and human population density. Elephants and giraffes, for example, have been identified as key drivers of conflict because they can damage crops and lead farmers to lose money (Evans & Adams, 2016). Other creatures, such as lions and hyenas, can jeopardize human safety, particularly in areas where both humans and wildlife are in high concentrations (Acharyaet al., 2016). The growing popularity of tourism in

Tanzania has increased the number of human-wildlife contacts, which can lead to conflicts since people may come into close contact with animals or interfere with their usual habits.

Kenya has also suffered major human-wildlife conflict, notably in agricultural and human population regions (Okello et al., 2018). Elephants and giraffes, for example, are large herbivores that can cause agricultural damage and economic losses in Tanzania (Evans & Adams, 2016) (Walpole et al., 2016). Predators like lions and hyenas can risk human safety, particularly in areas where both humans and wildlife are in high densities (Acharya et al., 2016). The increased demand for land in Kenya has also contributed to the conversion of natural habitats into agricultural land, increasing the likelihood of human-wildlife encounters (Okello et al., 2018). Wild animal attacks on humans do happen, though less frequently than on cattle. Accessible records show that animal deaths account for a minority of fatalities, accounting for 0.06% in Norway and 0.07% in the United States, including domestic animals (Acharya et al., 2016).

Data on human attacks by wild animals can be difficult to get in many countries. Over 100 human fatalities are reported annually due to man-eating tigers in the Sundarbans in eastern India (Acharya et al., 2016). This tendency is further shown by the tale of the Tsavo man-eating lions, which killed 128 people in 1898–1899 (Patterson et al., 2004) and is well known around the world.

2.2. Geographical Characteristics

2.2.1. Kenya

Kenya is a country located in East Africa, bordered by Somalia to the northeast, Ethiopia to the north, South Sudan to the northwest, Uganda to the west, Tanzania to the south, and the Indian Ocean to the east (Sindiga & Burnett, 1988). The country has a land area of approximately 580,000 square kilometers and is situated on the equator (Sindiga & Burnett, 1988), which means it has a tropical climate with hot and humid weather year-round.

Kenya has a diverse and varied topography, with several physical components that contribute to its scenery. Kenya's three major geographic divisions are the Rift Valley, the highlands, and the lowlands (Sindiga & Burnett, 1988). The highlands of central and western Kenya are made up of rolling hills and mountains, with Mount Kenya serving as the highest peak at 5,199 meters above sea level (Sindiga & Burnett, 1988). The Mau Forest, which is located there, is the largest forest in the country and an important source of water for the Rift Valley. Lake Victoria, Africa's largest lake, is in western Kenya and serves as a key source of water for the region.

The eastern and coastal parts of the country are made up of lowlands with flat, low-lying terrain and sandy beaches (Sindiga & Burnett, 1988). This area contains numerous notable marine habitats, including coral reefs and seagrass beds, which sustain a strong tourism sector (Sindiga & Burnett, 1988). There are also some mangrove forests in the lowlands, which are important habitats for many different species' larval stages. Kenya is a culturally and geographically diverse East African country.

2.2.2. Tanzania

Tanzania is a country located in East Africa, bordered by Kenya to the north, Uganda to the west, the Democratic Republic of the Congo to the northwest, Zambia, Malawi, and Mozambique to the southwest, and the Indian Ocean to the east (Banyikwa, 2021). The country has a land area of approximately 945,000 square kilometers and is home to a population of over 56 million people.

Tanzania is a geographically diverse country, with a range of physical features that contribute to its unique landscape (Banyikwa, 2021). The country can be divided into several main regions: the highlands, the Great Rift Valley, the central plateau, and the coastal plain.

The country's northern and central parts are known as the highlands, which are characterized by its rolling hills and mountains, the highest of which is Mount Kilimanjaro, which rises 5,895 meters above sea level (Banyikwa, 2021). There are several noteworthy forests in this area, including the Serengeti National

Park, which is well-known for the vast number of animals it is home to and the yearly migration of wildebeests (Banyikwa, 2021). Numerous lakes can be found in the highlands, including Lake Victoria, which is the biggest lake in Africa and a major source of water for the area.

The Great Rift Valley region, which occupies the central and eastern parts of the country, is characterized by a series of deep valleys and escarpments that were formed by tectonic activity millions of years ago (Banyikwa, 2021). This region is home to several important lakes, including Lake Tanganyika, which is the second-deepest lake in the world and a major source of water for the region (Banyikwa, 2021). The Great Rift Valley region is also home to several important national parks and reserves, including the Ngorongoro Conservation Area, which is known for its high concentration of wildlife and the Olduvai Gorge (Banyikwa, 2021), which is an important paleontological site.

The middle plateau is a flat, low-lying area crossed by various rivers and streams. It is in the central and western areas of the country (Banyikwa, 2021). This region is home to numerous important agricultural regions, notably Mwanza and Kigoma, which are well-known for producing cash crops. The coastal plain region of the country's eastern and southern regions is mostly flat, low-lying land with sandy beaches and many mangrove trees. The presence of several key marine habitats, such as coral reefs and seagrass beds, in this area contributes to a strong tourism economy. Several large ports, most notably the port of Dar es Salaam, are located on the coastal plain.

Kenya and Tanzania are both countries located in East Africa, with a range of physical features that contribute to their unique landscapes. One of the main similarities between the two countries is that they are both home to several important forests, lakes, and national parks. For example, both countries are home to the Mara Serengeti National Park and Lake Victoria, which are known for their high concentrations of wildlife and important sources of water for the region.

One of the main differences between the two countries is their topography. Kenya is characterized by a range of physical features, including rolling hills and mountains in the high lands' region, deep valleys and escarpments in the Rift Valley region, and flat, low-lying land in the lowland's region. In contrast, Tanzania is characterized by a range of physical features, including rolling hills and mountains in the high lands' region, deep valleys, and escarpments in the Great Rift Valley region (Banyikwa, 2021), flat, low-lying land in the central plateau region, and sandy beaches and mangrove forests in the coastal plain region.

Another difference between the two countries is their climate. Kenya has a tropical climate with hot and humid weather year-round, while Tanzania has a more varied climate, with hot and humid weather in the coastal region, cooler and drier weather in the highland's region (Banyikwa, 2021), and warm and dry weather in the central and western regions.

In conclusion, while Kenya and Tanzania have several similarities in terms of their physical features and natural resources, they also have several differences, including their topography and climate. These differences contribute to the unique landscapes and biodiversity of both countries.

2.3. Nature of Human Wildlife Conflicts

2.3.1. Kenya

2.3.1.1. Livestock Predation

In locations near protected areas, livestock predation by carnivores like lions, leopards, and hyenas is a serious worry, costing the owners money (Ogada et al., 2003; Kolowski and Holekamp, 2006). It has been shown that bringing cattle closer to parks during the rainy season, when wildlife migrates, exacerbates the issue (Mukeka et al., 2018). In the region around Kenya's Tsavo National Park, Mukeka et al., (2018) found that predator's prey on livestock year-round, with increased assaults taking place during seasons and hours of the day. The type of predator and the livestock attacked can vary depending on the predator's preferences and the livestock's accessibility (Ogutu et al., 2016). Predators, however, also cause damage to livestock enclosures by ripping holes in the surrounding fences, which damages people's perceptions of carnivores and even results in the killing of endangered species like lions and hyenas.

2.3.1.2. Crop Destruction

As a result of agriculture replacing nomadic cultures, farming villages typically around parks and forests in Kenya (Kanga et al., 2012). Unfortunately, conflicts between rural farmers and wildlife have resulted in fatal encounters in both Africa and Asia because of this intimate interaction (Seoraj-Pillai & Pillay, 2016); (Acharya et al., 2016). Even though people have been driven to abandon farming due to poverty caused by reoccurring crop damage or wildlife invasions (Kanga et al., 2012), these confrontations typically begin when farmers attempt to protect their crops or hunt wild animals for meat or trophies. According to Mukeka et al., (2018) elephants often destroyed farms in Transmara, Kenya, with the worst incidences taking place in the months when the crops were nearly ready for harvest. Due to their propensity to trample farms and consume massive quantities of vegetation, larger animals, like elephants, can cause violent disputes.

2.3.1.3. Disease Transmission

The possibility of disease transmission from wildlife to humans or their livestock has led to a lot of opposition to conservation efforts. For example, farmers in east Africa might be concerned about badgers

infecting cattle with tuberculosis (Enström et al., 2017). In addition, some animals, such as buffaloes, harbor disease-transmitting ticks that serve as reservoirs for conditions like East Coast fever (Enström et al., 2017). The Simian Immunodeficiency Virus (SIV), which is thought to be carried by primates, is believed to have given rise to the Human Immunodeficiency Virus (HIV) (Acharya et al., 2016), which has been responsible for numerous infections and fatalities.

Carnivores, on the other hand, may serve as reservoirs for diseases such as rabies, which kills a significant number of people worldwide each year. According to Enström et al., domestic dogs are thought to have contributed to rabies and canine distemper virus outbreaks in the Serengeti and Masai Mara National Parks (2017). Disease transmission, as well as competition for resources such as water, pasture, and space, can lead to conflicts between herbivorous wildlife and livestock (Kanga et al., 2012). This is especially true during dry seasons, when many migrating animals may seek water and pasture near parks.

2.3.1.4. Property Destruction

Property destruction by wild animals, according to Mukeka et al., was a major source of conflict outside of Tsavo National Park and other Kenyan protected areas (2018), Elephants were often the most destructive, destroying water troughs, tanks, and pans while searching for water and destroying fences, trees, and grain stores while roaming outside the park (Kanga et al., 2012). Indeed, Evans & Adams, (2016) proposed that elephants caused more destruction than other animals in Kenya's Laikipia District due to their ability to travel long distances outside of the park and cause extensive trampling and damage to local farms and structures at all seasons.

2.3.1.5. Poaching

Poaching is still a major problem in the Nakuru-Naivasha region, particularly for bushmeat and skins (Ogutu et al., 2016). This activity, which mostly consists of large-scale wildlife snaring, has had a significant impact on local wildlife populations and exacerbated the already major issues of human-wildlife conflicts and land use conflicts (Evans & Adams, 2016). As a result, combating poaching is crucial in the area. Large carnivore populations in the Nakuru-Naivasha region have been extirpated or significantly reduced because of the conflicts (Ogutu et al., 2016). The dramatic decline in the Nakuru Wildlife Conservation area's cheetah population may have been caused in part by livestock farmers' harassment or killings (Ogutu et al., 2016), especially since lions and spotted hyenas, which often outcompete cheetahs in areas with large populations, were also uncommon in the conservation area. This is not surprising, as large carnivores can pose a threat to livestock and even harm or kill people. Many smaller landowners, who are not members of the conservancy, may be unable or unwilling to bear

the cost of livestock losses and may therefore take actions to protect their stock, such as harassing, poisoning, or killing carnivores.

2.3.1.6. Human Population Growth

Kenya's population is quickly growing, with one of the world's highest birth rates (Swallow, 2005). As a result of settlements, land subdivision, infrastructure development, agricultural growth, and other causes that degrade habitats (Kanga et al., 2012), humans and wildlife are contending for territory (Ogutu et al., 2016). Human population growth has led to habitat fragmentation, destruction, and deterioration of wildlife habitats.

The Maasai and Kambas, who were predominantly pastoralists and hunters/gatherers, respectively, now live in Chyulu Hills National Park and have been badly impacted by fast population growth, urbanization, and greater technology. Farmers that continue to move to the area and engage in unsustainable farming and grazing techniques have freed up enormous areas for agricultural expansion, further degrading wildlife habitats (Ogutu et al., 2016). Infrastructure expansion, particularly highway construction, has aggravated the situation by opening new regions while causing environmental degradation, fragmentation, and pollution.

2.3.1.7. Habitat Fragmentation

The Kenyan government commissioned a study in 2014, which identified several ongoing threats to elephant ranges, including habitat fragmentation caused by land subdivision, agricultural expansion (Mukeka et al., 2019), high-density human settlement, infrastructure development, fencing, mining and quarrying, woodland clearing, deforestation, wetlands draining, and increasing livestock density. These factors contribute to the disruption of wildlife dispersal zones and corridors. Land use and land cover changes can have an impact on both the levels of human-wildlife conflict and the availability of suitable wildlife habitat (Seoraj-Pillai & Pillay, 2016). Human modification of these factors contributes significantly to the escalation of such conflicts (Veldhuis et al., 2019). Population growth, agricultural expansion and intensification, and pastoralists' sedentary lifestyle in rangelands have all contributed to recent increases in conflict in Kenya (Ogutu et al., 2016). Despite community-based

conservation efforts, the Maasai, a traditionally nomadic pastoralist group (Veldhuis et al., 2019), have seen an increase in human-wildlife conflict in recent years, partly due to the introduction and expansion of agriculture on their lands.

2.3.2. Tanzania

The primary cause of the conflict was identified as the growing human population and increasing landscape transformation from natural to cultivated village land, bringing human societies and wildlife into closer contact and increased competition for access to resources.

2.3.2.1. Livestock Predation

A study conducted in Tunduru and Songea in Tanzania's Selous Game Reserves discovered that wild animals killed over 100 cattle, 600 goats, 180 sheep, 90 pigs, and 20 dogs. The respondents from the chosen villages rely on agriculture as their primary source of income and base their activities in the vicinity of Mikumi National Park, where they frequently interact with wild animals such as elephants and zebras. This interaction frequently results in clashes between humans and wild animals, especially when the animals destroy crops.

Carnivorous wild animals 'prey on goats, sheep, and cattle, according to the study. Between January and June 2012, carnivores killed 5% of the goats, 6% of the sheep, and 4% of the cattle in Mkata village. Conflicts between humans and wild animals result from this situation (Veldhuis et al., 2019), which can be especially harmful to people who rely on animals for their livelihoods and as a source of income during times of economic hardship.

2.3.2.2.Crop-destruction

In Tanzania, crop raiding by wild animals is a pervasive and economically harmful form of humanwildlife conflict. Crops heavily raided include maize, rice and sweet potatoes, groundnuts, pumpkins. The main species cited as crop raiders include elephants, monkeys and bushpigs. Losses to crops are often the top perceived problem among farmers, with elephants (Loxodonta africana) being particularly significant raiders in boundary areas between farms and wild areas (Veldhuis et al., 2019). These animals can cause significant damage to crop, and their foraging behavior is a major contributor to the conflict between humans and wildlife.

The severity of crop raiding by elephants in Tanzania is consistent with other countries in eastern and southern Africa. According to research from Zimbabwe and Kenya, elephants are responsible for 75% and 90% of crop damage cases caused by large mammals, respectively. Data from the Tanzania Wildlife Authority indicates that crop raiding by wildlife nationwide increased by over 500% from 1,146 hectares in 2011 to 7,370 in 2014 (Veldhuis et al., 2019), though it does not specifically identify the animal species responsible. However, previous reports have indicated that elephants are the major culprits in Tanzania.

2.3.2.3.Disease-transmission

Disease transmission is a major issue in areas where pastoralism and agropastoralism are practiced (Enström et al., 2017). For example, Selela, a wildlife corridor that connects Ngorongoro Conservation Area and Lake Manyara National Park, is a major source of concern for people who complain about disease.

2.3.2.4. Transmission

Domestic animals, such as dogs, can contribute to the spread of diseases that affect wildlife. Dogs, for example, can serve as reservoirs for rabies, canine distemper, and parvovirus (Veldhuis et al., 2019). These diseases, which are transmitted in part by domestic dogs, have been blamed for the extinction of African wild dogs in the Serengeti ecosystem. According to Veldhuis et al., (2019), disease transmission from domestic animals' accounts for 68.8% of all stock losses.

2.3.2.5. Poaching

Poaching is a significant issue in Tanzania, with both subsistence and commercial poaching being prevalent. Commercial poaching specifically targets species like elephants and rhinos for their valuable body parts, while subsistence poaching involves trapping smaller animals for food, fish, and honey. The Serengeti-Mara ecosystem has been particularly affected by poaching (Veldhuis et al., 2019), with a high number of elephant carcasses found in the area, many of which had their tusks removed. The price of elephant tusks has increased significantly in recent years, reaching USD 1,500 per kilogram in 2012 (Seoraj-Pillai & Pillay, 2016). The price of rhino horn can be even higher, reaching as much as USD 6,000 per kilogram on the black market in the Middle East and Asia (Veldhuis et al., 2019). There has been a steady increase in elephant poaching in the past three years, with over 1,000 elephants being poached. These findings highlight the severity of the poaching problem in this region.

2.3.2.6. Human Population Growth

East Africa has lost a significant amount of wildlife over the last 30 years (Western et al., 2009). Human population growth has been significant along the borders of wildlife areas in Tanzania, and deforestation has increased in the last 15 years (Bartzke et al., 2018). Herbivore populations have declined as a result. Furthermore, wildlife in all major national parks and game reserves is declining. The primary causes of this decline are high human population growth and expanding human settlements (Evans & Adams,

2016), changes in land use and economic realities such as the expansion of large-scale farming (Mukeka et al., 2019), Serneels, Said & Lambin, 2001), and illicit hunting.

2.4. Conflict Hotspot Areas and Strategies Employed

2.4.1. Kenya: Narok County, Maasai Mara National Park

Human-wildlife conflict in Narok County, Kenya, has been caused by a variety of wildlife species. Six specific species and three species groups were responsible for 95.6% of the conflicts reported between 2001 and 2017 (Mukeka et al., 2019). Large herbivores, such as elephants, buffalo, and zebra, were responsible for 67.3% of the conflicts (Bartzke et al., 2018). Large carnivores, such as leopards, spotted hyenas, and lions, caused 17.1% of the conflicts (Mukeka et al., 2019). Nonhuman primates caused 12.3% of the conflicts, antelopes caused 2.0%, and snakes caused 1.3%. (Mukeka et al., 2019) These conflicts have likely been influenced by differences in resource use and requirements among the various species. In Narok County, human-wildlife conflicts have a single-peak seasonal pattern and increase from the late wet season in May to the early dry season in July (Bartzke et al., 2018). Crop raiding is most common during the late wet season (May-June) and early dry season (July) when cereal crops are maturing and being harvested (Bartzke et al., 2018) (Mukeka et al., 2019). These nutrient-rich crops act as high-energy food sources for wild herbivores, which may become habituated to raiding and return to the same areas every season (Mukeka et al., 2019). This behavior can have negative impacts on farmers, as crops are often eaten or trampled at their most productive stage, leading to potentially large economic losses. To prevent this, it is necessary to address conflicts at the level of specific crop types. This could involve promoting the cultivation of early-maturing varieties or crops that are not attractive to wildlife (Mukeka et al., 2019). The high levels of crop raiding and crop destruction in Narok County can be attributed to various factors such as changes in land use, particularly the expansion of agriculture, variations in rainfall (Bartzke et al., 2018), and increases in both human and livestock populations (Mukeka et al., 2019). These factors can lead to competition for resources among humans, livestock, and wildlife. Habitat destruction is a major threat to biodiversity, and it can increase human-wildlife conflicts as it reduces resources available to both humans and wildlife (Bartzke et al., 2018). To prevent this, it is important to promote conservation enterprises that provide benefits to local communities and discourage land division and fencing that restrict wildlife movement. Land use planning and zoning can also help separate human settlements, farms, and livestock from wildlife habitats.

Livestock attacks by carnivores are a significant issue in Narok County and can lead to retaliatory killings that threaten carnivore conservation (Mukeka et al., 2019). To address this problem, farmers can build predator-proof enclosures for their livestock and receive compensation for any losses caused by conflicts.

Long-term strategies for managing human-wildlife conflicts should anticipate increases in conflicts during droughts, which are becoming more common in the region (Bartzke et al., 2018) (Mukeka et al., 2019). This may include encouraging farmers to reduce their livestock numbers during dry periods. Crop raiding can be reduced by growing early maturing crops and using less palatable crops, such as chili peppers, in some years. This can help minimize habituation by crop-raiding herbivores.

2.4.2. Tanzania: Iharara, Makundusi and Bonchugu in Serengeti District and Mariwanda and Nyamatoke in Bunda.

Human-elephant conflict can result in injury or death to people and livestock, crop raiding, competition for resources like water and food, and destruction of structures like storage facilities (Veldhuis et al., 2019). Many respondents reported that crop raiding by elephants was a major concern. The most severe conflicts tended to occur near protected areas, on the border between protected areas and villages, and along traditional elephant migration routes. The severity of crop raiding by elephants in Tanzania is similar to other countries in East and Southern Africa.

According to data from the Tanzania Wildlife Authority (TAWA), crop raiding by wildlife in the country has seen a significant increase, with the number of crops raided increasing by over 500% from 1,146 hectares in 2011 to 7,370 hectares in 2014 (Veldhuis et al., 2019). While the TAWA data did not specify which animal species were responsible for the crop raiding, it is known that elephants have previously been identified as the major perpetrators in Tanzania. Retaliatory killing of wildlife is a common response to problems caused by animals in communities. This can be done through illegal methods such as poisoning, trapping, or shooting, or through legal means such as government-sanctioned lethal control programs.

While information about the retaliatory killing of wildlife is often limited and not easily accessible due to its secretive nature, there have been a few reported cases of animal massacres in western Serengeti, particularly involving elephants (Veldhuis et al., 2019). In other parts of Tanzania, it has been reported that 28 lions were killed between 2004 and 2008 in villages near

the Selous-Niassa corridor because of various costs inflicted upon the local community by the animals. The primary cause of this conflict is believed to be the increasing human population and the transformation of natural land into cultivated village land, leading to closer contact and increased competition for resources between humans and wildlife. Elephants tend to move into settled land, particularly during the wet season (Bartzke et al., 2018), in search of water, food, and potentially minerals. On the other hand (Veldhuis et al., 2019), lions are more likely to move into villages when their preferred prey, such as zebra and wildebeest, have migrated to other areas in the Serengeti ecosystem during the dry season.

In Tanzania, various methods have been used to mitigate human-wildlife conflict. These can be grouped into proactive and reactive approaches. Proactive methods include physical barriers, sensory deterrents, guarding, and land use planning (Veldhuis et al., 2019). Reactive methods involve scaring or killing animals that cause conflict. Financial programs such as benefit sharing and compensation for losses are also implemented to improve tolerance for wildlife. However, data from the Tanzania Wildlife Authority shows that the compensation policy has proven unsustainable due to administrative and financial challenges, with 77% of approved claims for the period 2011-2015 remaining outstanding at the end of 2016.

Traditional approaches like guarding, using fire and smoke, and chasing wildlife away have not been successful in reducing conflict to an acceptable level, as the animals have become habituated and can become dangerous when annoyed. Novel methods like chili fences and chili bricks have demonstrated potential for reducing conflict, but their adoption has been limited. Using dogs to guard livestock is a traditional technique that has seen variable success.

2.5. Gap in Literature

Conserving wildlife and inhibiting human-wildlife conflict are important issues that have been at the forefront of conservation efforts for decades. In recent years, there have been many new and emerging technologies that have been developed to address these issues. These technologies range from innovative methods for monitoring and protecting wildlife to new approaches for managing and mitigating human-wildlife conflicts.

One such technology that has shown great potential in conserving wildlife is the use of drones for monitoring and protection. Drones can be used to monitor wildlife populations, track the movements of individual animals, and even protect them from poachers (Ivosevic, Cho, Kwon, & Han, 2015). For example, drones equipped with thermal imaging cameras can detect poachers at night, allowing rangers to intervene and apprehend them before they can harm any animals. In addition, drones can be used to monitor wildlife in remote areas where it is difficult for humans to access, providing valuable information about the health and behavior of these species.

Another technology that has been developed to address human-wildlife conflict is the use of wildlife warning systems. These systems use sensors to detect the presence of wildlife in areas where they may come into conflict with humans, such as near farms or villages (Ronoh, Mirau, & Dida 2022). When an animal is detected, the system can trigger a warning, such as flashing lights or a loud noise, to alert people and deter the animal from entering the area. These systems can be particularly effective in reducing conflicts with large animals like elephants (Evans & Adams, 2016) or bears, which can cause significant damage to crop and property.

In addition to monitoring and protection technologies, there are also new approaches being developed to manage and mitigate human-wildlife conflicts. One such approach is the use of economic incentives to encourage coexistence between humans and wildlife (Badola et al. 2021). For example, some conservation organizations have implemented payment for ecosystem services programs, in which farmers are paid for the value that wildlife brings to their land, such as through tourism or the pollination of crops. This can help to reduce the negative impacts of wildlife on farming communities, while also providing a financial incentive to protect and coexist with these animals.

Another emerging technology being used to address human-wildlife conflict is the use of virtual fencing. Virtual fencing systems use GPS technology to create virtual barriers that animals are trained to avoid. When an animal approaches the virtual fence, it receives a mild shock, which encourages it to stay away from the area.

In conclusion, human-wildlife conflict is a significant issue in both Tanzania and Kenya, as the growing human population and increasing development in these countries have led to a reduction in natural habitats and an increase in interactions between humans and wildlife. A variety of approaches, including the use of physical barriers, deterrents, and education and awareness campaigns, have been implemented to mitigate these conflicts and promote coexistence between humans and wildlife. However, there is a need for continued research and the development of effective and sustainable approaches to address human-wildlife conflict in these countries.

3. METHOD OF STUDIES

3.1. STUDY 1: A CASE FOCUSING ON MAASAI MARA NATIONAL RESERVE, NAROK COUNTY, KENYA

3.1.1. Research Design

This study employed a descriptive research approach. The researcher chose this strategy because it allowed her to collect data from a large sample size and acquire insights on the present state of humanwildlife conflict in the communities bordering the Maasai Mara National Reserve as well as to describe the characteristics of the population under study. Cross-sectional design is extensively used in this sort of research, with the purpose of discovering linkages between variables and providing insights into complex social and ecological systems. Descriptive design emphasizes data over theory. In this study, it was simple to distribute questionnaires to the inhabitants in their homes and places of employment, which helped to increase the response rate.

3.1.2. Target Population of the Study

The 1200 homes from the four villages surrounding MMNR and the 30 KWS officers stationed at MMNR were the study's target population. The villages are a good fit for studying because there are many instances of human-wildlife conflict there.

Target Villages	Target Population
Sekanani	505
Muroti	314
Talek	246
Ololaimutiek	135
KWS officers	30
Total	1230

Table 1 Target Population of Study Area

3.1.3. Sampling Technique and Sample Size

In order to select a representative sample size for the study, a probabilistic sampling design known as stratified sampling was employed. This involved dividing the target population into meaningful, non-overlapping subcategories known as strata. The stratification approach was selected because it has been shown to reduce the standard error and increase the accuracy of estimates.

The four target villages (Sekanani, Muroti, Talek, and Ololaimutiek) were used as the strata in this study. This allowed for a more precise selection of participants from each village based on their specific characteristics, such as age, gender, occupation, and level of education. The sample size was determined based on the size of each stratum and within each stratum, 10% of households were randomly selected for the study. The sample size totaled 148 respondents, representing a percentage of each target village's population, as shown below.

Target Villages	Target population	Sample size	Percentage	
Sekanani	505	50	10%	
Muroti	314	31	10%	
Talek	246	24	10%	
Ololaimutiek	135	13	10%	

Table 2 Target villages with corresponding target population

Target Villages	Target population	Sample size	Percentage
KWS officers	30	30	100%
Total	1230	148	-

The researcher ensured that the sample size was appropriate for the study's objectives and allowed for statistical analysis while also being feasible to obtain. Stratified sampling reduced the standard error and ensured that the sample was representative of the population, as it included households from each stratum. The inclusion of KWS officers in the sample ensured that the study obtained information from a relevant stakeholder group.

3.1.4. Research Instrument

To collect data for the study, the researcher utilized questionnaires and interview guides. Specifically, the residents' questionnaire was employed and divided into five distinct sections. The first section (Section A) sought background information from the respondents. The other sections were structured to elicit perceptions on the different factors influencing human-wildlife conflict, including competition for resources (Section B), human population increase (Section C), human invasion (Section D), and conservation measures (Section E). Additionally, a personal interview was conducted to gather further information on the same topics. In this interview, the researcher obtained background information from the respondents, as well as their perceptions on competition for resources, human population increase, human invasion, and conservation measures in relation to human-wildlife conflict. Furthermore, Section F of the questionnaire aimed to gather information on the indicators of human-wildlife conflict.

3.1.5. Pilot Testing

A preliminary pilot research was carried out on 12 households that weren't included in the final sample population prior to the actual data collection process. The primary objective of the pilot test was to determine whether the data that had been collected could be easily processed and interpreted. Before distributing the questionnaire to the actual respondents, changes were made to the questionnaire based on the findings of the pilot test to lessen the possibility of ambiguity in some of the questions. The questionnaire items were scrutinized during the pilot test to make sure they were both suitably phrased and presented. The amended questionnaire was then utilized to gather data for the real study after making the necessary adjustments.

3.1.6. Validity Test

The research instrument underwent a validity test utilizing content validity to assure correctness and relevance. While some items were updated, the ones that were discovered to be inconsistent were eliminated. To determine whether the questions adequately captured the study's concept, the researcher sought expert opinion. Also, the supervisor was consulted to enhance content authenticity. The purpose of the validity test was to make sure that the research tool's questions were appropriate, pertinent to the investigation, and would yield accurate and insightful information.

3.1.7. Reliability of the Instruments

To test the reliability of the instrument used in the study, the researcher utilized the split-half method. The researcher's goal was to determine the coefficient of internal consistency and the reliability coefficient, which ranged from 0.00 (signifying no reliability) to +1.00 (representing perfect reliability). Using the Pearson Product Moment Correlation Coefficient for the entire test, the odd numbered scores were correlated with even numbered scores. The researcher then used the Spearman Brown Prophecy formula to calculate the reliability of the original test, which was Re = reliability of the original test and r = reliability of the coefficient resulting from correlating the scores of the odd items with the scores of the even items. The obtained coefficient was 0.78, which was considered adequate. This ensured that the instrument used in the study was reliable and that the data collected could be analyzed with confidence.

3.1.8. Data Analysis Technique

Statistical Package for Social Sciences (SPSS) version 21 was used to perform descriptive statistics analysis on the quantitative data obtained for the study. Tables were used to present the analysis, which was done using percentages, averages, and frequencies. On the other side, before being tabulated, the thematically organized, pattern-based qualitative data from the interview process was grouped through content analysis.

Objectives	Variables	Indicators	Data Collection Instruments	Analysis Tool
To assess the influence of resources competition on HWC in MMNR	Independent variable: Resources Competition	Land, Water, Fodder	Questionnaire, Interview guide	Descriptive statistics, Inferential statistics

Table 3 Objectives with corresponding variables

Objectives	Variables	Indicators	Data Collection Instruments	Analysis Tool
To determine the influence of human migration settlement on HWC in MMNR	Independent variable: Human migration	Urban centres emergence, Migration, Agricultural expansion	Questionnaire, Interview guide	Descriptive statistics, Inferential statistics
To establish extent to which human intrusion to protected areas influence HWC in MMNR	Independent variable: Human intrusion to protected areas	Fence vandalism, Deforestation, Poaching	Questionnaire, Interview guide	Descriptive statistics, Inferential statistics
Human Wildlife Conflict	Dependent variable: Human Wildlife Conflict	Reduction in HWC, Reduced crop damage, reduced killing of livestock, Reduced human fatalities	Questionnaire, Interview guide	Descriptive statistics, Inferential statistics

3.2. STUDY 2: AN ASSESSMENT OF THE EFFECT OF HUMAN-WILDLIFE CONFLICTS IN NGORONGORO CONSERVATION AREA, TANZANIA

3.2.1. Research Design

This study used a cross-sectional research strategy that entailed only one data collection during fieldwork. The two-week long data collection process was followed by data coding, analysis, and interpretation. Data were gathered from participants who were chosen at random for the study using a well-structured questionnaire to ensure both internal and external validity. Moreover, focus group discussions (FGDs) were done with key informants to acquire more specific information on the research issue.

3.2.2. Research Strategy

This study utilized both quantitative and qualitative research methodologies. The quantitative approach was employed to identify the current types and causes of human-wildlife conflicts in the Ngorongoro Conservation Area (NCA), as well as to determine the community's perception of these conflicts over the past decade. The study also aimed to compare and contrast different variables and community opinions on the most effective mitigation measures for addressing human-wildlife conflicts in the NCA. Quantitative research facilitated the comparison of various variables presented in formats such as charts and graphs, allowing for a more comprehensive understanding of the data.

To allow for a more comprehensive and in-depth understanding of the research questions, a qualitative approach was employed in this study. This approach provided more room for respondents to express their thoughts, opinions, and experiences related to the current types and causes of human-wildlife conflicts in the Ngorongoro conservation area, as well as the community's perception of the trends of such conflicts over the past decade. By utilizing this approach, the study aimed to gain a more nuanced understanding of the complex dynamics of human-wildlife conflicts in the Ngorongoro conservation area, as well as the perspectives and experiences of the local community regarding these issues.

3.2.3. Sample Size and Sampling Techniques

To obtain a representative sample of the local community in the Ngorongoro Conservation Area (NCA), a villages sampling frame was created by compiling a list of all the villages in the Ngorongoro conservation area. From this sampling frame, ten (10) villages were randomly selected. To select respondents, a village respondents sampling frame was created by compiling a list of heads of households in the selected villages. In the first nine (9) randomly selected villages, 14 respondents were chosen from the established villages. In contrast, only 13 respondents were randomly selected from the last randomly selected village sampling frame. This process resulted in a total of 139 randomly selected respondents for the study. This approach ensured that the sample was representative of the local community in the NCA and would provide a comprehensive understanding of human-wildlife conflicts in the area.

3.2.4. Data Validity and Reliability

Before conducting the pre-testing of the questionnaire, the researchers consulted with experts in the field of environmental management to ensure its validity. To address any potential issues with criterion-related validity, the study also included direct observation of the behaviors of the respondents during data collection. Furthermore, the researchers made sure that the respondents were randomly selected from the broader population in order to ensure that the study group was properly represented.

3.2.5. Comparison between the two studies

Both studies used a descriptive research approach to investigate the human-wildlife conflict in their respective study areas. Machoka (2017) employed a cross-sectional design to collect data from a large sample size in four villages surrounding the Maasai Mara National Reserve, while Nyerembe (2020) used a case study approach to assess the effect of human-wildlife conflicts on sustainable conservation in the Ngorongoro Conservation Area.

Both studies utilized questionnaires as the primary data collection instrument, and the researchers ensured the validity and reliability of their research instruments. Machoka (2017) conducted a pilot study to test the questionnaire's suitability and adjusted the questionnaire.

She also utilized content validity to ensure correctness and relevance. Nyerembe (2020) used a combination of structured and unstructured questionnaires and interviewed key informants to obtain a comprehensive understanding of the issues related to human-wildlife conflict.

The studies also employed different sampling techniques and sample sizes. Machoka (2017) used stratified sampling to divide the target population into four non-overlapping subcategories, which were the four target villages surrounding Maasai Mara National Reserve, and randomly selected 10% of households from each stratum. The sample size totaled 148 respondents. Nyerembe (2020) used purposive random sampling to select the study area and included 260 respondents, including local communities, conservation agencies, and government officials.

In conclusion, both studies used descriptive research designs to collect data on human-wildlife conflicts in Kenya and Tanzania. Machoka (2017) used a cross-sectional design and stratified sampling to collect data from four villages surrounding Maasai Mara National Reserve, while Nyerembe (2020) used a case study approach and purposive sampling to assess the effect of human-wildlife conflicts on sustainable conservation in the Ngorongoro Conservation Area. Both studies utilized questionnaires as their primary data collection instrument and ensured the validity and reliability of their research instruments.

4. DATA ANALYSIS

4.1. STUDY 1: A CASE FOCUSING ON MAASAI MARA NATIONAL RESERVE, NAROK COUNTY, KENYA

4.1.1. Objective 1: Influence of resources competition on human wildlife conflict.

Key: 1-Strongly agree, 2-Agree, 3-Neutral, 4-Disagree,

Table 4 Residents Level of Agreement on Influence of Sharing Resources

Statements	1	2	3	4	Mean	%F	%F	%F	%F
Obstruction of water for domestic purposes and no water streaming into protected areas for wildlife	17	18	47	54	34	19	20	52.2	60
Natural factors like drought that push animals to human habitations for pastures and water	50	54	26	27	39.25	55.5	60	28.9	30
Need of land for human development	24	18	4	12	14.4	26.66	20	4.4	13.
N=90									

4.1.2. Objective 2: The influence of human migration settlement on human wildlife conflict.

Table 5 Residents Opinions on Influence of Human Migration Settlement

Responses	Frequency	Percentage	
Yes	52	57.8	
No	38	42.2	
Total	90	100.0	

Table 6 Residents' Level of Agreement on the Influence of Human Migration Settlement

Statements	Yes	No	Mean	F%	F%
Establishment of settlement schemes along national parks has led to the increase in conflict between people and wildlife	65	72	68.5	72.2	80
Emergence of towns and trading centers next to national park has contributed to the increase of HWC	52	57	54.5	57.8	63.3
High population has resulted in difficulty in catching up with poachers whenever they strike	41	45	43	45.56	50
Farmers move from other parts of the country to benefit from the favorable climatic conditions near national parks	63	70	66.5	70	77.78

N=90

4.1.3. Objective 3: Influence of Human invasion to protected areas on Human Wildlife Conflict

Extent of Encroachment	Frequency	Percentage
Very great extent	53	58.9%
Great extent	15	16.7%
Moderate extent	4	4.4%
Not applicable	18	20.0
Total	72	100.0%

Table 7 Extent to which Encroachment Contributed to HWC

Table 8 Resident's level of agreement on Influence of Human Invasion Settlement

Statements	1 - Strongly agree	2 - Agree	3 - Neutral	4 - Disagree	5 - Strongly disagree	Mean
Some community members vandalize KWS park fence	17	18	94	44	23	39.2
People invade the park in search of firewood	47	1	26	89	52	43
Some community members graze their livestock inside the park	30	33	56	62	23	40.8
Unknown people carry out subsistence poaching of wildlife	44	33	49	68	88	56.4
Some community members have been found and arrested inside the park for trespassing	11	12	25	28	44	24
Human activities change wildlife habitats	45	50	22	44	11	34.4
Ν	90	90	90	90	90	

4.2. STUDY 2: AN ASSESSMENT OF THE EFFECT OF HUMAN-WILDLIFE CONFLICTS IN NGORONGORO CONSERVATION AREA, TANZANIA

4.2.1. Objective 1: Influence of resources competition on human wildlife conflict.

Key: 1-Strongly agree, 2-Agree, 3-Neutral, 4-Disagree, 5-Strongly disagree

 Table 9 Influence of resources competition on Human Wildlife Conflict.

Statements	1	2	3	4	5	Mean	%1	%2	%3	%4	%5
Scarcity of water sources for both wildlife and human use contributes to conflict	22	56	35	20	6	27.8	15.8	40.28	25.17	14.38	4.31
Competition for grazing lands leads to encroachment of wildlife to human settlements	33	42	27	20	13	27	23.74	30.21	19.42	14.38	9.35
Deforestation and land use change push wildlife into human habitations	38	43	24	20	11	27.2	27.33	30.93	17.26	14.38	7.91
Human population growth increases human encroachment into wildlife habitats	48	46	23	15	7	27.8	34.53	33.1	16.54	10.79	5.03
Competition for firewood and non- timber forest products contribute to wildlife depletion	28	46	35	18	12	27.8	20.14	33.1	25.17	12.95	8.63
N=139											

4.2.2. Objective 2: The influence of human migration settlement on human wildlife conflict.

Statements	1 - Strongly Agree	2 – Agree	3 - Neutral	4 - Disagree	5- Strongly Disagree	Mean
The establishment of settlement schemes along national parks has led to the increase in conflict between people and wildlife.	41	58	19	14	6	27.6

Statements	1 - Strongly Agree	2 – Agree	3 - Neutral	4 - Disagree	5- Strongly Disagree	Mean
The emergence of towns and trading centers next to national parks has contributed to the increase of HWC.	38	54	22	12	10	27.2
High population has resulted in difficulty catching up with poachers whenever they strike.	34	50	24	14	14	27.2
Farmers move from other parts of the country to benefit from the favorable climatic conditions near national parks.	46	56	14	11	10	27.4

4.2.3. Objective 3: Influence of Human invasion to protected areas on Human Wildlife Conflict

Statements	1 - Strongly agree	2 - Agree	3 - Neutral	4 - Disagree	5 - Strongly disagree	Mea n
Community members vandalize park fence	26	35	47	22	7	27.4
People invade the park in search of firewood	54	47	13	13	8	27
Community members graze livestock inside the park	38	50	30	11	6	27
Unknown people carry out subsistence poaching	52	33	17	20	9	26.2
Community members have been arrested for trespassing	14	13	27	44	36	26.8
Human activities change wildlife habitats	50	47	16	10	13	27.2
Ν	139	139	139	139	139	

 Table 11 Influence of Human invasion to protected areas on Human Wildlife Conflict

5. RESULTS

5.1. STUDY 1: A CASE FOCUSING ON MAASAI MARA NATIONAL RESERVE, NAROK COUNTY, KENYA

5.1.1. Objective 1: Influence of resources competition on human wildlife conflict.

The table presents the residents' level of agreement on the influence of sharing resources in Maasai Mara, Kenya. The study had a sample size of 90 residents. The first statement on the obstruction of water for domestic purposes and no water streaming into protected areas for wildlife had a mean agreement score of 34, with 17 residents strongly agreeing, 18 agreeing, 47 being neutral, and 54 disagreeing. For the second statement, natural factors like drought that push animals to human habitations for pastures and water, the mean agreement score was 39.25, with 50 residents strongly agreeing, 54 agreeing, 26 being neutral, and 27 disagreeing. The third statement on the need for land for human development had a mean agreement score of 14.4, with 24 residents strongly agreeing, 18 agreeing, 4 being neutral, and 12 disagreeing.

5.1.2. Objective 2: The influence of human migration settlement on human wildlife conflict. The data collected from 90 residents of Maasai Mara in Kenya showed that 57.8% agreed that human migration settlement influenced human-wildlife conflict, while 42.2% disagreed. Residents who agreed that human migration settlement influenced human-wildlife conflict were then asked to rate their level of agreement for specific statements. The mean scores for each statement were as follows: 1) Establishment of settlement schemes along national parks has led to the increase in conflict between people and wildlife (mean = 68.5), Emergence of towns and trading centers next to national park has contributed to the increase of human-wildlife conflict (mean = 54.5), High population has resulted in difficulty in catching up with poachers whenever they strike (mean = 43), Farmers move from other parts of the country so as to benefit from the favorable climatic conditions near national parks (mean = 66.5).

5.1.3. Objective 3: Influence of Human invasion to protected areas on Human Wildlife Conflict. The data collected showed that human invasion into protected areas in Maasai Mara has led to human-wildlife conflict. Of the 90 respondents, 58.9% indicated that encroachment had contributed to a very great extent to human-wildlife conflict, while 16.7% indicated that it had contributed to a great extent. Additionally, 4.4% of the respondents indicated that encroachment had contributed to a moderate extent, while 20% indicated that it was not applicable.

The residents' level of agreement on the influence of human invasion settlement showed that the mean responses were generally negative, with most of the respondents disagreeing that human invasion has a positive influence on protected areas. For instance, 89 respondents (64.02%) disagreed that people invading the park in search of firewood had a positive influence on protected areas, while only one

respondent (0.6%) agreed. Similarly, 68 respondents (48.92%) disagreed that unknown people carrying out subsistence poaching of wildlife had a positive influence on protected areas, while only 33 respondents (23.74%) agreed.

5.2. STUDY 2: AN ASSESSMENT OF THE EFFECT OF HUMAN-WILDLIFE CONFLICTS IN NGORONGORO CONSERVATION AREA, TANZANIA

5.2.1. Objective 1: Influence of resources competition on human wildlife conflict

The table presents the results of the survey on the influence of resources competition on human wildlife conflict. The responses are on a scale of 1 to 5, with 1 representing "strongly agree" and 5 representing "strongly disagree".

The statement "Scarcity of water sources for both wildlife and human use contributes to conflict" had a mean score of 27.8, with 15.83% of respondents strongly agreeing, 40.29% agreeing, 25.17% neutral, 14.38% disagreeing, and 4.32% strongly disagreeing.

For the statement "Competition for grazing lands leads to encroachment of wildlife to human settlements," the mean score was 27 and 23.74% of respondents strongly agreed, 30.21% agreed, 19.42% were neutral, 14.38% disagreed, and 9.35% strongly disagreed.

The statement "Deforestation and land use change push wildlife into human habitations" had a mean score of 27. and 27.33% of respondents strongly agreed, 30.93% agreed, 17.26% were neutral, 14.38% disagreed, and 7.91% strongly disagreed.

For the statement "Human population growth increases human encroachment into wildlife habitats," the mean score was 27.8 and 34.53% of respondents strongly agreed, 33.1% agreed, 16.54% were neutral, 10.79% disagreed, and 5.03% strongly disagreed.

Finally, the statement "Competition for firewood and non-timber forest products contribute to wildlife depletion" had a mean score of 27.8 and 20.14% of respondents strongly agreed, 33.1% agreed, 25.17% were neutral, 12.95% disagreed, and 8.63% strongly disagreed. The sample size for the survey was 139.

5.2.2. Objective 2: The influence of human migration settlement on human wildlife conflict.

"The establishment of settlement schemes along national parks has led to the increase in conflict between people and wildlife," 41 respondents strongly agreed, 58 agreed, 19 were neutral, 14 disagreed, and 6 strongly disagreed, with a mean of 27.6. For the statement "The emergence of towns and trading centers next to national parks has contributed to the increase of human-wildlife conflict (HWC) 38 respondents strongly agreed, 54 agreed, 22 were neutral, 12 disagreed, and 10 strongly disagreed, with a mean of 27.2. For the statement "High population has resulted in difficulty catching up with poachers whenever they strike," 34 respondents strongly agreed, 50 agreed, 24 were neutral, 14 disagreed, and 14 strongly

disagreed, with a mean of 27.2. For the statement "Farmers move from other parts of the country to benefit from the favorable climatic conditions near national parks," 46 respondents strongly agreed, 56 agreed, 14 were neutral, 11 disagreed, and 10 strongly disagreed, with a mean of 27.4.

5.2.3. Objective 3: Influence of Human invasion to protected areas on Human Wildlife Conflict. The majority of the residents agreed or strongly agreed that people vandalize park fences (mean=27.4) invading the park in search of firewood (mean=27), graze their livestock inside the park (mean=27), unknown people carry out subsistence poaching (mean=26.2), and human activities change wildlife habitats (mean=27.2). However, some residents were neutral about community members grazing their livestock inside the park, and unknown people carrying out subsistence poaching of wildlife. Some residents disagreed or strongly disagreed that community members have been arrested for trespassing.

5.3. Comparison

5.3.1. Objective 1: Influence of resources competition on human wildlife conflict.

In Kenya, residents strongly agreed that natural factors such as drought push wildlife to human habitats for pastures and water, with a mean agreement score of 39.25, while in Tanzania, the mean score for the same statement was 27.8, with 20.14% strongly agreeing. For the statement on competition for grazing lands, Tanzania had a higher mean score of 27. compared to Kenya's mean score of 14.4 In terms of human population growth leading to human encroachment into wildlife habitats, Tanzania had a higher mean score of 27.8 compared to Kenya's survey, which did not have a specific statement on this issue. However, Kenya's survey had a statement on the obstruction of water for domestic purposes and no water streaming into protected areas for wildlife, with a mean agreement score of 34, which was not present in Tanzania's survey. Overall, both surveys suggest that resource competition contributes to human-wildlife conflict in the respective regions.

5.3.2. Objective 2: The influence of human migration settlement on human wildlife conflict. In terms of the influence of human migration settlement on human wildlife conflict, both Kenya and Tanzania agree that it is a contributing factor. In Kenya, 57.8% of residents agreed that human migration settlement influenced human-wildlife conflict, while in Tanzania, 80% of respondents agreed with the statement. It is worth noting that the wording of the statements in Kenya and Tanzania is slightly different, which could affect the responses. For example, in Kenya, the statement was "Establishment of settlement schemes along national parks has led to the increase in conflict between people and wildlife," while in Tanzania, the statement was "The establishment of settlement schemes along national parks has led to the increase in conflict between people and wildlife". The use of "The" in the Tanzania statement implies that settlement schemes are a well-known and accepted phenomenon, while the Kenya statement presents it as a possible cause of conflict.

5.3.3. Objective 3: Influence of Human invasion to protected areas on Human Wildlife Conflict In terms of the influence of human invasion into protected areas on human-wildlife conflict, both Kenya and Tanzania showed a negative correlation between human invasion and protected areas. In Kenya, 58.9% of the respondents agreed that human invasion into protected areas had contributed to humanwildlife conflict to a very great extent, while 16.7% agreed to a great extent. In Tanzania, the majority of respondents agreed or strongly agreed that various human activities, such as vandalizing park fences, grazing livestock inside the park, and subsistence poaching, had a negative influence on protected areas. However, there were differences in the specific aspects of human invasion that were identified as contributing to human-wildlife conflict. In Kenya, residents disagreed that people invading the park in search of firewood and unknown people carrying out subsistence poaching had a positive influence on protected areas. In Tanzania, residents were neutral about community members grazing their livestock inside the park and unknown people carrying out subsistence poaching of wildlife. Additionally, some residents in Tanzania disagreed that community members had been arrested for trespassing.

6. DISCUSSION

The surveys reveal that resource competition, changes in land use, and human settlement patterns are significant contributors to the conflict. Studies by Kideghesho et al. (2007) and Kioko et al. (2018) support the findings of the surveys, highlighting the role of resource competition in exacerbating human-wildlife conflict. The studies also suggest that conservation policies should consider the needs of local communities to reduce conflict. The absence of a specific statement on human population growth and associated expansion of agriculture and settlements in Kenya highlights the need for more comprehensive surveys to capture a wider range of factors that contribute to human-wildlife conflict. The surveys conducted in Kenya and Tanzania reveal differences in the factors that push wildlife into human habitats in the two regions. The study by Ogutu et al. (2015) found that changes in land use, wildlife migratory patterns, and human settlement patterns are responsible for increasing human-wildlife conflict in Maasai Mara. On the other hand, the study by Kideghesho et al. (2007) found that livestock grazing in protected areas contributes to human-wildlife conflict in Tanzania. The higher mean score in Tanzania for the statement on competition for grazing lands suggests that resource competition is a significant factor in human-wildlife conflict in the region.

Studies by Lindsey et al. (2013), Ogada et al. (2003), and Kioko et al. (2016) provide additional evidence on the causes of human-wildlife conflict, supporting the findings of the surveys conducted in Kenya and

Tanzania. In terms of human population growth leading to human encroachment into wildlife habitats, Tanzania had a higher mean score compared to Kenya. The study by DeFries et al. (2010) conducted in Tanzania supports this finding, indicating that population growth and increasing demand for resources lead to the conversion of natural habitats to agriculture and settlements, increasing human-wildlife conflicts. The study recommends the need to address population growth and land-use change as a means of mitigating human-wildlife conflicts in Tanzania. The studies reveal that human encroachment into wildlife habitats, natural factors such as drought, and resource competition are significant contributors to the conflict.

The surveys and studies reviewed provide valuable insights into the factors contributing to humanwildlife conflict in Kenya and Tanzania. Resource competition, changes in land use, human settlement patterns, and natural factors such as drought are significant contributors to the conflict. The studies highlight the need for effective management strategies to mitigate the impacts of human activities on wildlife habitats. The findings of the surveys also suggest that more comprehensive surveys are needed to capture a wider range of factors that contribute to human-wildlife conflict in the regions.

7.CONCLUSION

In conclusion, human-wildlife conflict is a complex issue in Tanzania and Kenya that requires a multifaceted approach involving the government, conservation organizations, local communities, and other stakeholders. While measures such as education, community involvement, and the implementation of conservation policies have shown some success in mitigating human-wildlife conflict, there is still much work to be done to ensure the long-term survival of both wildlife and human populations in the region.

Despite efforts by the governments and conservation organizations, the conflict continues to pose a significant threat to both human lives and wildlife conservation. However, with proper land-use planning, community involvement, education, and innovative conservation strategies, it is possible to mitigate the conflict and promote peaceful coexistence between humans and wildlife in the region. It is crucial for all stakeholders, including governments, conservation organizations, and local communities, to work together towards finding long-term solutions that benefit both humans and wildlife. It is important to continue to address the underlying causes of the conflict, such as habitat destruction and loss of wildlife corridors, to promote sustainable coexistence between humans and wildlife.

The following recommendations are crucial for reducing human-wildlife conflict in the Maasai Mara National Reserve and Ngorongoro Conservation Area:

8.RECOMMENDATION

- I. Develop sustainable grazing plans such as rotational grazing to minimize conflicts over pasture.
- II. Increase community awareness and education on human-wildlife conflict.
- III. Enhance Park management capacity (drones, two-way radios, and light helicopters) to monitor wildlife populations effectively.
- IV. Promote alternative water sources such as boreholes for farming and artificial waterholes for wild animals to reduce conflicts over water resources during dry seasons.
- V. Advocate policies that promote equitable resource utilization, especially rivers, to control farming activities that deplete water for wild animals in protected areas.
- VI. Encourage collaborative governance between park management, communities, and stakeholders by offering locals jobs in parks, rewards for exposing poachers, and Corporate Social Responsibility (CSR) initiatives that develop a sense of ownership among locals, encouraging them to protect wild animal affairs.
- VII. Establish effective compensation schemes for communities affected by wildlife damage.
- VIII. Encourage sustainable land use practices such as agroforestry and conservation agriculture to stop humans from encroaching protected areas in search for grazing or farming land.
 - IX. Develop alternative livelihoods for communities living adjacent to wildlife habitats. Instead of planting corn, sugarcane, wheat, or vegetables, these communicators can resort to pepper, ginger, or bee farming, among other plants or activities that deter wild animals.

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