An assessment of human-wildlife conflict on non-conservancy communal land and commercial farms in Namibia

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Thesis submitted in partial fulfilment of the requirements for the degree of Master of Natural Resource Management at the Namibia University of Science and Technology

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November 2021

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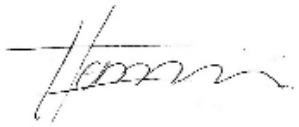
I, *(Herman Ndeliimona Aindongo)*, hereby declare that the work contained in the thesis entitled: *(insert full thesis title)* is my own original work and that I have not previously in its entirety or in part submitted it at any university or higher education institution for the award of a degree.



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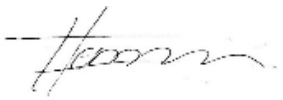

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List of Acronyms

CBNRM	Community Based Natural Resource Management
Ha	Hectares
HWC	Human Wildlife Conflict
IRDNC	Integrated Rural Development and Nature Conservation
MEFT	Ministry of Environment, Forestry, and Tourism
NACSO	Namibia Association of CBNRM Support Organizations

Acknowledgements

I would like to extend my sincere gratitude to the Namibian Chamber of Environment for their generous funding toward my studies' tuition and field expenditure costs. I offer special appreciation to Marina Tavolaro for the opportunity to be part of her study project, for guidance and support throughout my study, my gratitude to my supervisor Dr Morgan Hauptfleisch for his insightful guidance, suggestions and contribution to the study. I would like to thank the interpreters, Chilinda, Dede Khaiseb and Max Muyemburuko for their immense help and contribution to this project. I would like to thank David Ward for his selfless assistance with transport and setting up interviews in Zambezi. I would like to thank Chief David Khamuxab for allowing me to camp at his residence and taking part in the interviews. I would like to extend special appreciation to Deborah 'Debbie" Burger and Manna Marak for their kindness, hospitality and for providing most if not all contacts in the Kamanjab district, I would like to thank Rauha Iyambo for assisting with the maps. Finally yet importantly, I would like to thank all the respondents who willingly took part in this study and contributed to the knowledge obtained through this study.

Dedication

I dedicate this thesis to all those that contributed to my scholarly journey, guardians, parents and friends, I genuinely believe that it is by your diverse support that I have attained to where I am, you are all appreciated. Above all, I thank my GOD, the Giver and Sustainer of life, from whom all help comes.

Abstract

Human-wildlife conflict (HWC) remains an important contemporary issue, affecting both wildlife and people and should be managed for the well-being of wildlife and people living with wildlife. This study focuses on farmers living outside Namibian communal conservancies to better understand HWC as research on this category of farmers on HWC is majorly lacking. Interviews comprising of open-ended and close-ended questions in three regions, covering three land tenure systems (commercial, resettlement and communal) were carried out, with a sample size of 142 respondents. The aim of the study was to understand the impacts of HWC on these farmers, their attitude toward HWC and the mitigation method used to protect their livelihoods. Overall, most households interviewed had experienced HWC incidences at some point and perceived HWC to be increasing in their areas. The current Namibian legislation on wildlife and benefits from wildlife does not make provision for non–communal conservancy famers and communities, there is therefore no tangible benefits from wildlife to these farmers. Commercial farmers showed relatively positive attitudes toward wildlife compared to communal and resettlement farmers. The finding confirm what several studies have shown, that the way to ensure a secured future for wildlife is if people are benefiting from this resource that they are living with and that education and awareness is crucial in increasing wildlife tolerance.

Keywords: Human wildlife conflict, perception, attitude, tolerance, land type, non-conservancy communal farmers.

Chapter 1: General Introduction

1.1. Background

1.1.1. Global impacts of human-wildlife conflict on human livelihoods

The negative impacts of wildlife on human livelihoods have been and continue to be investigated extensively. According to Zimmermann *et al.* (2010), human-wildlife conflict occur when wild animal species' behaviour present a direct and periodic threat to the livelihood or safety of a community, which may lead to retaliatory persecution of the species. These conflicts are prevalent world-wide, with a vast array of species such as the North American wolf *Canis lupus* (Kellert *et al.* 1996), South American jaguar *Panthera onca* (Marchini and Macdonald 2012), Indian tiger *Panthera tigris* (Karanth *et al.* 2012), the African elephant *Loxodonta africana* (O'Connell-Rodwell *et al.* 2000) and lion *Panthera leo* (Hanssen *et al.* 2019). Human-wildlife conflict (HWC) have been recognised as one of the threats to global biodiversity conservation but also to livelihoods of those affected (Dickman and Hazzah 2016, Anand and Radhakrishna 2017). These conflicts are as old as human civilization (Anand and Radhakrishna 2017) and remain an important contemporary issue that conservation agencies, governments and all stakeholders need to tackle.

HWCs usually occur between diverse communities living among wildlife or in close proximity to protected areas containing wildlife (mega herbivores and large carnivores) (Newmark *et al.* 1994, Hemson *et al.* 2009, Gandiwa *et al.* 2013) and this 'locus' is known as the human-wildlife interface (Wehtje 1998). These conflicts are usually driven by movement, displacement and human population increase, loss and fragmentation of habitats, climate change, a decline of the natural prey species (in the case of carnivores) and in some parts of the world, an increase in wildlife populations due to successful conservation programmes (Mmopelwa and Mpolokeng 2008, Lamarque *et al.* 2009, Barua *et al.* 2013). They occur in the form of livestock depredation, crop damage, infrastructure damage, injury and even death of humans, in turn the perceived problem causing animal or groups may be killed (Lamarque *et al.* 2009).

Namibia is a dry country and experiences frequent droughts which tend to exacerbate HWC. Human-wildlife conflict in Namibia tend to differ in nature between regions. In the north-western regions, namely the Kunene and Erongo, losses are predominantly attributed to livestock depredation as well as infrastructure damage (e.g. water tanks) (Stander 2005, cited in Jones and Barnes 2006), whereas in the North-East it is mostly crop raiding followed by livestock depredation (O'Connell-Rodwell *et al.* 2000, Hanssen *et al.* 2019). Mitigating these conflicts has largely focused on livestock management and control of wildlife (problem-animal removal) rather than coexistence. Preventative measures

include herding, kraaling, guarding fields at night, elephant proofing waterpoints and many others (Jones and Barnes 2006, Hanssen *et al.* 2019), while wildlife perceived as problem-causing are often killed or translocated (Marker *et al.* 2003).

1.1.2. Research on attitudes toward human-wildlife conflict impacts worldwide

Historically little attention, if any, has been given to the human dimension in major ecological studies (St. John *et al.* 2014), specifically the issue of conservation conflicts or human-wildlife impacts outside protected areas (Dar *et al.* 2009). This can be attributed to some conservation practices, such as 'fortress conservation' (Adams and Hulme 1998), a generalised understanding of local communities' dynamics (Klein *et al.* 2007) and research limitations (financially, temporally and spatially) (Williams *et al.* 2002). Unfortunately some of these research outcomes end up being used to advise policies as 'precautionary measures' (Cooney 2004), which can lead to mistrust, alienation and even more drastic impacts on wildlife populations from local communities (Simasiku *et al.* 2008).

There has been a paradigm shift however in research approaches, conservation policies and practices (Sharma *et al.* 2010) in some parts of the world, such as the Namibian CBNRM programme (MET 2013). Here rural communities play a crucial role in the conservation of the environment and its wildlife resources (Hulme and Murphree 1999) and should therefore be included in designing and implementing solutions to HWC. This is where inter-disciplinary and transdisciplinary approaches which recognise the complexity of Social Ecological Systems (Berkes and Folke 1998 cited in Kansky and Knight 2014) have begun to be applied. Kansky and Knight (2014, p. 94) state that "these approaches typically highlight the need to integrate ecological, economic and social perspectives using concepts and methods from a range of disciplines (e.g. conservation biology, anthropology, social psychology, economics and development studies), but "within this approach effective solutions are not the preserve of any one discipline and focus equally on wildlife management as well as human dimensions".

Understanding attitudes and perceptions towards human–wildlife interactions can bring deeper insights to the drivers and consequences of HWC. In the African context, attitudes are not to be generalised with common rhetoric used by some researchers, who claim that "rural Africans have little sympathy for wildlife and see animals purely in terms of their meat value, and the damage they cause to agricultural livelihoods" (Lamarque *et al.* 2009, p. 16). Even though such a statement may hold some merit, it downplays the complexity and heterogeneity of African societies and consequently their attitudes and perceptions toward wildlife. Rather than presenting these generalised statements as facts, researchers ought to present evidence of what brought about such attitudes and behaviour.

Nevertheless, there has been and continues to be numerous studies with special interest on attitudes toward HWC worldwide. Attitudes and perceptions of any society toward wildlife species are pivotal to the survival of species in such a society (Williams *et al.* 2002, Zimmermann *et al.* 2005, Shumway *et al.* 2014).

Studies indicate that perceived losses of livelihoods to HWC are usually inflated compared to the actual losses (Marker *et al.* 2003). This can be attributed to farmers' understanding of the species involved/believed to cause HWC (Lindsey *et al.* 2013). This is expressed in behaviours such as indiscriminate elimination of predators even before they cause problems (Marker *et al.* 2003) or reporting inflated numbers to authorities to demand them to pursue problem–animal control proactive policies (Stein *et al.* 2010). Similarly, levels of tolerance of wildlife by farmers are said to be influenced by the value, or lack thereof, attributed by farmers to different species of wildlife that farmers interact with (Lindsey *et al.* 2013). For these reasons, numerous researchers have focused on these factors (perceived losses and tolerance levels) using different methods to understand HWC (Marker *et al.* 2003, Lindsey *et al.* 2013, Rust and Marker 2013, Edwards 2015).

1.1.3. Human-wildlife conflict impacts on human livelihoods in non-conservancy communal areas (including resettlement) and commercial farms of Namibia

Much research has been conducted within communal conservancies in Namibia, with most information collected at conservancy meetings and among conservancy game guards. Members of communal areas not part of conservancy programmes, as well as resettlement farmers, have largely not been engaged - with the exception of a study by Rust and Marker (2013) on HWC, which included resettlement farmers.

According to the Communal Land Reform Act of 2005 (Government Republic of Namibia 2005), a communal area in relation to a traditional community, is defined as an area comprising the communal land occupied by members of that community. Communal land makes up one of the three main land tenure systems in Namibia (the other being freehold and state land), as provided for through the land reform at independence to strive at achieving an even land distribution in an independent Namibia (Mendelsohn *et al.* 2002). Communal land where the inhabitants have customary right to the land makes up a total of 38 % of the country's total surface area (Mendelsohn *et al.* 2012). As of 2016, 52% of Namibia's population is reported to be residing in communal areas (Namibia Statistics Agency 2017).

Resettlement farms are freehold farms that have been purchased from former owners with the intent to resettle individuals or groups of people from previously disadvantaged backgrounds for farming

purposes (Gargallo 2010). Government resettlement farms comprise of a total of 3 021 959 ha (Namibia Statistics Agency 2018). These farms are located countrywide with some bordering protected areas, such as the Etosha National Park, while others are adjacent to commercial farms or communal conservancies that may have abundant wildlife populations. Private commercial farmlands make up a total of 34 237 254 ha, 42% of the country's total surface area (Namibia Statistics Agency 2018). In general, the main form of land–use in both land tenure systems is small and large livestock production. Additionally commercial farmers have been venturing into wildlife-based activities such as hunting and tourism (Jokisch 2009, Lindsey *et al.* 2013). In fact, most of Namibia's wildlife is found outside protected areas, foremost on private commercial farms (De Jager and Barnes 1996), followed by communal conservancies as well as on government resettlement farms. The latter however may have significantly low numbers of wildlife (Harring and Odendaal 2002).

A considerable amount of research has been carried out on the subject of human-wildlife conflict in communal conservancies in Namibia (O'Connell-Rodwell *et al.* 2000, Mulonga *et al.* 2003, Jones and Barnes 2006). All human-wildlife conflict fall into four categories namely garden and crop damage, livestock losses, infrastructure damage and human attacks. Jones and Barnes (2006) highlight that most human-wildlife impacts take place on communal land where most elephants and large predators residing outside national parks are found and where people are economically vulnerable to damage and losses from human-wildlife impacts. These conflicts in communal areas are complex in nature and are not evenly distributed between stakeholders, due to geographic location of homesteads (e.g. proximity to wildlife hotspots and corridors), seasonality of damage, the different array of species involved (Mulonga *et al.* 2003).

There are many communal farmers affected by human-wildlife impacts outside conservancies (Jones and Barnes 2006) as well as commercial farmers (Jokisch 2009, Lindsey *et al.* 2013). Intensity in number and severity of impacts will differ from area to area depending on wildlife populations, especially the presence of species known to have an impact on human livelihoods (e.g., elephant, jackal, hyena and leopard). The revised national policy on human wildlife conflict management 2018-2027 (MEFT 2018) mainly caters for communities/farmers who are registered members of communal conservancies and therefore "communities that are not formed into conservancies do not have the same institutional platform for dealing with HWC more comprehensively and don't have access to the benefits that come from conservancies that can act as mitigation of HWC" (Jones and Barnes 2006, p. 35). This is also true for commercial farmers, as they do not benefit from the monetary assistance offered by government through the Ministry of Environment, Forestry and Tourism (MEFT 2018) to offset the damage caused by wildlife (Edwards 2015). Adding all these factors together, there seems to be a greater impact of HWC on farmers on non-conservancy land and therefore understanding their

behaviour toward this problem would be of great value in coming up with solutions that can change perspectives toward wildlife and consequently harmonious co-existence with wildlife.

1.1. Problem Statement and study justification

Despite the successes of the communal conservancy programme (MEFT/NACSO 2019), it is widely recognised that living with wildlife carries a cost and these impacts spread far beyond the conservancies' boundaries (Jones and Barnes 2006). Research on human-wildlife impacts in communal areas has largely focused on people living within conservancies (Naidoo *et al.* 2016, Störmer *et al.* 2019), while communal farmland outside of conservancies has been neglected. Wildlife population increase and dispersion into communal and commercial areas outside designated wildlife zones may result in more frequent conflicts between people and wildlife, with elephants and predators in particular, and the impact of losses and damage on communal and commercial farmers have been exacerbated by the effects droughts (Jones and Barnes 2006, MET 2018, Stoldt *et al.* 2020, Gargallo 2021). Although these conflicts have always existed and will persist in the future, there is a need to invest in the understanding of conservation conflicts in a more holistic sense to effectively guide and add to the existing knowledge of human wildlife conflict management and mitigation.

1.1.1. Aims and Objectives

The aim of this study was to gain an understanding of human wildlife conflict impacts on the livelihoods of farmers in both communal and commercial farming areas which do not include wildlife conservation in their activities.

This was achieved through the following objectives:

i. **To understand the different types losses to wildlife**

The first objective was to understand the type of HWC impacts incurred by communal and commercial farmers living outside conservancies due to wildlife and what type of mitigation methods are used to minimise HWC.

ii. **To understand costs vs benefits of wildlife**

The second objective was to understand perceived costs and benefits of wildlife to communal and commercial farmers.

iii. **To assess people's attitudes towards wildlife**

The third objective was to understand what people's attitudes were towards wildlife in their area.

Chapter 2: Methods

2.1. Study Area

North – East (Zambezi)

The study took place in three regions, Zambezi, Kavango and Kunene The Zambezi region (17°30'S 24°16'E), which was known as Caprivi until 2013, is well known for its perennial Zambezi River which forms the North-Eastern boundaries of Namibia with its neighbouring countries (Zambia, Zimbabwe and Botswana) (Figure 1) but the region also shares borders with Angola. Annual rainfall for the region is about 700 mm (Kamwi *et al.* 2015). Zambezi has an area of 14,785 km^2 with Katima Mulilo as its capital (Institute for Public Policy Research 2013). This region falls within the Tree-and-Shrub Savanna Biome with tree species such as the Wild Willow *Salix mucronata*, the Sycamore Fig *Ficus sycomorus* as well as Large – leaved/ Poison Pod *Albizia versicolor* (Mendelsohn *et al.* 2000, Curtis and Mannheimer 2005). Because of the rich riverine habitats and high rainfall, the region has a high species richness and abundance of both plants and animals (Griffin 1998). Zambezi host three national parks, namely Bwabwata National Park, Mudumu National Park and Nkasa Rupara National Park. It is also home to 15 gazetted communal conservancies, one communal association (Kyaramacan Association in Bwabwata NP) and several ungazetted emerging communal conservancies (MEFT/NACSO 2019, NACSO-NRWG 2019). Because of these protected areas, several wildlife species such the African elephant *Loxodonta africana*, African Buffalo *Syncerus caffer* Plains Zebra *Equus quagga* and Common impala *Aepyceros melampus* are found in the region, along with a number of predators such lion *Panthera leo* and leopard *Panthera pardus* (Naidoo, Chase, *et al.* 2016, NACSO-NRWG 2019).

The Linyanti constituency where the interviews took place (the Linyanti settlement with its several villages) has an area of 1,781 km^2 (Brinkhoff 2020) and is one of the eight constituencies of the Zambezi region (Government Gazette of the Republic of Namibia 1992). The Linyanti settlement lies between Dzoti conservancy to the east and Bamunu conservancy to the west, one of few non-conservancy communal areas left in the region (MEFT/NACSO 2018). In 2011 Linyanti constituency's population was 15 477 with 3 745 households (Namibia Statistics Agency 2014), this was before the constituency was split into two in 2013 (the other quarter became Judea Lyaboloma constituency), so the actual population as of 2011 is 7 328 (Brinkhoff 2020). The constituency is also home to parts of both Nkasa Rupara and Mudumu National Parks which were all fully in Linyanti constituency before the western half was delimited to form the Judea Lyaboloma constituency. The Linyanti settlement is demarcated to the south by the Linyanti River, which forms the borders between Namibia and Botswana, with the Chobe National Park on the Botswana side.

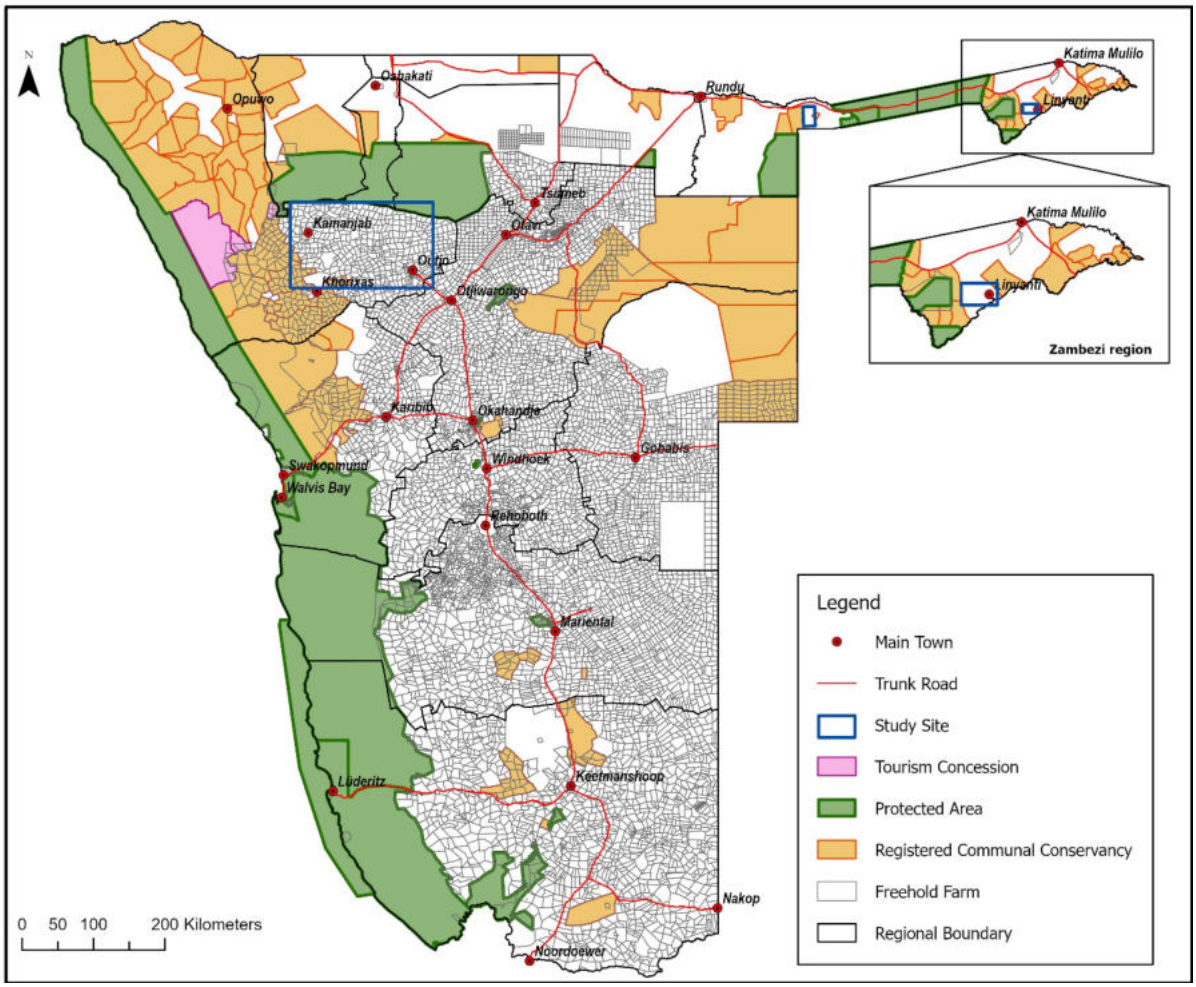

Figure 1: Map of Namibia in which our study areas are marked by a blue box. Communal conservancies are depicted in orange, protected areas in green and tourism concessions in purple, while main towns are marked with a dot (•).

Some of the the ethnic groups found in the Linyanti area are the Mafwe and Lozi (Chilinda, personal communication, 29 September 2020), whose major source of livelihood is mainly agricultural, that is subsistence farming with few individuals that are employed by the government (personal observation). There are also voluntary local game guards working in the area to record wildlife activities and conflicts, who were appointed by IRDNC (Intergrated Rural Development and Nature Conservation) and have been equipped with essential items to carry out wildlife monitoring in anticipation of future possibilities of the area becoming a communal conservancy (D. Ward, personal communication, 10 September 2019).

Kavango East

The Kavango East region (18°20'S 20°35'E) covers an area of 23 987 Km^2 and became a region in 2013 when the Kavango region was split into two, East and West (Namibia Statistics Agency 2017, Wikipedia 2021). The Kavango regions are well known for their perennial Okavango River which forms the Namibian – Angolan borders and intersects Kavango East region to the east before flowing into the famous Okavango Delta in Botswana. Annual rainfall for the Kavango regions (East and West) is 500 – 600 mm per annum (Mendelsohn *et al.* 2010). The region is located in the Kalahari Basin with a flat to undulating topography, characterised by Aeolian sand (Burke 2002, Mendelsohn and El Obeid 2004). At a broader level, the vegetation type of the region is described as forest savannah and woodland (Geiss 1998, as cited in Burke 2002), comprising of tree species such as the wild syringe *Burkea africana*, Kiaat *Pterocarpus angolensis*, African teak *Baikeaea plurijuga*, and silver cluster-leaf *Terminalia sericea* (Mendelsohn and El Obeid 2004). The region is home to a few protected areas such as Khaudum National park, Mangetti Natinal Park and part of Bwabwata National Park as well as four communal conservancies (MEFT/NACSO 2019). Due to human settlement among other disturbances, large mammals in the Kavango regions are mainly restricted to protected areas such as the Bwabwata National Park (former Mahango Game Reserve and West Caprivi Game Reserve) (Bethune 1991). Wildlife species prevalent in the region, mainly in the protected areas include the African elephant *Loxodonta africana*, the Nile crocodile *Crocodylus niloticus*, as well as the African buffalo *Syncerus caffer* (Bethune 1991). Interviews in Kavango East were carried out in the villages on the outskirts of George Mukoya and Muduva Nyangana conservancies which borders Khaudum National Park, north-east of Khaudum. Similar to the other two regions where interviews were carried out in non-conservancy communal land, the main form of livelihood is subsistence farming.

Kunene

The Kunene region (18°03'20"S 13°50'26"E) which covers an area of 115,260 km^2 (Institute for Public Policy Research 2013) is characterized by the central-western Plains in the south as well as the Etendeka Plateau and Kunene hills Landscapes (Mendelsohn *et al.* 2002). The region begins at the Kunene River where the river forms the northernmost borders of Namibia and Angola and extends south to the Ugab River (Martin 2009), thereafter ending on the north-western shore of Namibia's Atlantic Ocean. This area is very arid and has an annual rainfall of 50 – 300 mm, which usually falls during the summer months (November−April) (Mendelsohn *et al.* 2002). The area comprises of three different vegetation biomes (i.e., Tree-and-Shrub Savanna, Desert Biome and Nama Karoo Biome) dominated by tree species such as mopane *Colophospermum mopane*, Camelthorn trees *Vachellia erioloba* and *Commiphora spp*. (Curtis and Mannheimer 2005, Muntifering *et al.* 2019). In terms of wildlife, there are ungulate species such as Hartmann's mountain zebra *Equus zebra hartmannae*, springbok *Antidorcas marsupialis* and oryx *Oryx gazelle* as well as large predators such as lion *Pathera leo*, leopard *Panthera pardus*, cheetah *Acinonyx jubatus*, and spotted hyaena *Crocuta* (Muntifering *et al.* 2019).

Table 1: Kunene Region's various land uses and their coverages, modified from (Martin 2009, p. 7).

LAND CATEGORY	**SPECIFIC AREAS**	**TOTAL AREA (KM^2)**
PARKS	Skeleton Coast National Park	16,820
COMMUNAL LAND	Concessions Conservancies Other communal land	6,594 60,899 12,426
PRIVATE LAND	Kamanjab, Otjikondo, Outjo	18,535

Interviews in Kunene were carried out on commercial and resettlement farms north of Outjo and south of Etosha National Park as well is in the vicinity of Kamanjab. The major form of livelihood practice in this area is livestock farming, both commercial and subsistence. There are also game farming and tourism enterprises in the study area which are sometimes carried out alongside livestock farming on commercial farms (Jokisch 2009). The study area is also known to hold a variety of ungulate species such as Kudu *Tragelaphus strepsiceros,* Burcell's zebra *Equus burchellii* and springbok *Antidorcus marsupialis* (Mendelsohn *et al.* 2002, Environmental Information System Namibia 2021). HWC is prevalent in this area from both elephants and predators (Namibian Sun 2017, Thomson 2021). Resettled farmers in the study area are mainly San people, specifically the Hai//om, with a few Damara people (Personal observation). They were resettled in these government farms at around

Independence, having been evicted from what is now Etosha National Park in the 1960s (Legal Assistance Centre 2006).

2.2. Data Collection

2.2.1. Procedures

Interviews were conducted between September 2019 and October 2020 in Zambezi, Kavango and Kunene regions as part of a National study conducted by FM Tavolaro through University of Cape Town (Ethics approval FSREC 80 – 2019). Following a mixed methods survey approach (Johnson *et al.* 2007), both qualitative and quantitative data were captured. In-person interviews comprising of both closed and open-ended questions, targeting 40 individual per study area category (i.e., non-conservancy communal area, resettlement farms as well as commercial farms) were conducted. Data were entered in the field using a Forms app by Device Magic (Version 2.44.5) to simplify data entry and automatically georeference it in the field. Due to the fact that many households and farms were not readily accessible and considering the long distances between commercial farms and some resettled communities, this study utilised a mixed approach of convenience and snowball sampling (Teel *et al.* 2007, Cohen and Arieli 2011). For the non-conservancy communal areas and resettlement farms, an opportunistic street intercept-sampling frame of surveying the inhabitants was used having gained permission from the local chief to conduct interviews in the areas (Störmer *et al.* 2019). For commercial farms, phone calls as well as text message appointments were made to secure the interviews. Where possible, a balanced sample across genders (male/female) was obtained to account for gender differences. All Interviews were conducted in English, capable interpreters from the three regions who could speak English and knew the local languages assisted with the translation of questions into the participants' languages and vice versa for those who do not understand English in the non-conservancy's communal area as well in the resettlement farms. The purpose of the study and the structure of the questionnaire was well explained to the interpreters to ensure that they impart the right information to the participants. Basic ethical principles such as knowledge and truth promotion as well as error avoidance were followed (Störmer *et al.* 2019). Participants were informed about the purpose of the study, obtaining their informed consent, protecting their anonymity and confidentiality and were given the right to decline from participating or withdrawing from the interview at any time.

2.3. Data analysis

Demographic and socio-economic descriptive statistics data were analysed using Excel whereas other statistical analyses were performed using IBM SPSS Statistics (Version 26). The one-sample Kolmogorov-Smirnov test was used to check assumptions of normality for ordinal data, consequently, due to data being non-parametric, the Kruskal-Wallis H test with the Dunn-Bonferroni test for multiple pairwise comparisons was used. The Chi-square test of independence with the Bonferroni adjustment was also used. Significance was defined as $P < 0.05$.

Chapter 3: Results

3.1. Characteristics of sample

A total of 142 individuals (*n = 142*), representing the same number of households were interviewed between September 2019 and October 2020 across three different regions, namely Kunene, Kavango East and Zambezi, representing three different types of land uses (commercial, communal and resettlement). Of the 142 respondents, 60.6% (*n = 86*) were male, whereas 39.4% (*n = 56*) were female. Only 2.8 % (*n = 4*) of the 142 respondents (or their relatives) indicated having income through employment (Table 2). The socio-economic attributes of these sample varied greatly, especially in terms of household wealth and income.

Table 2: Some demographic and socio-economic descriptive statistics of the respondents, namely: i) age, ii) sex, iii) number of people in the household, iv) Number of adults who had earned money in the past year (from employment or sales) in the household, v) Average money (N$) from wages, sales and government grants that came into household each month, vi) Largest number of cattle the household had in the past year. Table depicting number of respondents (n), mean, standard error of mean, standard deviation, minimum and maximum values, and proportion (percent).

	N		Mean	SE of Mean	Std. Dev.	Min.	Max.	%
	Valid	Missing						
Age	142	0	49.84	1.31	15.56	20.00	83	
Male Female								60.60 39.40
No. of people in household	141	1	6.59	0.45	5.40	1.00	37	
No. people employed	142	0	0.27	0.06	0.71	0	4	5.68
HH monthly income (N$)	141	1	6699.97	2362.18	28049.37	0	200000	
No. of cattle	142	0	71.68	13.13	156.48	0	900	

3.1.1. Large-stock ownership (cattle)

Of the total 142 respondents, 76.1 % (*n = 108*) indicated that their households had owned large stock in the past year while 23.9 % (*n = 34*) said their households did not. There was no association between regions (X^2 = *10.104*, *df* = *2*, *p* = *.006*; Fig. 2a) and number of households owning cattle and no association between land type (X^2 = *9.488*, *df* = *2*, *p* = *.009*; Fig. 2b) and number of households owning cattle.

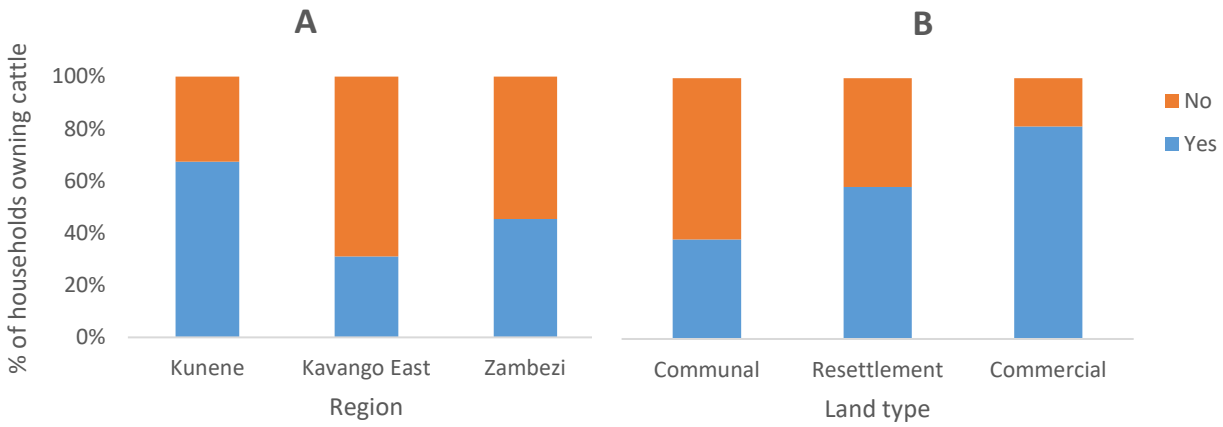

Figure 2: a) Cattle ownership among households across the Kunene, Kavango East and Zambezi regions (n = 142); and b) cattle ownership among households across communal, resettlement and commercial land types, in the past year (n = 142).

3.1.2. Small-stock ownership (goats and sheep)

Overall, 46.5 % (*n = 66*) of households had owned small-stock in the past year while 53.5 % (*n = 76*) said their households did not own small-stock. There was a significant association between regions (X^2 = *42.702*, *df = 2*, *p = .001*; Fig. 3a) and number of households owning small stock as well as land type (X^2 = *34.950*, *df* = 2, *p = .001*; Fig. 3b) and number of households owning small-stock. Households' small stock ownership in Kunene (*p = .001*) was not significantly different from Zambezi region's households (*p = .000*). Kunene and Zambezi regions households' small-stock ownership were significantly different from Kavango East's number of households owning small-stock (*p = 1.43*). Communal households' small-stock ownership (*p = .001*) was statically significant different from resettlement households (*p = .001*), as well as from commercial households' small-stock ownership (*p = .037*). More households in Kunene region had small stock in the past year compared to the other two regions. Fewer households in Zambezi region had small-stock.

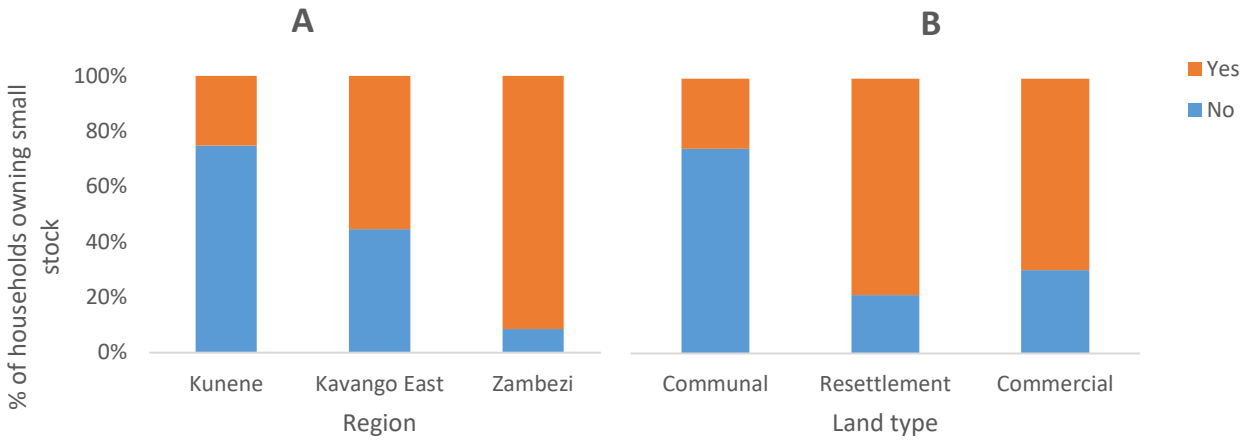

Figure 3: a) Households owning small-stock among respondents across the Kunene, Kavango East and Zambezi regions (n = 142); and b) households owning small-stock among respondents on communal, resettlement and commercial land types, in the past year (n = 142).

3.1.3. Garden or crop field ownership

In the past year, 78.9 % (*n = 112*) of the households had owned a garden or crop field while 21.1 % (*n = 30*) of households did not. Significant difference was found between regions ($X^2 = 27.651$, *df = 2, p = .001*; Fig. 4a) and land type ($X^2 = 27.328$, *df = 2, p = .001*; Fig. 4b) in number of households owning a garden or field. Number of households with a garden or field in Kunene (*p = .001*) was significantly different from number of household owning a garden or field in Kavango East (*p = .001*) and Zambezi (*p = .038*) regions. There was no statistically significant difference in number of households owning a garden or filed between commercial and resettlement farm households (*p = .001; p = .001*). Communal households had significantly more gardens or field compared to commercial farmers (*p = .001; p = .056*) as well as compared to resettlement communal farmers (*p = .001; p = .056*).

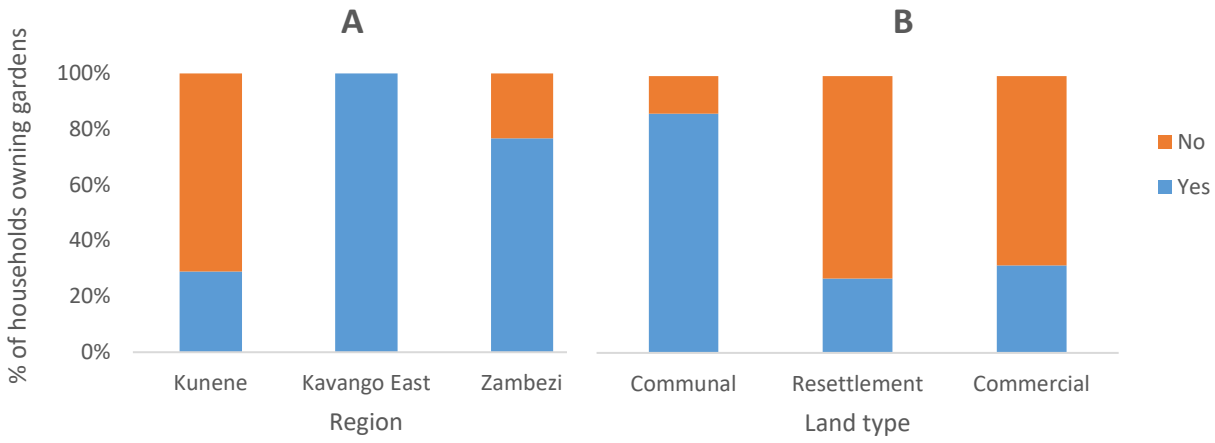

Figure 4*:* a) Number of h*ousehold*s owning *gardens* or crop *fields across the* Kunene, Kavango East and Zambezi *regions* (n = 142); b) number of households owning gardens or crop fields among respondents on communal, resettlement and commercial land types (n = 142).

3.2. Type of HWCs

3.2.1. Wildlife impacts on human livelihoods

Overall, 63.4 % (n = *90*) of the respondents reported having experienced damage associated with wildlife while 36.6 % (*n = 52*) said they have not experienced damage caused by wildlife. There was a significant relationship between region and experience with damage caused by wildlife (X^2 = *30.561*, *df = 2, p = .001*). A pairwise comparisons with the Bonferroni correction shows that farmers in Kunene (*p = .001*) and Kavango East (*p = .001*) experienced HWC significantly more than farmers in the Zambezi (*p = 2.40*) region (figure 5a). Furthermore, there was a significant relationship between experience of wildlife associated damages and land type (X^2 = 62.736, *df* = 2, *p* = *.001*). Resettlement farmers experienced significantly less HWC (*p = .001*) compared to both communal (*p = .001*) and commercial farmers (*p* = *.008*). Nevertheless, more communal and commercial farmers have experienced HWC compared to resettlement farmers as shown in figure 5b below.

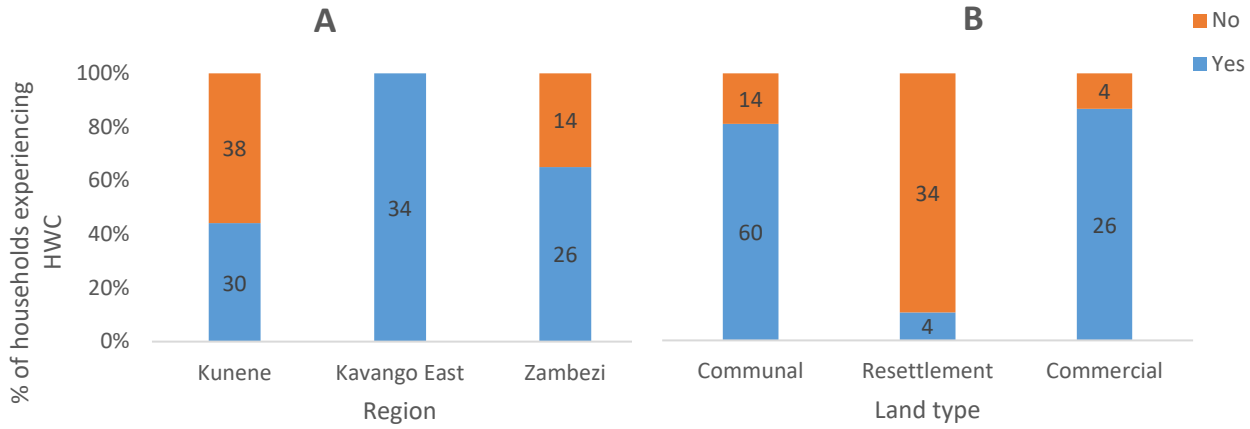

Figure 5: a) Number of households having experienced damage or losses due to wildlife (i.e., livestock loss, crop or infrastructure damage) across the Kunene, Kavango East and Zambezi regions (n = 142); b) number of households having experienced damage or losses due to wildlife (i.e., livestock loss, crop or infrastructure damage) among respondents on communal, resettlement and commercial land types (n = 142).

3.2.2. Perceived prevalence of HWC

There was a significant difference in respondents' perception toward the prevalence of HWC in their areas in the past decade (*H = 22.597 df = 2, p= .001*). Farmers from Zambezi region expressed significantly more concern of increasing HWC compared to those from Kunene (*p = .001*) and Kavango East (*p = .001*). Farmers' perceptions on HWC from Kavango East were not significantly different from those in Kunene (*p = 1.000*) and farmers from this regions showed a milder concern of the prevalence of HWC compared to farmers in Zambezi (figure 6a). Furthermore, there was significant difference in respondents' perception towards HWC prevalence (*H* = 27.878, *df* = 2, *p* = *.001*) across the land types. Commercial farmers expressed significantly more concern of increasing HWC compared to resettlement farmers (*p = .001*). Communal farmers also showed more concern over increasing HWC compared to resettlement farmers (*p = .001*). There was no significant difference on concern over increasing HWC between commercial and communal farmers (*p = 1.000*) (figure 6b).

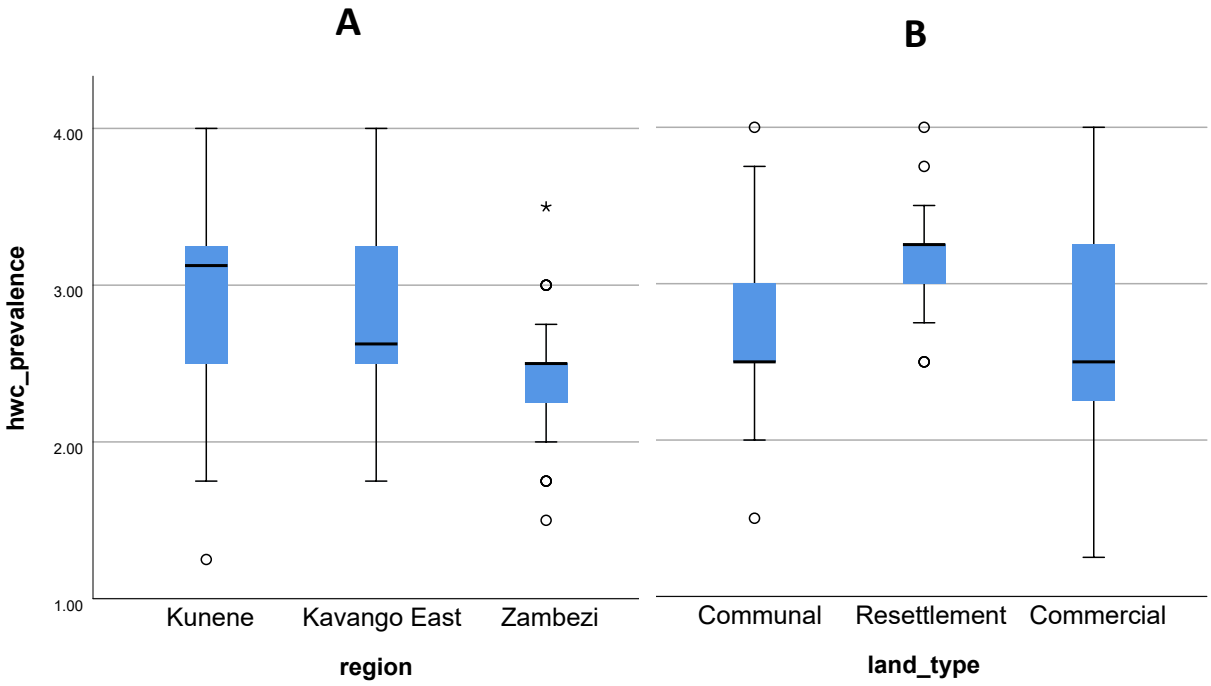

Figure 6: Farmer's perception of whether overall HWC in the past decade had increased, stayed the same, decreased or was not a problem in (Data were coded as 'hwc has increased' = 1, 'stayed the same' = 2; 'Decreased' = 3; 'Not a problem' = 4; and 'Do not know' = 0) a) the Kunene, Kavango east and Zambezi regions, and b) on communal, resettlement and commercial land types (n = 142).

3.2.3.Loss of livestock due to wildlife

There was a significant difference in terms of cattle losses due to wildlife ($H = 29.996$, $df = 2$, $p = .001$), drought ($H = 13.989$, $df = 2$, $p = .001$) and disease ($H = 12.157$, $df = 2$, $p = .002$) across the regions in the past twelve months from the time of the interview (Figure 7). Respondents from Kunene lost significantly more livestock to wildlife ($p = .001$) compared to other regions, but there was no significant difference between Kavango East and Zambezi. Significantly more cattle were lost to drought in Kunene compared to Zambezi ($p = .002$) and Kavango East ($p = .051$), and there was no significant difference between Kavango East and Zambezi. Significantly more cattle were lost to disease in the Kavango East compared to Kunene ($p = .001$). There was no significant difference in cattle losses to drought between Kunene and Zambezi, neither between Zambezi and Kavango East.

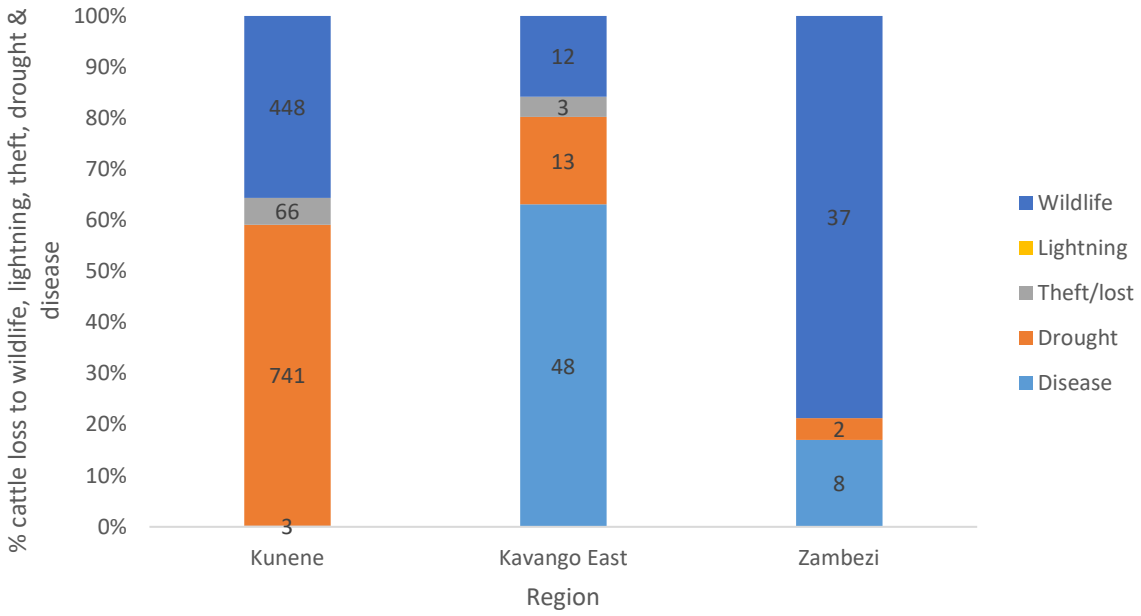

Figure 7: Number of cattle lost in the past year due to wildlife, lightning, theft or lost, drought and disease in the Kunene, Kavango East and Zambezi regions (n = 142).

There was a significant difference in cattle losses due to wildlife depredation (*H = 31.108, df = 2, p = .001*), drought (*H = 14.964, df = 2, p = .001*) and disease (*H = 7.457, df = 2, p = .024*) across land types (Figure 8). Commercial farmers lost significantly more cattle to wildlife (*p = .001*) compared to communal farmers. Resettlement farmers also lost more cattle to wildlife (*p = .001*) compared to communal farmers, there was no significant difference between resettlement and commercial farmers. Commercial farmers lost significantly more cattle to drought (*p = .001*) compared to communal farmers. Resettlement farmers also lost significantly more cattle to drought (*p = .037*) compared to communal farmers. It was predominantly communal farmers who experienced losses from disease, nevertheless a post hoc comparison could not made as losses to disease were mainly in the communal farming area.

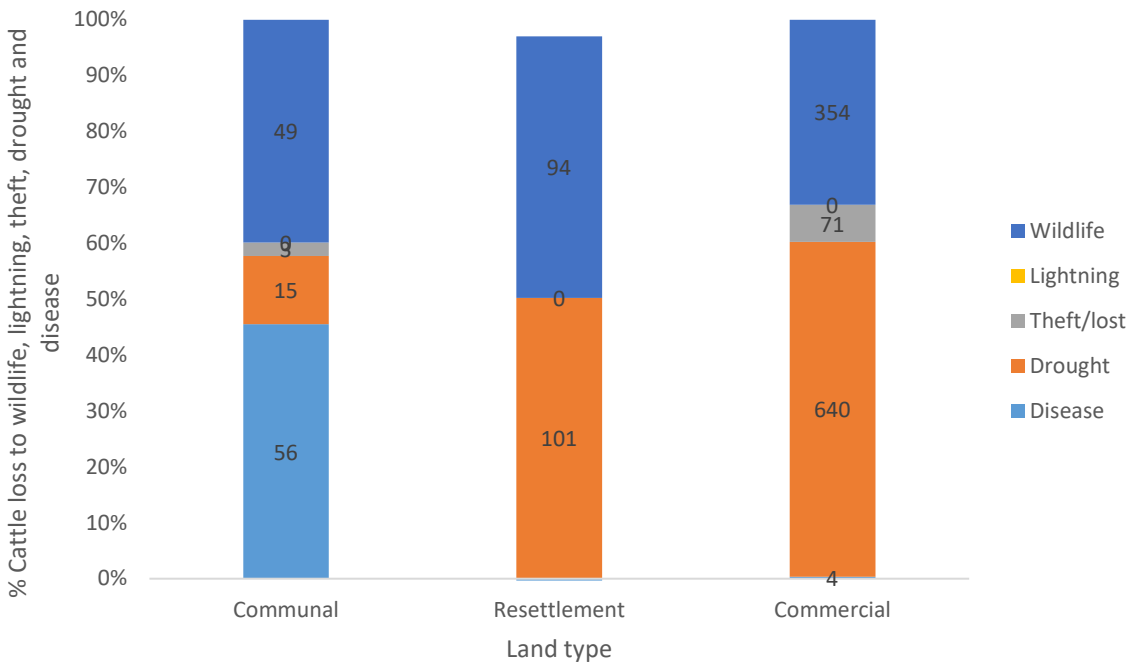

Figure 8: Number of cattle lost in the past year due to wildlife, lightning, theft or lost, drought and disease in communal, resettlement and commercial land types (n = 142).

Respondents in the Zambezi and Kavango East had small-stock losses due to wildlife in the past year, while 233 small-stock were lost to depredation in Kunene in the last 12 month before the study was undertaken. There was significant difference across the regions in terms of small-stock losses to wildlife (*H = 15.816, df = 2, p = .001*) as well as to disease (*H = 6.832, df = 2, p = .033*). Farmers in Kunene region lost significantly more small-stock to wildlife (*p = .001*) compared to Kavango East. Comparison of small-stock losses to wildlife could not be made between Kunene and Zambezi as well as between Kavango East and Zambezi as there were not small stock depredation in the study area in Zambezi region in the past 12 months before the study (figure 9).

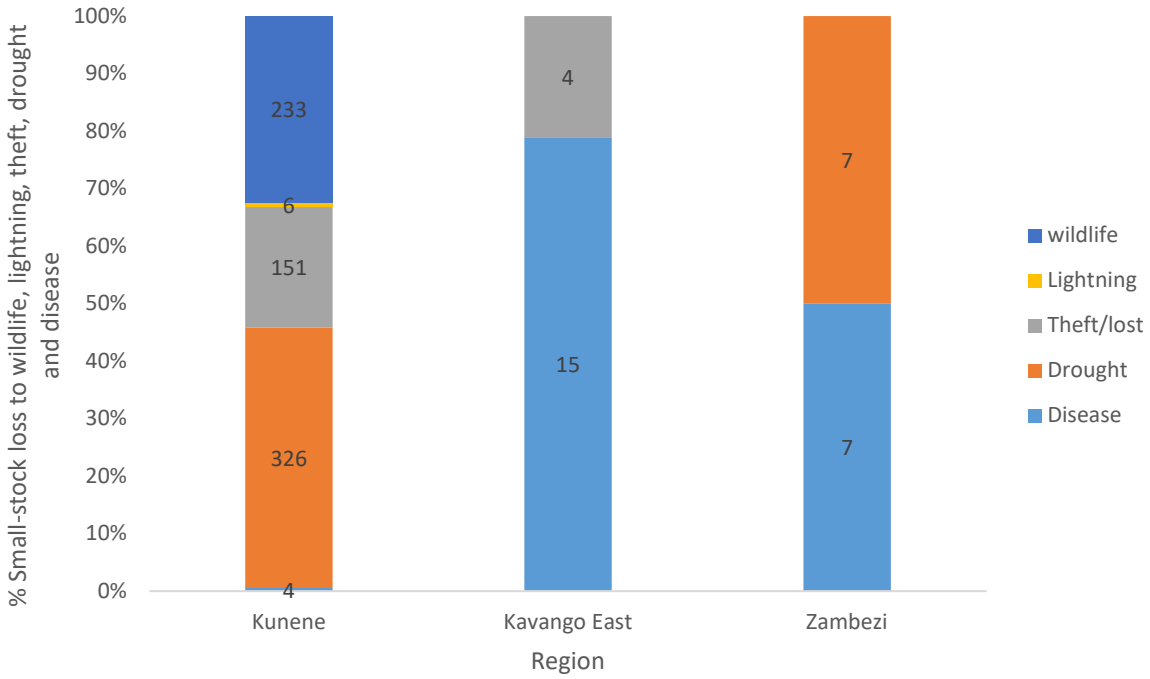

Figure 9: Number of small-stock lost in the past year due to wildlife, lightning, theft or lost, drought and disease in the Kunene, Kavango East and Zambezi regions (n = 142).

There was a significant difference across land types in terms of small-stock losses to wildlife (*H = 26.983, df = 2, p = .001*) and to disease (*H = 6.283, df = 2, p = .043*) (Figure 10) in the last twelve months. Commercial farmers lost significantly more small-stock to wildlife compared to communal (*p = .001*) and resettlement farmers (*p = .002*). Resettlement farmers lost significantly more small-stock to wildlife compared to communal farmers (*p = .048*). No statistical significant difference could be determined for disease across the land types.

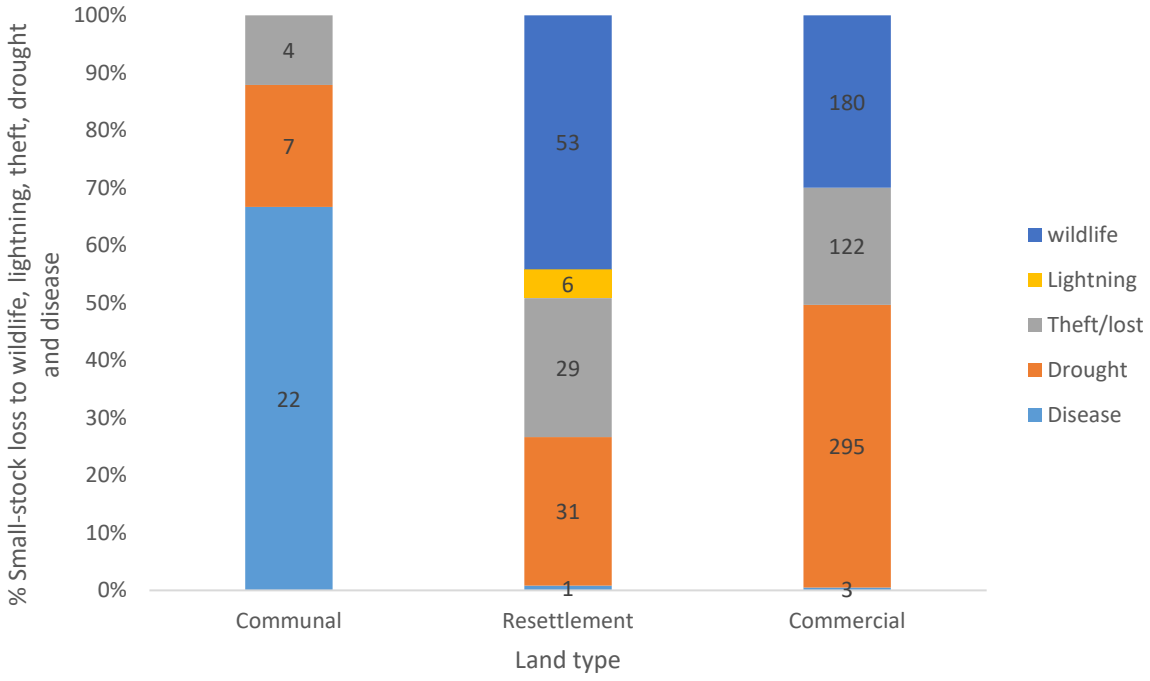

Figure 10: Number of small-stock lost in the past year due to wildlife, lightning, theft or lost, drought and disease in communal, resettlement and commercial land types (n = 142).

In the twelve months prior to the interviews, spotted hyena (290) were responsible for most cattle losses followed by leopard (67) and then lion (37; Fig. 11a). Some cattle (17) were reported to have been killed by unidentified predators (Figure 18). With regards to small-stock losses to depredation, jackals were reported to be responsible for the most losses (102), followed by cheetah (30) and spotted hyena (27). Caracals (16) were also reported to be responsible for a sizable number of small-stock losses (Fig. 11b).

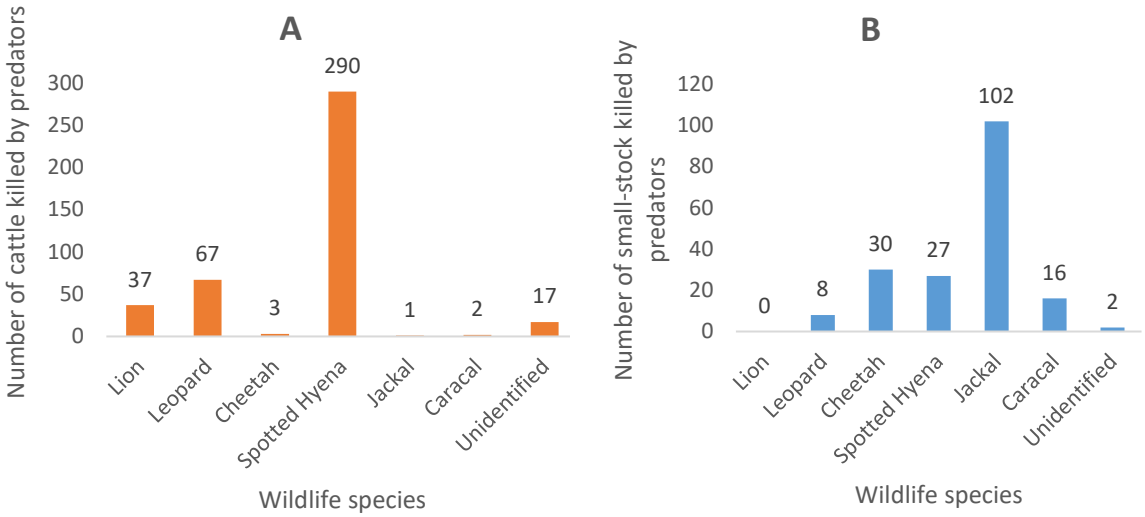

Figure 11: Number of (a) cattle and (b) small-stock losses due to different wildlife species, namely lion, leopard, cheetah, spotted hyena, jackal, caracal, crocodile and unidentified.

There was a significant difference in the number of cattle losses in the last 12 months before the study due to spotted hyena (*H = 24.768; df = 2; p = .001*), lion (*H = 6.073; df = 2; p = .048*) and leopard (*H = 8.354; df = 2; p = .015*) across the regions (Figure 12a). Kunene lost significantly more cattle to spotted hyena compared to Kavango East (*p = .001*) and Zambezi region (*p = .001*) but there was no significant difference between Kavango East and Zambezi. Zambezi lost significantly more cattle to lion (*p = .042*) compared to Kunene. There was no significant difference between Kunene and Kavango East or between Kavango East and Zambezi. Significantly more cattle were killed by leopard in Kunene compared to Zambezi (*p = .041*). There was no significant difference between Kavango East and Kunene nor between Kavango East and Zambezi. There was no significant difference in small-stock depredation across the regions.

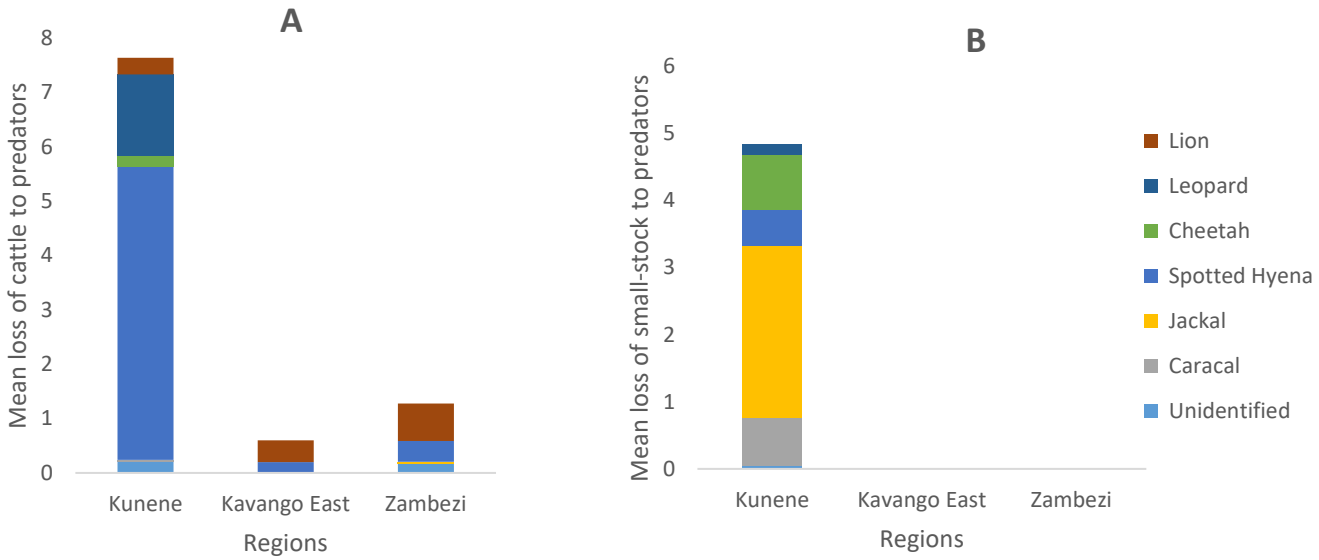

Figure 12: Mean number of (a) cattle and (b) small-stock killed by predator species (i.e., lion, leopard, cheetah, spotted hyena, jackal, caracal, crocodile, and unknown) in the Kunene, Kavango East and Zambezi regions in the past year (n = 142).

There was a significant difference in the number of cattle lost to leopard (*H = 21.996, df = 2, p = .001*) and spotted hyena (*H = 24.679, df = 2, p = .001*) across the land types. Commercial farmers lost significantly more cattle to leopard compared to communal (*H = 21.996, df = 2, p = .001*; figure 13a) as well as resettlement farmers (*H = 21.996, df = 2, p = .001*). There was no significant difference between communal and resettlement farmers. Resettlement farmers lost more cattle to spotted hyena compared to commercial farmers (*H = 24.679, df = 2, p = .001*) as well as to communal farmers (*H = 24.679, df = 2, p = .001;* figure 13a). There was a significant difference in small-stock depredation by jackals (*H = 14.570, df = 2, p = .001*), caracal (*H = 11.406, df = 2, p = .003*) and cheetah (*H = 11.978, df = 2, p = .003*) across land types (Fig. 13b). Commercial farmers lost significantly more small-stock to Jackal compared to communal (*H = 14.570, df = 2, p = .001*) and resettlement farmers (*H = 14.570, df = 2, p = .007*). Commercial farmers lost significantly more small-stock to caracal compared to communal (*H = 11.406, df =2, p = .006*) and resettlement farmers (*H = 11.406, df =2, p = .017*). Commercial farmers also lost more small-stock to cheetah compared to communal (*H = 11.578, df =2, p = .014*) and resettlement farmers (*H = 11.578, df =2, p = .004*; figure 13b).

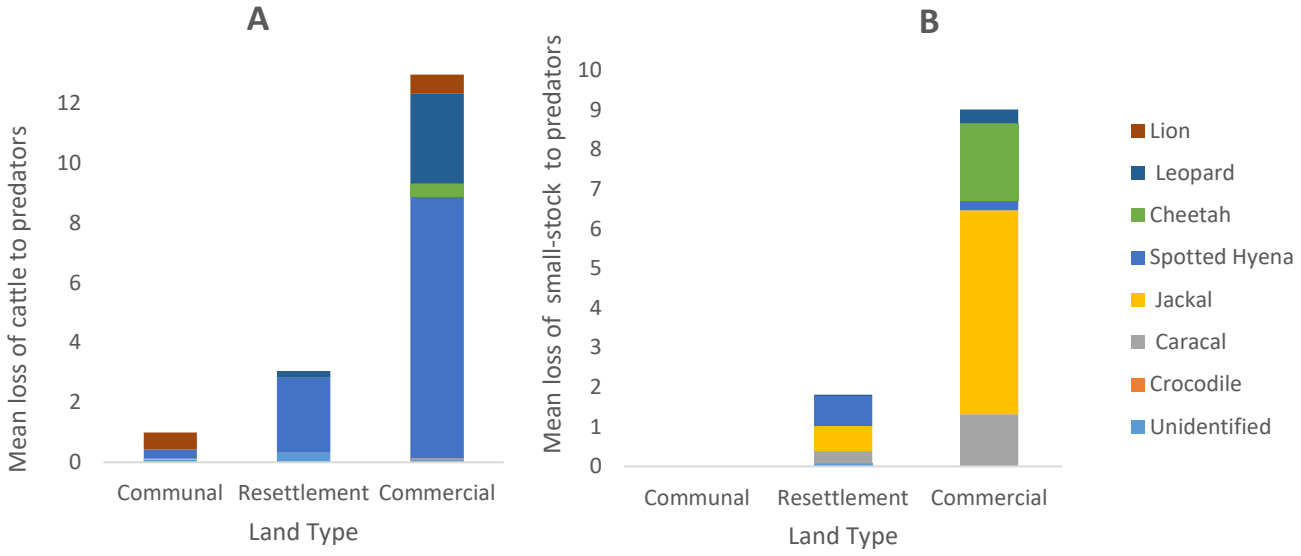

Figure 13: Mean number of (a) cattle and (b) small-stock killed by predator species (i.e., lion, leopard, cheetah, spotted hyena, jackal, caracal, crocodile, and unknown) on communal, resettlement and commercial land types in the past year (n = 142).

3.2.4. Crop raiding/damage

Overall, 42.9 % (*n = 61*) of the respondents said that crop raiding/damage by wildlife was increasing, 42.2 % (*n = 60*) said that crop raiding/damage by wildlife was not a problem while 8.4 % (*n = 12*) said that crop raiding had decreased and only 6.3 % (*n=9*) said that the problem of wildlife raiding/damaging crops had stayed the same. Respondents in Kavango East expressed a significant concern of increasing crop raiding by wildlife, compared to Kunene (*H = 83.662, df = 2, p = .001*), similarly, respondents in Zambezi show a similar significant concern compared to Kunene (*H = 83.662, df = 2, p = .001*). Communal farmers expressed a significant concern of increasing crop field raiding by wildlife compared to resettlement (*H = 84.023, df = 2, p = .001*) and commercial farmers (*H = 84.023, df = 2*, *p = .001*).

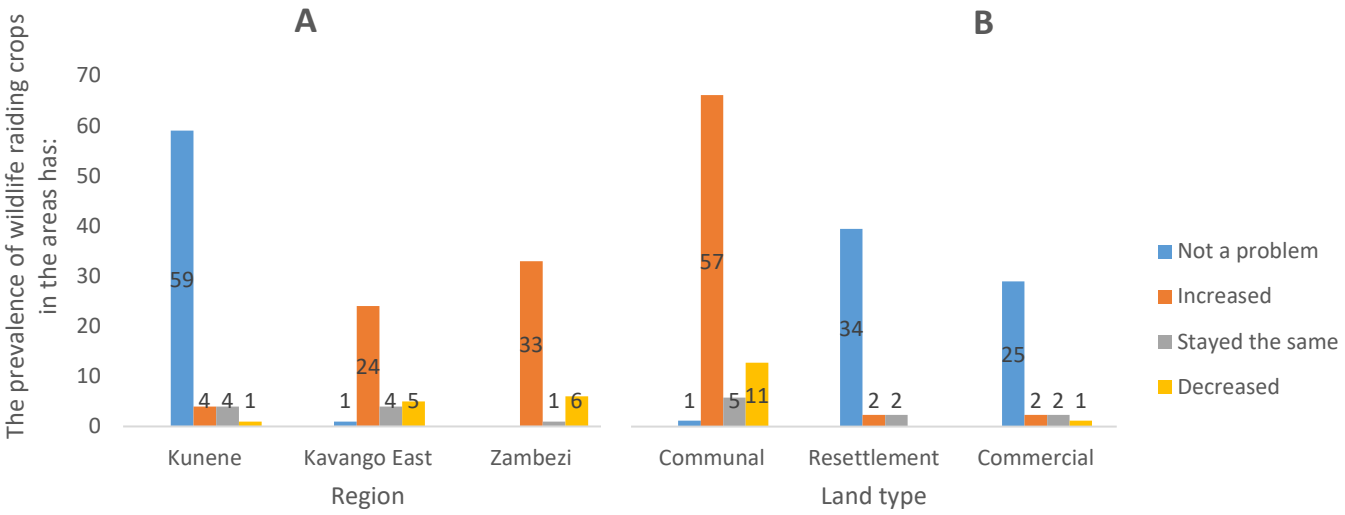

Figure 14: Farmers' perception of whether incidents of wildlife raiding crops had increased, stayed the same, decreased or was not a problem in a) the Kunene, Kavango east and Zambezi regions, and b) on communal, resettlement and commercial land types (n = 142).

Of all the participants (*n = 105*) that specified which wildlife species they consider to be the biggest problem for their fields or gardens (Figures 23 and 24), 47.6% said that elephants were the biggest problem, followed by antelopes (23.8%), wartohog and bushpig (9.5%), baboon and vervet monkeys (5.7%), porcupines (5.7%), buffalo (5.7%) and hippopotamus (1.9%). None of the participants in the Kunene region indicated that wildlife was a problem for their gardens, only Kavango East and Zambezi regions and likewise, only communal farmers and none in the resettlement and commercial areas (figure 15b).

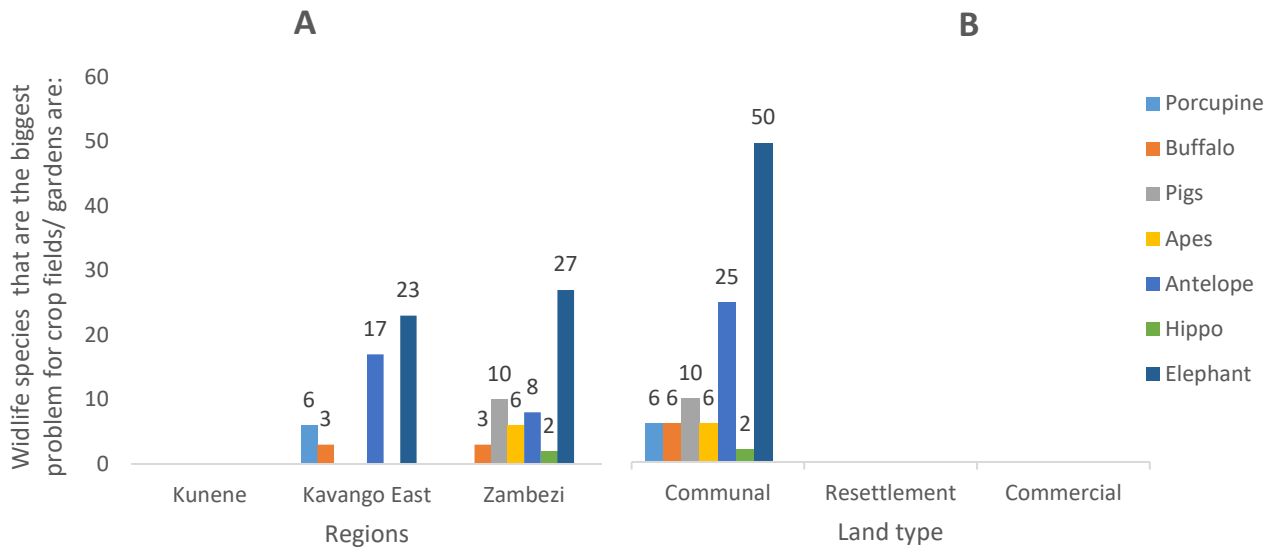

Figure 15: Wildlife species identified by farmers as being the most problematic for crop fields/ gardens (i.e., elephant, hippo, antelope, apes, pigs, buffalo and porcupines) in a) the Kunene, Kavango east and Zambezi regions, and b) on communal, resettlement and commercial land types (n = 142).

3.2.5. Infrastructure Damage

Overall, 74.6 % (*n = 106*) of the participants said that infrastructure damage was not a problem to them, 15.5 % (*n = 22*) said that it had increased, 7% (*n = 10*) said the problem had stayed the same and only 2 % (*n = 3*) said the problem had decreased. There was significant difference (*H = 23.559, df = 2, p = .001*) in infrastructure damage across the regions. Respondents from Kunene expressed a significant concern for an increase in infrastructure damage by wildlife compared to Zambezi (*H = 23.559, df = 2, p = .001*) and Kavango East (*H = 23.559, df = 2, p = .001*). There was no significant difference between Zambezi and Kavango East. More than half of participants (74.6 %, *n = 106*) said that infrastructure damage was not a problem to them, 15.5 % (n = 22) said that it has increased, 7% (n = 10) said the problem has stayed the same and only 2 % (n = 3) said the problem has decreased (figure 16a). There was a significant difference (*H = 38.948; df = 2; p = .001*) in terms of infrastructure damage across land type. Commercial farmers expressed a significant concern on the increase of infrastructure damage by wildlife compared communal farmers (*H = 38.948, df = 2, p = .001*) and resettlement farmers (*H = 38.948, df = 2p = .001*). There was no significant difference between communal and resettlement farms (figure 16b).

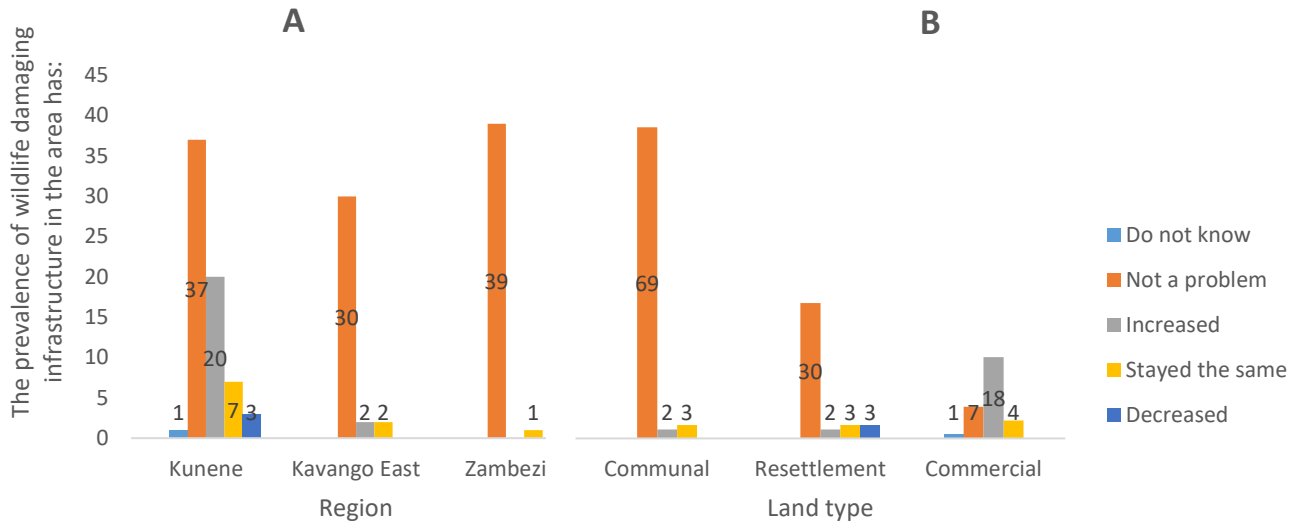

Figure 16: Farmer's perception of whether incidents of wildlife damaging infrastructure had increased, stayed the same, decreased or was not a problem in a) the Kunene, Kavango east and Zambezi regions, and b) on communal, resettlement and commercial land types (n = 142).

Infrastructure damage was only reported in Kunene region, mainly in the commercial area and some in resettlement area. Of the total reported damages (*n = 67*), 32.8 % were fences, pipes 14.9 %, water point/installation 26.8 %, windmill 8.9 %, Kraal 8.9 %, Dam 1.4 %, water tank 7.6 % and tap 2.9 % (figure 17).

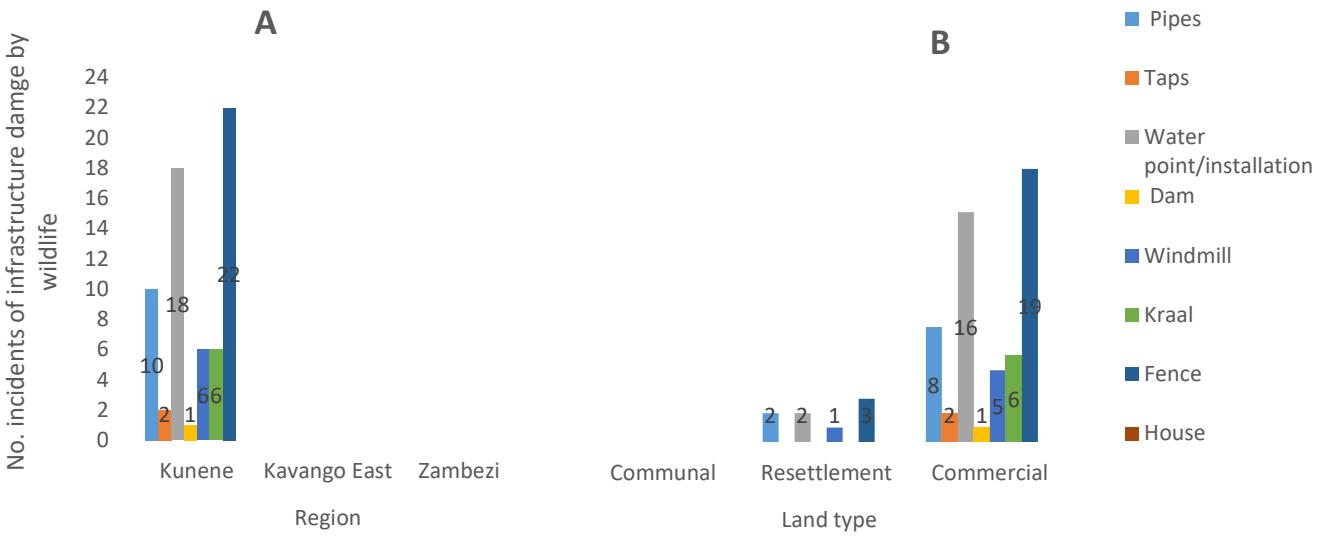

Figure 17: Number of infrastructure damage incidents by wildlife, specifically elephants. (i.e., house, fence, kraal, windmill, dam, water point/installation, tap, and pipes) in a) the Kunene, Kavango East and Zambezi regions, and b) on communal, resettlement and commercial land types, in the past year (n = 142).

3.3. Mitigation methods used to reduce HWC

3.3.1. Protection of livestock against losses due to wildlife

Nearly all the respondents from the three regions affirmed that they protect their livestock. All respondents in the Kavango and Zambezi said that they keep their livestock in the kraal at night.

***Table 3**: Reported mitigation measures employed by respondents to protect their cattle from predators' depredation across regions.*

		Region					
		Kunene		Kavango East		Zambezi	
		N	(%)	N	(%)	N	(%)
Do you protect your cattle from wildlife?	Yes	46	78%	20	100%	29	100%
	No	13	22%	0	0%	0	0%
Do you kraal your herd at night?	Yes	26	57%	20	100%	29	100%
	No	20	44%	0	0%	0	0%
What type of kraal do you have?	None	42	62%	14	41%	11	28%
	Traditional	4	6%	20	59%	12	30%
	Wire fence	5	7%	0	0%	0	0%
	Wooden palisade & lion proof (wooden)	17	25%	0	0%	17	43%
Do you kraal them at night also during the dry season?	Yes	19	73%	13	65%	26	90%
	No	7	27%	7	35%	3	10%
Do you have a herder following them during the day?	Yes	7	15%	2	10%	25	86%
	No	39	85%	18	90%	4	14%
Is your herder:	No herder	62	91%	32	94%	15	38%
	Adult	6	9%	2	6%	25	63%
	Child	0	0%	0	0%	0	0%
Does your herder stay with the herd also during the dry season?	Yes	2	33%	2	100%	16	64%
	No	4	67%	0	0%	9	36%
Other forms of mitigation	None	61	90%	34	100%	33	83%
	Make kraal out of cut bush when on the move	0	0%	0	0%	0	0%
	Kraal calves during the day in the wet season	0	0%	0	0%	7	18%
	Other	7	10%	0	0%	0	0%
	1 & 2	0	0%	0	0%	0	0%

3.3.2. Some commercial farmers said they do not protect their cattle but let them roam on the farm to increase body mass, however others said they do protect their cattle such as through keeping them in the Kraal at night.

***Table 4**: Reported mitigation measures employed by respondents to protect their cattle from predators' depredation across land types.*

		Land type					
		Communal		Resettlement		Commercial	
		N	(%)	N	(%)	N	(%)
Do you protect your cattle from wildlife?	Yes	49	100%	28	90%	18	64%
	No	0	0%	3	10%	10	36%
Do you kraal your herd at night?	Yes	49	100%	23	82%	3	17%
	No	0	0%	5	18%	15	83%
What type of kraal do you have?	None	25	34%	15	40%	27	90%
	Traditional	32	43%	3	8%	1	3%
	Wire fence	0	0%	3	8%	2	7%
	Wooden palisade & lion proof (wooden)	17	23%	17	45%	0	0%
Do you kraal them at night also during the dry season?	Yes	39	80%	16	70%	3	100%
	No	10	20%	7	30%	0	0%
Do you have a herder following them during the day?	Yes	27	55%	4	14%	3	17%
	No	22	45%	24	86%	15	83%
Is your herder:	No herder	47	64%	34	90%	28	93%
	Adult	27	37%	4	11%	2	7%
	Child	0	0%	0	0%	0	0%
Does your herder stay with the herd also during the dry season?	Yes	18	67%	1	25%	1	50%
	No	9	33%	3	75%	1	50%
Other forms of mitigation	None	67	91%	37	97%	24	80%
	Make kraal out of cut bush when on the move	0	0%	0	0%	0	0%
	Kraal calves during the day in the wet season	7	10%	0	0%	0	0%
	Other	0	0%	1	3%	6	20%
	1 & 2	0	0%	0	0%	0	0%

3.3.3. Kunene region had the most small-stocks, nearly all households with small-stock said they keep them in the kraal at night, as they are prone to predator attacks.

Table 5*: Reported mitigation measures employed by respondents to protect their small-stock from predators' depredation across regions.*

		Region					
		Kunene		Kavango East		Zambezi	
		N	(%)	N	(%)	N	(%)
Do you kraal your herd at night?	Yes	46	100%	12	92%	2	100%
	No	0	0%	1	8%	0	0%
What type of kraal do you have?	None	23	34%	22	65%	38	95%
	Mesh wire	10	15%	12	35%	2	5%
	Jackal proof	27	40%	0	0%	0	0%
	Jackal proof with corrugated iron at the bottom	1	2%	0	0%	0	0%
	Mesh wire, jackal proof	0	0%	0	0%	0	0%
	Other	7	10%	0	0%	0	0%
Do you kraal them at night also during the dry season?	Yes	42	93%	11	92%	2	100%
	No	3	7%	1	8%	0	0%
Do you have a herder following them during the day?	Yes	21	47%	0	0%	0	0%
	No	24	53%	13	100%	2	100%
Is your herder:	No herder	35	63%	1	100%	0	0%
	Adult	21	38%	0	0%	0	0%
	Child	0	0%	0	0%	0	0%
Does your herder stay with the herd also during the dry season?	Yes	12	92%	0	0%	0	0%
	No	1	8%	0	0%	0	0%
Other forms of mitigation	None	18	30%	0	0%	0	0%
	Make a kraal out of cut bush when on the move	0	0%	0	0%	0	0%
	Kraal kids/lambs during the day in the wet season	39	65%	0	0%	0	0%
	2&3	1	2%	0	0%	0	0%
	Other	2	3%	0	0%	0	0%

3.3.4. Overall, most household did not have herders for small-stock, unlike cattle, small - stocks are usually allowed to forage unaccompanied.

***Table 6**: Reported mitigation measures employed by respondents to protect their small-stock from predators' depredation across 1land types.*

		Land type					
		Communal		Resettlement		Commercial	
		N	(%)	N	(%)	N	(%)
Do you kraal your herd at night?	Yes	14	93%	27	100%	19	100%
	No	1	7%	0	0%	0	0%
What type of kraal do you have?	None	60	81%	11	29%	12	40%
	Mesh wire	14	19%	10	26%	0	0%
	Jackal proof	0	0%	17	45%	10	33%
	Jackal proof with corrugated iron at the bottom	0	0%	0	0%	1	3%
	Mesh wire, jackal proof	0	0%	0	0%	0	0%
	Other	0	0%	0	0%	7	23%
Do you kraal them at night also during the dry season?	Yes	13	93%	27	100%	15	83%
	No	1	7%	0	0%	3	17%
Do you have a herder following them during the day?	Yes	0	0%	9	33%	12	67%
	No	15	100%	18	67%	6	33%
Is your herder:	No herder	1	100%	22	71%	13	52%
	Adult	0	0%	9	29%	12	48%
	Child	0	0%	0	0%	0	0%
Does your herder stay with the herd also during the dry season?	Yes	0	0%	4	80%	8	100%
	No	0	0%	1	20%	0	0%
Other forms of mitigation	None	0	0%	10	26%	8	36%
	Make a kraal out of cut bush when on the move	0	0%	0	0%	0	0%
	Kraal kids/lambs during the day in the wet season	0	0%	28	74%	11	50%
	2&3	0	0%	0	0%	1	5%
	Other	0	0%	0	0%	2	9%

3.3.5. Crop damage mitigation/protection

Overall, 31 participants (Kunene, *n = 30* and Zambezi, *n = 1*) said they had a wire strand fence around their field or garden, 25 (Zambezi, *n = 21*; Kavango East, *n = 1*; Kunene *n = 3*) indicated that they had a traditional fence around their fields, one (Kunene) indicated that he/she had an electric fence around his/her garden (figure 18a). Overall, only 31 respondents (resettlement, *n = 18*; commercial, *n = 14*; communal, *n = 1*) indicated that they had a wire strand fence around their field/garden, 25 (Communal, *n = 22* and resettlement, *n = 3*) indicated that they had a traditional fence around their fields while one (commercial) indicated that he/she had an electric fence around his/her (figure 18b).

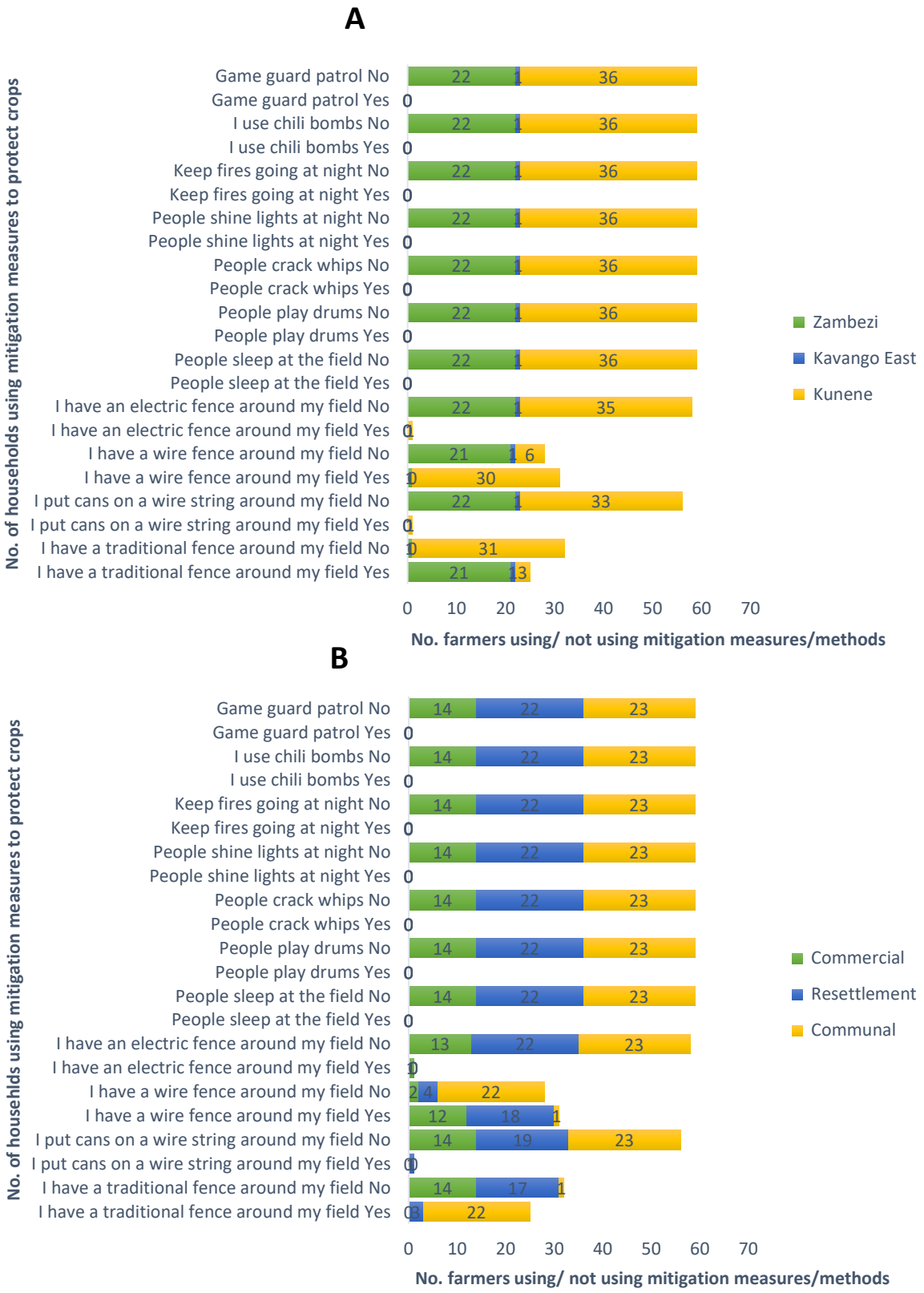

Figure 18: Mitigation measures/ methods used (or not used) by farmers to protect their crop fields/ gardens in a) the Zambezi, Kavango east and Kunene regions, and b) on commercial, resettlement and communal land types (n = 142).

3.3.6. Infrastructure damage mitigation/protection

Respondents were asked whether they employ any form of mitigation to protect their infrastructure from wildlife damage, mainly by elephants. They were then asked to list the methods they use. Only 15 respondents said that they use some form of mitigation to protect their infrastructure. Ten respondents said that they do not use any mitigation to protect their infrastructure and the rest did not respond. Below are the statements of mitigation methods individually listed by the 15 respondents. These were mainly from Kunene region, in the commercial area.

- "Collar elephant and monitoring them" (*n = 1*)
- "Chase the elephant away from the waterpoints" (*n = 3*)
- "Close the waterpoint" (*n = 1*)
- "Used stones around waterpoints" (*n = 1*)
- "Relocated the borehole" (*n = 1*)
- "Removed the fences encircling the water point and put stones around the water tank" (*n = 1*)
- "Use a drone to chase them away" (elephants) (*n = 1*)
- "Cover the underground pipe with thick bush above the ground" (*n = 1*)
- "Fixed the fence" (*n = 1*)
- "Just fixed the fence" (*n = 1*)
- "Replaced windmills with solar pump and build concrete wall around the borehole" (*n = 1*)
- "Electric fence, but it is also destroyed" (*n = 1*)
- "Packed rocks around water installations which are cemented" (*n = 1*)

3.4. Benefits from Wildlife

Overall, 76% (*n = 106*) of the participants said that there were no benefit from wildlife to their households, 8.4 % said the benefit have increased, 7% said that the benefit have stayed the same while 8.4 % said that the benefit have decreased. Almost all of the participants in both Kavango East (*n = 33*) and Zambezi (*n = 39*) regions indicated that there were no benefit from wildlife to their household, while 52.9 % (*n = 36*) of the participants in Kunene said there were no benefit from wildlife to the household. There was a significant difference in terms of benefit from wildlife to households across the regions (*H = 40.185, df = 2, p = .001*). Respondents from Kunene experienced significantly move benefit from wildlife to their households compared to Kavango East (*H = 40.185, df = 2, p = .001*) and Zambezi regions (*H = 40.185, df = 2, p = .001*). There was no significant difference between Kavango East and Zambezi in terms of benefit from wildlife (figure 19a).

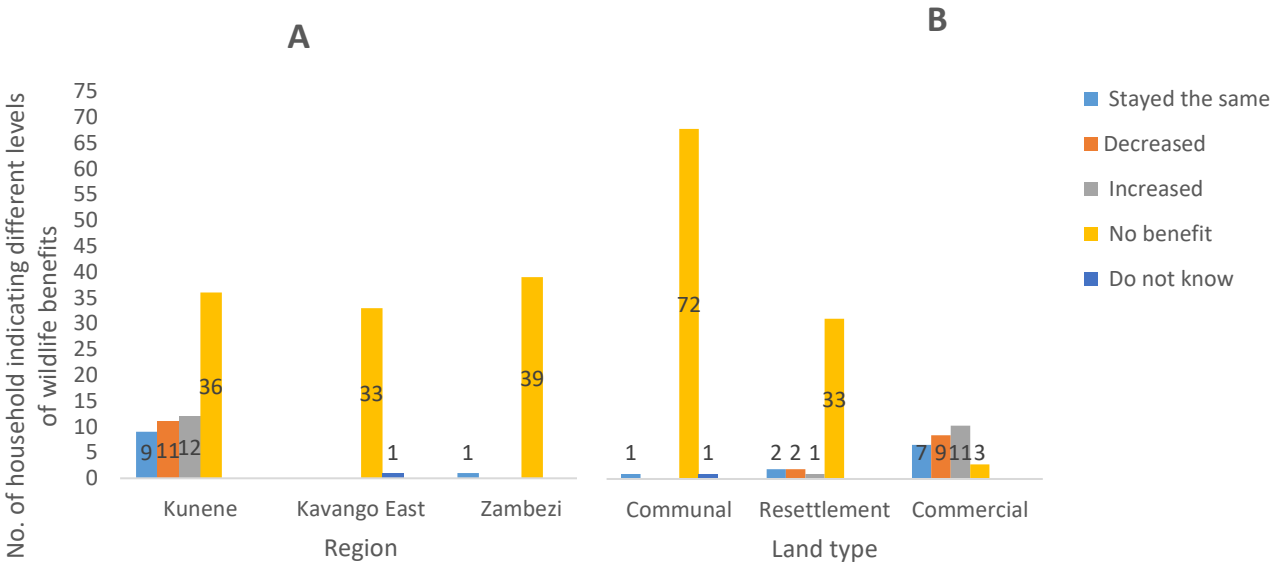

Figure 19: Farmers' perception on level of benefit from wildlife to their household (i.e., do not know, no benefit, increased, decreased or stayed the same in a) the Kunene, Kavango east and Zambezi regions, and b) on communal, resettlement and commercial land types (n = 142).

Most of the respondents from the communal area (97.2 %, *n = 72*) said that their households received no benefits from wildlife, 36.6 % (*n = 11*) said that benefit have increased, 30 % (*n = 9*) said that benefit have decreased while 23.3 % (*n = 7*) said that the benefit have stayed the same. There was a significant difference in terms of benefit from wildlife to households across the land types (*H = 89.600, df = 2, p = .001*). Respondents from commercial area experienced significantly more benefit from wildlife to their household compared to resettlement farms (*p = .001* and communal farms (*p = .001*). There was no difference between communal and resettlement (figure 19b).

Wildlife educational value was ranked the highest intangible benefit by participants (*n = 60,* figure 20b). That is to say participants indicated that that wildlife had an educational importance to their households, specifically for the children. This was followed by 'enjoyment from seeing wildlife' (*n = 58*), 'meat from own use quota' (*n = 10*), 'meat from from hunting enterprise' (*n = 7*), 'ownership' (*n = 5*) and 'ecosystem services' (*n = 1*). There was relationship between educational importance of wildlife and region ($X^2 = 48.539$, *df = 2, p = .001*), 'enjoyment from seeing wildlife' was associated to regions ($X^2 = 34.380$, *df = 2, p = .001*), 'meat from hunting enterprise' from wildlife and regions ($X^2 = 8.013$, *df = 2, p = .018*), 'meat from own use quota' was also associated with region ($X^2 = 34.380$, *df = 2, p = .019*). There was no relationship between 'ownership' as a benefit from wildlife and regions as well as between 'ecosystem services from wildlife' regions. Respondents from Zambezi enjoyed seeing wildlife significantly more compared to other regions (*p = .001*) and regarded the educational value of wildlife (*p = .001*) significantly more than Kunene and Kavango East. Respondents from Kunene benefited significantly more from wildlife meat through hunting enterprise (*p = .013*) and own use hunting (*p = .017*) than the other regions. Figure 34 indicates that educational value (n = 60) was ranked the highest across land type, followed by 'enjoyment from seeing wildlife' (n = 58), 'meat from own use quota' (n = 10), 'meat from hunting enterprise' (n = 7), 'ownership' (n = 5) and eco services (n = 1) (figure 20a).

There was no association between wildlife educational value as a benefit and land type, no association between enjoyment from seeing wildlife and land type, and no association between ecosystem services value of wildlife as a benefit and land type. There was a relationship between meat from own use quota as a benefit from wildlife and land type ($X^2 = 22.439$, *df = 2, p = .001*) and an association between meat from hunting enterprise and land type ($X^2 = 27.488$, *df = 2, p = .001*), only commercial farmers (n = 7) indicated this as a benefit to their households. There was also a relationship between ownership as a benefit and land type ($X^2 = 19.348$, *df = 2, p = .001*). Commercial farmer benefited significantly more from wildlife through hunting for own-use (*p = .001*) and trophy hunting enterprises (*p = .001*) (figure 20b).

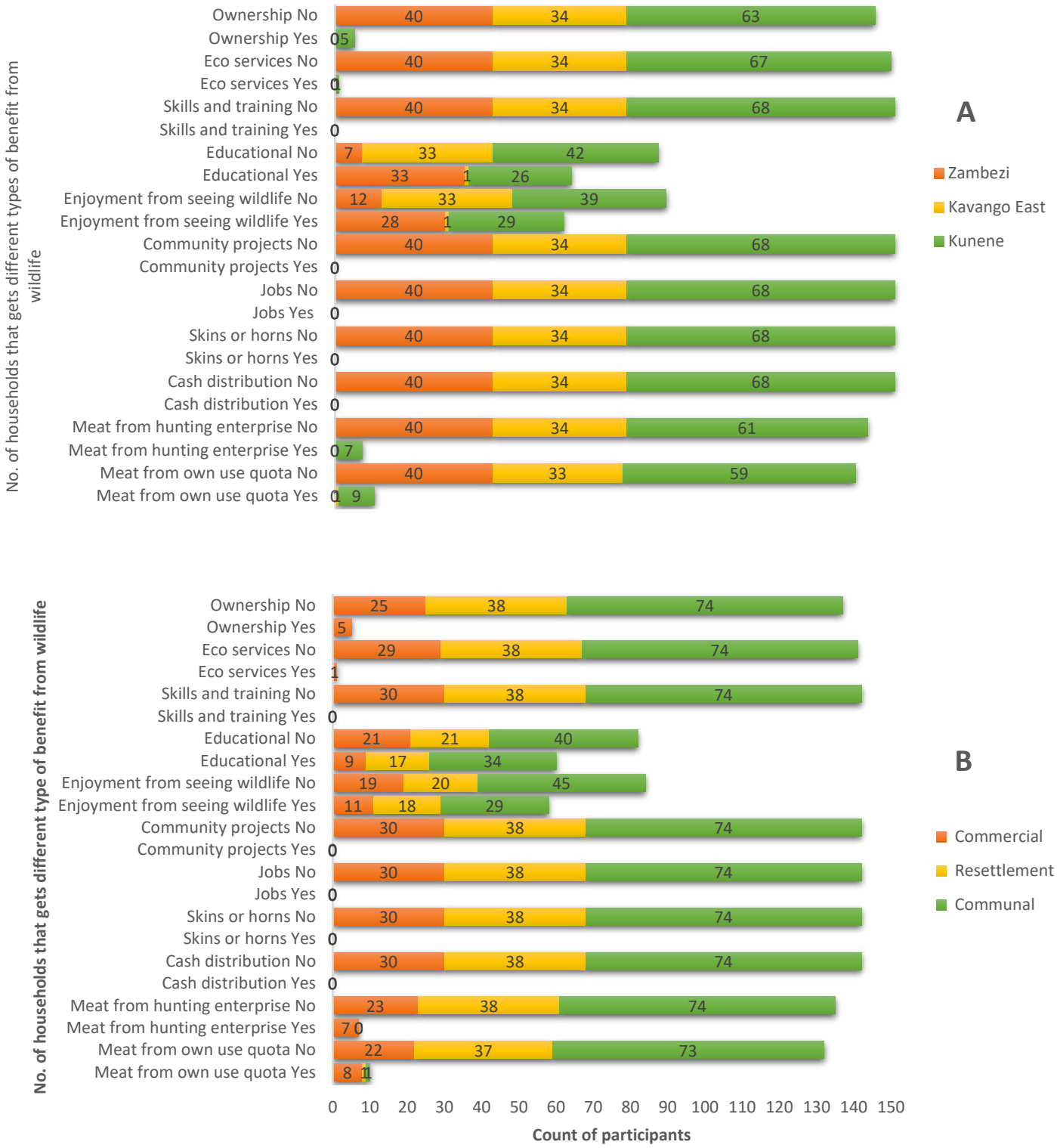

Figure 20: Farmers' indication of type of benefit they get from wildlife in the a) Kunene, Kavango east and Zambezi regions, and b) on communal, resettlement and commercial land types (n = 142).

4. Farmers' attitudes towards wildlife.

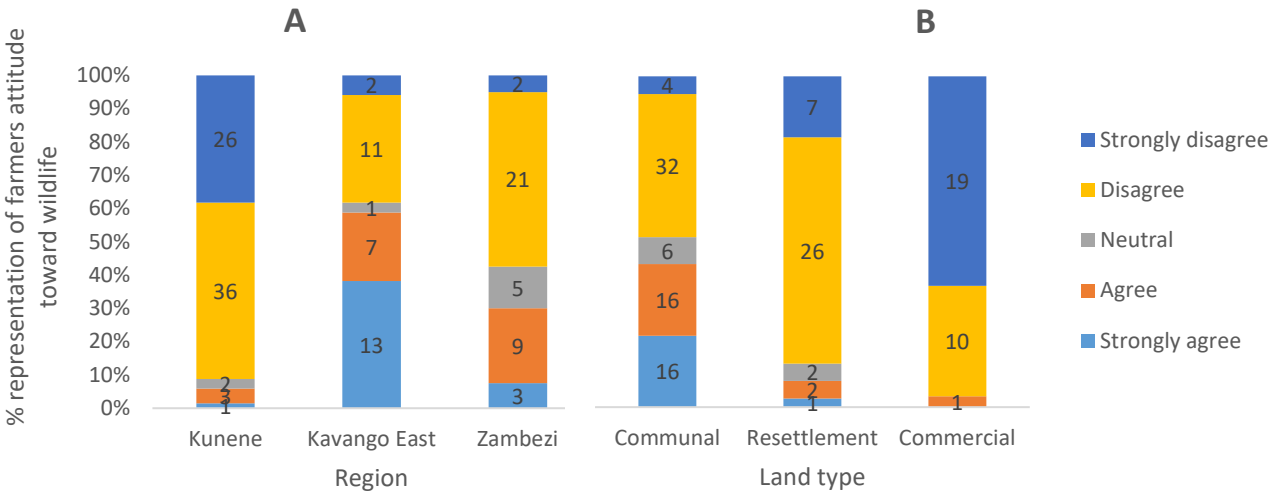

Figure 21: Farmer's attitude towards wildlife, whether they would be happy should wildlife disappear from their areas (i.e., strongly disagree, disagree, neutral, agree or strong agree) in a) the Kunene, Kavango east and Zambezi regions, and b) on communal, resettlement and commercial land types (n = 142).

More than half of the respondents (*69 %*) across the three regions said that they would not be happy if wildlife were to disappear from their area as opposed to 25.3 % who said they will be happy. There was significant difference different level of attitude toward wildlife across the regions (*H = 43.299, df = 2; p = .001*). Respondents from Kunene expressed significantly more positive attitude toward wildlife compared Zambezi (*H = 43.299, df = 2, p = .001*) and Kavango East (*H = 43.299, df = 2, p = .001*). Respondents from Zambezi were more significantly tolerant of wildlife compared to the Kavango East (*p H = 43.299, df = 2, p = .038*; figure 21a). There was a significant difference in the level of attitude across the land types (*H = 48.139; df = 2; p = .001*) (figure 21b). Commercial farmers expressed significantly more positive attitude toward wildlife compared to communal (*H = 48.139, df = 2, p = .001*) and resettlement farmers (*H = 48.139, df = 2, p = .001*). Resettlement farmers also expressed significantly more positive attitude toward wildlife compared to communal farmers (*H = 48.139, df = 2, p = .001*).

Chapter 4: Discussion

4.1. Introduction

The aim of the study was to gain an understanding of HWC in non-conservancy communal and commercial farms in north-west and the north-east of Namibia. In total, 142 people were interviewed in three regions, namely Kunene, Kavango East and Zambezi, specifically in areas adjacent to communal conservancies as well as in close proximity to protected areas (e.g., Etosha National Park). The sample sizes for the regions (Kunene n = 63; Kavango East n = 34; Zambezi n = 40) and the land tenure type (communal n = 78; Resettlement = 38; commercial n = 30) were comparably higher and/or equal to similar studies (Schumann *et al.* 2008, Stein *et al.* 2010, Rust and Marker 2013, Störmer *et al.* 2019) conducted in the same landscapes in Namibia on HWC related topics.

4.2. Farmers' source of livelihoods

The main source of livelihood of the respondents was agricultural with an exception of a minority venturing into tourism and game farming or mixed enterprises as also found by Anand and Radhakrishna (2017) as well as Schumann *et al.* (2008). Cattle ownership was very variable in terms of cattle numbers per household. This high variability can be attributed to various factors such as drought, mortality due to HWC or diseases, wealth (Sangay and Vernes 2008, Lamarque *et al.* 2009), theft or losses (animals getting lost), cultural reasons in addition to simply farming with cattle (Chaminuka *et al.* 2014). In the freehold farming area of the Kunene region (see Table 1), livestock farming is mainly for breeding and selling commercially (Rust *et al.* 2016) whereas for communal famers, livestock is generally perceived as a household's wealth (for manure, milk, meat, means of saving and live sales) and a way of life, which plays an important social role (Lamarque *et al.* 2009, Chaminuka *et al.* 2014). Nevertheless, in terms of wealth and savings (livestock as an asset), the same can be said for all types of livestock farmers. Interestingly, only a few households own small-stock in the Zambezi compared to the Kunene and Kavango East. Bollig and Vehrs (2020) have noted that goats, unlike cattle, are not as important for selling, for household's needs in Zambezi. Crop production was an important source of livelihood, especially in the communal areas, in the higher rainfall area of the Zambezi where cultivation is undertaken at the beginning and throughout the rainy season to produce staple foods (Frøystad *et al.* 2009, Kiesel n.d.). The main aim is usually for consumption in the household with a few exceptions where production is for both household consumption and for sale. Very few respondents had formal employment (n = 4; Table 2), meaning that livelihoods from livestock is a critical source.

4.3. Impacts of human-wildlife conflict

Understanding HWCs is important as perceptions on HWC often don't match actual losses due to wildlife and help us comprehend people's tolerance of different species (Rasmussen 1999, Kissui 2008, Lindsey *et al.* 2013, Rust and Marker 2013, Anand and Radhakrishna 2017). A large proportion of participants from all three regions, as well as from the three different land types, reported to have experienced HWC incidents at some point. In fact, all participants from Kavango East reported to have experienced damage caused by wildlife. Seeing that interviews were carefully carried out in a manner that eliminates bias as much as possible through non-leading questions (Milner-Gulland and Rowcliffe 2007 as cited in Aust *et al.* 2009) and that non-communal conservancy farmers are hardly compensated for losses due to HWC (Jones and Barnes 2006, MEFT 2018), there seems to be little reason to distort the information (Ogada *et al.* 2003, Jones and Barnes 2006), we therefore believe this information to be accurate as far as possible.

When asked whether HWCs were increasing or decreasing in their areas, 74% (*n = 106*) of participants indicated an increasing trend. In fact, large-stock losses were predominantly attributed to depredation, followed by drought and diseases. Similarly, small-stocks losses were mainly attributed to wildlife. For resettlement and commercial farmers in the Kunene region however, losses due to drought were much higher than the losses due to wildlife as the region is experiencing severe droughts (Ashipala 2021). For communal farmers in the Kavango region, number of cattle lost was mainly due to disease as foot and mouth disease is a major issue in the area (Muyamba 2020). These findings and trends are similar to other studies on HWCs which have attempted to understand the phenomenon of high perceived losses to HWC versus actual losses to wildlife (Dickman 2010, Dickman and Hazzah 2016), with livelihood losses being disproportionally attributed to wildlife compared to other causes. One possible practical explanation for this mismatch between perceived and actual losses is the big difference in livestock ownership per household, in which case losses from one or more households may overshadow the rest of the households' losses and may change the trend in either direction. Emotional anger towards predators is a factor seldom considered in this type of study (Pooley *et al.* 2021), which may leave a greater impression on farmers, while drought is seen as an inevitable part of life in this erratic rainfall area. Further studies in this area should therefore aim at obtaining bigger sample sizes, be spread out over longer periods and be carried out in years of favourable climatic conditions to see if the results will be different.

Spotted hyena which were responsible for most cattle losses compared to other predators, are also responsible for most livestock depredation events in communal conservancies, specifically in Kunene

(NACSO-NRWG 2019), with rare incidences of desert-adapted lions killing whole herds of small-stock (Steynburg 2017). Leopards were second followed by lions. Lion's kills were mostly reported by commercial farmers close to Etosha National Park as well as communal farmers in Zambezi. Black-backed Jackal were responsible for most of the small-stock losses, specifically in Kunene, which is linked to the abundance of the prey species which turned to be more common in Kunene compared to the other two regions. Land-use planning may be playing a role in these conflicts (Marker and Boast 2015), especially in the commercial farmland where some commercial farmers complained about their neighbouring tourism establishments, that these establishments harbour predators, which kill livestock on farms and retreat back to these establishments. It is surprising that this has not yet been empirically studied in Namibia.

Elephants remained the major problem animals when it came to infrastructure damage, particularly on the sample of commercial farms. Although this study did not attempt to estimate the monetary value of the damages caused by elephants, a recent article about an elephant auction tendered by MEFT, published on Conservation Frontlines website by Thomson (2021), highlights how a number of commercial farmers, participating in a recent consultation meeting on the Elephant Management Plan (MEFT 2020) said that their incurred losses range from N$ 100 000 to N$200 700 annually. These farmers just happen to be from the study area in Kunene region and some observations with regards to infrastructure damage caused by elephants, to affirm these claims, were made during the data collection period (Xinhua 2021). Some farmers say that they have given up on fixing the fences as it is usually unfruitful due to the frequency of events. To reduce elephant numbers and offset damage in areas where elephant conflict is prevalent, auctioning and live sale of elephants from the area has begun (MEFT 2021). The elephant auction may be an important step in addressing the human-elephant conflict in areas where such conflicts occur on a regular basis. It has however already resulted in conflicting views around the animal welfare and conservation impact thereof (Born Free Foundation 2021).

4.4. Mitigation Measures used to reduce HWC

The most common form of mitigation measure used by farmers to protect both their cattle and small-stock from predators is keeping the animals in the kraal during the night, as well as herding them during the day. This was mainly popular among communal farmers in the Zambezi as they have better

access to water and grazing nearby, whereas livestock in the North-West roam extensively away from the owners' homesteads and fields and pasture is not always available close to home due to overgrazing (Butler 2000, Lamarque *et al.* 2009). Some commercial farmers mentioned that keeping cattle in a kraal during the night is an opportunity cost as the animal tend to lose weight with reduced forage time, and therefore can reduce market prices, moreover there are additional costs incurred should they employ herders (Ogada *et al.* 2003). Therefore, on commercial farms, cattle mostly roam freely day and night on the property. This practice however undoubtedly put cattle at risk of depredation in areas where large predators are common, especially close to protected areas, not to mention making use of herders which normally decreases the risk of stock theft as an added advantage (Ogada *et al.* 2003). Most farmers confirmed that their kraal types were either wooden palisade or lion-proof when it came to cattle. As a way to protect calves during the calving season, they are kept in the kraal at home until the cattle return from grazing. In contrast to other studies (Dickman 2005, Megaze *et al.* 2017) where herders were mainly children, which reduces the effectiveness of carefully watching livestock and protecting them, in contrast all herders in this study were adults. Small-stock in the Kunene region for both commercial and resettlement farmers, are mainly kept in the kraal during the night with fewer households making use of herders to look after them during the day. To keep young animals safe, they are separated from the adult animals and kept at homesteads. This also ensures that the mothers return to feed their young.

Crop cultivation which is prominently an activity in the communal areas, especially in the Kavango East and the Zambezi regions, is a seasonal undertaking. As such, crops are usually at risk from herbivorous wildlife species during the growing season and therefore requires diligent protection for farmers to have a meaningful harvest. In the Zambezi region, specifically in the Linyanti area, most households' crop fields are located close to the Chobe River, a considerable distance from the settlement, making them prone to crop raiding by the wildlife. Despite vulnerability of their fields to wildlife, mitigation measures to protect their crops was uncommon, only some make use of a hedge of thorn bushes around the crop field otherwise known as a traditional fence. In the Kunene region, households mainly had small backyard gardens and indicated that wildlife posed no threats to these.

With regards to infrastructure, damages are predominantly to farm fences and water infrastructure, mainly caused by elephant. This problem was prominent in the arid Kunene, especially on the commercial farming areas but resettlement farms also experienced water infrastructure damage (Coleman 2020). Discussions between the affected farmers and the MEFT on what to do with the elephants have been locked in stalemate for several years (Chetty 2017). Several measures were used

by different farmers, with some innovative ones such as using a drone to chase the elephant away from a waterpoint where they are unwanted because of the competition for water with livestock. Other farmers made use of information provided to them by their neighbours about the whereabouts of the elephant herds which had collared individuals as early warning. Commercial farms in the Kamanjab-Outjo area are situated between the communal conservancies to the south-west and Etosha National Park to the north. As such, this area is said to be a historical elephant migratory path between Etosha and Damaraland (MEFT 2020). This makes it a costly exercise for farmers to fix their fences, knowing that the elephants could be coming back anytime. This also has indirect impact on the livestock as one farmer reported that about 60 of his cattle have gone missing to date as a result of a breach in his fence that the elephants made.

The revised national policy on human-wildlife conflict (2018 – 2027), which is an important document with regards to non-communal conservancy farmers on HWC and mitigations (communal, resettlement and commercial), acknowledges that these farmers are not currently part of the consideration, however "the Government will seek ways to offset losses caused by HWC in communal areas where conservancies have not been established. In order to do this Government will assist the appropriate local authorities (e.g., traditional authorities, village development committees,) and individual farmers to develop local HWC management and mitigation plans. Government will provide limited funds from the Game Products Trust Fund (GPTF) to assist in implementing these plans (e.g., to help pay for small infrastructure developments, but not wages). In addition, Government will also explore and establish appropriate legal channels for commercial farmers, and leasehold and/or resettlement farmers to derive economic benefits from wildlife" (MET 2018, p. 16). This envisioned further devolution of rights over wildlife and consideration of non-conservancy farmers in governments' plans of managing HWC has a high potential to incentivise wildlife conservation among these farmers and improve relations between stakeholders.

4.5. Benefit from wildlife

There is a link between benefit from wildlife and positive attitudes toward wildlife, especially when these benefits are direct to individuals or households (Infield 1988, Störmer *et al.* 2019). Currently there are no tangible benefits from wildlife to communal and resettlement farmers outside formally recognized communal conservancies as per the nature conservation amendment Act no. 5 of 1996 (Government Republic of Namibia 1996). Commercial farmers who have wildlife on their properties and meet the requirements can apply for permits to utilize huntable game species on their farms (Government Republic of Namibia 1975). It is also noteworthy that little information is available on the presence and amount of wildlife, especially huntable game species on resettlement farms as well as non-conservancy communal lands (Harring and Odendaal 2002), even those that are adjacent to communal conservancies or protected areas such as national parks. Therefore, it is not just a matter of policy, even though the policy can be changed but also a matter of wildlife resource availability in these areas and consequently the incentive to conserve wildlife if available in the area. The absence of huntable game species does not necessarily equal to the absence of other wildlife species, specifically predators and elephants. In fact the absence of natural prey species is known to be one of the drivers of HWC as predators turn to domestic animals (Lamarque *et al.* 2009, Marker and Boast 2015) and that coupled with their large home ranges (Edwards 2015, Marker and Boast 2015).

As expected, the majority of respondents said that there were no tangible direct benefits from wildlife to their households, with the exception of some commercial farmers. These are either commercial farmers who practice mixed farming or those that are running small tourism enterprises. There were different opinions on the level of benefits among those that get benefit (trophy hunting and own use quotas) from wildlife with a relatively equal number of those that said the benefits have either increased, stayed the same or decreased. These experiences are understandably farm-specific and many factors can influence benefit levels from wildlife to a household. However, benefit decline can be driven by landscape-level factors such as the persistent drought in the north-west which led to low hunting quotas (according to some respondents) which have been cited to be the major cause of less benefit from wildlife. Regarding the intangible benefits, nearly all participants said that wildlife had an educational value especially for children. Some respondents said that they enjoyed seeing wildlife and only one participant said that wildlife provided ecosystem services (Allan *et al.* 2017). These intangible values of wildlife are generally universally recognized (Kellert 1984) and are often expected from any community, but a few farmers thought the question on whether they get any benefits from wildlife was unfair in that the question lumps predators and elephants with other wildlife species that are not normally known to cause harm to people and their livelihoods and were therefore conflicted on how

to answer this question. It is therefore imperative to have an educational system and a holistic approach to wildlife awareness to educate the public about the importance of all wildlife species in the ecosystem, even those that can cause harm when in contact with people. Nevertheless, some farmers mentioned that they recognize the importance of all wildlife species and if they were empowered to generate some kind of benefits from the species that cause problem, they will be willing to put up with them.

4.6. Wildlife tolerance

Perceived benefits among other factors, has been recognised to be positively correlated to wildlife tolerance (Goodale *et al*. 2015). The logical assumption with regards to wildlife tolerance by those who bear the burden of living with wildlife is that the fewer losses they incur, the more tolerant they will be. This is however not always the case (Dickman 2010). As this study and several others show, tolerance is not always proportional to damage suffered (Lamarque *et al.* 2009), but it is influenced by several factors such as personal perception, cultural background, values, education and belief systems (Zimmermann *et al.* 2005). Neither does a positive attitude towards wildlife always result into favourable behaviours towards wildlife - i.e., not kill wildlife known to cause problems (Zimmermann *et al.* 2005). Although most communal farmers said they would be happy if wildlife were to disappear from their areas, they are generally known to be tolerant (Kansky *et al.* 2016) toward damage-causing species, this could be due to several reasons such as the lack of means to kill these animals (weapon) and the fear of the reprisal from the authority should they kill a problem-animal that is a protected species (Jones and Barnes 2006). Commercial farmers on the other hand, although they have largely showed positive attitude toward wildlife, generally would not hesitate to kill predators on their farms that kill their livestock (Marker *et al.* 2003, Edwards 2015). Again there are several possible reasons for this, such as the means to carry it out, the permission to kill predators that kill their predators with due procedures, given to them by the authority (Government Republic of Namibia 1975) and the general mistrust of the authority responsible for wildlife to expedite HWC's management to deal with the problem (personal observation).

On the magnitude of the conflict and wealth, a loss of one cattle or goat by a poorer farmer may have a larger impact on that individual than a loss of several cattle by a wealthier farmer and therefore affect their attitudes differently (Dickman *et al.* 2013, Dickman and Hazzah 2016). Respondents' level of education and benefit from wildlife are two important factors that can affect people's attitude

toward wildlife (Marker and Boast 2015, Kansky *et al.* 2016). Similar to what Zimmermann *et al.* (2005) found on cattle ranchers' tolerance of jaguars in the Brazilian's Pantanal region, most non-conservancy farmers acknowledged that they would tolerate problem-causing animal if they were allowed to derive benefits from species such as elephant, through consumptive-use such as trophy hunting. Due to their designation as specially protected species under current Namibian regulations, elephant cannot be trophy hunted on commercial and communal land (Government Republic of Namibia 1975), with the exception of communal conservancies.

Chapter 5: Conclusion and recommendations

5.1. Conclusion

5.1.1. Differences/similarities between HWC on different land-uses

The study found that communal farmers from the Kavango East experienced significantly more HWC incidents compared to the other two regions and land types. The majority of respondents, from all land types said that they believed that HWCs were going up in their areas, with commercial farmers and communal farmers showing a higher concern of increasing HWC, in comparison to resettlement farmers. Communal farmers outside of conservancies and resettlement farmers have to date not been the focus of any studies of HWC. Contrary to famers in conservancies (Kansky *et al.* 2016), non-conservancy farmers (specifically communal farmers) had less positive attitudes toward wildlife than any other farmer categories. They also had less positive attitudes toward wildlife compared to both commercial and resettlement farmers.

Across regions, most of the livestock was lost to wildlife, followed by drought and disease, with Kunene losing significantly more cattle to HWCs compared to the other two regions. This pattern was similar for land types, with commercial farmers losing significantly more livestock to wildlife compared to other farmers. In terms of small-stock, crop fields and infrastructures, HWC impacts were dependent on the livelihood practices linked to the aforementioned species, crops or infrastructure used by the farmers. For instance, very few households had small numbers of goats in Zambezi whereas the majority of households had crop fields in the north-east compared to Kunene, as this is a cultural practice and relies on the higher rainfall in those regions. Infrastructure damage was mainly experienced by commercial farmers in the dry Kunene region.

Spotted hyena were responsible for most livestock depredation in the Kunene region compared to other regions, followed by leopard, and most prevalent on resettlement farms. The main type of mitigation to protect livestock and small-stock across the regions and land types was by keeping the animals in kraals during the night as well as making use of herders to look after the animals during the day. Farmers also kept calves, kids and lambs at home during the day as they are more vulnerable to predators.

Currently, there are no tangible benefits from wildlife to resettlement and communal farmers as they are not part of the community-based natural resources management system (CBNRM) implemented in communal conservancies across Namibia. Freehold farmers who have wildlife on their properties

and meet the requirements for utilizing huntable game species (Government Republic of Namibia 1975), do benefit from wildlife. Nevertheless, some respondents do recognise the existential value (Kellert 1984) of wildlife such as its educational value for children as well as enjoyment from seeing wildlife (i.e., tourism). These positive attitudes however do not necessarily guarantee tolerance toward wildlife, especially problem-causing species. On the contrary, conservation programmes such as Namibia's CBNRM programme which aim at balancing the conservation of wildlife, while at the same time allowing those who live with wildlife to benefit from it, have been known to influence how people look at wildlife, not as a threat but as a resource (Kansky *et al.* 2016, Störmer *et al.* 2019).

5.2. Recommendations

The development of the National Elephant Management Plan (Ministry of Environment, Forestry and Tourism 2020) and the recent national discussion on the sale of elephants (Thomson 2021), some of which are from one of the study areas, is evidence to the relevance of these kind of studies. Rather than seeing HWCs as a challenge in these areas (the study area), it should be an opportunity for both researchers and those with interest in conservation to establish relationships with these farmers and communities and work jointly solving HWC challenges through coexistence and co-adaptive management (Carter and Linnell 2016). This is also an opportunity to begin collecting information on HWCs in a systematic way, for management purposes from these areas, whether by government or by institutions of higher learning, as this information is currently not collected and no one can really know what exactly is happening on the ground. Due to limitations, this study could not verify the claims of the existence of problem-causing species in the study area, this can be an opportunity to understand how wildlife species continue to persist in areas despite human impacts on these shared environments. Part of establishing relationships with farmers that are prone to HWCs, would be to work together for solutions through long term studies and monitoring of species known to cause problems which this study could not do. In so doing, farmers' attitude toward wildlife may be changed through the awareness that such studies can bring (Marker and Boast 2015). Similar future studies should aim at obtaining lager sample sizes in terms of respondents, which increases research effectiveness.

Resettlement farms in Namibia are to a large extent underutilised (lack of capacity among resettled farmers) and many times not productive in terms of livestock production (Gargallo 2010). Perhaps it is the right time to begin thinking about the opportunity that exist on enabling resettlement farmers to have wildlife introduced for them, to benefit and conserve wildlife, this can be explored through research and studies.

The study highlights that resettlement farmers are often forgotten when it comes to awareness of and managing HWC. They have few options to reduce or mitigate conflicts, where neighbouring commercial farmers repel wildlife, probably onto resettlement farms. As a future major land-tenure type, it is critical for them to be included in support programmes regarding HWC, whether from government and the NGO sector.

There is a need to improve and incentivise the freehold conservancy concept, which is currently not favoured by government. This should include resettlement farms where they can benefit collectively from preservation of wildlife, and provide habitat for wildlife. This would allow them to benefit from cooperative mitigation strategies with neighbouring commercial farmers.

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