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MSc Dissertation

Assessment of Socio-Economic Implications of Human-Wildlife Conflicts in Communities Adjacent to Nyerere National Park, Morogoro, Tanzania

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ASSESSMENT OF SOCIO-ECONOMIC IMPLICATIONS OF HUMAN-WILDLIFE CONFLICTS IN COMMUNITIES ADJACENT TO NYERERE NATIONAL PARK, MOROGORO, TANZANIA

Dissertation Submitted to Sokoine University of Agriculture in Partial Fulfilment of the Requirements for the Degree of Master of Science in Environmental and Natural Resources Economics

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EXTENDED ABSTRACT

Human-wildlife conflicts (HWC) present a pervasive challenge worldwide, particularly in regions adjacent to protected areas. The IUCN (2023) emphasize the importance of effectively managing HWC to achieve the United Nations for Biodiversity 2050. Despite the introduction of various conservation initiatives to mitigate HWC, the success rate remains low. Conservation management strategies have traditionally focused on addressing dispute level of conflicts focusing primarily on the visible impacts of HWC while neglecting the underlying and identity-based conflicts that drives social conflicts of HWC. Apart from neglecting the underlying and identity-based conflicts, hidden costs associated with HWC remain understudied and poorly documented leading to an exclusion from economic evaluations and mitigation policies. Therefore, there is a critical need for up-to-date studies focusing on addressing the social conflicts and the socio-economic implications associated with HWC. Specifically, the study aimed at (i) assessing the nature and extent of HWC (ii) assessing the current intervention strategies employed across the study area, (iii) identifying hidden costs associated with HWC, (iv) quantifying households' economic implications of hidden and visible costs associated with HWC, and (v) evaluating the socio-demographic predictors influencing respondents' attitudes towards wildlife conservation. Cross-sectional data were collected through household interviews, key informant interviews, and focus group discussions. Data analysis involved content analysis, descriptive statistics and binary logistic regression analysis. Results revealed that HWC resulted in both social and economic implications. in terms of livelihood, majority of households (78%) were engaged in agricultural farming. However, the nature of damage experienced by respondents exhibited a significant difference (χ^2=4.393, df= 1, P<0.05). Predominantly, crop damage emerged as the most prevalent form of conflict, mainly attributed to elephant intrusions. Despite livestock depredation being comparably lower than crop damages, respondents perceived it as highly significant and

distressing. Poultry losses constituted the highest proportion, with monkeys identified as the primary perpetrators. The study further delineated HWC across three levels of conflict: dispute, underlying, and identity-based conflicts. The prevalence of conflicts at the dispute level was observed to be lower in comparison to underlying and identity-based conflicts, underscoring the limited scope of addressing conflicts solely at the dispute level within the context of HWC. In addition, dispute and underlying levels of conflict $r=0.414$, ($p<0.05$); and underlying and identity-based levels of conflict $r=0.535$, ($p<0.05$) both indicated a positive significant correlation indicating that an increase in dispute level of conflict leads to an increase in underlying conflict. Dispute and identity-based levels of conflict showed a not significant correlation $r=0.328$, ($p=0.072$). Lethal and non-lethal intervention strategies were employed to mitigate conflicts under dispute level. However, no lethal methods were reported for mitigating livestock depredation. The intervention strategies employed including the utilization of chili pepper, fencing, farm guarding, scare tactics, solar torches, reporting to village leaders, firecrackers, smoke, throwing stones at wild animals, pesticides, and car oil/grease, were employed to alleviate crop damages. Enclosures for livestock, supplementary feeding, solar torches, and herding/guarding practices were employed to mitigate livestock depredation, with varying degree of effectiveness among respondents. Additionally, results revealed that respondents faced several challenges in soliciting assistance from local authorities, wildlife authorities and government authorities, including protracted HWC incident reporting process, lack of consolation payment for damages, exclusionary practices and lack of transparency. The HWC incident reporting process was perceived as a protracted chain, necessitating contacting the village leaders before relevant authorities are notified, thereby intensifying HWC cases within the study area. Exclusionary practices manifested in marginalizing affected communities from participating in decision-making processes concerning conservation and HWC-related issues. Lack of transparency further compounded the issue with majority of

respondents being unaware of NGOs operating within their communities in addressing HWC. Furthermore, the study revealed that HWC includes diverse dimensions of hidden costs, including opportunity costs, transaction costs psychological and health impacts. These hidden costs present significant implications, particularly for households reliant on agricultural farming and livestock keeping within the study area. Additionally, both visible and hidden costs associated with HWC pose economic implications stemming from crop damage, livestock depredation, monetary opportunity costs, and transactional expenses, with a total estimated annual economic loss of USD 1 455.53 per household. Nonetheless, no consolation payments were made to mitigate the economic losses incurred by respondents. The following variables were statistically significant in explaining the respondents' attitudes towards wildlife and conservation, namely: household head age, level of education, household size and HWC experience (X^2=24, df=7, $p<0.05$). Finally, the study therefore concluded that solely focusing on addressing HWC at the dispute level leads to a partial understanding of the overall situation and overlooks social conflicts, potentially resulting in recurring conflicts over time. Furthermore, respondents within the study area are faced with a range of hidden costs associated with HWC that not only include direct financial expenses but also non-monetary impacts such as psychological and health impacts. Therefore, the study advocates for the adoption and implementation of a holistic approach aligned with the Conservation Conflict Transformation Model (CCT) model to effectively address HWC, acknowledging their complexity and fostering cooperation among stakeholders to safeguard wildlife and enhance local livelihoods.

Keywords: Human-wildlife conflicts, levels of conflicts, intervention strategies, visible impacts, hidden costs, economic losses, attitudes, Nyerere National Park

IKISIRI KUU

Migogoro baina ya binadamu na wanyamapori (HWC) ni changamoto kubwa inayoyakumba maeneo mengi duniani kote, hasa maeneo ambayo jamii inapakana na hifadhi za wanyamapori. Ili kufikia malengo ya Umoja wa Mataifa kuhusu uhifadhi wa bioanuwai ya viumbe ifikapo mwaka 2050, shirika la umoja wa mataifa la uhifadhi wa asili (IUCN) (2023) linasisitiza umuhimu wa kutatua changamoto za migogoro baina ya binadamu na wanyamapori ipasavyo. Licha ya kuanzishwa kwa mipango mbalimbali ya uhifadhi ili kutatua changamoto hizi, mbinu za usimamizi wa uhifadhi zimekuwa zikielekezwa kutatua migogoro kwa kuzingatia athari zinazo onekana na za moja kwa moja, huku zikiachilia mbali vyanzo vinavyo chochea migogoro hiyo katika jamaii. Mbali na hayo, athari zilizo fichika zitokanazo na migogoro hiyo hazijafanyiwa utafiti wa kutosha na kutolewa taarifa, hali inayosababisha kutokufanyiwa tathmini za kiuchumi na kuzingatiwa katika sera za utatuzi wa migogoro hiyo. Hivyo, kuna umuhimu mkubwa wa tafiti za hivi karibuni kuchunguza migogoro ya binadamu na wanyamapori katika jamii na kutathimini athari za kiuchumi zinazotokana na migogoro hiyo. Utafiti huu ulilenga (i) kutathmini aina na kiwango cha migogoro ya binadamu na wanyama pori (HWC), (ii) kutathmini mikakati inayotumika kudhibiti migogoro hiyo katika eneo la utafiti, (iii) kutambua athari zilizofichika zinazohusiana na migogoro hiyo, (iv) kutambua kiwango cha athari za kiuchumi zionekanazo na zisizo onekana katika kaya zinazokumbwa na changamoto ya migogoro ya binadamu na wanyamapori, (v) kutathmini mtazamo wa kijamiii na ushawishi kuhusu uhifadhi wa wanyamapori. Taarifa za utafiti huu zilikusanywa kupitia mahojiano ya nyumba kwa nyumba, mahojiano ya wahusika wakuu, na majadiliano ya vikundi kuhusu changamoto za migogoro ya binadamu na wanyamapori. Uchambuzi wa taarifa zilizo kusanywa ulihusisha, takwimu za maelezo, na uchambuzi wa kidemografia ili kujua sababu za kijamii ambazo zinaathiri mtazamo wa washiriki kuhusu wanyamapori na matumizi ya mbinu za kutatua changamoto.

Matokeo yalionyesha kuwa migogoro ya binadamu na wanyamapori ilisababisha athari za kijamii na za kiuchumi. Kati ya kaya zilizo tembelewa, zaidi ya 78% ni wakulima, ambapo idadi kubwa ilithibitika kukumbwa na changamoto hizo za migogoro (χ^2=4.393, df= 1, $p<0.05$). Uharibifu wa mazao ulijitokeza kama aina ya mgogoro ulioshamiri zaidi, ikisababishwa hasa na uvamizi wa tembo. Licha ya kuwa na matukio machache ya mifugo kushambuliwa na wanyamapori ikilinganishwa na matukio ya uharibifu wa mazao, washiriki wengi waliona kuwa ni vyema sana kushughulikia hili maana ni hatari na linaleta wasiwasi mkubwa katika jamii. Migogoro hii ilitenganishwa katika vipengele vitatu: migogoro ya binadamu na wanyamapori yenye madhara ya waziwazi, migogoro ya binadamu na wanyamapori itokanayo na kutokushughulikia kikamilifu migogoro iliyo pita, na tatu migogoro itokanayo na kuweka kipaumbele kikubwa kwa wanyamapori na kutotilia maanani maslahi ya jamii na mali zao. Wakati aina ya migogoro ya kipengele cha kwanza ikionekana kupewa kipaumbele kikubwa katika kushughulikiwa, aina ya migogoro ya kipengele cha pili na cha tatu ilionekana kuongezeka ikidhihirisha nguvu ndogo iliyo elekezwa katika kushughulikia aina hii ya migogoro.

Aidha, uchambuzi wa takwimu ulionesha kuwa kuna uhusiano mkubwa kati ya migogoro ya binadamu na wanyamapori yenye madhara ya waziwazi na migogoro itokanayo na kuweka kipaubele kikubwa kwa wanyamapori ($r=0.414$, $p<0.05$), pamoja na migogoro itokanayo na kutokushughulikia kikamilifu migogoro ya waziwazi ($r=0.535$, $p<0.05$). Hii inamaanisha kuwa ongezeko la migogoro ya wanyamapori na binadamu yenye kuleta madhara ya moja kwa moja na ya waziwazi huchochea ongezeko la migogoro itokanayo na kutokutatua kikamilifu migogoro ya awali. Wakati migogoro ya waziwazi na ile itokanayo na uhifadhi kuthamini zaidi wanyama pori na kuweka kipaumbele kwao, haikuonesha ihusiano mkubwa na wenye tija ($r=0.328$, $p=0.072$).

Taarifa iliyo kusanywa ilionesha kuwa, changamoto za migogoro ya binadamu na wayamapori hususani zenye kusababisha madhara ya waziwazi katika jamii zilitatuliwa kwa njia mbalimbali ikiwa ni pamoja na kuuwa ama kuwafukuzia mbali wanyama wasumbufu kutoka katika eneo la mashamba, mifugo na makazi ya watu. Mbinu mbalimbali ikiwemo kutumia pilipili ya unga, kuweka uzio, kuweka walinzi wa kulinda mashamba na mifugo, mbinu za kuwatishia, tochi za jua, kutoa taarifa kwa viongozi wa vijiji kuhusu uvamizi wa wanyamapori ili kuharakisha udhibiti kabla madhara makubwa hayajatokea, kutumia moshi, kurusha mawe, kutumia mafuta machafu ya magari; vyote hivi vilitumika kukabiliana na wanyamapori wasumbufu katika jamii. Zaidi ya hayo, matokeo yalionyesha kuwa wahojiwa walikabiliwa na changamoto kadhaa wakati wa kuomba msaada kutoka kwa mamlaka za vijiji, mamlaka za wanyamapori na mamlaka za serikali, ikiwa ni pamoja na mchakato mrefu wa kuripoti matukio ya kuvamiwa na wanyamapori, ukosefu wa malipo ya fidia kwa uharibifu uliofanywa na wanyamapori na ukosefu wa uwazi. Hivyo kupelekea ongezeko la matukio yasiyo na utatuzi katika jamii. Changamoto zingine zilizoainishwa ni uhusishwaji mdogo ama kutohusishwa kikamilifu kwa jamii zilizo athirika ili kushiriki katika michakato ya maamuzi kuhusu uhifadhi na masuala yanayohusiana na migogoro ya binadamu na wanyamapori.

Hasara zitokanazo na migogoro hii, zinachangia kwa kiwango kikubwa kuzorotesha maendeleo katika jamii hizi, hasa migogoro yenye matokeo ya hasara zisizo za wazi ama za moja kwa moja kwa wakulima, wafugaji na wakazi wote kwa ujumla. Tathmini iliyofanywa na utafiti huu, inaonyesha kuwa, jumla ya hasara inayotokana na upotevu wa kiuchumi unakadiriwa kuwa ni dola za kimarekani 1 455.53 kwa kila kaya kwa mwaka. Hata hivyo, hakuna malipo ya fidia yaliyotolewa kupunguza hasara za kiuchumi walizopata wahojiwa. Kupitia utafiti huu, mambo kadhaa yaliyo chunguzwa yalionesha umuhimu mkubwa kitakwimu katika kuelezea vitu vinavyo athiri mitazamo ya wahojiwa kuhusu wanyamapori na

uhifadhi kama ifuatavyo: umri wa mkuu wa kaya, kiwango cha elimu, ukubwa wa kaya na uzoefu katika kukabiliana na changamoto za binadamu na wanyamapori ($X2=24$, $df=7$, $p<0.05$).

Hitimisho, matokeo ya utafiti huu yanadhihirisha kwamba kushughulikia migogoro baina ya binadamu na wanyamapori kwa kuzingatia athari zinazoonekana na za moja kwa moja tu ni moja ya sababu inayochangia kupelekea kuwa na uelewa mdogo wa hali halisi ya migogoro na madhara yake kwa ujumla katika jamii husika. Hivyo kusababisha migogoro hiyo kujirudia rudia na kuendelea kuleta madhara siku hadi siku. Aidha, wahojiwa katika eneo la utafiti pamoja ya kuwa wanakabiliwa na madhara ya migogoro ya binadamu na wanyamapori inayopelekea athari za kiuchumi za moja kwa moja, vilevile wanakabiliwa na madhara yasiyo ya moja kwa moja kama vile athari za kisaikolojia na kiafya, ambazo huchangia kwa kiwango kikubwa kuzorotesha uchumi wa jamii husika. Hivyo basi, utafiti huu unapendekeza kuundwa na kutekelezwa kwa mbinu za utatuzi wa migogoro ya binadamu na wanyamapori inayoendana na mfumo wa Utambuzi na Upangaji wa Utatuzi wa Migogoro itokanayo na Uhifadhi (CCT) ili kushughulikia migogoro hii kwa ufanisi, kwa kushirikiana na wadau mbalimbali katika kuendeleza uhifadhi wa wanyamapori huku hali ya maisha ya jamii katika maeneo hayo ikiboreshwa kwa kuhamasisha maendeleo endelevu.

Maneno muhimu: Migogoro ya binadamu na wanyamapori, ngazi za migogoro, mbinu za kufidia migogoro, athari zinazoonekana, athari zisizo onekana mojakwamoja, athari za kiuchumi, mitazamo, Hifadhi ya Taifa ya Nyerere.

DECLARATION

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

_____ _____.

Ivy Nanvula Simasiku Date
(MSc. Candidate)

The above is confirmed by;

_____ _____.

Dr. Greyson Z. Nyamoga Date
(Supervisor)

_____ _____.

Dr. Beatus J. Temu Date
(Supervisor)

LIST OF MANUSCRIPTS

Manuscript 1: Assessing the Nature and Extent of Human-Wildlife Conflicts Using the Conservation Conflict Transformation Model in Communities Adjacent to Nyerere National Park, Tanzania

Manuscript 2: Assessment of Hidden Costs Associated with Human-Wildlife Conflicts in Communities Adjacent to Nyerere National Park, Tanzania

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DEDICATION

This work is dedicated to my mother Mrs Hildah Kahimbi Sezuni, and my father Mr. Benedict Musialike Simasiku for the love, support, encouragement and prayers rendered to me throughout my academic journey. I also extend my dedication to my siblings Heather Manga Simasiku, Bernadette Naungwe Simasiku, and Raphael Simasiku Simasiku for being supportive throughout my studies.

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LIST OF ABREVIATIONS AND ACRONYMS

BAU	Business as Usual Intervention Scenario
BLRM	Binary Logistic Regression Model
CCIIP	Conservation Conflicts Identification and Intervention Planning Model
CCT	Conservation Conflict Transformation Model
CIM/CIT	Conflict Intervention Model/ Conflict Intervention Triangle Model
HCC	Human-Carnivore Conflicts
HHC	Human-Herbivore Conflicts
HWC	Human-Wildlife Conflicts
HWI	Human-Wildlife Interactions
IUCN	International Union for Conservation of Nature
KfW	Kreditanstalt für Wiederaufbau
LCM	Level of conflicts Model
MEFT	Ministry of Environment, Forestry and Tourism
MNRT	Ministry of Natural Resource and Tourism
NGOs	None Governmental Organisations
NHWCMS	National Human-Wildlife Conflict Management Strategy (2020-2024)
NNP	Nyerere National Park
NPs	National Parks
NWMAS	National Wildlife Management Areas Strategy (2023-2033)
PAs	Protected Areas
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
TZS	Tanzanian Shillings
UNAM	University of Namibia
URT	United Republic of Tanzania
USD	United States Dollars
WCA	The Wildlife Conservation Act of 2022

CHAPTER ONE

1.0 GENERAL INTRODUCTION

1.1 Background Information

Present-day wildlife conservation endeavors are increasingly concentrated in ecosystems profoundly influenced by human activities, coinciding with regions characterized by both rural poverty and biodiversity (Muyoma, 2016). In Tanzania Wildlife holds considerable economic value, supporting the nation's photographic tourism and tourism hunting industries, thus serving as a vital natural resource (Benjaminsen *et al.,* 2013; Homewood *et al.,* 2015). Beyond economic significance, wildlife contributes to protein sources through bush meat and generates employment via conservation systems (URT, 2012). Despite all these benefits, challenges such as human encroachment, deforestation, and habitat fragmentation threatens the delicate balance between human needs and the preservation of endangered species.

In response to these challenges, the Tanzanian government resulted in deploying paramilitary forces to protect wildlife across National Parks as well as other protected areas, intensifying wildlife management initiatives alongside anti-poaching programs (Nyaga, 2016). However, this intensified approach has inadvertently led to additional challenges, prominently exemplified by the rise in Human-Wildlife Conflicts (HWC) cases (Nyaga, 2016). According to The East African (2019), the government's actions to combat illegal activities and poaching has been associated with an increase in the wildlife population, consequently contributing to an increase in HWC cases. According to the National Wildlife Management Areas Strategies (NWMAS) of (2023-2033), HWC remains a challenge in Tanzania. The occurrence of HWC extends beyond Tanzania's borders, representing a global challenge, particularly in regions adjacent to protected areas. These conflicts have gained attention in various social, political and economic forums worldwide, highlighting the urgency of effectively managing them to achieve long-term

conservation goals, as emphasized by the International Union for Conservation of Nature (IUCN) in their 2023 report.

Various countries adopt diverse strategies to address these issues. For instance, Namibia, through the Ministry of Environment, Forestry and Tourism (MEFT) as well as Conservancies, mitigates community and farmers' losses caused by wild animals, through the use innovative techniques to prevent wildlife from encroaching on human settlements (MEFT, 2018). In Zimbabwe, measures such as overnight field guarding, night time fire lighting, and erecting fences at water points aim at alleviating HWC; however, these strategies exhibit a low success rate, due to evident gradual increase in cases from 2013 to 2021 (Machamire, 2022). Kenya employs solar-powered predator lights and other methods to minimize human-wildlife conflict incidents, with substantial financial investment, allocating approximately 1.77 billion Kenya shillings to compensate conflict victims between the year 2013 and 2020 (Njagi, 2021). In Tanzania, various conservation initiatives have been introduced by the Tanzanian government to address the increasing conflicts arising from human-wildlife interactions (HWI) over the years. However, despite the diverse initiatives to address the issue, the success rate in mitigating human-wildlife conflicts remains notably low (Rutta, 2023). However, conservation management strategies have primarily focused on addressing the visible impacts of HWC, such as crop raiding and livestock depredation, while overlooking the underlying and identity-based conflicts that drives the social conflicts associated with it.

Furthermore, underlying and identity-based conflicts result in hidden costs associated with HWC, including opportunity costs, transaction costs, and health costs. These hidden costs remain poorly documented and understudied (Barua *et al.,* 2013; Ogra, 2008). Therefore, addressing underlying and identity-based conflicts that drives the social conflicts is crucial for effectively managing human-wildlife interactions and reducing associated impacts/costs.

Neglecting the underlying and identity-based conflicts has resulted in an inadequate understanding and ineffective mitigation of HWC, exacerbating tensions and hindering successful coexistence between humans and wildlife. Therefore, there is an urgent need for-up-to-date studies focusing on addressing the social conflicts and the socio-economic implications associated with HWC.

1.1.1 Human-wildlife conflict concept

Human-Wildlife Conflicts (HWC) is not a new concept; global studies indicate its occurrence worldwide. HWC poses a significant threat to the continued survival of numerous species in various parts of the world. It is defined as negative interactions between humans and wildlife (Kaswamila, 2010). This conflict is not confined to specific regions, as it occurs in both developed and developing countries. However, developing countries experience a higher incidence, attributed to rural populations heavily reliant on crop farming and livestock keeping for sustenance. HWC manifest when the needs and behaviour of wildlife negatively impact the goals of humans and vice visa (Kaswamila, 2010; Makindi *et al.,* 2014; Mekonen, 2020; Morzillo *et al.,* 2014). The world Conservation Union (World Park Progress, 2003) emphasizes that conflicts emerge when wild animal needs surpass those of humans, leading to competition over limited resources.

A study conducted by Mekonen (2020), highlights that these conflicts occur when wild animals cause damages to crops, injure or kills livestock, damages to human properties, or pose threats to human safety. These forms of conflicts exhibit diverse patterns influenced by various wildlife species and human activities, prompting defence measures by humans including retaliatory killing that may drive species towards extinction (Lwankomezi & Abwe, 2016). Additionally, HWC experiences may breed resentment towards the government in affected communities (Sampson *et al.,* 2021). According to Wangchuk *et al*. (2023), the loss of crops to wildlife disrupts households' food supply and dismays farming,

leading to increased uncultivated areas. Proximity transforms these uncultivated areas into wildlife habitats, intensifying HWC and contributing directly to reduced food production (Wangchuk *et al.,* 2023).

Beyond local impacts, HWC occurs globally, affecting sustainable development agencies and tourism enterprises (Mekonen, 2020). The consequences encompass a broad spectrum of economic and financial losses for affected households, including socio-economic costs and loss of human lives (Lwankomezi & Abwe, 2016). HWC occurs in vast rage of situations and is specific in terms of habitat, vegetation, climate as well as geographical location. It is categorized into various forms: crop raiding, livestock predation, human attacks, disease transmission as well as game species predation. It is a reciprocal process with adverse effects on both humans and wild animals, presenting complex and serious challenges in wildlife management and conservation efforts (Mekonen, 2020). In Tanzania, where agriculture crops and livestock are integral to rural livelihoods, increase for natural resources aggravates HWC, imposing higher costs on local human population (Nyerembe & Busheha, 2021).

1.1.2 Nature and extent of human wildlife conflicts

Human wildlife conflict exists in various forms. It presents a pervasive and serious challenge globally, particularly impacting those coexisting within the same ecosystems or residing near national parks and other protected areas (Shemwetta & Kideghesho, 2000). This global phenomenon arises from adverse impacts of wildlife behaviour or needs on human livelihoods or, conversely, human pursuits that affects wildlife needs (Kaswamila, 2010; Makindi *et al.,* 2014; Mekonen, 2020; Morzillo *et al.,* 2014). It is identified as the major primary threats to wildlife and conservation efforts in Africa (Makindi *et al.,* 2014).

In African regions HWC tends to be dominant in areas where large herds of iconic mammals such as elephants and lions inhabit marginal rangelands and protected areas. In Tanzania, the country's wildlife resources represent a distinctive natural legacy of considerable national and global significance (Ract *et al.,* 2024). Nonetheless, the costs incurred by humans due to wildlife, coupled with human-related issues within Tanzania's wildlife sector have made HWC a key challenge requiring conservationists' urgent focus (NWMAS of 2023-2033). The recent study by Nyerembe and Busheha (2021) underscore the persistent nature of HWC in the Ngorongoro Conservation area, emphasizing the ongoing need for effective mitigation measures.

The Tanzanian government has implemented various conservation initiatives to mitigate the growing conflicts arising from human-wildlife interactions (HWI) over time. However, despite these efforts, there has been a low success rate (Rutta, 2023). Research conducted globally indicate that these conservation initiatives fall short if they do not address the underlying and identity-based conflicts that drives the social conflicts associated with HWC (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). Therefore, conservationists need to proactively address these underlying and identity-based conflicts (Zimmermann *et al.,* 2020). HWC exists in different forms and encompass three levels: dispute, underlying and identity-based levels of conflict (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). Yet in studying the HWC, majority of research predominantly focuses on the dispute level of conflict dealing with only the obvious, tangible manifestation of HWC conflicts, while neglecting the underlying (the unresolved conflicts from the past) and identity-based conflicts (core-values, beliefs, or social-psychological necessities integral to the identity of at least one party engaged in the conflict), leading to an increase in the intensification of HWC (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). According to Zimmermann *et al*. (2020), focusing solely

on the dispute level frames the apparent problem faced in the field of conservation with regards to HWC.

1.1.3 Intervention strategies to mitigate human-wildlife conflicts

Resolving the challenges associated with HWC involves addressing the dynamic needs of both humans and wild animals as well as rejecting the standardized solutions of one-size-fits-all (Barua *et al.,* 2013). While complete elimination of human-wildlife conflict is unlikely, various methods are employed for mitigation. In Tanzania, local people employ spicy chili-based scents to deter elephants from encroaching on farmland or human settlements (Chang'a, *et al.,* 2016; MNRT, 2020). Although large quantities of chill are required in order to reach elephants that are far away, this strategy has been proven successful and effective (Chamba, 2018).

Additionally, other mitigation measures encompass non-electric barriers, physical guarding, use of fire crackers, and producing loud noises with metal objects (Chang'a *et al.,* 2016; Mayengo *et al.,* 2017; Nyerembe & Bushasha, 2021; Runyoro *et al.,* 2019). However, in many circumstances, approaches and techniques employed to address the HWC issue are regularly constrained by local, national or international regulations, laws or treaties. Furthermore, the ineffectiveness of the management approaches and techniques is directly reliant on the formation, application and enforcement of policies and guidelines governing a wide range of human activities (Mayengo *et al.,* 2017). In Tanzania, efforts to compensate for losses caused by wildlife include a proposed consolation scheme (MNRT, 2020). However, there are no active consolation payment schemes in Tanzania (Chamba, 2018; Mkonyi, 2022). Highlighting the gap between policy intentions and implementation realities.

1.1.4 Hidden costs associated with human-wildlife conflict

Interactions between wild animals and humans residing in rural areas predominantly yield negative consequences, manifesting as visible and hidden impacts on the well-being (Barua *et al.,* 2013). The visible impacts, termed as direct costs comprise of tangible impacts such as crop and livestock losses, property damage, and incidents resulting in injury or fatalities (Barua *et al.,* 2013; Mayberry, 2015). These direct costs lead to material consequences such as decreased food supply, loss of life, and income loss. Beyond the evident effects, there is evidence suggesting that HWC also gives rise to a variety of indirect costs, unfolding through a more compound chain of causation (Manoa *et al.,* 2021; Mayberry, 2015; Richardson *et al.,* 2012; Yeshey *et al.,* 2022). Indirect costs also referred to as hidden costs are characterized as uncompensated, temporally delayed, and psychological or social in nature (Barua *et al.,* 2013), entail:

(a) Opportunity costs

Opportunity costs are part of the societal challenges experienced by communities residing near protected areas (Manoa *et al.,* 2020). For instance, farmers faced with repeated crop raiding by wildlife must allocate additional labour and financial resources to replanting crops and repairing damaged infrastructure, thereby sacrificing opportunities for alternative income-generating activities. Manoa and Mwaura (2016) concluded that pastoralists in Amboseli region of Kenya who had not fortified their kraals against predators were compelled to spend numerous nights especially during wet season safeguarding their livestock from wildlife attacks. Similarly, in west Kilimanjaro Tanzania, the destruction of water pipes led to individuals having to travel long distances to obtain water, thereby sacrificing other social and economic activities (Mariki, 2016).

(b) Transaction costs

Transaction costs arise from bureaucratic inefficiencies and delays in compensating HWC victims (Barua *et al.,* 2013). Compensation

schemes are implemented to reimburse individuals facing financial losses due to wildlife-related damages, aiming to foster coexistence between humans and wildlife. However, affected individuals, especially those in developing countries encounter challenges in accessing compensation payments as intended. Additionally, transaction costs associated with HWC results in affected communities having negative attitudes towards wildlife. For example, studies conducted by Mbise *et al.* (2018) and Mekonen (2020), concluded that lack of consolation schemes leads to negative attitudes towards wildlife. Similarly, Rutta (2023), highlighted that unnecessary consolation delays and inadequate government responses indicate a lack of concern for the well-being of affected communities.

(c) Health impacts:
HWC have significant implications on the health and well-being of affected individuals. Beyond the physical injuries inflicted during confrontations with wild animals, the chronic stress and psychological strain stemming from prolonged conflict situations lead to adverse health outcomes (Barua, *et al.,* 2013). Moreover, the fear and anxiety associated with living close to dangerous wild animal species can contribute to mental health disorders and diminished quality of life among community members (Ogra, 2008).

However, these hidden costs associated with HWC remain understudied and poorly documented especially in low-income countries (Barua *et al.,* 2013). Hidden costs extend beyond the immediately observed impacts, encompassing various indirect consequences that often go unrecognized but significantly affect the well-being of communities in rural areas, especially those dependent on agriculture and animal husbandry (Mayberry, 2015; Muyoma, 2016). For instant, when wild animals raid crops, farmers are faced with increased labour and financial demands, such as re-planting crops and re-pairing fences, or when predatory species disrupt livestock herding, susceptibility to dehydration and health consequences increase (Barua *et al.,* 2013; Mayberry, 2015).

Addressing these hidden costs necessitates a comprehensive understanding of the multifaceted impacts of HWC and the development of targeted interventions that go beyond mitigating direct impacts. By incorporating the assessment of hidden costs into conflict management strategies, policymakers and conservationists can better support affected communities and foster sustainable coexistence between humans and wildlife.

1.1.5 Household economic implications associated with HWC

HWC takes a heavy toll on local economies, extending far beyond the immediate losses incurred through crop raiding and livestock depredation. The economic implications are multifaceted, with both visible/direct and hidden/indirect costs intensifying financial burdens for affected households. While direct economic losses are typically quantified and addressed by governments, the hidden or indirect costs associated with HWC are often overlooked (Manoa *et al*., 2021; Mayberry, 2015; Yeshey *et al*., 2022). Additionally, beyond the immediate financial impacts on farmers' livelihoods, HWC jeopardizes food security and disrupts cash income streams (Hariohay & Røskaft, 2015). The loss of crops and livestock not only diminish household resources but also undermines the stability of local economies reliant on agriculture and animal husbandry. According to a study conducted in Nepal, financial losses attributed to wildlife-induced livestock damages amounted to USD 115 656.00, equivalent to USD 142.61 per household representing an average income loss of 23% per household (Baral *et al.,* 2021). Similarly, crop losses amounted to USD 83 424.00, corresponding to USD 102.86 per household, with an average income of about 17% per household (Baral *et al.,* 2021). These figures underscore the significant economic burden placed on local farmers and their families, compounding existing financial hardships.

Addressing the economic implications of HWC requires a comprehensive approach that consider both visible/direct and hidden/indirect costs. While careful documentation of households' economic losses is vital for assessing the extent of damage caused

as indicated by Meing'ataki (2005), policymakers must also recognize the broader socio-economic implications of HWC and implement strategies to mitigate its impacts. Failure to address these hidden/indirect costs not only perpetuates poverty among local farmers but also undermines conservation efforts by fostering antagonistic attitudes towards wildlife.

1.1.6 Socio-demographic predictors influencing attitudes towards wildlife conservation

The interaction between humans and wildlife has significant implications for wildlife conservation efforts. Therefore, understanding the attitudes of different local communities towards wildlife and conservation initiatives is crucial for developing effective policies and educational programs. The literature clearly shows that socio-demographic characteristics have a substantial influence on attitudes toward wildlife and wildlife conservation. Studies have indicated that younger people have more positive attitudes toward wildlife conservation as compared to older generations. For example, Kansky *et al.* (2014) found that younger age groups exhibited greater concern for animal welfare and environmental issues. Furthermore, education is one of the strongest determinants of positive attitudes toward wildlife conservation. Higher levels of education are associated with increased awareness and understanding of environmental concerns. Kwaslema (2018) and Lyamuya (2016) demonstrated that individuals with higher levels of education are more likely to support conservation policies and engage in conservation activities. Education improves environmental literacy, resulting in a greater awareness of the ecological and economic benefits of biodiversity.

1.2 Problem Statement

In Tanzania, regions surrounding national parks and game reserves are inhabited by local communities, some of which predates the parks' establishment, while others have migrated seeking fertile land for agriculture or good pastures for livestock (Salerno *et al.,* 2015).

These communities from time-to-time face wildlife attacks due to factors like proximity to protected areas, farming near park boundaries, and grazing within protected areas (Walpole *et al.,* 2007; Liendekiye *et al.,* 2022). Furthermore, as mobile and territorial animals search for food and water, conflict arise, leading to damages and injuries (Machoka, 2017). These damages and injuries are the ones termed as human-wildlife conflicts (HWC). HWC present a pervasive challenge worldwide, particularly in regions adjacent to protected areas (PAs). HWC is a reciprocal process that affects both humans and wildlife negatively, often resulting in detrimental impacts on both parties. It stands out as a paramount and concerning issue discussed in various social, political, and economic forums around the globe. The IUCN (2023) underscore the importance of effectively managing HWC to achieve the United Nations for Biodiversity 2050, wherein "humanity coexists harmoniously with nature, ensuring the protection of wildlife and other living species".

Despite various conservation initiatives introduced by governments, including the Tanzanian government, to mitigate HWC, the success rate remains notably low (Rutta, 2023). Conservation management strategies have traditionally focused on addressing dispute level of conflicts which primarily focuses on the visible impacts of HWC Madden and McQuinn (2014), such as crop raiding and livestock depredation Aryal *et al.* (2014) and Kebede *et al.* (2016) and Malugu *et al.* (2011) and Meing'ataki, 2005), while neglecting the underlying and identity-based conflicts that drives the social conflicts associated to HWC (Zimmermann *et al.,* 2020). In addition to neglecting the underlying and identity-based conflicts, hidden costs associated with HWC are understudied and poorly documented especially in low-income countries (Ogra, 2008; Barua *et al.,* 2013). These hidden costs include opportunity and transaction costs, as well as health impacts, which are often excluded from economic evaluations and mitigation policies. However, studies suggest that these hidden costs have a more significant impact on affected communities than

the visible costs. Despite their importance, hidden costs are rarely recognized in wildlife conservation policies and are scarcely researched to inform consolation policy decisions.

Furthermore, neglecting the underlying and identity-based conflicts results in insufficient information regarding the social conflicts associated with HWC. Hence, the intensity of conflict increases when the underlying and identity-based conflicts are ignored and only material incentives (dispute-level tactics) are offered (Zimmermann *et al.,* 2020). Additionally, this oversight of underlying and identity-based conflicts has resulted in an insufficient understanding and ineffective mitigation of HWC, aggravating tensions and hindering coexistence success between humans and wildlife. Existing literature has highlighted the importance of addressing the underlying and identity-based conflicts to achieve long-term conservation success. However, current approaches often fail to consider the social dynamics associated with HWC, resulting in ineffective and unsustainable interventions. Therefore, there is a critical need for up-to-date studies focusing on addressing the social conflicts (underlying and identity-based conflicts) and the socio-economic implications associated with HWC (Zimmermann *et al.,* 2020).

1.3 Justification of the Study

Research studies conducted on HWC often overlook the social conflicts and the socio-economic implications associated with HWC. To ensure the success of long-term conservation efforts, it's crucial to comprehend and resolve complex social conflicts and socio-economic implication of HWC, through comprehensively quantifying both visible and hidden costs associated with HWC. Currently, most attention is given to addressing dispute-related conflicts focusing on the actual/visible impacts of HWC, while hidden costs, underlying, and identity-based conflicts remain understudied, leading to inadequate information in literature regarding conflicts that drives the social conflicts of HWC. Through assessing these conflicts, the

study contributes to understanding the well-being of communities living near protected areas, informing policymakers and conservationists about their needs and challenges. The study provides insight and understanding into the diverse aspects of targeted interventions across different- levels of conflict and ensures a holistic approach to conflict resolution. It also informs evidence-based policy-makers to rectify existing imbalances and foster coexistence between humans and wildlife. Furthermore, insights from the study can enhance conservation management strategies by tailoring interventions to mitigate HWC's specific underlying, and identity-based conflicts as well as the socio-economic implications in the context of Nyerere National Park. The findings also inform policy development, guiding the design of targeted interventions to address the underlying, and identity-based conflicts, and support affected communities. Additionally, the research aligns with the sustainable development goals through mitigating HWC and supporting affected communities, thereby promoting environmental sustainability and social-economic development.

1.4 Objectives

1.4.1 Overall objective

The general objective of this study was to assess and understand the underlying and identity-based conflicts that drive the social conflicts and the socio-economic implications associated with human-wildlife conflicts.

1.4.2 Specific objectives

i. To assess the nature and extent of HWC
ii. To assess the current intervention strategies employed across the study area,
iii. To identify hidden costs associated with human-wildlife conflicts,
iv. To quantify households' economic impacts of hidden costs and visible costs of HWC,

v. To evaluate the socio-demographic predictors influencing attitudes towards wildlife conservation

1.4.3 Research questions

i. What is the nature and extent of human-wildlife conflict within the study area?
ii. Does HWC exist in all three levels of conflicts
iii. What are the types of HWC at each level of conflict?
iv. What are the main species causing conflict within the study area?
v. What are the types of intervention strategies employed by community members in mitigating HWC within the study area?
vi. What is the level effectiveness of each strategy in mitigating HWC?
vii. What are the socio-demographic factors influencing the utilization of intervention strategies?
viii. What are the hidden costs associated with HWC within the study area?
ix. What is the economic loss of crop damages caused by wild animals based on market value?
x. What is the economic value of livestock depredation caused by wild animals based on market value?
xi. What is the economic loss of hidden costs associated with HWC within the study area?
xii. What are the socio-demographic predictors influencing community members' attitudes towards wildlife conservation?

1.5 Theoretical Framework

This study is predicated on the rational choice theory, which holds that people act rationally when motivated primarily by financial incentives. A paradigm for comprehending economic behavior known as "Rational Choice Theory" is based on the notion that every person is a rational agent seeking to maximize "utility" or "happiness." According to (Sato, 2013), rational choice is defined as

follows: "People are influenced when making decisions by their understanding of how they are expected to behave within society as well as the potential financial costs and benefits of a given course of action." Rational choice theory can also be defined as a set of guidelines that help understand economic and social behaviour (Cuofano, 2024). When coupled with facts on people's observed choices or with assumptions about preferences, rational choice becomes a powerful predictive theory (Sato, 2013). While the application of rational choice theory is not the main emphasis of this study, it serves as a crucial justification for the assumptions made about rational human conduct motivated by financial gain. therefore, the financially driven assumption shall be referred to in this study as merely "rational choice." Policies and conservation programs can be created that maximize conservation efforts in consideration of the social conditions and local economic by having a better grasp of the motivating factors that lead individuals to act as either protectors or poachers (Messerli *et al.,* 2019).

1.6 Analytical Framework

To address specific objectives (i) and (ii), the study applied an analytical framework of the Conservation Conflict Transformation Model (CCT) (Fig.2.1). The CCT focuses on understanding and addressing deep-rooted conflicts driven by non-negotiable needs, particularly those rooted in identity-based. It comprises of two models: the Level of Conflict Model (LCM) and the Conflict Intervention Model (CIM) (Madden & McQuinn, 2014). The LCM, categorizes conflicts into three levels: disputes, underlying, and identity-based conflicts (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). The LCM was designed to provide a structured approach with regards to understanding and addressing deep-rooted conflicts driven by non-negotiable needs, particularly those rooted in identity-based as faced by farmer stakeholders, while the CIM identifies conflict dimensions for intervention planning (Madden & McQuinn, 2014). Through integrating these models, the study aimed to provide a holistic view of conflicts involving farmer stakeholders adjacent to

Nyerere National Park and enable planning for appropriate interventions.

1.7 Study Limitations

The following are the limitations were encountered during the study

i. It was observed that some of the household heads who were interviewed were reluctant to reveal certain information for reasons well known to themselves and the perception that the researcher was only interested in gathering information and would not be able to assist them in solving the issue.

ii. Despite having a contract agreement in place with one of the NGOs operating within the study area that guarantees they will supply the necessary data, efforts to obtain such data from them proved unsuccessful.

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CHAPTER TWO

Manuscript One

2.0 Assessing the Nature and Extent of Human-Wildlife Conflicts Using the Conservation Conflict Transformation Model in Communities Adjacent to Nyerere National Park, Tanzania

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Abstract
Human-wildlife conflicts (HWC) pose a significant challenge in communities neighboring Nyerere National Park. To ensure the success of long-term conservation efforts, it's crucial to comprehend and resolve complex social conflicts. Currently, most attention is given to addressing dispute-related conflicts, while underlying, and identity-based conflicts remain understudied, leading to inadequate information in literature regarding underlying and identity-based conflicts that drive social conflicts. Through the use of the Conservation Conflict Transformation Model (CCT), this study aimed to identify existing conflicts across three levels of conflicts and assess current intervention strategies employed within the study area. Based on data collected through questionnaire survey of 324 respondents, the study revealed that dispute level of conflicts was lower than the underlying and identity-based levels of conflicts, highlighting the limited scope of addressing conflicts solely at the dispute level within the HWC context. To alleviate dispute level of

conflicts, respondents employed both lethal and non-lethal control measures, with a preference for non-lethal methods. Additionally, socio-demographic factors such as age, gender, household size, respondent's attitude towards wildlife and residence revealed a significant influence on the use of intervention strategies ($P<0.05$). Additionally, results revealed that respondents faced several challenges such as protracted HWC incident reporting process, lack of consolation payment for damages, exclusionary practices, and lack of transparency in soliciting assistance from local authorities, wildlife, and government authorities. Overall, the study, advocates for the adoption and implementation of a holistic approach aligned with the CCT model to effectively address HWC. Future research should delve into detailed case studies and practical applications of this model to manage HWC.

Keywords: Human-wildlife conflicts, levels of conflict, intervention strategies, planning interventions, livelihood, Nyerere National Park

2.1 Introduction

Understanding and addressing the social conflicts in communities near protected areas is central to attaining long-term conservation success (Dickman, 2010; Peterson *et al.,* 2012). Human-wildlife conflicts (HWC) occur when the needs and actions of wildlife negatively impact people's goals, and vice versa (Kaswamila, 2010; Morzillo *et al.,* 2014). The challenges of coexistence between humans and wildlife arise mostly in areas close to agricultural and other production sites and protected areas (PAs) (König *et al.,* 2020). HWC can lead to undesirable effects on humans especially farmers in fluctuating degree of severity, such as crop raiding, livestock depredation, disease transmission, infrastructure damages and loss of life (Hariohay & Røskaft, 2015). In Tanzania, various conservation initiatives have been introduced to address the increasing conflicts arising from human-wildlife interactions (HWI).

However, despite these attempts, the interventions have not resulted in significant improvement with studies suggesting insufficiency if the psychological values and needs that drive social conflicts are not taken into consideration (Peterson *et al*., 2012). Therefore, conservationists need to proactively address underlying and identity-based conflicts (Zimmermann *et al.,* 2020).

HWC exist in various forms and there are 3 levels of conflict, namely: Dispute, underlying, and identity-based levels of conflicts. According to Madden and McQuinn (2014), most HWC studies have primarily concentrated on the dispute level of conflicts (the obvious, tangible, visible manifestation of a conflict), disregarding the underlying (unresolved conflicts from the past) and identity-based conflicts (core values, beliefs, or social-psychological necessities integral to the identity of at least one party engaged in the conflict) in stakeholder decision-making processes as they are believed to be outside the purview of conservation. Hence, the intensity of conflict may increase when the underlying and identity-based conflicts are ignored (Zimmermann *et al.,* 2020). Additionally, the essential focus of conservationists' incline towards navigating dialogue to wildlife itself or ecosystems and away from the impact that conservation decisions and actions may have on a community or person's psychology, culture, beliefs, values, or history (Dickman, 2010; Redpath *et al.,* 2015). Page (2023) concluded that socio-cultural issues should also be highly considered and included when examining HWC and interventions.

A study concucted by Songhurst (2010) concluded that in many cases, not paying attention to relationship and process components increases social conflicts and communities' social-psychological needs leading to communities disliking imposed approaches. Conversely, regardless of the characteristics, complexity and depth of conflicts in most wildlife conservation and management perspectives, they are frequently approached as transactional disputes that can be resolved once common interests are

established. which leads to failure in acknowledging, engaging, and responding to deeper social and psychological dynamics between individuals of which the immediate wildlife-related dispute represents only a surface manifestation. As a result, Dickman (2010) and Peterson *et al.* (2012) suggested that long-term conservation success requires deepening conservationists' capacity and strategies to include responses that seek to understand and address these more elusive underlying and identity-based conflicts (social conflicts).

Therefore, the continued occurrence of HWC in Tanzania and around the world stimulates the need for up-to-date studies focusing on mitigation factors. Practical conservation procedures cannot be accomplished by solely addressing the dispute concerns at the surficial level of conflict, without assessing the underlying and identity-based values, concerns, and needs of stakeholders (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). Therefore, this research aimed at identifying existing conflicts through the use of the Level of Conflicts Model (LCM), assess current intervention strategies employed across the study area and formulate appropriate and suitable intervention strategies by making use of the Conflicts Intervention Model (CIM),evaluate the influence of socio-demographic factors on the utilization of intervention strategies and indicate the importance of identifying the underlying and identity-based conflicts that are frequently ignored in HWC related studies.

2.2 Analytical framework

To identify and evaluate the nature and extent of HWC on farmer stakeholders (crop farmers, livestock keepers and mixed farmers) in communities adjacent to Nyerere National Park, the Conservation Conflict Transformation Model (CCT), as outlined by Madden and McQuinn (2014) was applied; incorporating elements from the public acceptance and consensus framework developed by (Liordos *et al.*, 2016) (Fig.2.1). Farmer stakeholders were assessed because of their crucial contribution to sustaining livelihoods in Tanzania, yet facing challenges posed by HWC. The CCT analytical framework

was designed to provide a structured approach with regards to understanding and addressing deep-rooted conflicts driven by non-negotiable needs, particularly those rooted in identity-based as faced by farmer stakeholders. The CCT focuses on delving into the social, psychological, and systemic root causes of conflict, going beyond the more obvious dispute-level conflicts (Madden & McQuinn, 2014). This type of analysis is inadequate in literature describing HWC in the developing world, leading to adoption of intervention strategies that are not backed-up with adequate scientific knowledge to the conflicts.

The CCT comprises of two models: the Levels of Conflict Model (LCM) and the Conflict Intervention Model (CIM). The LCM, which is the initial stage of the CCT, is a tool to be incorporated at the designing stage of the conservation plan or intervention (Madden & McQuinn, 2014). It classifies conflicts into three levels: dispute, underlying, and identity-based level of conflicts, and enables analysis of the complexity, scope and depth of conflicts. Disputes are material-based conflicts, while underlying conflicts stem from unresolved historical disputes. Identity-based conflicts revolve around values, beliefs, and social-psychological needs essential to the identity of one or more parties involved in the conflict, prompting them to defend if their identity is threatened (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). This study intended to identify, assess and reveal such conflicts for farmer stakeholders (Fig. 2.1) in villages bordering Nyerere National Park (Fig. 2.2).

The second model within the CCT is the Conflict Intervention Model (CIM), which aids in planning conflict intervention strategies. It identifies possible sources and dimensions of conflict, including areas that need to be addressed. The CIM consists of 3 sources and dimensions of conflict namely: Substances (related to dispute), Process (related to overall design of decision-making, equity and authority), and Relationships (involving personal conflicts between people or groups whose relationship lacks trust and respect) (Madden & McQuinn, 2014). The three dimensions were assessed

following a scenario analysis framework Liordos *et al.* (2016), whereby 3 scenarios on HWC interventions namely, scenario 1-Business as Usual (BAU) which includes revealing the existing intervention strategies on HWC employed by stakeholders (crop, livestock, and mixed farmers) in the study area, scenario 2 highlights intervention strategies on HWC employed elsewhere and scenario 3 involves the planning intervention actions. All 3 intervention scenarios applied the model variables (substance, process and relationship) (Fig. 2.1) to enable the assessment. Integrating these two frameworks allows for a holistic view of conflicts involving farmer stakeholders adjacent to Nyerere National Park and enables planning for appropriate intervention strategies.

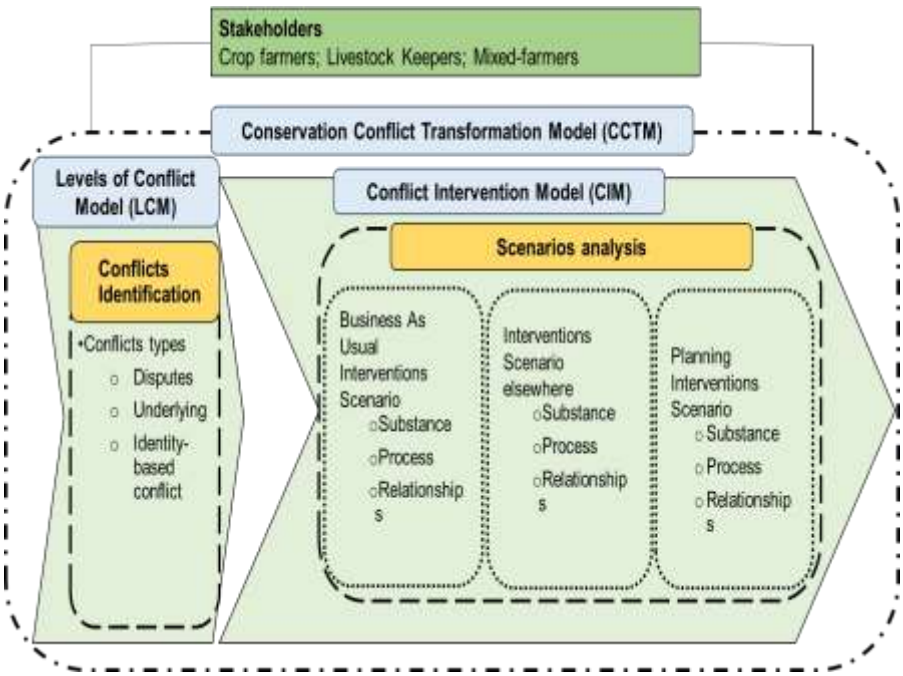

Figure 2.1: Analytical Framework on Conservation Conflicts Identification and Intervention Planning for Stakeholders (crop, livestock and mixed farmers) Adjacent to Nyerere National Park (Adapted from Liordos *et al*., 2016; Madden & Mcquinn, 2014)

2.3 Methodology

2.3.1 Study area description

Nyerere National Park, formerly part of the Selous Game Reserve, is Tanzania's largest national park and one of the world's largest wildlife sanctuaries (UNESCO & IUCN, 2013). It was gazetted in 2019 and named in honor of Tanzania's first President, the late Mwalimu Julius Kambarage Nyerere. The Park is situated in South Eastern Tanzania, covering approximately 30 893 km2. It borders Mikumi National Park to the Northwest and Udzungwa Mountains National Park to the West (Saanya *et al.,* 2021). Additionally, it is divided into six sectors: Kalulu, Seka, Ilonga, Mbarangandu, Msolwa, and Matambwe sectors (Saanya *et al.,* 2021). This study was conducted in six villages adjacent to the Nyerere National Park. These villages were purposively sampled based on reported HWC cases in the villages. The sampled villages included Kanyenja, Katurukila, Magombela, Msolwa Station, Nyange, and Sagamaganga.

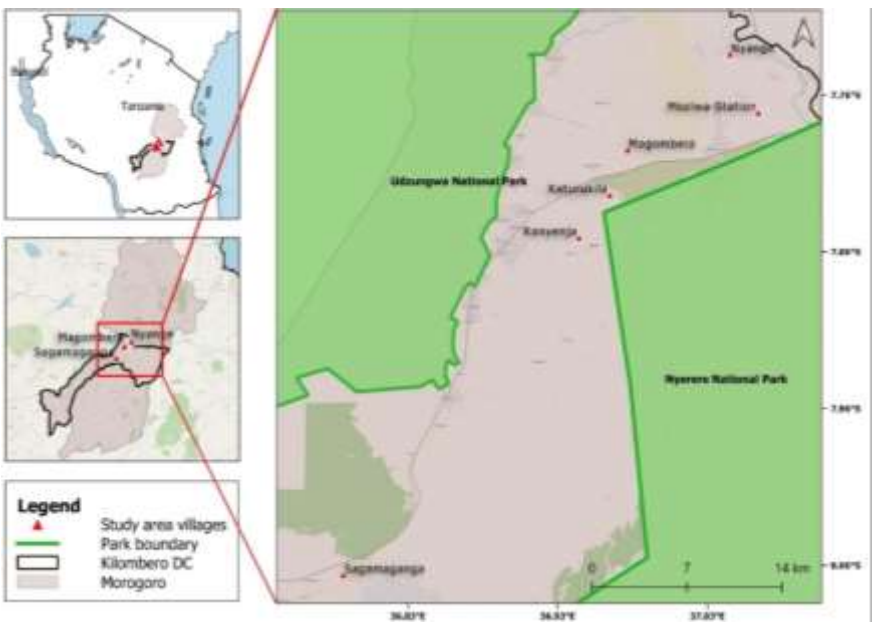

Figure 2.2: Map of the study area indicating the selected villages (Source: Simasiku *et al.,* 2024)

2.3.2 Research design

A cross-sectional study design was employed in the study due to its cost-effectiveness and ability to provide a momentary snapshot of the population. According to Given (2008), this study design facilitates effective population description and the construction of cause-and-effect relationships by allowing the identification of patterns, correlations, and incidence rates within a community.

2.3.3 Sampling procedure

The local communities' households in the 6 villages were 18 864 in total, of which, 13 801 households (≈73%) composed the study population, in particular included crop farmers, livestock keepers and mixed farmers. Sample size was determined using the formula described in Bartlett *et al*. (2001), which gave a minimum returned sample size of 303 households (Equation 2.1). Hence for each village at least 54 households were randomly selected for interviews, making a total of 324 units for the whole study. Sample size composition (farmer stakeholders) were purposively chosen due to their significant role in sustaining livelihoods in Tanzania, yet they bear the consequences of HWC. As noted by the United Republic of Tanzania (2021), agriculture supports the livelihoods of approximately 80% of Tanzanians, primarily characterized by smallholder farmers.

2.3.3.1 Sample size determination formula

$$n_0 = \frac{t^2 * p * (1-p)}{d^2} \quad \text{.....Equation 2.1}$$

$$n_0 = \frac{t^2 * p * (1-p)}{d^2} = \frac{1.96^2 * 0.73 * (1-0.73)}{0.05^2} = 303 \text{ household sample size}$$

Where:

- n_0 = Minimum estimated sample size
- t^2 = Value of the t-distribution corresponding to the chosen alpha level
- p = Estimate of population proportion
- d^2 = Margin of error (recommend using 5%

2.3.4 Data collection methods

The study collected data through primary and literature review methods. Primary data were obtained from household questionnaire, key informant interviews, and focus group discussions. The questionnaire was pre-tested on 30 randomly selected individuals from the six selected villages of varying age, sex, and background among the local communities, which were not included in the main sample group. This helped to modify the questionnaire accordingly. The pretested questionnaires were used to examine the practicability, reliability, and suitability of the method (Hashim, 2022). The respondents' comments helped to improve the sequence and layout of the questionnaire. The questionnaire comprised closed and open-ended questions. Household questionnaire involved in-person oral interviews to obtain data related to the socio-demographic characteristics of the respondents, the nature and extent of HWC within the study area, intervention strategies currently employed and their effectiveness in mitigating HWC. 12 Key informant interviews comprising village leaders and extension officers were conducted to explore the nature and extent of HWC.

Focus Group Discussions (FDG) were conducted to gather information on how local communities perceived human-wildlife conflicts, benefits derived from wildlife, and suggestions on how HWC can be better managed. In addition, the method was used to reinforce the data collected through the questionnaires. 6 FGD sessions were conducted in each study village, and the group size in each discussion site varied from 8 to 12. Participants of the FGD were village community members of both sexes to discuss their experience of human-wildlife conflict and gather information on problem causing species in the area. They also provided insights into the knowledge, opinions, and attitudes of the local communities regarding HWC and helped assess the effectiveness of local HWC management methods. Data collected from group discussions was collated and summarized using the context analysis method. Thus, the information acquired was triangulated through questionnaires and focus group discussions. A guide checklist was prepared for the

focus group discussions. Secondary data method was used to obtain information from peer-reviewed journal articles, technical reports, dissertations and theses regarding effective intervention strategies employed in mitigating HWC in various regions within and outside Tanzania.

2.4 Data Analysis

Data analysis followed an analytical framework model adapted from Madden and McQuinn (2014) and the public acceptance and consensus scenario framework from Liordos *et al.* (2016) in order to explore the nature and extent of HWC and develop suitable solutions for specific scenarios (Fig. 2.1). Hence the analysis involved; first, assessing the nature and extent of HWC by identifying and categorizing types of HWCs into three levels of conflicts namely dispute, underlying and identity-based levels of conflict as indicated in Madden and McQuinn (2014) and second, assessing current intervention strategies employed across the study area and formulate appropriate and suitable through the scenarios analysis within the framework of the Conflicts Intervention Model (Fig. 2.1) using content analysis (Shava *et al.,* 2021). The data was subsequently subjected to grouping and coding procedures for further analysis using Statistical Package for the Social Sciences (SPSS) to derive meaningful insights. Descriptive statistics such as frequencies and percentages were derived from SPSS to enable comparisons between levels of conflicts and the effectiveness of intervention strategies employed within the study area. Data were presented using graphs and tables. Spearman's correlation test was used to test the strength and direction of the association among the three levels of conflicts.

Binary Logistic Regression Model (BLRM) analysis was employed to evaluate the relative influence of socio-demographic factors on the utilization of intervention strategies (Equation 2.2). The model was assessed for compliance with binary logistic regression assumptions. The data satisfied the binary logistic regression assumptions pertaining to the independent variables. The

independent variables had no multicollinearity and linear relationship between the continuous variables (X_{HHA}, X_R, X_{HHS}, X_{ATW}, X_{DFNP}, X_{HWCEXP}, and X_{HHG}) (Hariohay *et al.,* 2019; Heinrich, 2016; Larson *et al.,* 2021; Makumbe *et al.,* 2022; Munuo, 2016) as indicated in Table 2.1 and the logit of the outcome (Pallant, 2011). In all statistical analyses, the significance value (alpha) was set at 0.05.

$$\boldsymbol{Yi} = \frac{e^{\beta o+\beta XHA+\ \beta 2XG+\beta XHHS+\ \beta XATW+\beta XDFNP+\beta XR+\ \beta XHWCEXP}}{1+e^{\beta o+\beta XHA+\ \beta 2XG+\beta XHHS+\ \beta XATW+\beta XDFNP+\beta XR+\ \beta XHWCEXP}} \text{.....Equation 2.2}$$

Where:

Y_i = Dependent variable

β_o = y-intercept (Constant term)

β = Coefficients which show the average change in the dependent variable

X = Socio-demographic predictors: age of household head (X_{HHA}), gender of household head (X_{HHG}), household size (X_{HHS}), attitude towards wildlife (X_{ATW}), distance of farm from national park boundary (X_{DFNP}), residence status of household head (X_R), and HWC experience status (X_{HWCEXP}).

Table 2.1: Description of the dependent and independent variables

Variables	Symbol	Variable description
Dependent		**Dependent (Y)**
Intervention Strategies	(Y_{IS})	Intervention Strategies 0=No method used 1=Use of method
Independent		**Independent (X)**
Age of household head	(X_{HHA})	Age of household head= Years
Gender of household head	X_{HHG}	Gender of household head 1=Male, 2=Female
Number of household members	(X_{HHS})	Number of household members 1-3 people=1; 4-6 people=2; 7-9 people=3; ≥10 people=4
Residence of household head	(X_{R})	Residence of household head 0=Not a resident 1=Resident
Attitude towards wildlife	(X_{ATW})	Attitude towards wildlife Positive=1; Negative=2
HWC experience	(X_{HWCEXP})	HWC experience 0=No conflicts 1=Conflict
Distance of farm from national park boundary	(X_{DFNP})	Distance of farm from national park boundary 1=0-10(Near) 1= 9- ≥15(Far) 0=Within the village

Source: (Simasiku *et al.,* 2024)

2.5 Results

2.5.1 Conflicts identification

Out of 324 respondents; 135(41.7%) were crop farmers, 95(29.3%) livestock keepers and 94(29%) mixed farmers. According to Fig. 2.3, crop (48.5%) and mixed farmers (48.1%) experienced more underlying conflicts as compared to identity-based (35.8%) (30%) and dispute 15.6% (21.8%) level of conflicts respectively, while livestock keepers, experienced more identity-based conflict (51.4%) as compared to underlying (39.2%) and dispute (9.4%) levels of

conflict. In all three stakeholders' dispute level of conflicts were lower as compared to underlying and identity-based levels of conflict. In addition, dispute and underlying levels of conflict r = 0.414, $p<0.05$; and underlying and identity-based levels of conflict r= 0.535, $p<0.05$ both indicated a positive significant correlation. Therefore, an increase in one variable leads to an increase in another variable. However, dispute and identity-based levels of conflict indicated a non-significant correlation relationship r= 0.328, p=0.072.

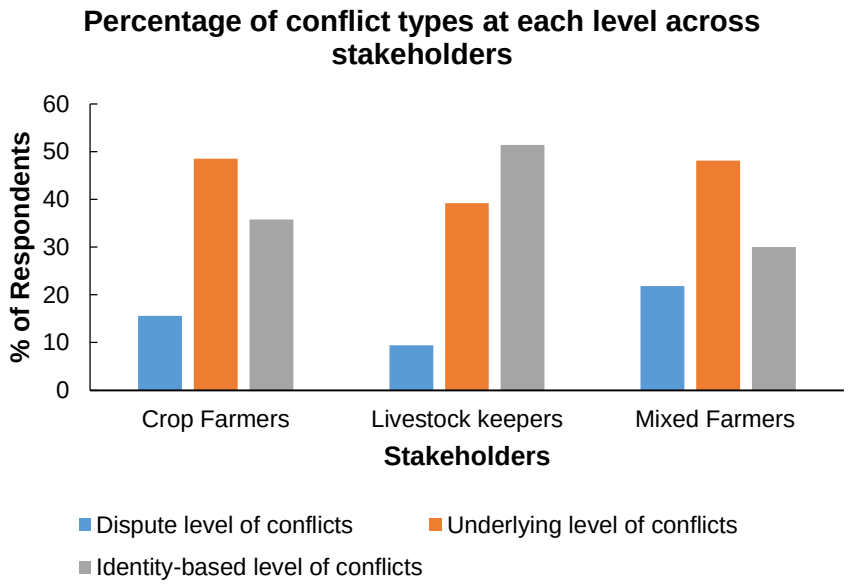

Figure 2.3: Occurrence of different types of conflicts at each level across 3 stakeholders

The findings depicted in Fig. 2.4 present a comprehensive analysis of conflict types across the three levels of conflict for all three stakeholder groups. At the dispute level, a significant proportion of respondents (97%) highlighted income loss as a predominant concern, attributable to crop damages and livestock depredation caused by wild animals. The absence of consolation payments as

raised by respondents (98%), resulted in majority of respondents (99%) expressing negative attitudes towards wildlife, particularly the species responsible for the damages. Furthermore, within the realm of identity-based conflicts, it was observed that respondents (100%) attributed blame to both village leaders and government officials for their perceived failure to promptly address reported cases.

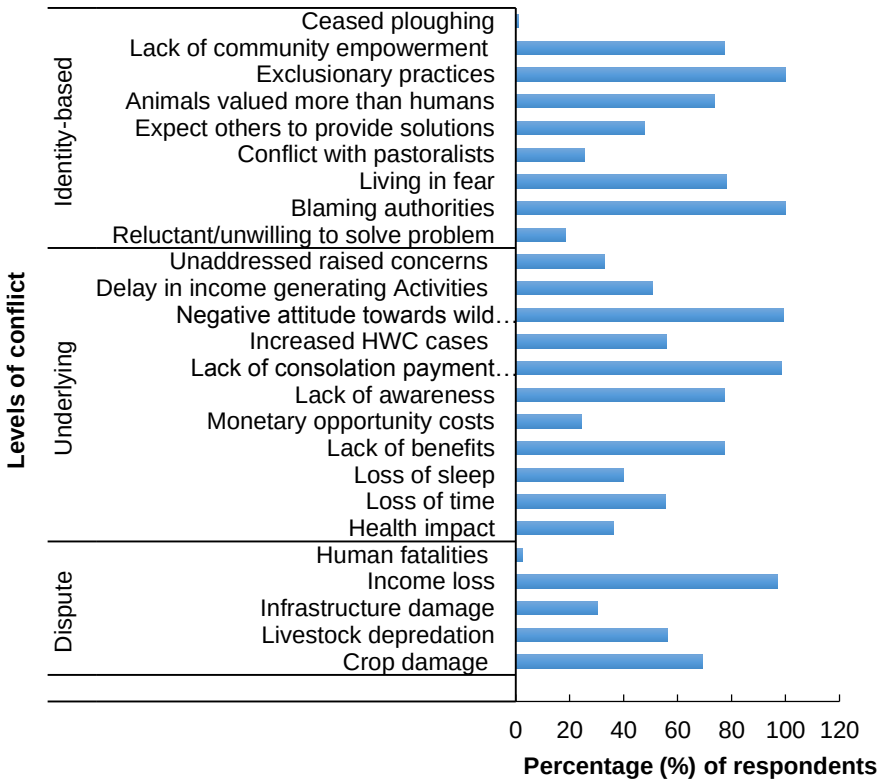

Figure 2.4: Overall percentage distribution of conflict types across three stakeholder groups (crop farmers, livestock keepers and mixed farmers)

2.5.2 Conflicts intervention scenarios

Three intervention scenarios were designed and assessed using 3 variables namely: substance, process and relationships (Fig.2.5). The scenarios include:

1. Business as usual (BAU) intervention scenario
2. Intervention elsewhere scenario
3. Planning intervention scenario

Stakeholders: Crop farmers, Livestock farmers and Mixed-farmers

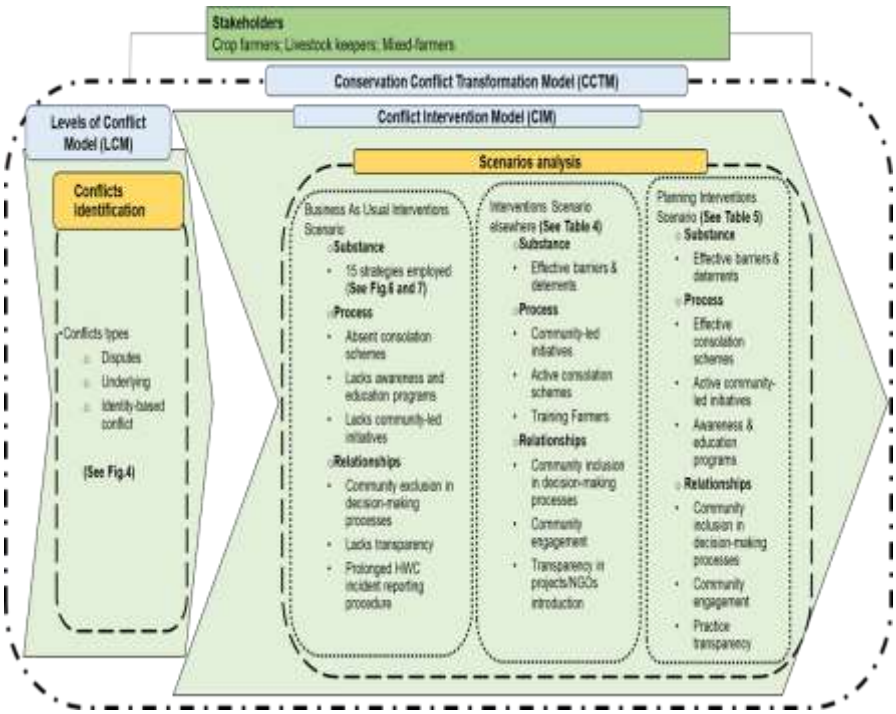

Figure 2.5: Framework on Conservation Conflicts Identification and Intervention Planning for Communities Adjacent to Nyerere National Park.

2.5.2.1 Scenario 1: Business as usual (BAU) Interventions within the study area

Scenario 1 examined the current strategies farmers and livestock keepers apply to minimize HWC. Respondents employ a variety of strategies, totaling 15, with 10 being non-lethal and 5 involving lethal methods (Fig. 2.6 and 2.7). However, the effectiveness of these methods varied from not effective to highly effective, with a statistical difference of (F statistics $p<0.05$) among respondents. Respondents reported facing several challenges when seeking assistance from wildlife and government authorities. The major challenges that were consistently mentioned by the respondents were the HWC incident reporting process, lack of consolation for damages and exclusionary practices. According to respondents the HWC incident reporting process is a lengthy chain as it required contacting the village leader first, before the responsible authorities are informed. This resulted in delays in responding to reported cases and/or no response at all. Leading to HWC cases increasing. Additionally, respondents also mentioned lack of consolation for damages instigated by wild animals even when they report HWC incidents with evidence. Concerns regarding exclusionary practices were also raised by respondents, where respondents felt marginalized in decision-making processes related to HWC, and conservation at large. Lack of transparency was observed, with majority of respondents being unaware of NGOs operating within their communities addressing HWC.

2.5.2.1.1 Effectiveness of intervention strategies employed by stakeholders

Fig. 2.6 and Fig. 2.7 indicate the efficacy of various strategies employed by farmers to mitigate both crop damages and livestock depredation instigated by wild animals. The strategies were categorised into two management methods: non-lethal and lethal. Under non-lethal methods six forms of strategies were identified, while five forms were classified under lethal methods (Fig.2.6). Among non-lethal methods, respondents (96.1%) predominantly

noted that reporting to village leaders was ineffective, with the use of chili pepper (78.2%) and fencing (79%) considered less-effective. Scare tactics (54%) and solar torches (51%) were perceived as moderately-effective, while guarding of farms (55%) was reported as highly effective. According to Fig. 6, some respondents reported employing lethal methods, of which throwing of stones (51%) and pesticides (79.6%) were reported as less-effective, while smoke (51%) and car oil/grease (83.7%) were assessed as moderately-effective. The use of firecrackers (100%) was reported as highly effective.

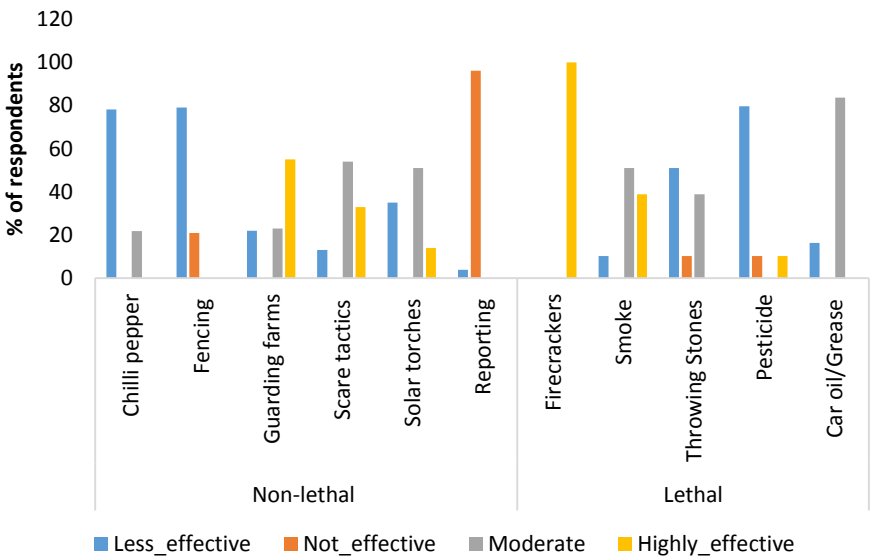

Figure 2.6: Effectiveness of strategies employed by farmers in minimizing crop damages

According to the findings depicted in Fig. 2.7, no implementation of lethal methods was reported by livestock farmers. The majority of respondents identified solar torches (66.7%) as ineffective, while the utilization of enclosure for livestock (52.9%) was perceived as less-effective. Conversely, herding/guarding of livestock (65.5%) was

reported to be moderately-effective and livestock feeding (100%) was perceived as highly-effective.

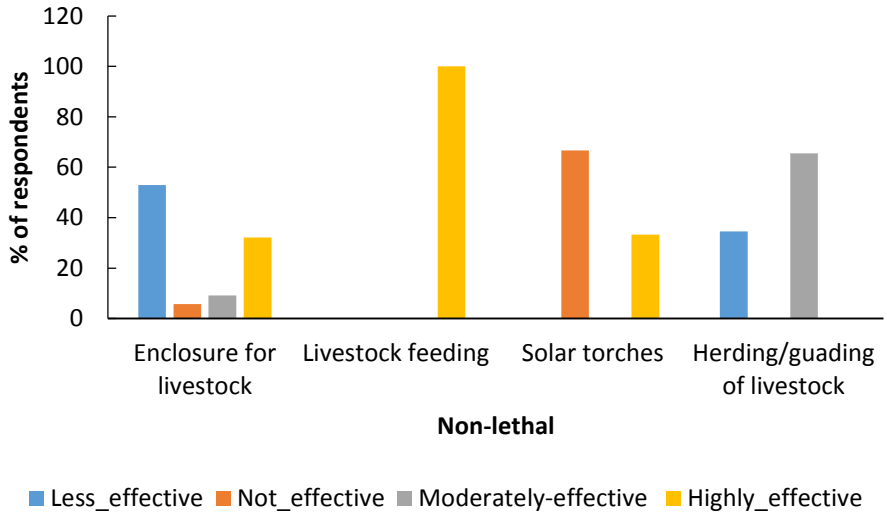

Figure 2.7: Effectiveness of strategies employed by farmers in minimizing livestock depredation

2.5.2.1.2 Evaluation of the relative influence of socio-demographic factors on the utilization of intervention strategies

Binary logistic regression was performed to evaluate the relative influence of socio-demographic predictors on respondents' utilization of intervention strategies (Table 2.2). The model contained seven independent variables (age of household head (X_{HHA}), residence of household head (X_R), household size (X_{HHS}), respondents' attitude toward wildlife (X_{ATW}), distance of farm to form the national park boundary (X_{DFNP}), human-wildlife conflict experience (X_{HWCEXP}), and gender of household head (X_G) (Table 2.1). The model containing all predictors was statistically significant, $\chi 2$ (7, N = 324) = 36.477, p=0.000, indicating that, overall, the model applied can significantly predict the dependent variable, respondents' utilization of intervention strategies to minimise HWC in correlation to

determinant factors as listed in table 2.1. As illustrated in Table 3, five of the independent variables made a statistically significant contribution to the model; age of household head (p=0.029), residence (p=0.000), household size (p=0.038), respondent's attitude towards wildlife (p=0.011) and gender of household head (p=0.027). The odds ratio of the five statistically significant independent variables ranged from less than 1 to greater than 1. The strongest predictor of respondents utilizing intervention strategies to mitigate HWC was residence (X_R) indicating an odds ratio of 4.670 with a positive relationship, emphasizing that respondents who are residents of the area are 4 times more likely to employ intervention strategies. The lowest predictor was respondents' attitude toward wildlife (X_{ATW}), indicating an odds ratio of 0.139 with a negative relationship, highlighting that respondents with negative attitudes towards wildlife were 0.1 times less likely to employ intervention strategies to mitigate HWC.

Table 2.2: A model output from a Binary logistic regression analysis evaluating the relative influence of socio-demographic factors on the utilization of intervention strategies.

Variables	B	S.E.	Wald	df	Significance	Exp(B)
X_A	-0.027	0.011	9.957	1	**0.029***	0.973
X_R	1.541	0.428	12.974	1	**0.000***	4.670
X_{HHS}	0.620	0.300	4.284	1	**0.038***	1.859
X_{ATW}	-1.973	0.777	6.445	1	**0.011***	0.139
X_{DFNP}	-0.158	0.217	0.532	1	0.466	0.853
X_{HWCEXP}	0.913	1.183	0.596	1	0.440	2.492
X_G	-0.879	0.012	4.765	1	**0.027***	0.415

a. Dependent Variable: Y_{IS}, standardized coefficients (+) indicate a positive influence in the use of intervention strategies and (–) indicate a negative influence in the use of intervention strategies, *represents significance level P<0.05. The total sample size (N) considered in this analysis was 324 households.

2.5.2.2 Scenario 2: Interventions employed elsewhere

Scenario 2 outlines successful and effective HWC intervention strategies practiced elsewhere, both locally and globally obtained through literature review. A range of strategies, such as chili fencing, beehives, scout camps, electrified fencing, and mobile phone communication alert system are implemented successfully and effectively in various areas within Tanzania to reduce HWC. Indicating that the success of an intervention strategy depends on various factors such as: socioeconomic factors, education and awareness, collaboration and coordination among stakeholders, resource availability, community engagement and participation, adaptability, flexibility and the effectiveness of the strategy. According to Table 2.3, successful global intervention strategies include communal conservancy program, Kenya's lion guardian program and Nepal's Annapurna Conservation Area project, all aiming at empowering local communities and reducing HWC while building trust, good relationships and promoting coexistence with wildlife.

Table 2.3: Review of HWC interventions employed elsewhere

HWC intervention	Intervention type	Location/region/country	Source
Chili fencing, Beehives, Noise-making, Scout camps & Electrified fencing	Substance	Rungwa, Kizigo & Muhes game reserve; Western Serengeti	Hariohay *et al.* (2019) and Matata *et al.* (2022)
Fortified livestock enclosure	Substance	Tarangire-Simanjiro ecosystem, Tanzania.	Mkonyi *et al*. (2017)
Herding with domestic dogs/ specialized breeds of guard dogs; Cooperate herding, Defensive herding equipment	Substance	Eastern Serengeti, Tanzania	Mbise (2018) and Mbise, Skjærvø, *et al.* (2018)
Mobile phone communication	Process	Simanjiro district, Northern Tanzania	Lewis *et al.* (2016)
Communal conservancy program; HWC management plan; Delegation of decision-making to staff & communal area conservancies; Training farmers to carry out preventative measures	Process & Relationship	Namibia	Wenborn *et al.* (2022)
Active community-based organisation	Relationship	Rungwa, Kizigo &Muhes game reserve	Hariohay *et al.* (2019)
Kenya's Lion Guardian Program	Relationship	Kenya	Dolrenry *et al.* (2016)
Nepal's Annapuraa Conservation Area Project (ACAP)	Relationship	Nepal	Schuett *et al.* (2016)

Source: (Simasiku *et al*., 2024)

2.5.2.3 Scenario 3: Planning interventions

Planning HWC intervention strategies necessitate structured approached to achieve conservation goals. Based on results in scenario 1 and 2, potential strategies for future interventions in HWC management within the study area include: employing technical solution such as cooperate guarding of farms, fencing and deterrents are reported to be effective in reducing wildlife damages and economic losses while promoting the use of non-lethal methods. Additionally, employing a combination of strategies has proven to be more effective, especially in reducing crop damages. Measures such as fencing enclosure for livestock, herding with dogs and adjusting to livestock feeding practices demonstrate efficacy in reducing livestock depredation and economic losses. In addressing the underlying and identity-based conflicts readdressing past injustices and fostering trust among stakeholders through active community engagement, education and awareness program, active response to reported cases, transparency and effective implementation of consolation schemes are suggested (Table 2.4).

Table 2.4: Planning of HWC interventions for communities adjacent to Nyerere National Park

Potential strategies for future intervention	Intervention type	Relevance of the strategy to communities adjacent to NNP	Source
Individual/Cooperate guarding of farms	Substance	Protects crops & livestock, reduces economic losses for farmers; minimise retaliatory killings	Field data (2023) and Mbise, Skjærvø, *et al*. (2018)
Use of multiple strategies simultaneously	Substance	Promotes the use of non-lethal methods	Field data (2023)
Fencing enclosure for livestock	Substance	Proactive measure to prevent conflict; minimise economic losses; reduce cases of livestock predation	Field data (2023) and Mbise, Skjærvø, *et al.* (2018)
Herding with specialized guard dog breeds	Substance	Offers a non-lethal and proactive approach to conflict mitigation	Mbise (2018) and Mbise, Skjærvø, *et al.* (2018)
Livestock feeding	Substance	Minimise the exposure of livestock to predators; minimise the need for lethal measures; prevents economic losses	Field data (2023)
Establishing a direct HWC emergency call line	Process	Provides rapid response mechanism, enabling timely assistance in situations of conflict.	Field data (2023)
Community Mobile phone communication alert system	Process	Crucial element in effective HWC management strategies; reduces potential risks to both humans & wildlife	Lewis *et al.* (2016)
Community empowerment, establishing of HWC management plan	Process & Relationship	Improves decision-making process, empowers local communities to manage wildlife, benefits from wildlife & tourism revenue	Wenborn *et al.* (2022) and Westberg (2017)
Active involvement of local communities in conservation & tourism efforts & utilizing tourism revenue	Relationship	Reduce economic burden of wildlife damage in communities	Hariohay *et al.* (2019) and Schuett *et al*. (2016)
Active and effective implementation of consolation payment schemes	Process & Relationship	Mitigates economic losses; builds community trust; legal compliance; improves behaviour towards wildlife; promotes coexistence	Field data (2023) and LeFlore *et al.* (2019) and Tarimo *et al*. (2020)
Active community engagement in all aspects that affects them both directly and indirectly	Relationship	Allows exchange of traditional knowledge; promotes acceptance & compliance; fosters a sense of ownership and cooperation	Wenborn *et al.* (2022) and Westberg (2017)
Attending to reported HWC cases promptly	Relationship	Helps minimize potential harm to both humans & wildlife as well as properties; promotes safety and fosters positive community relations; prevents escalation of HWC cases	Field data (2023)

(Source: Simasiku *et al.,* 2024)

2.6 Discussion

2.6.1 Nature and extent of human-wildlife conflicts

Human-wildlife conflicts (HWC) is a pressing issue in communities adjacent to Nyerere National Park, with more damages caused by elephants followed by buffalo, hippopotamus, monkey, hyena, wild cat, and crocodile. These findings are consistent with findings from a study conducted by Makindi *et al.* (2014) who stated that HWCs are prevalent with large numbers of big mammals such as elephants, buffalo, and lions still roaming freely in marginal rangelands and protected areas. Other studies indicated elephants as the top leading crop raiders (Distefano, 2010; Kaswamila, 2010; Kitampui & Odhiambo, 2021; Merkebu & Yazezew, 2021; Mkuburo *et al.,* 2020; Mukeka *et al.,* 2019). However, the impacts instigated by these species varied for each respondent. Different types of HWC were identified in all 3 levels of conflict following a framework with key area questions and typical responses. Understanding and addressing the social conflicts is central to attaining long-term conservation success, as it helps in understanding the nature and extent of HWCs which is vital because such conflicts tend to negatively affect local people's livelihoods (Dickman, 2010; Newmark *et al.,* 1993; Peterson *et al.,* 2012).

(a) Disputes: It is interesting to note that conflicts under dispute level appeared to be lower in all three stakeholder groups, with livestock farmers having the lowest percentage. Indicating that conflicts under this level only cover the smallest fraction. The findings correspond with those of Zimmermann *et al*. (2020), stating that the dispute level of HWC is a division of the bigger category of underlying and identity-based. Hence, focusing solely on the dispute level can lead to an incomplete understanding of the whole aspect as well as missing the crucial context resulting in recurrent conflicts over time. Consistent with the study conducted by Zimmermann (2014) and Zimmermann, McQuinn, *et al.* (2020), merely addressing dispute level of conflicts without acknowledging the underlying history of deeper friction of values and identities does not bring

about substantial change in the situation. The findings indicate that conflicts at the dispute level predominantly involve direct forms of HWC, with income loss emerging as the primary concern stemming from wildlife-induced damages, particularly crop damages. This is because majority of respondents practice agricultural crop farming. These findings correspond with other studies, who indicated crop losses as the primary agricultural threat in their respective studies (Kitampui & Odhiambo, 2021; Mekuriaw & Getahun, 2022; Mkuburo *et al.,* 2020).

(b) Underlying conflicts: Even though the 2022 wildlife conservation act demands victims of HWC to be consoled immediately after filing their claims to wildlife authorities, the study revealed that apart from human fatalities, none of the respondents received financial consolation for the damages caused by wild animals. Resulting in respondents facing financial burdens without any means of recovery. These findings correspond with findings from a study conducted by Chamba (2018) and Mkonyi (2022), who stated that there are no active consolation payment schemes in Tanzainia. Damages by wildlife causes substantial financial loss to farmers, resulting in affected stakeholders (farmers) resenting and developing negative attitudes towards the species (Kaswamila, 2010; Santangeli *et al.,* 2016). These findings correspond with the current study findings as it was noted that majority of respondents expressed negative attitude towards wildlife especially the problem causing species (PCS). Explaining the reason why some farmers employed lethal methods, additionally, these findings coincide with those of Mekonen (2020) and Mbise (2018), who found that absence of consolation schemes resulted in killing of wild animals. Therefore, active implementation of consolation schemes is crucial in addressing HWC, it might not directly settle the dispute level of conflict but it will resolve the underlying conflicts. Furthermore, the study underscores the lack of awareness programs and education on HWCs, leading to increased HWC cases, ineffective conflict resolution, economic impacts, psychological stress and increased

threats on personal safety. These findings coincide with the study conducted by Mekonen (2020) who stated that without proper education local communities will not know how to safely coexist with wildlife, leading to potential risks to human lives and properties. Kross *et al.* (2018), reported that farmers without knowledge of wildlife behaviour and mitigation measures will suffer significant losses due to damages caused by wildlife. Lack of awareness also contributes to fear and stress among communities living adjacent to protected areas, affecting their mental well-being.

(c) Identity-based conflicts: the results from this study also indicate that majority of respondents blame both village leaders and local government authorities due to failure to promptly attend to and address reported cases. This finding underscores a perceived lack of efficacy in the administrative and government structures tasked with conflict resolution and mitigation efforts. According to respondents' government officials are slow in responding to reports of HWC incidents and frequently fail to take timely action in addressing the conflict leading to respondents feeling neglected and blaming officials for their alleged negligence. Additionally, respondents also blame officials due to challenges faced in accessing help due to prolonged reporting procedure as there is no direct HWC emergency calls line, lack of consolation schemes, awareness programs and unaddressed raised concerns regarding HWC; resulting in other respondents not reporting HWC incidents. These findings correspond with findings from a study conducted by Liendekiye *et al.* (2022) and Rutta (2023), who stated that due to insufficient commitment of village leaders in reporting HWC on time other respondents do not report HWC cases because they feel nothing will be done. Overall, due to exclusionary practices majority of respondents feel neglected in decision-making process related to HWCs and conservation issues. This coincides with the study conducted by (Liendekiye *et al.,* 2022; Page, 2023).

2.6.2 Socio-demographic factors on the utilization of intervention strategies

Within the research area, the use of intervention measures for minimizing HWC is significantly influenced by socio-demographic characteristics. The age household head showed a significant negative association, suggesting that younger people are more likely to employ intervention measures than older individuals. This is due to the possibility that younger people have a different understanding of the risks involved with wild animals and often see the long-term benefit of using intervention strategies rather than none at all. These outcomes coincide with those of a study carried out by (Kansky *et al.,* 2014). The household head's residence was significant in predicting respondents utilizing intervention strategies. This is because locals can react quickly to animal dangers on the property, which makes the application of intervention strategies more essential and realistic. Furthermore, studies conducted by Dickman (2010) and Kwaslema *et al.* (2018) and Redpath *et al.* (2013), found that prior experiences with wildlife have a significant impact on negative views about wildlife. The results showed a strong negative association between respondents' attitudes toward wildlife and their likelihood of using intervention strategies to reduce HWC. This suggests that respondents who have negative views toward wildlife are less likely to use these strategies, because people who have unfavorable opinions about wildlife may be reluctant to use intervention strategies. The motivation of people to devote time, energy, and resources to implementing intervention strategies to reduce HWC declines when they fail to see the importance of managing and conserving wildlife**.**

2.6.3 Intervention strategies for mitigating human-wildlife conflict

When addressing HWC, it is essential to consider three key aspects in determining the appropriate intervention strategies at various conflict levels, namely: substance, process, and relationships (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). Existing

literature has predominantly concentrated on addressing conflicts at the dispute level, while neglecting the underlying and identity-based conflicts.

(a) Substance intervention

The primary dimension involves addressing HWC at the dispute level by implementing technical solutions to minimize actual damage (Zimmerman *et al.,* 2020). However, the results from this study indicated that the effectiveness of intervention strategies employed within the study varied among respondent based on the type of damage being prevented and type of wildlife species involved. These results correspond with findings from a study conducted by Liendekiye *et al.* (2022) who stated that effectiveness of intervention strategies can vary based on the specific context, species involved and the level of community engagement within the area. Based on the study findings, the technical intervention strategies employed by respondents include: both lethal and non-lethal methods. Although, lethal methods may reduce threats to human lives and livelihood, they also pose significant environmental damages as stated by Hampton *et al*. (2019) and health implications (Dad *et al.,* 2022). The use of the types of lethal methods within the study area, indicate lack of awareness in environmental, conservation and conflict issues because communities do not fully understand the ecological importance of wildlife or the long-term consequences of using lethal methods. For example, when plastics are burnt, they release noxious gases which contaminate the atmosphere and cause severe respiratory ailments and environmental issues (Adeniran *et al.,* 2022). Additionally, Perez-Lucas *et al.* (2018), states that the use of pesticides pose undesirable effects on human health and the environment (contaminating ground water and the soil). Therefore, effectively administering awareness and education programs covering these issues must be a priority in order to foster coexistence between humans and wildlife. According to Sitati *et al.* (2005), greater guarding effort combined with active deterrents

decreases the likelihood of damages and increases the chance of detecting wild animals before they enter the farm.

(b) Process intervention

To effectively address the underlying conflicts, it is crucial to ensure that initiatives to address past concerns are implemented efficiently, to promote coexistence between humans and wildlife. Within the study area, respondents highlighted concerns such as lack of consolation payments and lack of awareness and education programs. These issues led to negative perceptions towards wildlife and a sense that animals are prioritized over humans. These results are consistent with findings from studies conducted by Mbise *et al*. (2018) and Mekonen (2020), who found that lack of consolation schemes leads to negative attitudes towards wildlife. Rutta (2023), highlighted that unnecessary consolation delays and inadequate government responses indicate a lack of concern for the well-being of affected communities. Thus, it is crucial to actively implement consolation schemes, and promote awareness and education programs to tackle these conflicts effectively.

(c) Relationship interventions

The final phase involves implementing intervention strategies to address identity-based conflicts through means of readdressing past injustices and fostering trust to enhance the relationships among stakeholders (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). Within the study area, respondents highlighted major concerns such as exclusionary practices, and blaming authorities. Exclusionary practices have left majority of respondents feeling marginalized especially in decision-making processes related to HWC and conservation issues, leading to lack of community engagement and empowerment. This aligns with previous studies which have shown excluding local communities from decision-making undermines conservation efforts (Liendekiye *et al.,* 2022; Page, 2023). Respondents blame both village leaders and local government authorities for failure in addressing reported cases, emphasizing the

need for improved administrative structures and support programs. To address these conflicts, it is crucial for the government and NGOs to advocate for community-led initiatives, which has shown to be effective in fostering trust and positive relationships between local community members and government authorities, as stated by (Esmail *et al.,* 2023). Establishing an emergency HWCs hotline and a mobile community alert system could facilitate rapid responses. Additionally, tailored HWC Management Plans for each conservation area are necessary due to the variability of conflict dynamics. Acknowledging and accommodating diverse socio-economic factors contributing to the HWC occurrences, can effectively mitigate conflicts and promote coexistence between humans and wildlife if actively and effectively implemented.

2.7 Conclusion

In conclusion, the study revealed the pervasive nature of human-wildlife conflicts (HWC) across all three levels of conflict, emphasizing that concentrating exclusively on addressing HWC at the dispute level of conflicts can lead to partially understanding the whole aspect and overlooking crucial context resulting in recurrent conflicts over time. It highlights the key issues such as income loss, lack of consolation payment schemes, exclusionary practices and lack of transparency, indicating that there are systemic challenges hindering effective mitigation of HWC and provision of assistance to affected communities. Collectively, these key issues underscore the need for effective consolation payment schemes, inclusive decision-making processes, enhanced transparency and establishment of an emergency HWC hotline in HWC management efforts to foster more equitable and effective outcomes for both wildlife conservation and community well-being. Furthermore, the study emphasizes the importance of a holistic approach and active participation and involvement of all relevant stakeholders in conflict resolution. Advocating for the application of the Conservation Conflict Transformation Model (CCT) to address the multifaceted nature of these conflicts. While acknowledging the variation of HWC intensity

from region to region, the study advocates for the development of specific conflict management plans tailored to individual conservation areas alongside the existing “National Human-Wildlife Management Plan”.

2.8 Recommendations

Based on the presented findings and conclusion, it is recommended for governmental authorities and non-governmental organizations (NGOs) to prioritize disseminating conservation education and awareness initiatives among local communities near protected areas. In addressing the financial constraints imposed on affected communities due to HWC, the study recommends the establishment of innovative and effective financial consolation schemes. Additionally, fostering community involvement can enable the development and implementation of strategies at national, regional, district, and ward levels to mitigate the impact of Human-Wildlife Conflicts (HWC). This involves adopting alternative and preventative measures, including both traditional and innovative conservation approaches. Continuous monitoring of wildlife activities and behaviour by government authorities is crucial for obtaining information on the distribution of problematic animals within and around protected areas. Such data is essential for predicting spatial and temporal patterns of HWC. Lastly, it is suggested that similar studies involving all relevant stakeholders be conducted regularly to enhance the effectiveness and inclusivity of national conservation policies.

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Conflict of interest statement

The authors declare no conflict of interest which may be considered as potential competing interests.

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CHAPTER THREE

Manuscript two

3.0 Assessment of Hidden Costs Associated with Human-Wildlife Conflicts in Communities Adjacent to Nyerere National Park, Tanzania

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Abstract
Human-wildlife conflicts (HWC) inflict significant challenges to communities, predominantly affecting farmers neighboring Nyerere National Park (NNP). Over the years, HWC has been documented in the form of crop raiding, animal predation, property destruction, and human attacks, while the hidden costs such as opportunity, transaction, and health costs have been overlooked. As a result, it contributes to an insufficient body of comprehensive literature on the issue. The Wildlife Conservation Act (WCA) of 2022 does not address the hidden costs of HWC, which are understudied to inform consolation policies. However, communities neighboring NNP and others bear the burden of these hidden costs. This study seeks to examine HWC by holistically assessing both visible impacts and hidden costs of HWC, focusing on identifying existing visible and hidden costs, quantifying their economic implications, and evaluating socio-demographic factors influencing community members' attitudes towards wildlife conservation within the study area. Data were collected using household questionnaires (n=324), key informant interviews, and focus group discussions. The results

showed that respondents suffered significant economic losses associated with HWC in addition to visible impacts and hidden costs. Local communities, especially farmers in the study area, incurred hidden costs such as opportunity costs, transaction costs, psychological effects, and health impacts. The total estimated economic losses for both visible impacts and hidden costs was about USD 1 455.53 per household/year. Hidden costs alongside uncompensated economic losses pose adverse impacts and contribute to majority of respondents (98.8%) expressing negative attitudes towards wildlife. These results, highlight the importance of comprehensively addressing both visible and hidden costs to foster sustainable human-wildlife coexistence and conservation efforts in Tanzania. Additionally, respondents across the study area differed significantly (X^2=24, df=7, $p < 0.05$) in their attitudes towards wildlife conservation. There is a need to review the WCA of 2022 to incorporate the hidden costs and effectively implement consolation schemes to affected parties in order to ensure sustainable management of wildlife resources in the country.

Key words: Human-wildlife conflicts, visible impacts, hidden costs, economic losses, farmers' perspectives

3.1 Introduction

Human-wildlife conflicts (HWC) presents a significant concern within the field of conservation worldwide. It occurs when the needs and behavior of wildlife negatively impact the goals of humans or when goals of humans negatively impact the needs of wildlife (Hariohay & Røskaft, 2015). It also results into adverse impacts to the affected parties. HWC stands out as a paramount and concerning issue discussed in various social, political and economic forums around the globe. The IUCN (2023) underscore the importance of effectively managing HWC for the purpose of achieving the United Nations for Biodiversity 2050, wherein "humanity coexists harmoniously with nature, ensuring the protection of wildlife and other living species".

Over the years, studies have primarily focused on the visible impacts of HWC, documenting them in form of crop raiding by wild herbivores and livestock depredation by wild carnivores (Aryal *et al*., 2014; Kebede *et al*., 2016; Malugu *et al.,* 2011; Meing'ataki, 2005). For instance, in African regions, communities may experience agricultural yield reduction of 10-15% due to elephants, imposing substantial burdens on affected individuals particularly those in marginalized socio-economic strata. Several studies in Kenya documented livestock predation around Kajiado country Manoa and Mwaura (2016) and Manoa *et al.* (2020) as well as Serengeti and Ruaha National Park in Tanzania (Kalyahe *et al.,* 2022).

Apart from the visible impacts, HWC has a range of poorly documented and understudied hidden costs on communities in low-income nations, comprising of opportunity and transaction costs Barua *et al.* (2013) and Ogra (2008), as well as health impacts that weaken farmer's physical and mental abilities. These effects extend beyond immediate wildlife threats and associated economic losses (Mayberry, 2015; Muyoma, 2016). Additionally, Manoa (2021) stated that hidden costs are frequently excluded from economic evaluations. However, some studies indicate that hidden costs have more impact on affected communities than visible costs. Nonetheless, most efforts to address HWC and implement mitigation polices tend to focus on visible aspects of the issue, neglecting the hidden costs (Mayberry, 2015; Manoa *et al*., 2021; Yeshey *et al*., 2022). Additionally, the understudied hidden costs associated with HWC are not addressed in Tanzania's Wildlife Conservation Act of (2022) and receive limited research attention to guide policy decisions. However, communities adjacent to Nyerere National Park incur these hidden costs.

Furthermore, some of the hidden costs arise from the visible impacts of HWC, which are usually delayed and only become apparent after such conflict occurs, leading to the conclusion that the two types of

impacts are sometimes intertwined. According to Barua *et al.* (2013) and Ogra, (2008), hidden costs associate with HWC include: opportunity costs, transaction costs, and health impacts. Communities near protected areas are faced with societal issues, including opportunity costs (Manoa *et al.,* 2020). For example, farmers who experience frequent crop raids by wildlife are forced to devote more time and money to restoring damaged properties, replanting crops, travel long distances to obtain water, which limits their options for other income-generating activities (Manoa & Mwaura, 2016; Mariki, 2016). According to Barua *et al.* (2013), transaction costs are caused by inefficient bureaucracy and delays in compensating HWC victims. Furthermore, due to transaction costs related to HWC, affected individuals have negative perception towards wildlife. For instance, research by Mekonen (2020) and Mbise *et al.* (2018) indicated that absence of consolation schemes results in negative perception towards wildlife. Furthermore, HWC have significant impacts on the health and well-being of those who are impacted. In addition to the physical harm caused by encounters with wild animals, persistent conflict situations can cause chronic stress and psychological strain, which can lead to negative impacts on one's health (Barua *et al.,* 2013).

Hence, by adopting a holistic viewpoint hidden costs which are often overlooked can be identified. It is suggested that understanding the entire context of HWC beyond the visual, economic, and physical is necessary as it contributes to the sustainable and successful management of HWC. Furthermore, there is a need to comprehend human rights and social justice-based conservation techniques Fernández (2010), as well as the hidden components of HWC (Barua *et al.,* 2013). Therefore, this study aimed to evaluate both visible impacts and hidden costs of HWC in communities adjacent to NNP by, identifying existing visible and hidden costs, quantifying their economic implications, and evaluating factors influencing communities' attitudes towards wildlife conservation.

3.2 Methodology

3.2.1 Study area description

The study was conducted in villages adjacent to Nyerere National Park. A total of six villages namely Kanyenja, Katurukila, Magombela, Msolwa Station, Nyange, and Sagamaganga (Fig. 3.1) were purposively sampled based on proximity to NNP and the number of human-wildlife conflict cases. Nyerere National Park was gazetted in 2019 and named in honor of Tanzania's first President the late Mwalimu Julius Kambarage Nyerere. It is one of the world's largest wildlife sanctuaries and Tanzania's largest National Park. The Park is situated in South Eastern Tanzania, covering approximately 30 893 km^2. It is bordered by Mikumi National Park to the Northwest and Udzungwa Mountains National Park to the West (Saanya *et al.,* 2021). It is divided into Kalulu, Seka, Ilonga, Mbarangandu, Msolwa, and Matambwe sectors (Saanya *et al.,* 2021).

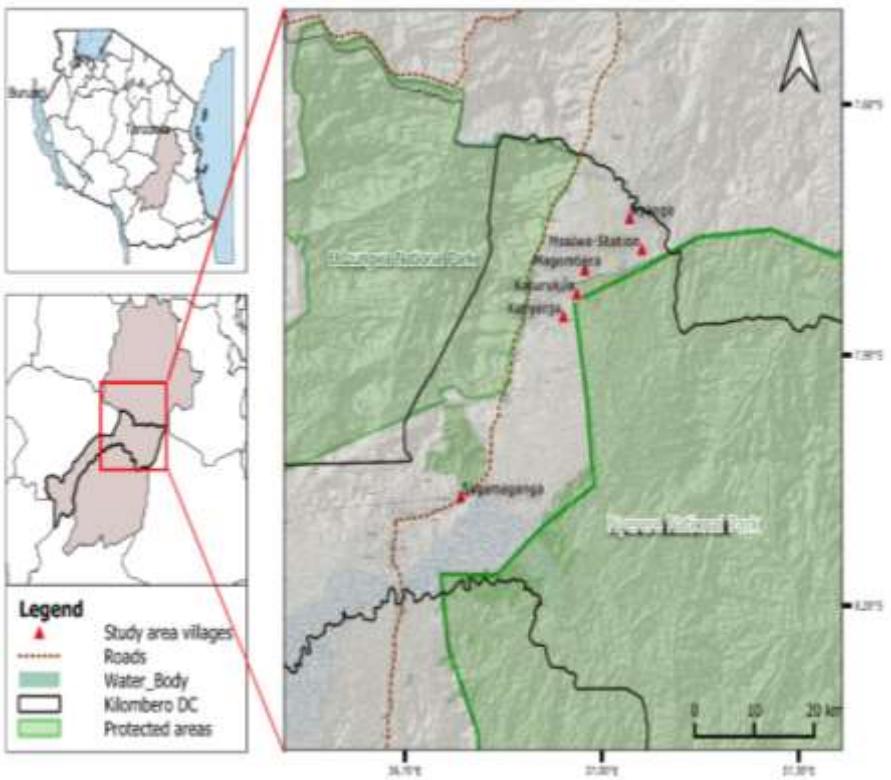

Figure 3.1: Map of the study area outlining the selected villages (Source: Simasiku *et al.,* 2024)

3.2.2 Study design

The study employed a cross-sectional design because it is cost-effective and can provide an instant overview of the population. The study design is effective for describing populations and establishing cause-and-effect relationships by identifying patterns, correlations, and incidence rates within a community (Given, 2008).

3.2.3 Sampling procedure

The minimum Sample size was determined using the formula (Equation 3.1) described in Bartlett *et al*. (2001).

$\mathbf{n_0 = \frac{t^2 * p * (1-p)}{d^2}}$**……**Equation 3.1

$\mathbf{n_0 = \frac{t^2 * p * (1-p)}{d^2} = \frac{1.96^2 * 0.73 * (1-0.73)}{0.05^2}}$ **= 303 household sample size**

Where:

n_0 = Minimum estimated sample size

t^2 = Value of the t-distribution corresponding to the chosen alpha level

p = Estimate of population proportion

d^2 = Margin of error (recommend using 5%

The total number of households in 6 selected villages amounted to 18 864 with 13 801 households (equivalent to 73%) forming the study households. This resulted in a minimum required sample size of 303 households. Henceforth for each selected village, at least 54 study households were randomly selected for interviews, making a total of 324 households for the whole study.

3.2.4 Data collection methods

The study collected data through primary method. In acquiring primary data from the designated villages; 324 household questionnaires, 12 key informant interviews, and 6 focus group discussions were employed. The questionnaire was pre-tested on 30 randomly selected individuals from all 6 selected villages of varying age, sex, and background among the local communities, which were not included in the main sample group. This assisted in adjusting the questionnaire accordingly. The pretested questionnaires were used to assess the method's practicability, reliability, and suitability (Hashim, 2022). Feedback from respondents helped to enhance the sequence and layout of the questionnaire. The questionnaire comprised of closed and open-ended questions. Household questionnaire involved in-person oral interviews to obtain data related to the socio-demographic characteristics, forms of HWC within the study area, types of livestock and cultivated crops, types of species causing damages, attitudes towards wildlife conservation, benefits derived from wildlife, hidden costs and their effects, as well

as household economic losses of HWC. 12 Key informant interviews comprising village leaders and extension officers were conducted to explore the types of visible and hidden impacts associated with HWC.

Focus Group Discussions (FDG) were conducted to gather information on how local communities perceived HWC and the benefits derived from wildlife. In addition, the method was used to reinforce the data collected through the questionnaires. 6 FGD sessions were conducted in each study village, and the group size in each discussion site varied from 8 to 12. Participants of the FGD were village community members of both sexes to discuss their experience of HWC and gather information on problem-causing species in the area. They also provided insights into the knowledge, opinions, and attitudes of the local communities regarding HWC. Data collected from group discussions was collated and summarized using the context analysis method. Thus, the information acquired was triangulated through questionnaires.

3.3 Data Analysis

This study employed a Statistical Package for Social Sciences (SPSS) to analyze the collected data from which descriptive statistics such as means, frequencies, and proportion were computed. Graphs and tables were developed to summarize the key findings from the collected data. The economic losses for both crops and livestock were calculated based on the market price with reference from the markets within the study area. Monetary opportunity costs and transaction costs were assessed and quantified to provide a comprehensive assessment of the economic implication of hidden costs on respondents. Binary logistic regression was used to evaluate the influence of socio-demographic predictors on respondents' attitudes towards wildlife conservation. The independent variables were the socio-demographic predictors of (X_{HA}, X_G, X_{HHS}, X_{EDU}, X_{EA}, X_R, and X_{HWCEXP}) as indicated in Table 3.1 (Heinrich, 2016; Larson *et al.,* 2021; Makumbe *et al.,* 2022; Munuo,

2016; Tadesse & Zewde, 2019). The logistic equation is expressed in Equation 3.2. Prior to the binary logistic regression analyses, the model was assessed for compliance with binary logistic regression assumptions. Pearson correlation test was used to measure the correlation between independent variables and dependent variable. It indicated a substantial correlation between the independent variables and dependent variable and the correlation between independent variables was < 0.7 (Pallant, 2011). In all statistical analyses, the significance value (alpha) was set at 0.05. The qualitative component of the data was analysed using content analysis (Shava *et al.,* 2021). All financial attributes were quantified in Tanzanian currency and converted to USD (@ 1 $ =2 388.38TZS) to enable comparison with the existing literature.

$$Yi = \frac{e^{\beta o+\beta XHA+\beta 2XG+\beta XHHS+\beta XEDU+\beta XEA+\beta XR+\beta XHWCEXP}}{1+e^{\beta o+\beta XHA+\beta 2XG+\beta XHHS+\beta XEDU+\beta XEA+\beta XR+\beta XHWCEXP}} \ldots\ldots \text{Equation 3.2}$$

Where:

Y_i = Dependent variable

β_o = y-intercept (Constant term)

β = Coefficients that show the average change in the dependent variable

X = Socio-demographic predictors: household age (X_{HA}), household gender (X_{HG}), household size (X_{HHS}), education level of household (X_{EDU}), main source of income (X_{EA}), residence status of household head (X_R), and HWC experience status (X_{HWCEXP}).

Table 3.1: Description of the dependent and independent variables

Variables	Symbol	Variable description
Dependent		**Dependent (Y)**
Attitudes towards wildlife conservation	(Y_{ATWC})	0=Positive 1=Negative attitude towards wildlife conservation
Independent		**Independent (X)**
Age of household head	(X_{HA})	Age of household head (Years)
Gender of household head	X_G	Gender of household head 0=Female, 1=male
Number of household members	(X_{HHS})	Number of household members 1-3 people=1; 4-6 people=2; 7-9 people=3; ≥10 people=4
Education level of household head	(X_{EDU})	Education level of household head 0=No formal education 1=Primary level 2=Secondary level 3=Tertiary
Economic Activity: Main source of income	(X_{EA})	Main source of income 1=Crop farming 2=Livestock farming 3=Mixed farming
HWC experience	(X_{HWCEXP})	0=No conflicts 1=Conflicts

(Simasiku *et al.*, 2024)

3.4 Results

3.4.1 Demographic and socio-economic characteristics of respondents

Table 3.2 depict the demographic and socio-economic characteristics of respondents. A total number of 324 respondents were interviewed, of which 71% (n=230) were male and 29% (n=94) were female. Respondents aged 18 to 95, were distributed across various age groups, with a mean of 44.25, of which 9% (18-25 years), 46.6% (26-45 years), and 44.4% (≥46 years). Findings

indicated a diverse educational background, ranging from no formal education to tertiary education, with 75.6% having primary education, 7.7% secondary education, 0.9% tertiary education and 15.7% had no formal education. This implies a significant level of illiteracy within the study area. Additionally, the predominant occupation of the respondents (41.7%) was crop farming, while livestock keepers and mixed farmers accounted for (29.3%) and (29.0%) respectively.

Table 3.2: Demographic and socio-economic characteristics of respondents

Variables	Frequency	Percentage (%)
Age		
18-25	29	9.0
26-45	151	46.6
≥46	144	44.4
Gender		
Male	230	71.0
Female	94	29.0
Education level		
No formal education	51	15.7
Primary	245	75.6
Secondary	25	7.7
Tertiary	3	0.9
Primary livelihood activity		
Crop farming	135	41.7
Livestock keeper	95	29.3
Mixed farming (crop farming and Livestock)	94	29.0

(Simasiku *et al.,* 2024)

3.4.2 Human-wildlife conflicts identification

3.4.2.1 Visible impacts associated with human-wildlife conflict

Out of 324 respondents, 97.4% reported to have experienced HWC while 2.6% reported that they do not experience any HWC. Among those who experienced HWC, 43% reported that they experienced

crop damage, 29% faced livestock depredation and 28% experienced both crop damage and livestock depredation. The type of damages faced by respondents within the study area was significantly different (X^2 = 4.393, df = 1, $p < 0.05$). Crop damage was the most prevalent form of conflict as compared to the others. Figure 3.2a, indicate that the main crops cultivated within the study area included rice (*Oryza sativa*: 66.1%), maize (*Zea mays* 11.1%) Sugarcane (*Saccharum officinarum* 10.2%), Cassava (*Manihot esculenta* 3.3%) and Sweet Potato (*Ipomoea batatas* 3.0%). Other crops were combined, making up approximately 6.3%. Results further revealed that crop losses were mainly caused by Elephants (*Loxodonta Africana)* 57.5%, followed by Monkeys (*Chlorocebus pygerythrus)* 19.9%, Buffalo (*Synerus caffe)* 5.4%, and Hippopotamus (*Hippopotamus amphibious)* 4.6% (Figure 3.2b). Although livestock depredation was comparatively lower than crop losses, farmers still perceived it as highly significant and excruciating. Livestock were categorized according to the affected animal, namely cattle, goat, sheep, and poultry. Results in Figure 3.2c and d indicate that poultry accounted for the highest loss at (91.4%) with monkeys (56.8%) being the main cause, followed by cattle (3.3%), sheep (2.9%) and goats (2.4%).

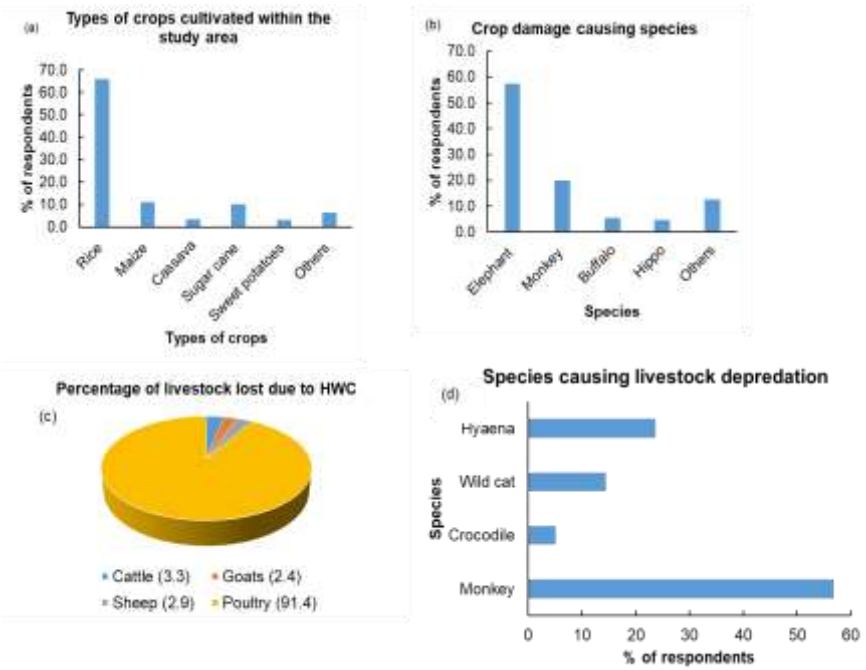

Figure 3.2: (a) Types of crops cultivated within the study area, (b) crop damage causing species, (c) percentage of livestock lost due to HWC and (d) species causing livestock depredation

3.4.3 Hidden costs associated with human-wildlife conflict

Results show that, respondents identified various hidden costs of HWC and how they impact their well-being (Table 3.3). The study highlighted that these hidden costs pose a major obstacle for communities, particularly farmers reliant on agricultural farming and livestock keeping for their livelihood.

(a) Opportunity cost

Majority of respondents perceived wildlife as destructive due to damages instigated by them. The findings indicated that crop damage and livestock predation resulted in a series of hidden costs for communities, particularly crop farmers and livestock keepers within the study area. Farmers invested considerable time and

resources (Table 3.4) in protecting their crops and livestock from wildlife attacks, diverting attention from productive agricultural activities, leading to reduced yield, food insecurity, and income instability (Table 3.3). Increased workload due to these challenges resulted in physical exhaustion and stress among farmers, impacting their health and well-being. Additionally, the presence of wildlife within the vicinity restricted respondents' movements, leading to further hidden costs such as loss of school time for their children, inability to attend to sick relatives as indicated by several respondents, and threats to their safety. Guarding farms and herding livestock were the common practices within the study area, which exposed households to harsh weather conditions and insect-borne diseases like malaria. These practices also resulted in ultimate delay in income-generating activities, increased workload, loss of time, loss of sleep, living in fear, increased stress and anxiety, and costs endured due to preventing wildlife attacks.

(b) Transaction costs

Respondents within the study area also faced adverse impacts from the transaction costs of HWC (Table 3.3) resulting into substantial financial burden. Transaction costs were incurred through respondents making follow-ups regarding their consolation claims. The estimated transaction costs amounted to USD 172.65 per household/year (Table 3.4), indicating additional financial burdens and resources allocation faced by respondents.

(c) Psychological impacts

Communities living adjacent to Nyerere National Park, particularly farmers, live in constant fear of wildlife threats, leading to increased stress and anxiety. According to results obtained from respondents, the need to guard farms and livestock resulted in sleep deprivation, which further intensified the psychological toll on farmers (Table 3.3).

(d) Health costs

According to Table 3.3, both the opportunity costs and psychological impacts incurred by farmers had implications on respondents' health. According to respondents sleep deprivation and stress negatively affected their mental health, while guarding, property damage repair, and crop replanting exposed farmers to harsh weather conditions and insect-borne diseases like malaria. These practices not only increased the risk of contracting diseases but also contribute to a rise in local malaria cases. Additionally, medical treatment resulting from HWC incidents imposed an increased economic burden on respondents.

Table 3.3: Visible costs of HWC that serve as sources of hidden costs as reported by respondents

Visible costs	Intermediary	Impacts	Hidden costs
Crop damage Livestock depredation	Loss of crops and livestock to wild animals	Destructive, Reduced yield, food insecurity, income instability, and workload increase	Opportunity cost/ Monetary opportunity cost; Transaction costs
Restricted movement	Presence of wild animals within the area	Delay in income-generating activity, Loss of school time, Loss of time, Unable to take sick relatives to hospital, Threatened safety	Opportunity costs
Increase implementation of intensive crop protection and management measures	Guarding farms and livestock exposes them to hard weather conditions and vector-borne diseases	Increased workload, loss of time, loss of sleep, living in fear, increased stress and anxiety, exposure to harsh weather conditions and diseases, costs of preventing attacks	Opportunity, Transaction and Health costs, Psychological impacts

Source: (Field data, 2023)

3.4.4 Economic valuation for both visible and hidden costs of human-wildlife conflict

Results in Table 3.4 show that, visible and hidden costs of HWC pose economic costs on affected parties through crop damage, livestock depredation, monetary opportunity and transaction expenses. The total estimated economic loss incurred by respondents through crop damage was USD 1 088.84 per household/year, while livestock losses were estimated to be USD 72.82 per household/year. In addition to the visible costs, monetary opportunity expenses comprised of fencing, guarding, and costs on other mitigation measures and transaction costs consisting of expenses related to consolation fees follow-up were incurred by respondents. Collectively, the expenses incurred on fencing comprised of the installation, maintenance and repair which included labor costs, purchasing of wire and iron sheets as well as solar panels, while guarding consisted of labor and material costs on purchasing torches, batteries, wood fuel as well as vuvuzela, and expenses on other mitigation measures included purchasing of required equipment as well as maintenance. According to the results obtained the total estimated expenses borne by respondents within the study area was USD 121.22 per household/year. Transaction costs amounted to USD 172.65 per household/year. Results show that the total estimated economic loss due to HWC as reported by respondents amounted to USD 1 455.53 per household/year. However, no consolation fees were paid for the losses incurred.

Table 3.4: Economic losses and expenditure due to human-wildlife conflict

Category of HWC	Expenses	Total annual costs TZS	Average costs TZS per HH/Year	Average costs USD per HH/Year
Visible costs	Crop raiding	582 530 000	2 600 580.36	1 088.84
	Livestock depredation	31 480 000	173 922.65	72.82
Hidden costs	Monetary opportunity costs	23 383 500	289 521.06	121.22
	Transaction costs	36 288 000	412 363.64	172.65
Grand Total		**673 681 500**	**3 176 436.84**	**1 455.53**

Remark: *1 USD = 2388.38 TZS based on the exchange rate of September 2023, TZS=Tanzania shillings, HH=household

3.4.5 General description of respondents' attitudes towards wildlife

Majority of the respondents held a negative attitude towards wildlife and wildlife conservation. There was a statistical difference in the attitudes towards wildlife/ wildlife conservation among respondents χ^2 (7, N = 324) = 24, p=0.001 < 0.05 (Table 3.6). A total of (98.8%) respondents disliked wildlife as they considered them as destructive, dangerous and aggressive, and only (1.2%) of respondents liked them as they considered them interesting but only when they are not causing damages. Additionally, (72.2%) indicated that wildlife conservation is not beneficial to their community and only (21%) reported that it is beneficial as depicted in (Table 3.5).

Table 3.5: Respondents' attitudes of towards wildlife and wildlife conservation (N=324)

	Respondents' perception on wildlife	Percentage	Wildlife conservation beneficial	Percentage
Dislike	Dangerous and aggressive	9.6	Neutral	6.8
	Destructive	89.2	No	72.2
Like	Interesting species	1.2	Yes	21

3.4.5.1 Influence of socio-demographic predictors on respondents' attitudes towards wildlife conservation

Due to reported hidden costs (Table 3.3) and perceived economic losses (Table 3.4) associated with HWCs within the study area, binary logistic regression was performed to evaluate the relative influence of socio-demographic predictors on respondents' attitudes towards wildlife conservation within the study area (Table 3.6). The model contained seven independent variables (household head age (X_A), economic activity (X_{EA}), level of education (X_{EDU}), household head gender (X_G), household size (X_{HHS}), human-wildlife conflict experience (X_{HWCEXP}), and residence of household head (X_R). The full model containing all predictors was statistically significant, χ^2=24, df=7, p=0.001 < 0.05, indicating that the model was able to distinguish between respondents who indicated negative and positive attitudes towards wildlife conservation. As illustrated in Table 7, only four of the independent variables made a statistically significant contribution to the model; household head age (p=0.002), level of education (p=0.042), household size (p=0.022), HWC experience (p=0.052). 3 independent variables indicated an odds ratio less than 1 and 1 independent variable indicated an odds ratio greater than 1. The strongest predictor of reporting negative attitude towards wildlife conservation according to results was human-wildlife conflict experience (X_{HWCEXP}) indicating an odds ratio of 4.238 with a positive relationship, emphasizing that respondents who

experienced HWC were 4 times more likely to indicate negative attitudes towards wildlife conservation. The lowest predictor was level of education (X_{EDU}) indicating an odds ratio of 0.558 with a negative relationship, highlighting that respondents' with high level of education were 0.5 times less likely to have negative attitudes towards wildlife conservation (Table 3.6).

Table 3.6: Binary logistic regression model analysis evaluating the influence of socio-demographic predictors on respondents' attitudes of towards wildlife conservation.

Variables	β	S.E.	Wald	df	Significance	Exp (β)
Constant	3.258	1.145	8.098	1	0.004	0.038
X_A	-0.035	0.011	9.957	1	**0.002****	0.965
X_{EA}	-0.130	0.165	0.615	1	0.433	0.878
X_{EDU}	-0.583	0.287	4.136	1	**0.042****	0.558
X_G	0.117	0.302	0.15	1	0.698	1.124
X_{HHS}	-0.515	0.226	5.217	1	**0.022****	0.597
X_{HWCEXP}	1.435	0.739	3.776	1	**0.052****	4.238
X_R	0.099	0.411	0.058	1	0.81	1.104

Dependent Variable: Y_{ATWC}, **represents significance (P<0.05) at 95% significant level. The total sample size (N) considered in this analysis was 324 households.

3.5 Discussion

The study revealed that crop farming is the predominant economic activity within the study area. This aligns with other studies by Mkuburo (2020) and Kitampui and Odhiambo (2021) who emphasized the prominence of crop farming as a primary occupation in rural settings. Findings also depict that both crop farming and livestock keeping are crucial for the local community's livelihood but highly prone to HWC, particularly with elephants being the main culprits for crop raiding. This aligns with results from studies emphasizing the detrimental impact of HWC on agricultural activities as well as community wellbeing (Karanth & Vanamamalai, 2020;

Malugu *et al.,* 2011; Mayengo *et al.,* 2017; Milupi *et al.,* 2023). Inclusively, these findings contribute to the multifaceted understanding of rural livelihood dynamics and highlights the complex interplay between agricultural activities, economic diversification and wildlife within the study area.

3.5.1 Human-wildlife conflicts identification

(a) Visible costs of human-wildlife conflicts

In the study area, both crop farming and animal husbandry play vital role in sustaining the livelihood of local communities; though susceptible to damages caused by wildlife, resulting in adverse consequences for affected parties. These findings correspond with results from a study conducted in villages neighbouring Mikumi National Park by Rutta (2023), who highlighted the detrimental impact of wildlife damages on the socioeconomic wellbeing of individuals reliant on crop cultivation and animal husbandry. Among the various forms of conflict observed within the study, crop damage emerged as the most prevalent problem. These findings coincide with other researcher who found that crop damage was the most serious problem in their respective study areas (Karanth and Vanamamalai, 2020; Malugu *et al*., 2011; Mayengo *et al*., 2017; Milupi *et al*., 2023). Respondents identified several wild animals responsible for crop damage within the study area of which elephants were considered more problematic. This aligns with findings from studies conducted by Mayengo *et al.* (2017) and Milupi *et al.* (2023), who identified elephants as the primary culprits of crop damage. Even though livestock depredation was comparatively lower than crop losses, farmers still perceived it as highly significant and excruciating. Poultry accounted for the highest loss, attributed to monkeys.

(b) Hidden costs of human-wildlife conflicts

The findings of this study contribute to the literature on HWC, particularly in terms of opportunity costs, transaction costs, psychological, and health impacts within affected communities.

These findings underscore the significance of hidden costs associated with crop damage and livestock depredation caused by wild animals. These hidden costs extend beyond the immediate economic losses and encompass various dimensions affecting the livelihood and well-being of households. Consistent with studies conducted by Hariohay and Røskaft (2015) and Mayberry (2015) and Muyoma (2016) and Yeshey *et al.* (2022), the current study highlights the opportunity costs incurred by farmers who allocate substantial time and resources towards protecting their crops and livestock from wildlife attacks. This diversion of effort not only diminishes agricultural productivity but also aggravates food and income insecurity among affected communities. Additionally, these opportunity costs are significant if quantified into monetary terms for all affected household.

The reported increase in workload by respondents due to wildlife-related damages align with findings from similar studies conducted by Linuma *et al.* (2022) and Manoa *et al.* (2020) and Ogra (2008), emphasizing the physical and psychological toll experienced by farmers under such circumstances. According to Barua *et al.* (2013) and Linuma *et al.* (2022) and Ogra (2008), HWC just as crop raiding reduces food supplies, prompting men to search for work and urging women to remove or replant damaged crops. The current study results agree with previous findings from studies conducted by Hariohay and Røskaft (2015) and Kaswamila (2010) indicating that the presence of wildlife imposes additional burdens on households, manifesting in loss of school time, restricted movements, and compromised safety. The common practice of guarding farms and livestock, as observed in this study, confirms with the findings of research conducted by (Mekonen, 2020). This practice not only exposes individuals to adverse weather conditions and diseases but also disrupts income-generating activities, prolonging cycles of poverty and vulnerability. The multifaceted impacts in this study, including increased stress, anxiety, and increased malaria cases, underscore the interconnectedness of wildlife-related challenges

with broader health and socio-economic dynamics within the study area.

Additionally, this study highlights the substantial burden that HWC imposes on farmers, particularly in terms of transactional and monetary opportunity costs. These results align with previous research highlighting the economic strain faced by individuals and communities living close to wildlife habitats (Redpath *et al.,* 2015). The negative impact of transaction and monetary opportunity costs, as evidenced by the significant investments made by farmers in preventive measures such as fencing, solar panels, and deterrents, reflects the persistent nature of HWC. These findings support previous research demonstrating the substantial economic and social costs borne by agricultural communities due to wildlife conflicts (Dickman and Hazzah, 2016). Hidden costs incurred due to property repair and crop replanting further emphasize the financial strain experienced by individuals faced with HWC. Such costs not only disrupt agricultural livelihood but also aggravate existing socio-economic vulnerabilities within affected communities (Dickman, 2010). Results from this study confirm with previous studies highlighting the increasing economic consequences of HWC, including reduced income and food insecurity (Ogra, 2008). Additionally, it was evident that the majority of the affected households followed up on the consolation claims. However, despite all their efforts, no consolation payments were made for the reported cases. Respondents revealed that the time and money consumed could be used for other income-generating activities.

Furthermore, the intensified fear of wild animal attacks reported by respondents align with existing literature highlighting the psychological burden carried by individuals living in HWC-prone areas (Ogra, 2008; Nafeesa, 2014; Muyoma, 2016). The constant threat of wildlife intrusions not only induces stress and anxiety but also disrupts daily routines and impairs mental well-being, as demonstrated by respondents. The loss of sleep reported by farmers

underline the pervasive nature of HWC, highlighting its potential to aggravate existing health disparities and prolong cycles of poverty within affected communities. In addition, the exposure of farmers to adverse weather conditions and insect-borne diseases while safeguarding their farms and livestock emphasizes the intersecting challenges faced by individuals living at the interface of human settlements and wildlife habitats. These findings correspond with Muyoma (2016) and Ogra (2008)'s observation that prolonged night guarding increases the risk of diseases such as malaria, which underscore the crucial need for holistic and context-specific interventions aimed at mitigating the impacts of HWC while promoting coexistence between humans and wildlife.

3.5.2 Economic magnitude of human-wildlife conflicts for both visible and hidden costs

The findings from this study highlight the significant economic burden imposed on farmers within the study area due to HWC, particularly through crop raiding, livestock depredation, monetary opportunity costs and transaction costs. The occurrence of crop raiding incidents, with an estimated annual economic loss of USD 1 088.84 per household per year, underlines the tangible financial impact experienced by farmers. This can be attributed to majority of respondents practicing agricultural crop farming with majority of farms situated close to the national park boundary. This correspond with previous studies by Biset *et al.* (2019) and Kideghesho (2010), who noted that farms situated near protected areas or national park boundaries are more susceptible to wildlife raids, resulting in substantial economic losses. Comparing our findings to those reported by Kideghesho (2010), we observed a higher average loss per household/year, potentially attributed to variations in factors such as farm sizes, cultivated crops, and wildlife species present in the area. Furthermore, the predominance of crop farming as the primary source of income within the study area likely contributes to the higher economic losses incurred through crop damage

compared to losses from livestock depredation, consistent with findings by Baral *et al.* (2021) in Nepal.

Apart from the visible losses, the study evaluated the monetary opportunity and transaction costs incurred by farmers in implementing preventative measures to mitigate HWC events and making follow-ups on consolation fee claims. These expenses include costs on materials and labor, which highlights the additional financial strain placed on farmers in safeguarding their crops and livestock; indicating additional financial burdens and resources allocation faced by respondents within the study area. Furthermore, when considering the total economic impact of crop damage, livestock depredation, monetary opportunity and transaction costs, it becomes evident that crop losses outweigh other losses, emphasizing the severity of human-herbivore conflicts (HHC) within the study area. This corresponds with similar studies conducted elsewhere, which also highlights crop damage as a critical issue in human-wildlife conflict management strategies (Amare & Serekebirhan, 2019; Ayalew & Melese, 2022; Kabuusu *et al.,* 2018; Leta *et al.,* 2016; Nyamwamu, 2016).

3.5.3 Factors influencing respondents' attitudes towards wildlife and conservation

Majority of respondents held a negative attitude towards wildlife conservations due to the damages caused and financial burdens that came along with it with no consolation fees received for the damages incurred. This contributed to the negativity expressed by respondents towards wildlife and wildlife conservation. These results are consistent with findings from studies conducted by Mbise *et al.* (2018) and Mekonen (2020), who found that lack of consolation schemes leads to negative attitudes towards wildlife. Rutta (2023), highlighted that unnecessary consolation delays and inadequate government responses indicate a lack of concern for the well-being of affected communities. Thus, it is crucial to actively implement of consolation schemes, and promote awareness and education

programs to tackle these conflicts effectively. Additionally, factors such as education, age, household size and HWC experience significantly influenced respondents' attitudes towards wildlife conservation. Increase in education level resulted in a positive increase in respondents having positive attitudes towards wildlife conservation. This corresponds with results from studies conducted by Kwaslema (2018) and Lyamuya (2016), who found that respondents with formal education were more likely to have positive attitudes, while those with no formal education were more likely to have negative attitude towards wildlife conservation.

3.6 Conclusions and Recommendations

There are complex dynamics surrounding human-wildlife conflict (HWC) and its far-reaching impacts on communities, particularly farmers in the study area. The significant losses from crop raiding and livestock depredation, underscore the urgent need for effective mitigation strategies to alleviate economic burdens and enhance agricultural sustainability. The substantial monetary opportunity expenses incurred by farmers in implementing preventative measures highlight the ongoing struggle to mitigate HWC incidents and minimize associated costs. Furthermore, the hidden costs of HWC, including opportunity costs, transaction costs, psychological impacts, and health costs, unveil the multifaceted nature of the challenges faced by affected communities. These hidden costs not only intensify economic losses but also take a toll on farmers' physical and mental well-being, as well as the overall resilience of the affected households. Furthermore, negative attitudes towards wildlife species and wildlife conservation among the majority of respondents indicate a critical need for community engagement and education initiatives to ensure sustainability in managing wildlife resources in NNP. Therefore, addressing negative perceptions and fostering greater understanding of the value of wildlife and conservation are vital for enhancing sustainable livelihoods of the people as well as economic growth and development. In addition, further studies to investigate household economic losses and hidden

costs of HWC in various geographical locations as well as explore innovative financing mechanisms to support HWC management initiatives are encouraged. Conservation efforts should adopt integrated approaches that address both the direct visible losses and the hidden costs of HWC. Effective conservation education programs should be developed and implemented to promote tolerance, understanding and positive attitude towards wildlife among communities. Most importantly, there is also a need to review the WCA 2022 to incorporate the hidden costs and effectively implementing consolation schemes to affected parties, insurance programs or alternative livelihood opportunities that can help alleviate the financial burdens of HWC.

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Conflict of interest statement
The authors declare no conflict of interest which may be considered as potential competing interests.

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CHAPTER FOUR

4.0 GENERAL DISCUSSION, CONCLUSION AND RECOMMENDATIONS

4.1 General Discussion

4.1.1 Nature and extent of human-wildlife conflicts

Human-wildlife conflicts pose a significant challenge in communities neighboring Nyerere National Park, with elephants causing the most damage followed by buffalo, hippopotamus, monkey, hyena, wild cat, and crocodile. These findings are consistent with previous studies that identified elephants as the primary culprits of crop raiding (Distefano, 2010; Kaswamila, 2010; Kitampui & Odhiambo, 2021; Merkebu & Yazezew, 2021; Mkuburo *et al.,* 2020; Shemwetta & Kideghesho, 2000). However, the impacts of these species varied among respondents. Despite livestock depredation being relatively lower than crop losses, it was still perceived as highly significant and distressing, particularly with poultry suffering the highest losses attributed to monkeys. The study identified different forms of HWC across three levels of conflict, emphasizing the importance of understanding and addressing social conflicts to achieve long-term conservation success.

(a) Disputes

Conflicts at the dispute level were relatively low across all stakeholder groups, with livestock farmers experiencing the lowest percentage. This suggests that conflicts under dispute level cover only a small fraction of conflicts. These findings align with Zimmermann *et al.* (2020), who emphasized that focusing solely on disputes may lead to an incomplete understanding of the broader context, resulting in recurrent conflicts over time. Therefore, addressing only the dispute level without considering underlying and identity-based conflicts does not bring about significant change.

(b) Underlying conflicts

Despite the Wildlife Conservation Act of 2022 requiring immediate consolation for victims of HWC, the study found that respondents, apart from human fatalities, did not receive financial consolation for damages caused by wild animals. This lack of consolation results in financial burdens for respondents without any means of recovery. These findings align with other studies indicating significant financial losses to farmers due to wildlife damages, leading to negative attitudes towards wildlife species (Kaswamila, 2010; Santangeli *et al.,* 2016). Majority of respondents expressed negative attitudes towards wildlife, especially problem-causing species. Additionally, the study highlights the lack of awareness programs and education on HWC, leading to increased cases, ineffective conflict resolution, economic impacts, psychological stress, and threats to personal safety. These findings agree with other studies emphasizing the importance of education for safe coexistence with wildlife (Mekonen, 2020; Kross *et al.,* 2018).

(c) Identity-based conflicts

The study revealed that the majority of respondents blame both village leaders and local government authorities for failing to promptly address reported HWC cases. This highlight perceived inefficiencies in administrative and government structures responsible for conflict resolution and mitigation. Respondents cited lack of timely action, prolonged reporting procedures, absence of emergency call lines, and insufficient commitment from village leaders as challenges in accessing help and reporting HWC incidents. Exclusionary practices were also an issue of concern, leading to respondents feeling marginalized in decision-making processes related to HWCs and conservation issues. These findings highlight the gap between policy intentions and implementation realities. These findings correspond with other studies highlighting the insufficient commitment of village leaders in addressing HWC, resulting in reluctance of respondents in reporting incidents (Liendekiye *et al.,* 2022; Rutta, 2023).

4.1.2 Intervention strategies of human wildlife conflicts

In addressing HWC it is vital to consider three key dimensions: which involves consider substance, process, and relationships (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020).

(a) Substance intervention strategies involve implementing technical solutions to minimize actual damage at the dispute level (Zimmermann *et al.,* 2020). Respondents within the study area utilised both lethal and non-lethal methods. However, the effectiveness of these intervention strategies within these categories varied among respondents. This coincides with a study conducted by Liendekiye *et al.* (2022), who stated that the effectiveness of interventions varies based on context, species involved, and community engagement levels. The use of lethal methods indicates lack of awareness and educational programs among communities regarding the ecological importance of wildlife and the consequences these methods have. This highlights the need for prioritizing awareness and educational programs to foster coexistence between humans and wildlife.

(b) Process intervention strategies aim to address underlying conflicts efficiently by implementing initiatives to address past grievances and promote coexistence (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). Concerns such as lack of consolation payments and awareness programs were raised by respondents, highlighting the gap between policy intentions and implementation. Therefore, actively implementing consolation schemes and promoting awareness and educational programs are crucial to tackling these conflicts effectively.

(c) Relationship intervention strategies focuses on addressing identity-based conflicts by readdressing past injustices and fostering trust among stakeholders (Madden & McQuinn, 2014; Zimmermann *et al.,* 2020). Respondents complained about exclusionary practices in decision-making processes, intensifying feelings of

marginalization among local communities and undermining conservation efforts. This is consistent with studies by (Liendekiye *et al.,* 2022; Page, 2023). Therefore, advocating for community-led initiatives, improving administrative structures, and support programs are essential in building trust and positive relationships with government authorities. Establishing emergency hotlines and community mobile alert systems can facilitate rapid responses to HWC reported incidents.

4.1.3 Hidden costs associated with human-wildlife conflicts

This study sheds light on the hidden costs associated with HWC, revealing its multifaceted impacts on various aspects of community well-being. One of the primary hidden costs identified is the opportunity cost incurred by farmers. In their efforts to protect crops and livestock from wildlife attacks, farmers invest considerable time and resources. This investment not only leads to reduced agricultural productivity, but also contributes to food insecurity and income instability. Results from this study confirm with previous studies highlighting the increasing economic consequences of HWC, including reduced income and food insecurity (Ogra, 2008). Furthermore, transaction costs associated with processing and making follow-ups regarding consolation claims impose a financial burden on affected households, diverting resources from other essential needs. Psychologically, communities living adjacent to Nyerere National Park, particularly farmers, experience heightened levels of fear, stress, and anxiety due to the constant threat of wildlife encounters. Sleep deprivation, exposure to harsh weather conditions, and the risk of insect-borne diseases further intensify the psychological toll on farmers, affecting their overall well-being and quality of life. These findings correspond with Muyoma (2016) and Ogra (2008)'s observation that prolonged night guarding increases the risk of diseases such as malaria, which underscore the crucial need for holistic and context-specific interventions aimed at mitigating the impacts of HWC while promoting coexistence between humans and wildlife. The health costs stemming from HWC are also

significant. The combination of opportunity costs and psychological impacts directly affects farmers' health, increasing their vulnerability to various ailments such as malaria. Additionally, the need for medical treatment resulting from HWC incidents imposes an additional economic burden on respondents, further straining already limited resources. These findings confirm with studies by Linuma *et al.* (2022) and Manoa *et al.* (2020) and Ogra (2008), who concluded that farmer endure both physical and psychological health impacts.

4.1.4 Economic magnitude of human-wildlife conflicts for both visible and hidden costs

This study highlights the substantial economic impact of HWC, including both visible and hidden costs, notably from crop raiding, livestock depredation, monetary opportunity costs, and transaction costs. Crop raiding alone results in an estimated annual economic loss of USD 1 088.84 per household per year, revealing the significant financial strain on farmers within the study area. This aligns with previous research by Biset *et al.* (2019) and Kideghesho (2010), indicating that farms near protected areas or national park boundaries are more vulnerable to wildlife raids, leading to substantial economic losses. Comparing our findings with those of Kideghesho (2010), we note a higher average loss per household/year, possibly due to variations in factors like farm sizes, cultivated crops, and wildlife species present in the area. Additionally, the dominance of crop farming as the primary income source likely contributes to higher economic losses from crop damage compared to losses from livestock depredation, consistent with findings from a study conducted by (Baral *et al.,* 2021). Beyond visible losses, the study assessed the monetary opportunity and transaction costs incurred by farmers in implementing preventive measures against HWC incidents and pursuing consolation payment claims. These costs highlight additional financial burdens on farmers, emphasizing crop losses as predominant when considering the total economic impact.

4.1.5 Factors influencing respondents' attitudes towards wildlife and conservation

Factors influencing respondents' attitudes towards wildlife conservation were also explored, revealing a prevailing negative sentiment attributed to damages incurred and lack of consolation for the damages. This negativity contributes to respondents' unfavorable perceptions of wildlife and conservation efforts. These results align with studies by Mbise *et al.* (2018) and Mekonen (2020), indicating that lack of consolation schemes fosters negative attitudes towards wildlife. Hence, active implementation of consolation schemes and awareness programs is deemed crucial for effectively addressing these conflicts. Additionally, factors such as education, age, household size, and HWC experience significantly shape respondents' attitudes towards wildlife and conservation, with higher education levels correlating with more positive perceptions of wildlife and conservation. Consistent with findings from a study conducted by Lyamuya (2016), who indicating that respondents with formal education are more likely to have positive attitudes, while those without formal education tend to hold negative attitudes towards wildlife conservation.

4.2 General Conclusion and Recommendations

4.2.1 General conclusion

Based on the study results indicating that local communities experience diverse consequences of HWC, the study concludes that HWC results in both social conflicts and socio-economic implications on the local communities, particularly farmers. The study revealed the pervasive nature and complex dynamics of human-wildlife conflicts across all three levels of conflict, along with its far-reaching impacts on communities particularly farmers within the study area. The findings revealed that HWC results in both social and economic consequences. It also indicated the existence of HWC impacts in all three levels of conflict, with dispute level exhibiting a lower percentage compared to the underlying and identity-based levels of conflict. This indicates that solely focusing on addressing HWC at

the dispute level leads to a partial understanding of the overall situation and overlooks crucial contexts, potentially resulting in recurrent conflicts over time. Therefore, the study advocates for the adoption and implementation of a comprehensive approach aligned with the Conservation Conflict Transformation Model (CCT) to effectively address HWC, while acknowledging their complexity and fostering cooperation among stakeholders to safeguard wildlife and enhance local livelihoods. The main concerns associated with HWC within the study area encompass income loss stemming from crop damage, and livestock depredation, compounded by the absence of adequate consolation payment schemes which underlines the tangible financial impact experienced by farmers within the study area. Blame directed at local authorities reflects a breakdown in trust and effective governance. Furthermore, hidden costs such as opportunity costs, transaction costs, psychological and health impacts, reveal the multifaceted nature of the challenges faced by affected communities, particularly farmers adjacent to protected areas. The substantial monetary opportunity expenses and transaction costs borne by farmers in implementing preventative measures highlight the ongoing challenges in mitigating HWC incidents. Furthermore, the prevalence of negative attitudes towards wildlife and conservation among respondents underscores the crucial importance of community engagement, awareness and educational initiatives, highlighting the gap in policy intentions and implementation realities.

4.2.2 General recommendations

Based on the presented findings and conclusion, it is recommended for governmental authorities and non-governmental organisations (NGOs) to prioritize the dissemination of conservation education, awareness initiatives, and training within local communities neighboring protected areas. These initiatives are vital for conveying information, knowledge, and skills regarding Human-Wildlife Conflicts (HWC) and natural resource management. It is also imperative for governmental authorities and NGOs to foster

community involvement in the development and implementation of mitigation strategies at various levels of conflicts. Additionally, collaboration between governmental authorities, conservation officials, local communities, and other stakeholders is also crucial for the successful implementation of conservation and mitigation measures. Innovative and effective financial consolation schemes should be established to address the financial constraints imposed on affected communities due to HWC. These schemes can provide crucial support to communities impacted by wildlife-related economic losses. Furthermore, conservation efforts should adopt integrated approaches that address both the direct economic losses and the hidden costs of HWC. Continuous monitoring and evaluation of conservation and mitigation efforts are essential to assess their effectiveness and identify areas for improvement. Most importantly, there is also a need to review the WCA 2022 to incorporate the hidden costs and effectively implementing alternative livelihood opportunities that can help alleviate the financial burdens of HWC.

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APPENDICES

Appendix 1: (Household) Semi-Structured Questionnaire

Dear Respondent

I am a postgraduate student from Sokoine University of Agriculture. I am conducting interviews for my MSc. research. The aim of the research is to obtain insights into smallholder farming and the economic impacts of crops and livestock damage by wild animals as well as assess current coping strategies adopted, including those advised by conservation authorities. You are kindly invited to voluntarily participate in an interview, which will require approximately 45 minutes of your time. The information you provide will only be used for this research and will be treated with strict confidentiality. Do you agree to participate in the interview?

Name of Facilitator:……..
Date:…… Questionnaire number……..
Region:…….District…….
Village name:……
Coordinates:…….……

General information

Gender: (a) Male (b) Female
Age of respondent:……
Marital Status: (a) Single (b) Married (c) Widowed
(d) Divorced
Head of Household: (a) Father (b) Mother (c) Others
(specify)…….
Highest level of education: (a) Primary (b) Secondary
(c) College/University (d) other (specify)……
Size of household: (a) 1-3 people (b) 4-6 people (c) 7-9 people
(d) ≥10 people

Residence

1. Are you a resident of this area? (a) Yes[ ] (b) No[ ]
2. If No, (a) Where did you come from? ....., (b) How long have you been living in this village? ....., (c) What was the reason for resettling here? .....

Occupation

1. What are your major sources of income?
    a) Agricultural crop farming
    b) Livestock farming
    c) Mixed farming
    d) Petty Business (e.g. Bar, Kiosk, Shop)
    e) Formal employment
    f) Other (specify)……..
2. If agricultural crop farming/ mixed farming, where do you farm?
    a) Around the homestead
    b) Away from homestead
3. If away from homestead, what is the approximated distance from the NNP in KM
    (a) 0-5 (b) 6-10 (c) 11-15 (d) >15
4. What are the major crops you plough and the size of each field? .....
5. What was the yield last year (2021) ……. and this year (2022)? .....
6. If farming livestock, what type of livestock do you farm and how many are they? ……
7. Where do you graze your livestock?
    a) Own land around homestead
    b) Own land away from homestead
    c) Village land reserved for grazing
    d) Nyerere National Park land
    e) Other (Specify)…….
8. Is grazing area sufficient? (a) Yes[ ] (b) No[ ]

9. If No, how do you solve it? .....

Conflict and Economic Value

10. Do you experience any human-wildlife conflict? (a) Yes[ ] (b) No[ ]
11. If yes, what type of conflict and the wild animals involved?
    a) Crop damage…… (b) Food storage breakage……. (c) Water source destruction…. (d) Infrastructure damages…..… (e) Human injury…. (f) Human death…… (g) Livestock depredation…… (h) Livestock death…… (i) Others (specify)……..
12. If crop damage:
    a) What was the portion of damaged field? (size)……
    b) What would have been the harvest if it weren't for HWC? (in bags/Kg)……..
    c) What would have been the value of crops lost (TZS)……..
    d) How many incidents from 2021 to 2022? …….
    e) Was there any consolation fee paid? ……
    f) If (d) is yes, how much? …… if no why? ……..
    g) If consolation forms were filled, were there any other expenses involved in following up such claim forms?
    h) If (g) is yes what are those expenses and how much did you spend?
13. If food storage breakage, water source and infrastructure destruction:
    a) How many incidents from 2021 to 2022? ……
14. If livestock depredation:
    a) How many incidents from 2021 to 2022……

b) How many of the injured livestock fall under (a) Cattle… (b) Goats… (c) Sheep... (d) Pig….
(e) Chicken…. (f) Duck… (g) Others ……..
c) Based on answer in (b) how many of each species fall under (a) Young…… (b) Adult……
d) How many of the killed livestock fall under (a) Cattle… (b) Goats… (c) Sheep….. (d) Pig…. (e) Chicken….
(f) Duck…. (g) Others…..
e) Based on answer in (b) how many of each species fall under (a) Young…… (b) Adult……
f) Where were the livestock? (a) Grazing
(b) in Boma/enclosure
g) What time of the day was it: (a) in the morning
(b) During the day (c) late in the afternoon
(d) at night
h) Was there any consolation fee paid (a) Yes[ ]
(b) No[ ]
i) If yes, how much? …… if No, why? ……..
j) If consolation forms were filled, were there any other expenses involved in following up such claim forms?
(a) Yes[ ] (b) No[ ]
k) If (g) is yes what are those expenses and how much did you spend?.....
l) If grazing, were the livestock guarded? (a) Yes[ ]
(b) No[ ]

15. Based on past experience, is HWC decreasing or increasing in this area?

Mitigation

16. Do you use any mitigation measure?
17. What measures do you use to mitigate HWC and its effectiveness?

Methods	Very-effective	Less-effective	Moderate	Not-effective
1				
2				
3				
4				
5				

NB: Effectiveness rating: (a) Very effective (b) Moderate (c) Less effective (d) Not effective

18. How do you rate the implementation of mitigation measures in this area? (a) Low (b) Moderate (c) High
19. How many NGOs are involved in solving HWC issues in this area? Please list them
    ……
    ……
20. Do these NGOs offer any awareness programmes? (a) Yes[ ] (b) No[ ]
21. If yes, how many programmes offered by NGOs have you attended from 2021 to 2022?
    ……
    ……
22. How does the government help in solving HWC issues? .....
23. Do you receive any awareness programmes from the government regarding HWC?
    (a) Yes[ ] (b) No[ ]
24. If yes, how many programmes have you attended from 2021 to 2022? ……
25. Have you ever attended a meeting (organized by the government) dealing with decision making or any other HWC related issues? ……..
26. Does the government help in addressing issues raised by community members regarding HWCs? ……..
27. If yes, explain the type of help received……

28. What do you think should be done to solve HWC problem? .....

Perception

29. Using a likert scale, is wildlife conservation beneficial to your community?

30. If agree/ strongly agree, what type of benefits do you receive? ……..…
31. How do you perceive/view wild animals in general? ……..
32. Do you think it possible for humans and wildlife to live in harmony and why? (a) Yes[ ] (b) No[ ]
33. Would you kill wildlife if your interests are threatened? Yes [ ] No [ ]
34. What actions do you take once an attack on your livestock or crops occurs? (E.g. hunt and kill the animal, kill the animal on the spot, injure the animal or chess the animal without injuring it).....
35. Do you report HWC incidences as soon as they occur Yes [ ] No [ ]
36. If No, why? ……

Hidden Costs and Their Distribution

37. Apart for the visible costs what are the hidden costs incurred by your household due to human wildlife conflict?

Replacement of damages costs	Crop replanting
Cost of preventing animal attack	Health impacts
Loss of sleep	Spending money on guarding against wildlife
Guarding against wildlife	Spending money on property repair
Loss of school time	Spending on crop replanting
Living in fear	Spending money on other HWC mitigation measures
Restricted movement	Others (specify):
Delays in other income generating activities	

38. How does HWC problems and difficulties affect your day to day living? .....
39. Which group(s) of people in your household are affected by problems with wildlife? Males [ ] Females [ ]: (a) Adults [ ] (b) Children [ ] (c) Youth [ ]
40. Based on your response to question 34 above, explain how each group is affected……..……
41. Where there are problems caused by wildlife, do you receive any help from the government? Yes [ ] No [ ]
42. If yes, explain the type of help received……
43. How much time do you spend on guarding against wildlife

a) Livestock guarding hours…….
b) Crops guarding hours…….

44. How much time and money do you spend on repairing property damages……
45. How much time and money do you spend on crops replanting….
46. How much money do you spend on guarding against wildlife……
47. How much money do you spend on other HWC mitigation measures……

48. How much is your household annual income? (TZS) ……
49. Do problems with wildlife affect your household income? Yes [ ] No [ ]

THANK YOU FOR YOUR TIME AND COOPERATION

Appendix 2: Checklist for Key Informant Interviews

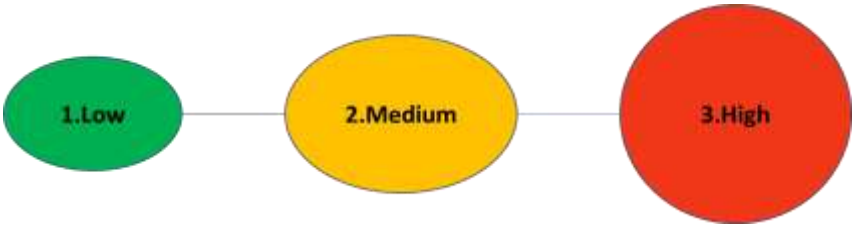
Dear Responds

I am a postgraduate student from Sokoine University of Agriculture. I am conducting interviews for my MSc. research. The aim of the research is to obtain insights into smallholder farming and the economic impacts of crops and livestock damage by wild animals as well as assess current coping strategies adopted, including those advised by conservation authorities. You are kindly invited to voluntarily participate in an interview, which will require approximately 45 minutes of your time. The information you provide will only be used for this research and will be treated with strict confidentiality. Do you agree to participate in the interview?

Date……..... Respondent No……

Village Name..…… Occupation status……..

1. On a scale of 1 to 3 how do you rate the HWC incidences in this area?



2. Which animal species cause human-wildlife conflict in this area?
3. What type of conflict do they cause?
4. From the reported incidences, how many have been compensated by the government?
5. If yes to (4), how much was paid? If no why?
6. What are the local perceptions of the severity of the damages?
7. Are they any human injuries and deaths caused by wild animals reported in your area from the year 2019 to 2022?
8. What strategies taken by the communities to mitigate HWC

9. Are the strategies successfully working for the purpose they are intended for? If answer is No;
   a. Why?
   b. What do you think can be done to improve the situation?
   c. If yes, rate them

Methods	**Very-effective**	**Less-effective**	**Moderate**	**Not-effective**
1				
2				
3				
4				
5				

10. What other alternative do you think can help in mitigating human wildlife conflicts apart from the currently applied strategies?
11. Do the local people receive any awareness, educational programs and training on HWC related issues from the government? (a) Yes[ ] (b) No[ ]
12. Does the government involve local people in decision-making processes regarding HWC issues/ conservation?
13. Are there any NGOs assisting in mitigating HWC in the area? (a) Yes[ ] (b) No[ ]
14. If yes to 13, name them
15. Do the NGOs mentioned in 14 offer any awareness/educational programs and training on HWC related issues to the local people in the area? (a) Yes[ ] (b) No[ ]
16. Apart from the direct effects of HWC, what indirect effects do you think are incurred by the communities due to HWC?

THANK YOU FOR YOUR TIME AND COOPERATION

Appendix 3: Checklist for Focus Group Discussion

Dear Participants

I am a postgraduate student from Sokoine University of Agriculture. I am conducting interviews for my MSc. research. The aim of the research is to obtain insights into smallholder farming and the economic impacts of crops and livestock damage by wild animals as well as assess current coping strategies adopted, including those advised by conservation authorities. You are kindly invited to voluntarily participate in an interview, which will require approximately 45 minutes of your time. The information you provide will only be used for this research and will be treated with strict confidentiality. Do you agree to participate in the interview?

Date…….....
No. of Participants……
Village Name..……

1. What is the farming cycle in this area i.e. planting and harvesting time and type of crops grown?
2. What are the key farming related problems experienced by the local communities around the park?
3. What is the nature of the human-wildlife conflicts in this area?
4. What are the main animal species causing human-wildlife conflicts?
5. What type of conflict do they cause?
6. Which time of the year do you experience human-wildlife conflict more often?
7. To what extent do the damages inflicted by wild animals affect the communities in this area?
8. From the reported incidences, how many have been compensated by the government?
9. If yes to (8), how much was paid? If no why?
10. What are the local perceptions of the severity of the damages?

11. Apart from the direct effects of HWC, what indirect effects do you think are incurred by the communities due to HWC?
12. What are the local perceptions of the severity of damages caused by wild animals?
13. What strategies taken by the communities to mitigate HWC
14. Are the strategies successfully working for the purpose they are intended for? If answer is No;
    d. Why?
    e. What do you think can be done to improve the situation?
    f. If yes, rate them

Methods	**Very-effective**	**Less-effective**	**Moderate**	**Not-effective**
1				
2				
3				
4				
5				

15. What other alternative do you think can help in mitigating human wildlife conflicts apart from the currently applied strategies?
16. What are the local views on how crops and livestock damages caused by wild animals should be dealt with and why do you think it should be this way?
17. How is the government helping the communities in mitigating HWC?
18. Do the local people receive any awareness, educational programs and training on HWC related issues from the government? (a) Yes[ ] (b) No[ ]
19. Does the government involve local people in decision-making processes regarding HWC issues/ conservation?
20. Are there any NGOs assisting in mitigating HWC in the area? (a) Yes[ ] (b) No[ ]
21. If yes to 13, name them

22. Do the NGOs mentioned in 14 offer any awareness/educational programs and training on HWC related issues to the local people in the area? (a) Yes[ ] (b) No[ ]
23. Apart from the direct effects of HWC, what indirect effects do you think are incurred by the communities due to HWC?

THANK YOU FOR YOUR TIME AND COOPERATION

Appendix 4: Research Permits

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

SOKOINE UNIVERSITY OF AGRICULTURE
DIRECTORATE OF POSTGRADUATE STUDIES, RESEARCH, TECHNOLOGY TRANSFER AND CONSULTANCY
P. O. Box 3151, CHUO KIKUU, MOROGORO, TANZANIA
Telephone: +255 23 264 0013, 023 264006-9 E-mail: ***drpgs@sua.ac.tz***
Website: www.dprtc.sua.ac.tz

Our Ref: SUA/DPRTC/MEN/D/2021/0004/07 **Date:** 07th November, 2022

Ms. Ivy Nanvula SIMASIKU
Department of Forest and Environmental Economics
SUA, Morogoro

Forwarded & Congratulations
08/11/2022

Ufs: The Head
Department of Forest and Environmental Economics
SUA, Morogoro

Dear Ms. Simasiku,

RE: APPROVAL OF YOUR MSc. (ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS) RESEARCH PROPOSAL

Please refer to the above mentioned subject.

2. This is to inform you that, the Directorate of Postgraduate Studies, Research, Technology Transfer and Consultancy (DPRTC) has noted the approval made by the Board College of Forestry, Wildlife and Tourism for your MSc. research proposal. Therefore, you are hereby permitted to embark on data collection as per your approved research proposal.

3. In addition to the permission granted, please be notified that, you are required to present yourself at the office of the Deputy Vice Chancellor Academic, Research and Consultancy (DVC-ARC), to kindly request for research clearance letter.

Wishing you all the best in your research work.

Yours sincerely,

T. A. Medard
For: DIRECTOR

Director
Postgraduate studies, Research,
Technology Transfer and Consultancy
Sokoine University of Agriculture
P. O. Box 3151, Morogoro
TANZANIA

Cc: The Principal, College of Forestry, Wildlife and Tourism
The Chairperson, College Postgraduate Studies Committee
Supervisors: Dr. G. Z. Nyamoga and Dr. B. J. Temu

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

Anuani ya Simu "TAMISEMI" DODOMA
Simu Na: +255 26 2321607
Nukushi: +255 26 2322116
Barua pepe:ps@tamisemi.go.tz

Mji wa Serikali – Mtumba,
Mtaa wa TAMISEMI,
S.L.P. 1923,
41185 DODOMA.

Unapojibu tafadhali taja:-

Kumb. Na. AB.307/323/01/195 **25 Novemba, 2022**

Katibu Tawala wa Mkoa,
Ofisi ya Mkuu wa Mkoa,
S.L.P. 650,
MOROGORO.

Yah: **KIBALI CHA KUFANYA UTAFITI KUHUSU ASSESSMENT OF SOCIO-ECONOMIC IMPACTS OF HUMAN-WILDLIFE CONFLICTS ON LIVELIHOODS IN COMMUNITIES ADJACENT TO NYERERE NATIONAL PARK, TANZANIA**

Tafadhali rejea somo tajwa hapo juu.

2. Ofisi ya Rais – TAMISEMI imetoa kibali kwa **Bi. Ivy Namvula, Mwanafunzi** kutoka Chuo Kikuu cha Kilimo Sokoine (SUA) kwa ajili ya kufanya utafiti tajwa katika Halmashauri ya Wilaya ya Ulanga Mkoani Morogoro.

3. Muda wa kufanya utafiti huu ni kati ya mwezi Novemba, 2022 na mwezi Machi, 2023. Ofisi ya Rais - TAMISEMI kwa kushirikiana na Taasisi nyingine za Serikali itafanya ukaguzi wakati wowote kujiridhisha na utekelezaji sahihi wa kibali hiki. Takwimu zitakazokusanywa kutokana na utafiti huu ni kwa ajili ya matumizi ya ndani tu na iwapo zitatakiwa kuchapishwa na kusambazwa kibali kutoka Mamlaka husika kitapaswa kuombwa.

4. Kwa barua hii, tafadhali muelekeze Mkurugenzi wa Halmashauri tajwa ili kutoa ushirikiano utakaohitajika na kukamilisha utafiti huu kama uliivyokusudiwa. Kazi hii isimamiwe na Mtakwimu wa Mkoa na Halmashauri husika na kutoa taarifa ya utekelezaji.

5. Ninakushukuru kwa ushirikiano wako.

Eng. Gilbert G. Mwoga
KAIMU KATIBU MKUU

Nakala: Katibu Mkuu Kiongozi,
Ofisi ya Rais,
IKULU,
1 Barabara ya Julius Nyerere,
Chamwino,
S. L. P. 1102,
40400 DODOMA. *(Aione RSO wa Mkoa wa Morogoro).*

Makamu Mkuu wa Chuo,
Chuo Kikuu cha Kilimo Sokoine,
S. L. P 3000,
Barua Pepe: vc@sua.ac.tz,
MOROGORO. *(Rejea barua yenye Kumb Na. SUA/ADM/R.1/8/927)*

Bi. Ivy Namvula,
Chuo Kikuu cha Kilimo Sokoine,
S. L. P 3000,
MOROGORO. *(Nakala ya taarifa ya utafiti iwasilishwe Ofisi ya Rais - TAMISEMI na Ofisi husika ya Mkuu wa Mkoa na Halmashauri. Kibali kinaweza kufutwa muda wowote endapo kutakuwa na ukiukwaji wowote au sababu nyingine yoyote)*

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

Anuani ya simu: **MKUUMKOA**
Simu Nambari: **2934306/2934305**
Fax Nambari: **2601308/2604988**
Tovuti: www.morogoro.go.tz
Email: ras.morogoro@tamisemi.go.tz
Unapojibu tafadhali taja:

Ofisi ya Mkuu wa Mkoa,
Boma Road,
S. L. P. 650,
67117 MOROGORO

Kumb.Na. AB.175/245/01/185 **13 Desemba, 2022**

Mkurugenzi Mtendaji,
Halmshauri ya Wilaya ya Ulanga na Kilombero,
MOROGORO.

Yah: **KIBALI CHA KUFANYA UTAFITI KUHUSU ASSESSMENT OF SOCIO-ECONOMIC IMPACTS OF HUMAN- WILDLIFE CONFLICTS ON LIVELIHOODS IN COMMUNITIES ADJACENT TO NYERERE NATIONAL PARK, TANZANIA.**

Tafadhali husika na kichwa cha barua tajwa hapo juu.

2. Ofisi hii imepokea barua yenye Kumb. Na. AB. 307/323/01/195 ya tarehe 25 Novemba, 2022 kutoka kwa Katibu Mkuu, Ofisi ya Rais- TAMISEMI ikimtambulisha **Bi. Ivy Nanvula** kutoka katika Chuo Kikuu Cha Kilimo Sokoine (SUA), ambaye anafanya utafiti tajwa katika Mkoa wetu.

3. Kwa barua hii, unaombwa kutoa ushirikiano stahiki ili kufanikisha kazi hii. Utafiti huu utaanza tarehe **13 Desemba, 2022** hadi tarehe **13 Machi, 2023**. Kazi hii isimamiwe na Mtakwimu wa Halmashauri na kutoa taarifa ya utekelezaji.

4. Ofisi ya Rais – TAMISEMI kushirikiana na Taasisi nyingine za Serikali itafanya ukaguzi wakati wowote kujiridhisha utekelezaji sahihi wa kibali hiki. Takwimu zitakazokusanywa kutokana na utafiti huu ni kwa ajili ya matumizi ya ndani tu na iwapo zitatakiwa kuchapishwa na kusambazwa kibali kutoka Mamlaka husika kitapaswa kuombwa.

5. Nashukuru kwa ushirikiano wako.

Captain A. Kasililika

Kny: KATIBU TAWALA MKOA

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

HALMASHAURI YA MJI IFAKARA

Unapojibu tafadhali taja:

Kumb. Na.IFTC/E.10/80/ Vol IV

19 Desemba, 2022

Afisa Mtendaji Kata
Kata ya **Mang'ula B**
IFAKARA

YAH; **RUHUSA YA KUFANYA UTAFITI KUHUSU "ASSESSMENT OF SOCIO-ECONOMIC IMPACTS OF HUMAN-WILDLIFE CONFLICTS ON LIVELIHOODS IN COMMUNITIES ADJACENT TO NYERERE NATIONAL PARK, TANZANIA".**

Tafadhali husika na kichwa cha barua tajwa hapo juu.

2. Ofisi imepokea barua yenye kumb. Na. AB. 175/245/01/185 ya tarehe 13 Desemba, 2022 kutoka kwa Katibu Tawala Mkoa, Ikimtambulisha **Bi. Ivy Nanvula** Kutoka katika Chuo Kikuu cha Kilimo Sokoine **(SUA),** ambaye anafanya utafiti tajwa katika Kata yako Kijiji cha **Kanyenja**.

3. Kwa barua hii unaobwa kutoa ushirikiano stahiki ili kufanikisha kazi hii.

4. Nakutakia kazi njema.

Lena Nkaya

MKURUGENZI WA MJI IFAKARA

Nakala: Bi. Ivy Nanvula

Ofisi ya Mkurugenzi wa Mji , S.L.P 433 ,Ifakara, Simu na:023-2934212,Nukushi:023-2934212,Barua Pepe:info@ifakaratc.go.tz, Tovuti:http://ifakaratc.go.tz

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

HALMASHAURI YA MJI IFAKARA

Unapojibu tafadhali taja:

Kumb. Na.IFTC/E.10/80/ Vol IV

19 Desemba, 2022

Afisa Mtendaji Kata
Kata ya **Mkula**
IFAKARA

YAH; **RUHUSA YA KUFANYA UTAFITI KUHUSU "ASSESSMENT OF SOCIO-ECONOMIC IMPACTS OF HUMAN-WILDLIFE CONFLICTS ON LIVELIHOODS IN COMMUNITIES ADJACENT TO NYERERE NATIONAL PARK, TANZANIA".**

Tafadhali husika na kichwa cha barua tajwa hapo juu.

2. Ofisi imepokea barua yenye kumb. Na. AB. 175/245/01/185 ya tarehe 13 Desemba, 2022 kutoka kwa Katibu Tawala Mkoa, Ikimtambulisha **Bi. Ivy Nanvula** Kutoka katika Chuo Kikuu cha Kilimo Sokoine **(SUA),** ambaye anafanya utafiti tajwa katika Kata yako Vijiji vya **Magombera** na **Katurukila**.

3. Kwa barua hii unaobwa kutoa ushirikiano stahiki ili kufanikisha kazi hii.

4. Nakutakia kazi njema.

Lena Nkaya

MKURUGENZI WA MJI IFAKARA

Nakala: Bi. Ivy Nanvula

Ofisi ya Mkurugenzi wa Mji , S.L.P 433 ,Ifakara, Simu na:023-2934212,Nukushi:023-2934212,Barua Pepe:info@ifakaratc.go.tz, Tovuti:http://ifakaratc.go.tz

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

HALMASHAURI YA MJI IFAKARA

Unapojibu tafadhali taja:

Kumb. Na.IFTC/E.10/80/ Vol IV

19 Desemba, 2022

Afisa Mtendaji Kata
Kata ya **MSOLWA STATION**
IFAKARA

YAH: **RUHUSA YA KUFANYA UTAFITI KUHUSU "ASSESSMENT OF SOCIO-ECONOMIC IMPACTS OF HUMAN-WILDLIFE CONFLICTS ON LIVELIHOODS IN COMMUNITIES ADJACENT TO NYERERE NATIONAL PARK, TANZANIA".**

Tafadhali husika na kichwa cha barua tajwa hapo juu.

2. Ofisi imepokea barua yenye kumb. Na. AB. 175/245/01/185 ya tarehe 13 Desemba, 2022 kutoka kwa Katibu Tawala Mkoa, Ikimtambulisha **Bi. Ivy Nanvula** Kutoka katika Chuo Kikuu cha Kilimo Sokoine **(SUA),** ambaye anafanya utafiti tajwa katika Kata yako Vijiji vya **Msolwa Station** na **Nyange**.

3. Kwa barua hii unaobwa kutoa ushirikiano stahiki ili kufanikisha kazi hii.

4. Nakutakia kazi njema.

Lena Nkaya

MKURUGENZI WA MJI IFAKARA

Nakala: Bi. Ivy Nanvula

Ofisi ya Mkurugenzi wa Mji , S.L.P 433 ,Ifakara, Simu na:023-2934212,Nukushi:023-2934212,Barua Pepe:info@ifakaratc.go.tz, Tovuti:http://ifakaratc.go.tz

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

HALMASHAURI YA MJI IFAKARA

Unapojibu tafadhali taja:

Kumb. Na.IFTC/E.10/80/ Vol IV

19 Desemba, 2022

Afisa Mtendaji Kata
Kata ya **Signal**
IFAKARA

YAH; **RUHUSA YA KUFANYA UTAFITI KUHUSU "ASSESSMENT OF SOCIO-ECONOMIC IMPACTS OF HUMAN-WILDLIFE CONFLICTS ON LIVELIHOODS IN COMMUNITIES ADJACENT TO NYERERE NATIONAL PARK, TANZANIA".**

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3. Kwa barua hii unaobwa kutoa ushirikiano stahiki ili kufanikisha kazi hii.

4. Nakutakia kazi njema.

Lena Nkaya

MKURUGENZI WA MJI IFAKARA

Nakala: **Bi. Ivy Nanvula**

Ofisi ya Mkurugenzi wa Mji , S.L.P 433 ,Ifakara, Simu na:023-2934212,Nukushi:023-2934212,Barua Pepe:info@ifakaratc.go.tz, Tovuti:http://ifakaratc.go.tz

Kuhusu Tasnifu Hii

Migogoro ya binadamu na wanyamapori (HWC) ni changamoto kubwa inayoyakumba maeneo mengi duniani kote, hasa maeneo ambayo jamii inapakana na hifadhi za wanyamapori. Utafiti huu ulilenga (i) kutathmini aina na kiwango cha migogoro ya binadamu na wanyamapori (ii) kutathmini mikakati inayotumika kudhibiti migogoro hiyo (iii) kutambua athari zilizofichika na zionekanazo (iv) kutathmini mtazamo wa jamii kuhusu uhifadhi. Matokeo yalidhihirisha kuwepo kwa athari za kijamii na za kiuchumi zitokananazo na migogoro hiyo, huku tembo wakibainishwa kuwa chanzo kikubwa cha migogoro hiyo. Migogoro hii ilitenganishwa katika vipengele vitatu: migogoro ya binadamu na wanyamapori yenye madhara ya waziwazi, migogoro itokanayo na kuto kushughulikia kikamilifu migogoro iliyo pita, na migogoro itokanayo na kuweka kipaumbele kwa wanyamapori kuliko maslahi ya jamii. Aina ya migogoro ya kipengele cha kwanza ilionekana kushughulikiwa japo kwa kiasi, ikilinganishwa na migogoro ya kipengele cha pili na cha tatu. Utafiti huu unahamasisha mbinu za kimkakati kushughulikia aina zote za migogoro ya binadami na wanyamapori ili kupata suluhisho endelevu kwa maendeleo ya jamii na uhifadhi wa wanyamapori.