HUMAN-WILDLIFE CONFLICT ALONG THE BORDERS OF ETOSHA NATIONAL PARK

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1.0. BACKGROUND OF THE STUDY

1.1 INTRODUCTION

The land along the borders of Etosha National Park (ENP) is utilised for commercial and communal agriculture. The land north of the Park is communally utilised for subsistence agriculture, combining livestock and crop farming. The land to the south of the ENP is commercially utilised for livestock production and game keeping for tourism. Close proximity to the Park facilitates the interaction between humans and wildlife, which is the cause of human-wildlife conflict (HWC). HWC manifests itself in different forms, including crop raids by elephants, loss of livestock to predators such as lions, jackals and hyenas and even threat to human life.

The incidents of human-wildlife conflict in Namibia are on the increase (World Wildlife Fund (WWF), 2008), especially with the expanding community-based natural resource management (CBNRM) program. Before the introduction of CBNRM, HWC was mainly prevalent in close proximity to the Park; but it has since expanded into communal and commercial lands that are further away from the national park. The CBNRM program was developed to provide an opportunity for communities in rural areas to improve their livelihood by using wildlife in a sustainable way (NACSO, 2010). One outcome of the CBNRM program is the increase in numbers of wildlife (NACSO, 2010). Ecologically, the establishment of conservancies near protected areas provides habitat connectivity where conservation management is practised. However, these benefits to both humans and wildlife are not without problems. Increased wildlife and the expansion of their ranges have led to more frequent encounters or conflicts between people and animals. The Namibian government has acknowledged this problem and a human-wildlife conflict policy has been developed. The policy recognises that the scale of impact of HWC changes at different times of the year, and the nature of conflict is diverse. Thus, different methodologies are required for different species of problem wildlife.

Namibia, like other countries across the world, continues to face challenges of human-wildlife conflicts (WWF, 2008). Human-wildlife conflict issues in Namibia have received considerable attention because humans suffer direct and indirect costs. These costs include, but are not limited to, damage to crops and water points, stock losses, and threats to and loss of human life. This severely affects the livelihoods of about 70% of Namibians that live in rural areas, most of whom are generally poor (Census, 2011).

In order to effectively address and manage HWC, it is important to understand the ecology of the problem animals, including their spatial distribution patterns and behaviour. In addition, since commercial and communal farmers along the ENP boundary suffer from HWC, it is important to understand their perception of problem wildlife; how problem animals affect their economic livelihoods; and what the local people undertake to prevent and respond to damage of livestock, property and crops due to wildlife. Although the Ministry of Environment and Tourism (MET) has guidelines and policies on HWC, there is an outcry from commercial and communal farmers regarding the effectiveness of the MET to manage the HWC. Although much is known regarding HWC, there has been little attempt from both communal and commercial farmers to understand HWC holistically, particularly around protected areas.

1.2 RESEARCH OBJECTIVES

The general objective of this study was to investigate and understand the nature of the human-wildlife conflict along the boundary of Etosha National Park (ENP).

The specific objectives included:

i. To determine and characterise the demography of HWC in the defined area;
ii. To establish the socio-economic nature of HWC;
iii. To review the biology and ecology of HWC along the boundary of ENP;
iv. To document perceptions of key stakeholders adjacent to ENP concerning HWC issues; and

v. To analyse the effectiveness of current HWC management, support systems and policy issues surrounding HWC along the boundary of ENP.

2.0. METHODOLOGY

2.1. STUDY SITE

The study was conducted along the (northern and southern) boundaries of Etosha National Park. The study targeted communal farmers, households in conservancies and commercial farmers. The study sites comprised of the following: cattle posts, conservancies, commercial farms, villages outside conservancies and sites within Etosha National Park. Each study site is described in detail below, according to location.

2.1.1 CATTLE POSTS

The cattle post respondents were drawn from 14 cattle posts, with the majority from Ovenduka and Okatumba cattle posts. The remainder were taken in low numbers from across the remaining cattle posts. The cattle posts were widely distributed across different constituencies in the Oshikoto, Oshana and Omusati regions. Most cattle posts that were part of the study were located in Okahao and Uuvudhiya constituencies, while a few others were in Omuthiyangwipundi, Oshivelo, Guinas and Otamanzi constituencies. The Omuthiyangwipundi constituency was widely represented across most land-use types, except for commercial farms.

2.1.2 CONSERVANCIES

The sample in conservancies was taken from 14 settlements located within the boundaries of the conservancies. The higher number of respondents (44) was interviewed in Otjokovare village in Ehirovipuka conservancy. The conservancies were located in the Sesfontein and Omuthiyangwipundi constituencies, which are in the Kunene and Oshikoto regions respectively.

2.1.3 COMMERCIAL FARMS

The researchers conducted interviews in 41 commercial farms, which were located south of Etosha National Park. Mooi *plaas* and Belauaika had the highest concentration of commercial farm interviews. All commercial farms were located in the Kamanjab and Outjo constituencies of the Kunene region.

2.1.4 VILLAGES OUTSIDE CONSERVANCIES

The respondents were drawn from five (5) villages. The Uutele and King Kauluma villages were the most represented in the study, while other villages had less representation. The majority of the interviews were conducted in villages located in Omuthiyangwipundi constituency; other villages were in Guinas and Otamanzi constituencies. Almost all the villages were located in Oshikoto Region, except one village that was in Omusati Region.

2.1.5 ETOSHA NATIONAL PARK

In the Park, the researchers obtained data from middle management and rangers at the following sites: Okaukuejo, Namutoni and Otjovasandu. Staff of MET in ENP also formed part of the study population in order to obtain their understanding of the HWC and their involvement in the HWC issues.

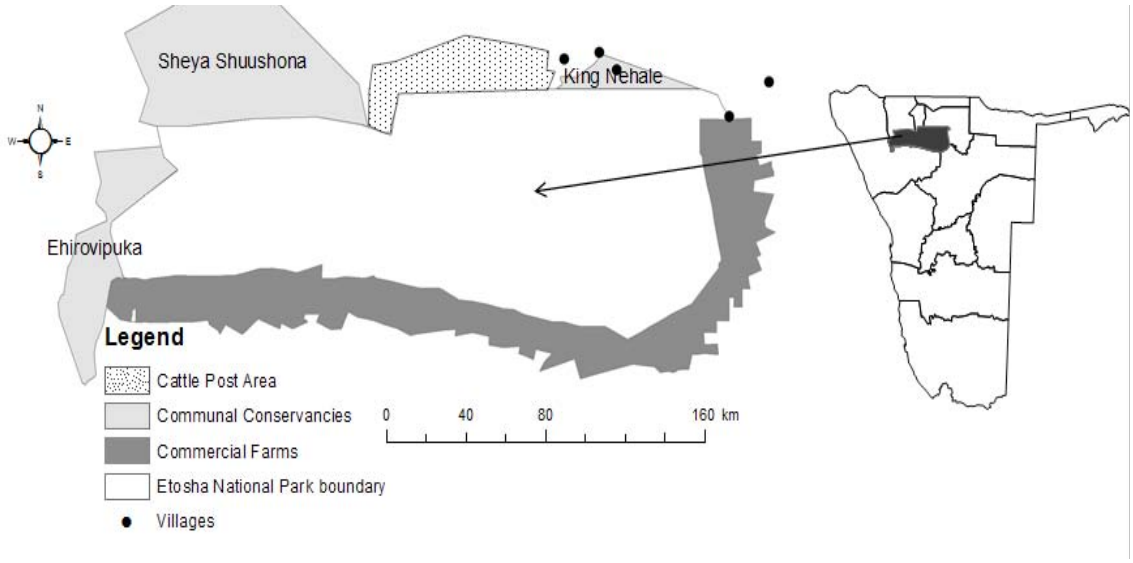

Figure 1: Etosha National Park and the surrounding land-use types

2.2. FIELD DATA COLLECTION

Data on HWC was collected using a structured questionnaire survey of households and on-site observations. Key informant interviews were conducted both in person and by telephone in order to collect information on human-wildlife conflict incidents, baseline mapping and identification of species that cause conflict, and procedures that are followed once a HWC incident has occurred. Key informants included the Government of the Republic of Namibia (GRN) staff involved with HWC, traditional authority representatives such as chiefs and village headmen, representatives of NGOs and conservancy management committees.

The questions were designed to solicit information that included the following: general socio-economic status of the households; HWC currently experienced along ENP; extent of damage to wildlife and humans; economic implications of such damage; attitudes and behaviour of humans in relation to HWC; mitigation measures and initiatives designed to enable communities to benefit from wildlife; and measures undertaken to tolerate some level of damage and loss to crops, livestock and property from wildlife.

2.3. DATA PROCESSING

Data were processed using SPSS. The data were arranged into different categories and according to specific objectives of the study. Descriptive statistics, cross tabulations and frequency tables were used for report production.

3.0. RESULTS AND DISCUSSION

3.1. DEMOGRAPHY AND SOCIO-ECONOMIC NATURE OF HWC

3.1.1. DESCRIPTION OF LAND-USE TYPES

The study classified the respondents according to land-use type. The four land-use types were village, cattle post, commercial farm and conservancy. A village refers to a community settlement outside the boundaries of a conservancy. Cattle posts are traditionally temporary settlements reserved for grazing during winter, after grazing areas around permanent settlements are depleted. Commercial farms are privately-owned land. A conservancy is an area of land registered for wildlife management, with clearly defined boundaries in which are several human settlements.

Figure 2 below illustrates that most respondents (37.7%) for the study were within conservancies, in

particular the Ehirovipuka and King Nehale conservancies. The Ehirovipuka conservancy is located in Kunene Region, west of Etosha National Park (ENP) and King Nehale is located in Oshikoto Region, north and northeast of Etosha National Park. The second and third largest proportions of interviews were on commercial farms (26.3%) and cattle posts (24.7%) respectively.

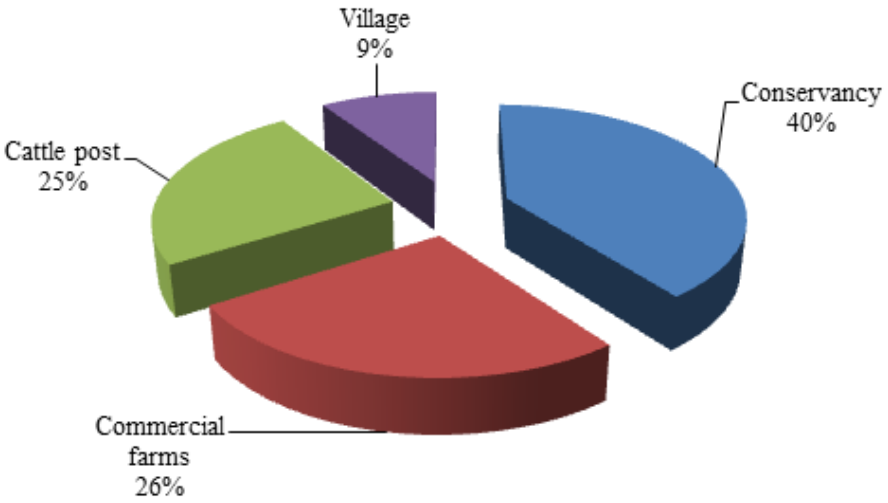

Figure 2: **Distribution of respondents by land-use type**

3.1.2. HOUSEHOLD DEMOGRAPHY

Figure 3 below demonstrates that the study was male dominated (78.7%), with only about a quarter of the respondents being female. The findings indicate that most households in the study area were headed by males.

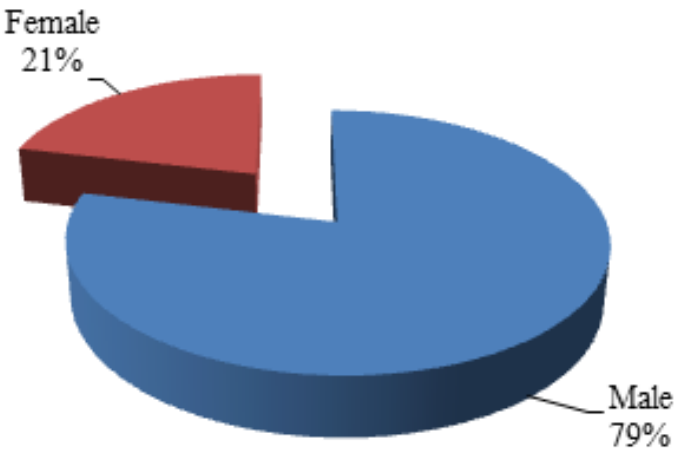

Figure **3: Gender of household heads in the study area**

The findings in Figure 4 below illustrate that although Figure 3 shows that most households were male dominated, some land-use types were female dominated. The households in villages and conservancies were mainly female headed, while the households in cattle posts and commercial farms were male dominated. The high sample population of households in cattle posts and commercial farms contributed to the high disparity in the gender of household heads in Figure 3. No female households were recorded in cattle posts, probably because cattle posts were traditionally inhabited by unmarried young men who looked after household cattle. Young men were also recruited for employment from other households, and

were left at cattle posts to look after the livestock of their employers. Commercial farms were traditionally owned by males because a perception existed in the past that farming was a male activity, thus very few households were female headed.

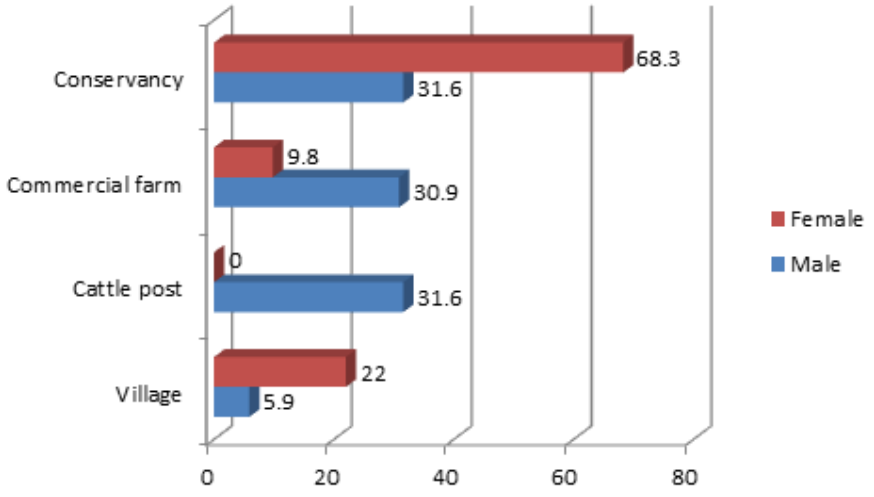

Figure 4: Distribution of gender of heads of households by land-use type

Household heads in the study area occupied different positions. For example, in the villages household heads were mainly farmers, pensioners and police officers. Heads of households in cattle posts were herders, farmers and pensioners, although the majority were employed as herders. Few farmers lived on cattle posts to care for their livestock. The occupations of those on commercial farms were farmers, farm managers and herders. In conservancies, most respondents were farmers, pensioners and police officers. The occupations of the respondents across land-use type were diverse and reflected the skills that household heads generally possess.

The number of members of households varied across different land-use types. In villages, the numbers varied widely between the lowest with one household member and the highest with fifteen household members. However, most households had an average of between three and four household members. Most cattle posts had one or two household members only, whereas a few had three members. This could be attributed to the temporary nature of cattle posts. These were set up not as a permanent settlement, but herders looked after livestock and practised small-scale crop production for a short time. In contrast, villages were permanent settlements where all household members with their relatives lived and produced crops. Households in commercial farms had fewer members per household. Members of households at most commercial farms ranged between one and eight; very few households had more than eight members.

The household with the highest number of members on a commercial farm had eighteen members. This was considered an exception. Although commercial farms were characterised by low density at the main homestead, households of farm workers had high numbers of members because of extended families, which were important food safety networks. Farm workers were also an important labour source for the functioning of the commercial farming sector. Households in conservancies showed characteristics similar to villages. Here, the number of members of households ranged from 1 to 22. This was partly because, in conservancies, households were part of settlements (villages) that formed the conservancy. Equally, villages in the conservancies were permanent settlements, the majority of whom were engaged in agricultural activities.

The educational level of household members differed across the type of land-use. Figure 5 below shows that very few respondents completed tertiary education (10.2%) with the majority having completed

primary (30.1%) and secondary education (31.1%). Close to a quarter of the respondents had no formal education.

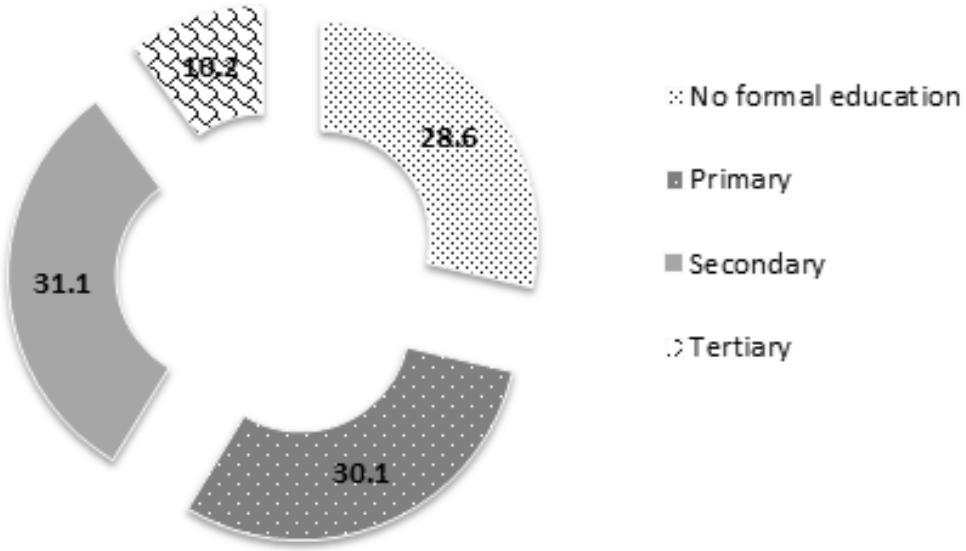

Figure **5: Level of education of household members**

The educational levels of the respondents varied widely across land-use types. The majority of respondents among household members in cattle posts, commercial farms and conservancies did not have formal education. Villages showed the lowest number of household members with no formal education. The majority of members of the households at cattle posts had primary education (53%), while others had secondary education (25%) or no formal education (22%). No members of households at cattle posts had tertiary education. On commercial farms, about 30% of respondents had no formal education. Only 18% and 31% had completed primary and secondary education respectively. More members of households on commercial farms had tertiary education compared to other land-use types. The second highest number of household members with tertiary education (10%) was recorded in conservancies. In contrast, the highest number of household members with no formal education (36%) was also recorded in conservancies. The rest of the household members in conservancies had only primary and secondary education.

3.1.3. HOUSEHOLD LIVELIHOOD STRATEGY

The main sources of livelihood for households in different land-use types in the study area included livestock farming, crop production and a combination of livestock and crop production. Livelihood in the villages was predominantly crop production, with a few households combining livestock and crop farming. At the cattle posts, most members were involved in livestock farming and, on a smaller scale, a combination of livestock and crop farming. The commercial farming areas were mainly supported by livestock farming and a few farmers had diversified their livelihood to include combinations of livestock and crop farming and livestock and game farming. Livelihoods in conservancies were more diverse than in other land-use types, inclusive of livestock, crops and a combination of livestock and crop farming.

The study (Figure 6) shows that respondents attached high importance to farming as a source of livelihood. Very few respondents, who might have other sources of livelihood, for example employment, attached a low value to farming. Farming was thus confirmed as very important, and any negative impact on farming would have severe implications for the livelihood of the respondents. Some respondents attached a moderate importance to farming. Analysis by land-use type did not demonstrate any difference in terms

of the importance of farming in the study. Livestock farming was attached a high importance as a source of livelihood in all land-use types. Loss of livestock to predators could thus compromise the livelihood of many households.

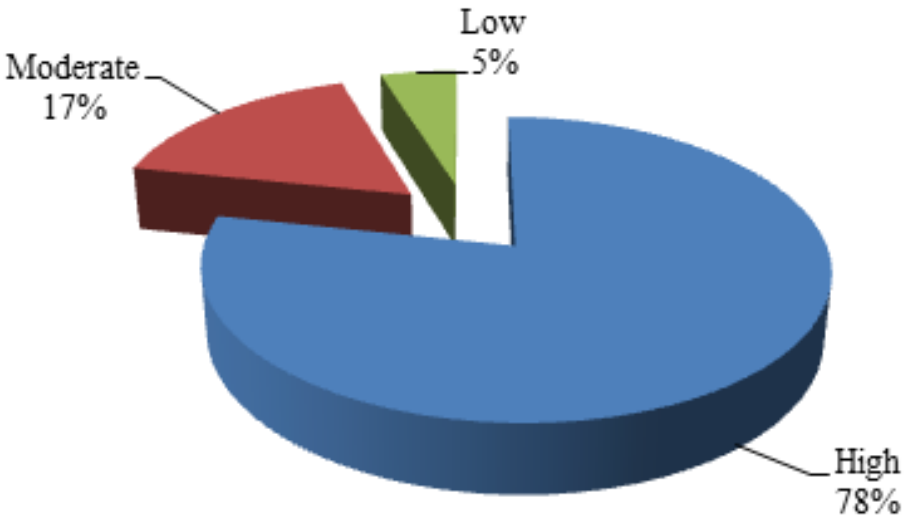

Figure **6: Importance of farming to respondents**

Monthly income was an important source of livelihood to many households in the study area. More households with monthly income were recorded in conservancies (38.7%), compared to other land-use types (Figure 7). Commercial farms and cattle posts recorded almost the same number of households with monthly income, and the least number of households with monthly income were recorded in villages.

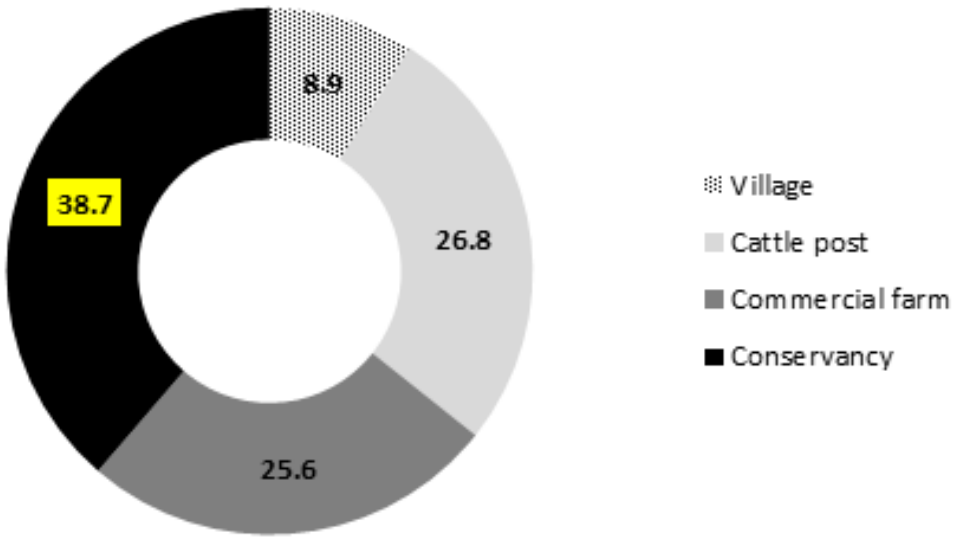

*Figure **7**: Respondents with monthly source of income*

Table 1 below indicates that the majority of households with a monthly income in villages and cattle posts earned less than N$1,000. However, there were a few cases of households earning more. Although commercial farms also had a number of households earning less than N$1,000, the monthly income was widely distributed up to N$10,000. Interestingly, most households with an income of N$10,000 were recorded in commercial farms, with the exception of one other household in a village. The conservancies also had more households with a monthly income of less than N$1,000, but generally, income for households

varied.

Table 1: Average household income by land-use type

Monthly income (N$)	Village	Cattle post	Commercial farm	Conservancy	Total
<1,000	8	35	18	40	**101**
1,001 - 2,000	2	3	5	10	**20**
2,001 - 3,000	3	4	3	6	**16**
3,001 - 4,000	0	1	2	4	**7**
4,001 - 10,000	1	2	5	5	**13**
10,001<	1	0	10	0	**11**
Total	**15**	**45**	**43**	**65**	**168**

The residents in the different land-use types derived many benefits from living in the area. The common benefits from land across different land-use types were grazing land, fertile soil, land for cultivation and water availability for livestock, crops and household use. Hunting, tourism and game farming were only mentioned as benefits in the commercial farm land-use type. The benefits seemed to dictate the use of land and the type of farming that was practised on the land. Apart from livestock, wildlife was an important source of meat on commercial farms and conservancies. Meat from livestock was acquired either from own livestock or was bought from other residents.

The majority of respondents claimed that they did not derive any benefits from wildlife or from residing in close proximity to Etosha National Park (ENP). However, some respondents in all land-use types acknowledged benefits from ecotourism. On commercial farms, the presence of wildlife was viewed as a benefit as it attracted some tourists. In conservancies, the education that community members received about wildlife, either from the Ministry of Environment and Tourism, wardens or non-governmental organisations was seen as a benefit to the residents. Very few people across all land-use types regarded wildlife as a benefit, but in conservancies, some respondents noted conservancy income as a benefit.

3.2. REVIEW OF THE BIOLOGY AND ECOLOGY OF THE HWC ALONG THE BOUNDARY OF ENP

Local communities, conservancies and commercial farms that surround ENP utilise the land and its resources for their livelihood. Land-use patterns along the boundary of ENP include communal livestock grazing (most of the northern border of the Park), farming (most of the eastern ENP), game farming and commercial farming (western and southern borders of ENP).

A good understanding of the biology and ecology of wildlife species that escape from ENP will help to address HWC along the borders of ENP. Wildlife species that escape from ENP become problem animals for communities along the boundary of ENP, for example, because they cause damage to crops and livestock.

The HWC along the boundary of ENP is precipitated by various factors. This study showed that the two main factors that led problem animals from ENP to raid livestock (Plate 1, Figure 8) were grazing livestock close to ENP (38.1% of respondents) and the fence of ENP that was broken in many sections (28.1%). During this field study, the researchers came across a herd of cattle that crossed through a broken fence and grazed inside Etosha National Park (Plate 1).

Cattle grazing inside Etosha National Park

Plate **1: Cattle grazing inside Etosha National Park after pushing down the fence**

The sections of the ENP fence in Omusati Region (Figure 8) were in the worst condition compared to those in Oshana and Oshikoto regions, such that it would make it easier for lions and hyenas to escape from the Park in Omusati than in the other two regions (Mfune, Mosimane, Hamukuaja &Angula, 2005). Waterholes located outside but close to the fence of ENP (19%) also attracted wildlife, including predators, to escape the Park.

The ecology and behaviour of wildlife led the wildlife to escape from ENP. For example, during the breeding season, females (e.g. lions) that had young, had high energetic demands to eat enough in order to suckle their young while the migratory behaviour of elephants caused them to leave the Park and destroy crops and infrastructure along their migratory route.

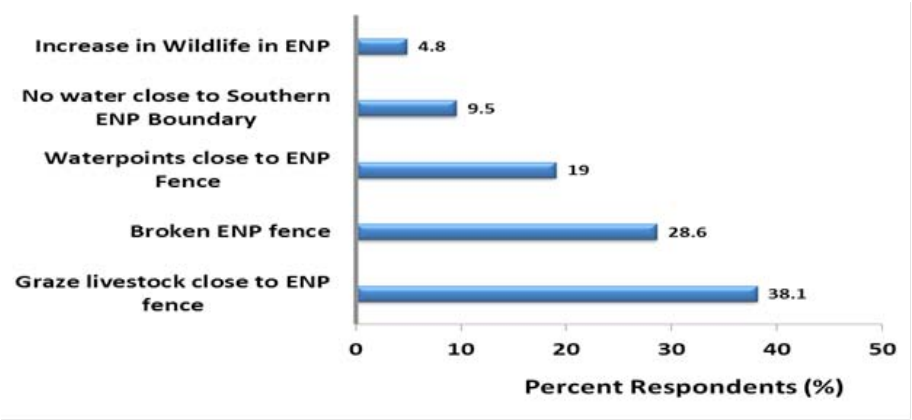

Figure **8**: *Factors contributing to escalating HWC along the borders of ENP*

Plate **2**: *Livestock grazing close to the ENP fence*

(Photo by M.N. Angula, 07/2005)

3.2.1. WILDLIFE SPECIES INVOLVED IN HWC

The present study revealed that hyenas, lions, jackals and elephants were the most commonly reported wildlife involved in HWC along the borders of ENP, when data from cattle posts, village, commercial farms and conservancies were combined (Figure 9) and when separated (Figure 10).

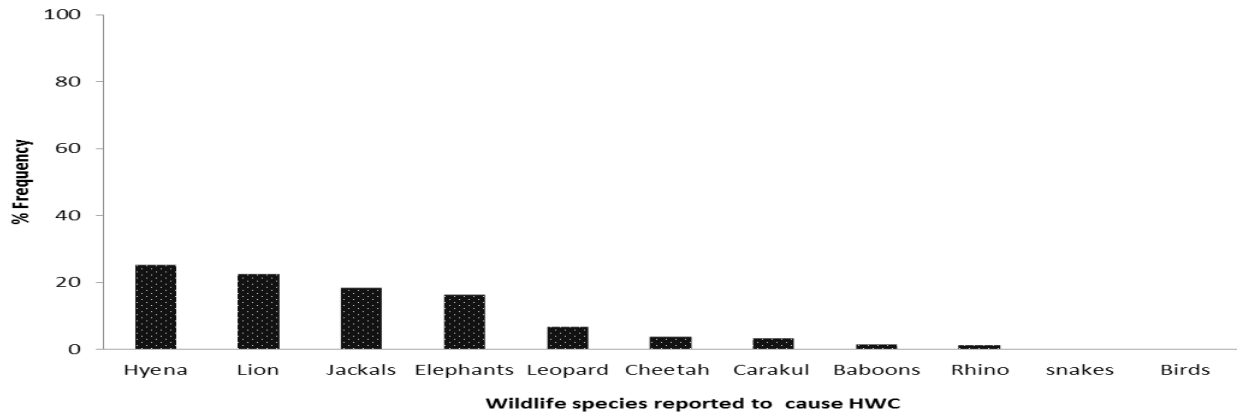

Figure **9**: *Most common wildlife species causing HWC along borders of ENP*

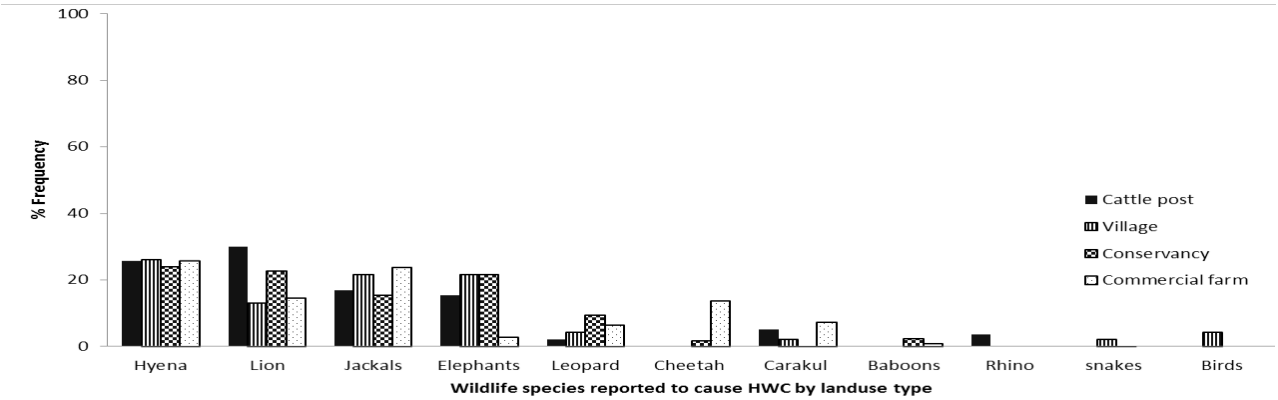

Figure **10: Most common wildlife species causing HWC along the boundary of ENP by land-use type**

There was wide variation regarding the wildlife that caused the most conflict in different land-use types along the boundary of ENP. The most problematic wildlife at cattle posts, where local communities kraal and graze their animals, were lions and hyenas (Figure 10) while the hyenas, jackals, cheetahs and lions were reported to be the dominant problem wildlife to commercial farms. Elephants were the most problematic animals for conservancies, villages and cattle posts as indicated by respondents in Figure 10. Elephants were problem animals for people located in the eastern, central and northern parts of ENP, because this was a known route of migrating elephants in ENP (Mfune et al., 2005). Hence, any crops and infrastructure, e.g. water points, water tanks along their migratory path fell victim to these elephants. Mfune et al. (2005) reported similar problem animals in the northern borders of ENP.

3.2.2. DAMAGE CAUSED BY WILDLIFE

The damage caused by wildlife problem animals along the borders of ENP varied widely. They included, but were not limited to, the following: damage to gardens and loss of crops mainly by elephants; death/loss of small stock (goats and sheep) and large stock (cattle, donkeys, horses) by predators mainly lions, hyenas and jackals; damage to property/infrastructure such as water points especially by elephants; and threat to or loss of human life, and injury to humans by predators such as lions. In this study, the interview

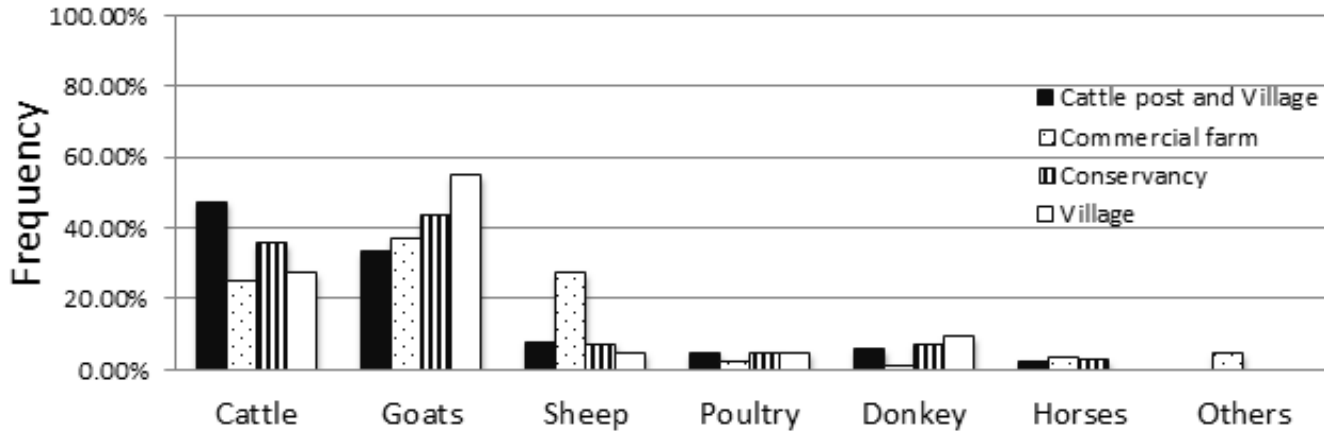

Figure **11: Frequency of livestock and other domestic animals most predated along boundary of ENP**

There was a significant difference in what the respondents indicated as the most predated livestock and other animals. At cattle posts, cattle were reported to be most predated while the most livestock lost to predators at commercial farms were goats, followed by sheep and cattle. At the villages and in conservancies most losses were experienced in goats, followed by cattle (Figure 11).

It was not easy to quantify and put a price to the loss and damage caused by problem animals. It was especially difficult to estimate the number of livestock losses to wildlife in a given area. This is partly due to the absence of an objective and practical method to ascertain and confirm such losses. In addition, due to the emotive nature of loss of livestock and the temptation to inflate the number of losses in anticipation of possible compensation from MET and from conservancies (where applicable), the numbers obtained from livestock owners, were not reliable. However, notwithstanding this, such numbers and incidents reported helped to highlight the reality of human-wildlife conflict. The estimated total number of livestock killed by problem animals between 2006 and March 2010 are presented in Figure 12 below.

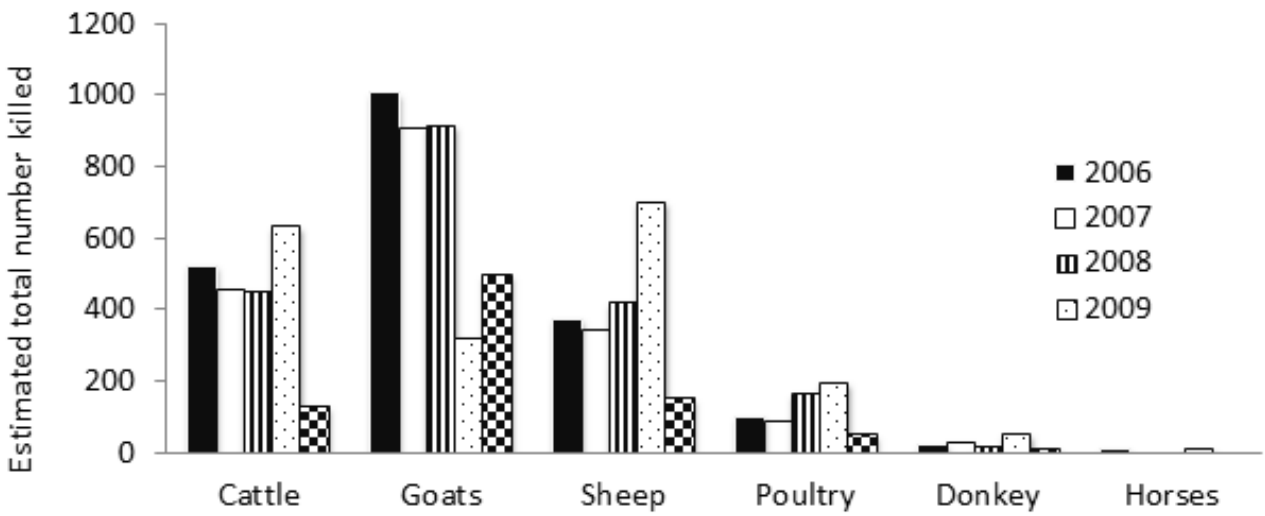

Figure **12: Estimated total number of livestock killed by problem animals along ENP in different years**

Figure 12 above indicates that the highest total estimates of livestock killed by problem animals along ENP were cattle (range: 127-631/year), goats (range: 319-1004/year) and sheep (range: 150-701/year). Losses of livestock were estimated to be least for donkeys (range: 110-151/year) and horses (range: 9-10/year). The total estimate of each type of livestock or other animals killed varied widely over the

years.

Although the estimated total number of livestock losses obtained from respondents in this study may not accurately represent the actual numbers of livestock killed by predators, these figures represent or reveal the trends of livestock that were killed in highest numbers by predators every year. A similar trend (Figure 13) was obtained from a study conducted along the northern borders of ENP in Oshana, Omusati and Oshokoto regions in 2005 (Mfune et al., 2005).

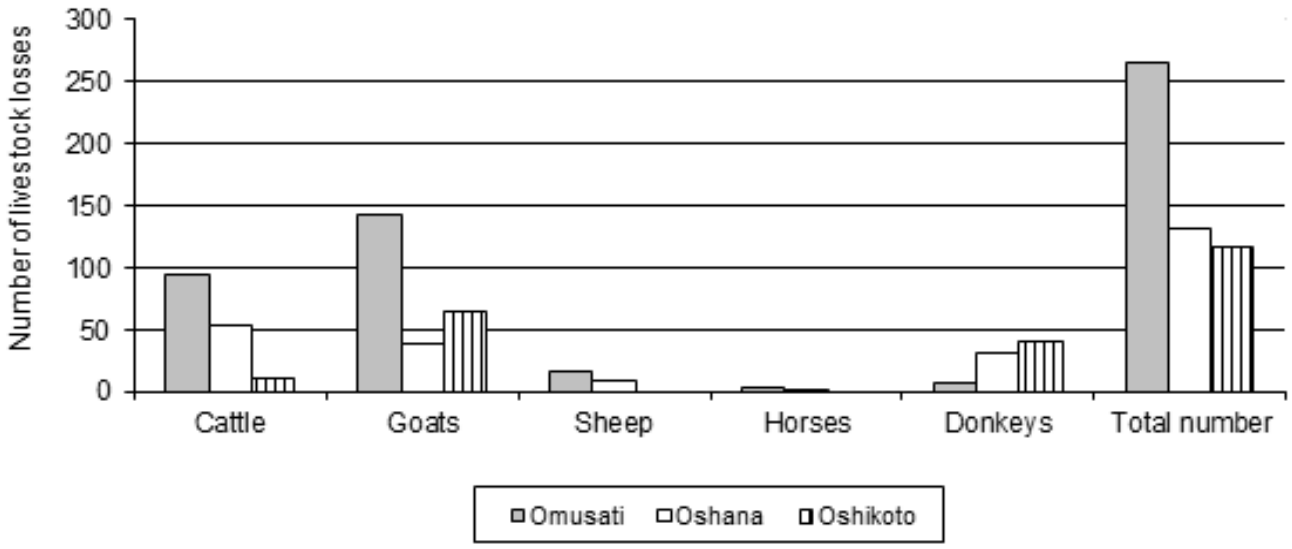

Figure **13: Number of livestock lost to predators in different regions along the northern border of ENP**

Figures 12 and 13 above reveal that predators mainly attacked livestock especially goats, cattle and sheep. These three livestock types contributed significantly to livelihoods of the people along the ENP borders. In this study, respondents clearly stated that crops and livestock/game farming were highly important to their livelihoods (Figure 14).

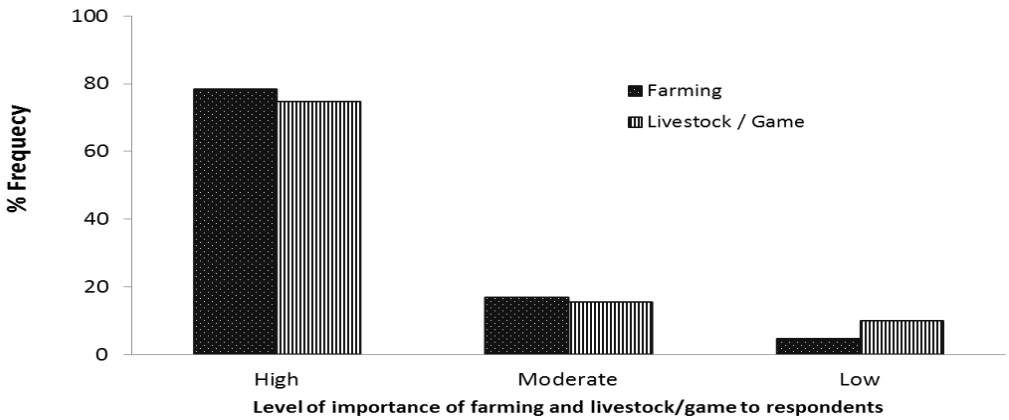

Figure 14: Importance of farming crops and livestock/game farming to respondents along ENP

3.2.3. ECOLOGY, BEHAVIOUR AND STATUS OF WILDLIFE SPECIES CAUSING CONFLICT

The present study demonstrated that elephants and predators including lions, hyenas and jackals are involved in conflicts with humans under different land-use types. In order to understand the extent of the conflict between humans and wildlife along the borders of ENP, it is important to have an understanding

of the ecology, behaviour and status of these wild animals. In this section, the researchers describe what is known about elephants, lions, jackals and hyenas based on literature review, since no detailed or targeted study was undertaken regarding the ecology and behaviour of problem animals due to time and financial constraints.

3.2.3.1.Lions

The present and other similar previous studies (Mfune et al., 2005) revealed that lions ranked amongst the top four wildlife involved in HWC, together with hyenas, elephants and jackals. Lions, especially females, escaped from the ENP, most likely through the many parts of the broken fence. The lions also found access out of the Park through gaps of holes which warthogs dug below the ENP (Plate 3). Once outside the fence, lions hunted cattle, goats and sheep and also threatened human life. According to the studies, HWC escalated especially where local communities grazed their livestock close to the fence of ENP because cattle were easy prey to catch compared to prey in the Park such as springbok, kudu, etc., which lions must spend more energy to catch than cattle.

Plate 3: Part of the fence of the northern border of ENP

Photo (left) by H. Hamukuaja, July 2005 and (right) by J. Mbadi, March 2010.

In the two photos (Plate 3) above, gaps in some sections of the fence can be seen, while in sections the fence is easily brought down. It would be easy for predators such as hyenas, lions, jackals and elephants to escape from the Park through such gaps or broken parts of the fence.

Lions caused more problems during the breeding season when they searched for food for their cubs. Lions were even more problematic if a female had given birth to cubs outside ENP. Even after being translocated into ENP, they were able to travel long distances to return to areas where they gave birth or areas where they were captured and transported into the Park (John Shilipipo, ENP Game Ranger, personal communication, July 2005).

In the present study, it was not possible to count the number of lions that roamed along the borders of ENP and those that were killed outside the Park when they raided cattle and other livestock. Very few studies have been carried out to document the number of lions along the Park boundary. In a study on analysis of spatial, temporal and demographic patterns of lions destroyed along the borders of ENP between 1982 and 2001, Stander (2004) revealed that a total of 563 lions had been killed along the outside borders of the entire perimeter of ENP. About 93% of these lions were killed along the eastern, southern and south-western borders of the Park.

The box below shows a brief report of the return of a captured lion to its original farm after translocation to ENP. The map in Figure 15 below shows the route taken by the lion to return to Omburu cattle post from where it had been captured. The lion had been translocated and released at Nebrownii waterhole about

10km east of the Okaukuejo camp.

On 25th April 2004 MET staff immobilized and radio-collared an adult male lion at Omburu cattle post north of Narawandu. It was part of the pride that raided livestock in the area. The lion was released at Nebrownii waterhole about 10km east of Okaukuejo camp (Figure 14). On 30th April 2004, the collared lion was located by air-tracking about 1.5 km from the site of its capture. The direct route from Nebrownii to Omburu's cattle post is about 72 km. The lion must have taken a longer route. The lion was radio-tracked by air and was located on several occasions after its return to Omburu area.

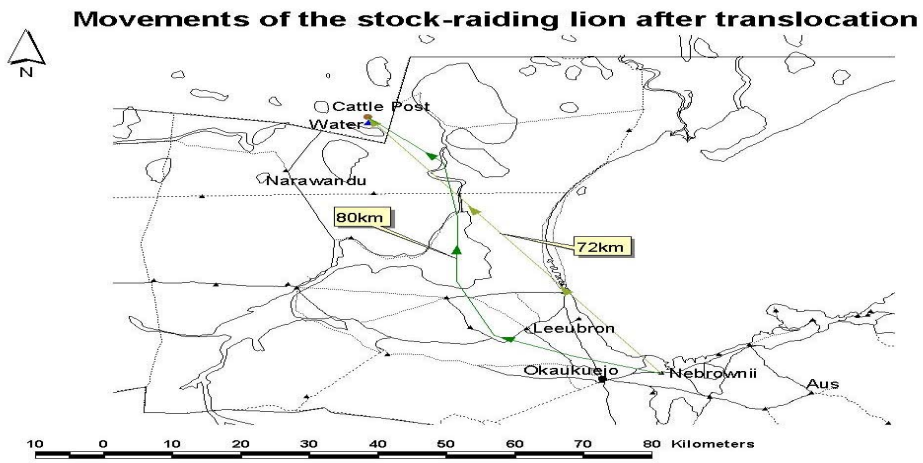

Figure **15: Movements of a stock-raiding lion after translocation**

Stander (2004) reported that the least number of lions (about 60) were killed in the north of Etosha. The annual variation of the number of lions killed is given in Figure 16. There was wide variation in the number of lions destroyed annually as illustrated in Figure 16 (Stander, 2004). The highest number of lions were killed in 2000. The variation in the numbers of lions killed in different years may be due to several factors. It may reflect the severity of conflicts with humans, the number of lions that were reported, or the presence of influential cattle owners such as government ministers or chiefs who were able to enlist immediate intervention of MET once lions became a problem. In addition, the ecology and behaviour of lions could influence these numbers.

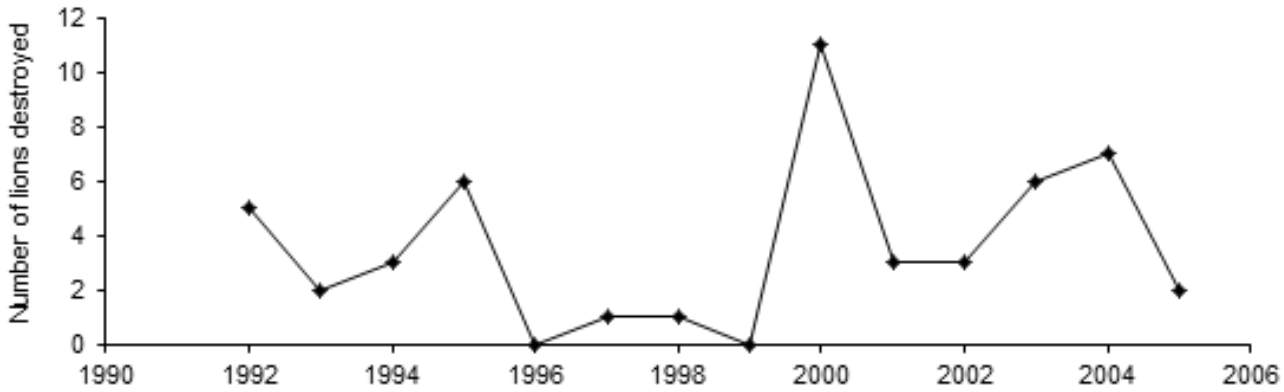

Figure **16**: *Number of lions destroyed along the northern borders of ENP between 1992 and May 2005*
Data obtained from Stander (2004) and MET Minister's Report (2005)

The study by Stander (2004) also revealed that the majority (35%) of lions killed along the borders of ENP, including the northern border, were sub-adult males (Figure 17). There was little difference in the proportion of adult males (17%), adult females (19%) and sub-adult females (18%) that were killed

along the borders of Etosha. Sub-adult males were reported to have been often chased from their natal pride by resident adult male lions. Some of these sub-adults might have escaped from Etosha and this could therefore explain the high number of sub-adult males killed.

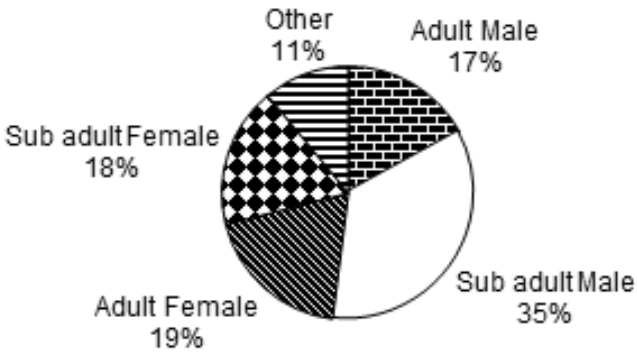

*Figure **17**: Proportion of lions destroyed along ENP borders from 1996 to May 2005 by age and gender*

Source: Stander (2004)

In the absence of data from detailed studies on populations of resident lions along the northern border of ENP, it is difficult to infer whether lions outside the borders of ENP have increased or decreased. A study for the Namibian Large Carnivore Atlas revealed that the population densities of lions along the borders in Oshikoto Region were high (1-1.8 lions per 100 km^2), decreasing to medium density (0.4-1 lion per 100 km^2) from Onanke area to the north-western boundary of Etosha National Park (Stander & Hanssen, 2003). These estimates were based on responses from participants who sighted the lions and from evidence of lion spoor in different localities. The same study revealed that the majority of lions were sighted at waterholes (27%) and woodlands (22%) (Stander & Hanssen, 2003). In a study on the demography of lions in ENP, Stander (1991) reported a positive correlation between lion densities with artificial water points and prey densities.

The need for detailed research in population dynamics and other aspects of the ecology and behaviour of lions along the boundary of ENP cannot be overemphasised. When we have an understanding of the ecology and behaviour of lions and other predators, it will be possible to devise ways to prevent and control them in order to reduce conflicts between humans and lions.

3.2.3.2. Elephants

Elephants usually cause problems during the crop-growing rainy season as well as during the dry season when water become scarce and most pans run dry. At ENP, elephants destroyed the fence and created openings for predators such as lions to go outside the Park. They trampled the fence as they moved in and out of the Park. Elephants also damaged infrastructure such as water points (Plate 4) and fences as they migrated out of the Park (Plate 5). Very little is known about populations of elephants and their ecology along the northern border of ENP. However, based on estimates of elephants from the 1998 aerial survey for ENP (Mendelsohn, El Obeid & Roberts, 2004), there were more elephants (0.1-2 elephants per km^2) in the eastern part of the study area, in Etosha pans and grasslands or Andoni plains.

The rest of the northern area had less than 0.1 elephants per km^2. It is therefore no surprise that elephants caused most problems to humans on the eastern side of ENP, in Oshikoto Region. There were some elephants that caused problems in Omusati Region. Similarly, incidents in Uukwaluudhi area involved elephants that probably moved from Etosha or from Kunene Region in the west (Mendelsohn et al., 2004). As they moved in and out of the Park, elephants also destroyed the fence (Plate 5). Note that in such a condition of the fence as shown in Plate 5, other wildlife such as a lions or hyenas can easily get out of the Park.

*Plate **4**: Water tank destroyed by elephants*

(Photo by John Mfune, March 2010)

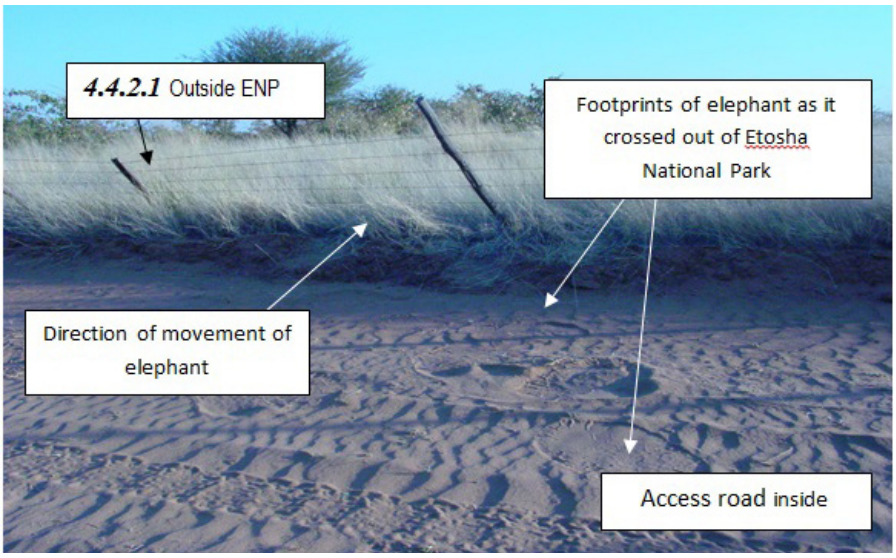

*Plate **5**: Footprints of elephants crossing the fence of ENP*

(Photo taken by John Mfune during the field visit on July 2005)

Naturally, elephants can travel long distances. A study undertaken through satellite tracking to investigate movements of three elephants in ENP revealed that one radio-tracked elephant moved from the centre of the Park to the north of the border of the Park in Oshana Region and into western Oshikoto Region, covering an area of about 2,800 km^2 (Mendelsohn et al., 2004). The other two females that were tracked in the western part of the northern boundary of Etosha had larger ranges of up to 18,600 km^2 (Mendelsohn et al., 2004). Most elephants that caused problems for local communities along the northern border of ENP originated from the Park, where the population of elephants was estimated at about 1,200 according to the aerial counts of 1998.

3.2.3.3. Hyenas, jackals, leopards, and cheetahs

Very little is known about the status of predators such as hyenas, leopards, cheetahs and jackals along the border of ENP despite their involvement in HWC. However, the Namibian Large Carnivore Atlas (Stander & Hanssen, 2003), which was compiled from visual sightings submitted by various participants throughout the country and from evidence from spoor of these species, has some information. According to the atlas, Hyenas, leopards, cheetahs and jackals occurred at medium density along the boundary of ENP with a few areas where they were estimated to occur at high density. While the population of spotted hyenas was estimated to have high density in the eastern boundary (Oshikoto Region) and western section of the

northern boundary (Omusati Region), the brown hyena population had high density at the western end of the northern boundary. The high density of leopards followed the pattern of the spotted hyenas. The cheetah population was estimated to have a high density in the western section of the northern boundary. There is urgent need to undertake research on the ecology and behaviour of hyenas, leopards, cheetahs and jackals along the border of ENP in order to gain knowledge that will facilitate development of prevention and control measures to address the HWC caused by these predators.

3.3. STAKEHOLDERS PARTICIPATION IN MANAGEMENT OF HWC

3.3.1. PERCEPTIONS AND VIEWS OF KEY STAKEHOLDERS REGARDING HWC ISSUES

Stakeholder participation in natural resource management has a long history starting in the 1960s (awareness-raising), and efforts to involve users and beneficiaries of natural resources are on-going (Reed, 2008). The level and type of participation is influenced by stakeholders' views and perceptions regarding natural resource management. In essence, meaningful biodiversity governance requires participation of primary stakeholders in the planning, decision-making and implementation of management strategies and associated monitoring systems. This also applies for human-wildlife conflict management because participation of primary stakeholders, who in this study are commercial farmers, communal farmers (cattle posts), village households and conservancy members. These have a potential to provide a comprehensive picture of the human-wildlife conflict situation along ENP boundaries and its management options. Such participation can also lead to a collaborative decision-making process, producing management decisions relevant for human-wildlife conflict solutions (Reed, 2008; Billgren & Holmen, 2008; Davies & White, 2012).

According to Reed (2008), participation is defined as a process where individuals, groups and organisations choose to take an active role in making decisions that affect them. In this study, participation is defined as a process where individuals, households, communities and organisations are taking an active role in addressing HWC along the boundaries of ENP. To this end, this study examined the perceptions, views and understanding of key stakeholders regarding human-wildlife conflict along Etosha National Park. Understanding stakeholders' views and perceptions regarding HWC may provide insight into the level of their participation (or lack thereof) in addressing HWC.

The interactions and experiences of farmers and managers with problem wildlife animals influence their views, perceptions and understanding of HWC. It is important to study these views and understanding because conflicts between humans and wildlife can be real or perceived, economic or aesthetic, social or political (Messmer, 2000). Farmers living along the boundaries of ENP were asked how they understood the HWC situation. The majority of respondents (65%) defined HWC as a situation whereby wildlife kill, injure, chase or threaten livestock and humans. The overall perceptions of the farmers regarding the HWC situation are summarised in Table 2 below.

Table 2: Farmer's perceptions regarding HWC along ENP

Perception	Commercial Farm (%)	Village (%)	Cattle Post %)	Conservancy (%)	TOTAL (%)
Wildlife kill, injure, chase or threaten livestock and humans	68	53	65	66	**65**
Destruction of property crops, fence, water point	8	32	13	26	**19**
Predators causing problems or loss to non-predator species	8	5	11	2	**6**
Problems or conflicts between humans and wildlife	8	5	9	5	**7**
Farmers kill wildlife (predators are not protected)	4	5	0	1	**2**
Protecting people from wildlife	4	0	2	0	**1**

Similarly, the animals involved in the conflict were viewed as predators that kill, injure, chase or threaten humans and livestock or as wild animals that destroy farmers' properties (57%). Non-predators were also viewed as unwanted animals that make life difficult for humans (10%). The Ministry of Environment and Tourism staff in ENP had similar views and understanding of the HWC situation. Staff members reported that people and wild animals were competing for the same resources resulting in conflicts leading to crop damages and livestock losses. Farmers reported that HWC was caused by wild animals, mainly predators because livestock was herded near the Park. According to commercial and communal farmers, this situation was intensified because ENP fence had many holes, making it easier for predators and elephants to escape from the Park. Wild animals were not the only culprits in these human wildlife conflicts; humans also had their share.

Due to inadequate grazing areas close to settlements, many communal farmers admitted grazing their livestock close to the ENP fence where there was sufficient grass. This practice unfortunately brought livestock too close to the Park; basically, at the doorstep of predators. In addition, many communal farmers did not guard their livestock during the day when they were grazing and others did not kraal them at night when predators roamed about. Farmers also pointed out that HWC was escalated by factors such as lack of water points in the Park, increasing livestock population and decreasing prey population in the Park. Moreover, problem animals (lions, hyenas and caracul) were escaping into commercial farms and neighbouring cattle post areas. These animals were breeding and increasing over time, thereby worsening the HWC situation. Given these problems, commercial and communal farmers along ENP felt that the HWC situation was very serious (Figure 18).

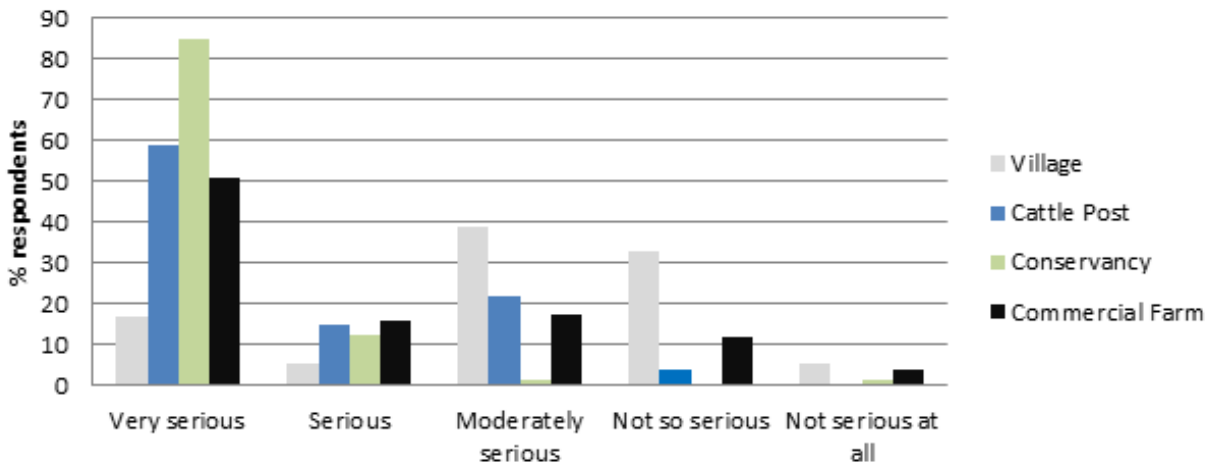

Figure **18: Views of communal and commercial farmers regarding the degree of HWC along ENP boundaries**

About half (51%) of the farmers interviewed felt unable to protect their households and families against problem animals because they had no means (dogs, weapons) to do so. Farmers also felt that there was no information about problem animals and how to deal with them. Furthermore, farmers felt that they were not permitted to kill wild animals, thereby making them more vulnerable. Those who were able (49%) to protect themselves mentioned the following factors: erecting and maintaining electric fences, scaring off wildlife with lightning, beating of drums and gun shots. Some farmers, particularly commercial farmers (14%) mentioned that they killed problem animals.

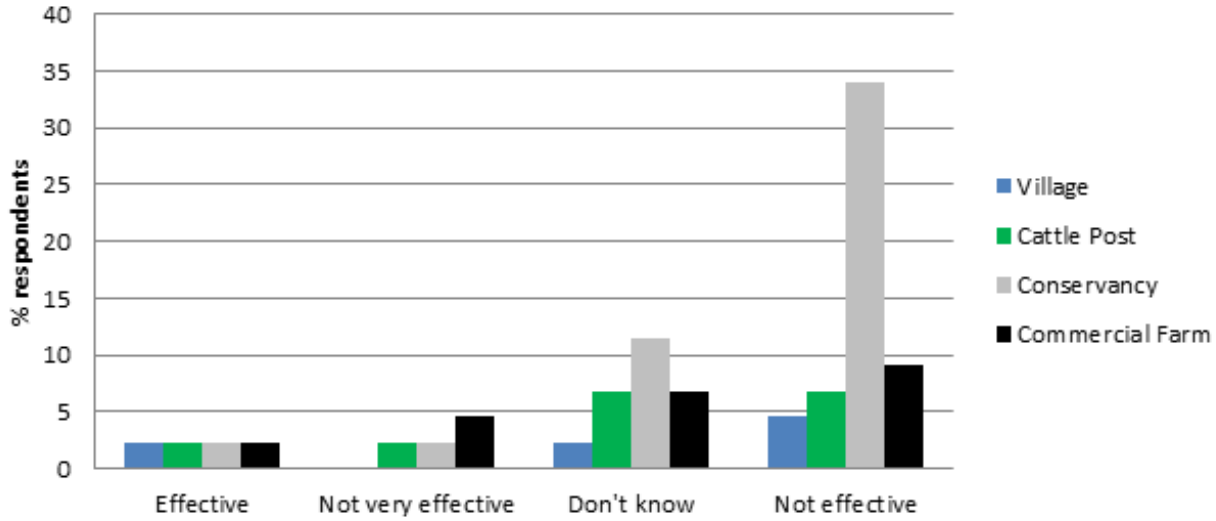

Figure **19: Perceptions of farmers regarding effectiveness of local management efforts**

The respondents in conservancies (34%) and commercial farms (9%) admitted that their efforts to control or prevent HWC along ENP were not effective (Figure 19). These views might have produced negative attitudes toward predators and other wildlife that escape from ENP. However, farmers who were interviewed expected the ENP management to address HWC in their areas or at least to be compensated for the livestock and property losses they incurred. Farmers reported that the MET's response to HWC complaints was inadequate (conservancy: 37%, commercial farmers: 28%, cattle posts: 29%). Therefore, their perceptions regarding MET/ENP management of HWC was very poor. Stakeholders' participation in decision-making and management of HWC is crucial. In particular, regular and effective communication between MET and farmers could influence positive attitudes and perspectives among farmers towards

wildlife.

Table 3: Farmers' perceptions regarding MET's HWC management approach

Management statement (N = 193)	Agree (%)	Moderately agree (%)	Disagree (%)	Do not know (%)
Existing MET interventions are adequate	14	16	60	9
Compensation for losses resulting from HWC is sufficient	2	5	83	8
Farmers' views are considered for management decisions	8	9	62	19
Platforms to discuss HWC problems and solutions exist	11	10	67	10
Farmers are fully aware of procedures to follow when faced with HWC	43	21	24	10

There is a clear trend emerging from Table 3 above that farmers disagreed that the current HWC management strategies were effective. Farmers' perceptions may influence the level of complaints, the level of tolerance, as well as collaboration with HWC managers. Table 3 also demonstrates that there was a one-way consultation between the managers (MET) and the farmers. 43% of the farmers were aware of procedures to follow when faced with HWC, yet limited efforts were invested in instituting platforms to discuss and identify possible solutions in addressing the HWC situation. Interestingly, the HWC policy seeks to address issues of local communities' participation in the management of HWC. The Ministry, through the HWC policy, has started implementing joint HWC management and mitigation plans and provides technical support in applying mitigation methods (Republic of Namibia, 2009).

The study revealed that the following factors could influence farmers' perceptions and attitudes towards HWC: poor environmental governance, lack of stakeholder participation, insufficient data and understanding of HWC, failure to consider indigenous knowledge in HWC management practices and insufficient financial, technical and human capacity to deal with HWC. Furthermore, the extent and seriousness of the HWC incidents and losses could be influenced by farmers' and MET's attitudes and perceptions.

This study further demonstrates that the number of livestock losses per annum (see Table 4 below) was moderately high for a single household. However, the numbers do not reflect the extent of the HWC problem as expressed by farmers during the interviews. Most farmers expressed strongly that HWC was very serious and that they were losing a large number of livestock every year. The strong expression of HWC severity was also influenced by factors relating to vulnerability and risk. The risk here refers to the likelihood of loss, while vulnerability refers to the capacity to cope with such a risk. Table 4 below illustrates the number of cattle and goats lost per household during 2009. The majority of households (86%) lost a minimum of 1 and a maximum of 10 cattle per household. Still, the majority of households (79%) lost a minimum of 1 and a maximum of 20 goats per household. On average, most households lost a maximum of 1 cow and/or 2 goats per month per household.

Table 4: Number of cattle lost to predators per household in 2009

Number of livestock lost	Cattle lost (% of households)	Goats lost (% of households)
1-5	70	14
6-10	16	40
11-20	11	25
21-30	1	11
31-40	0	2
41-50	0	2
51-60	0	1
61-70	0	0
>71	2	5

Stakeholder participation can enhance good governance through decision-making depending on the nature of collaboration with MET. Therefore, successful implementation of the HWC policy requires stakeholders' participation at all management levels in the research, monitoring and evaluation of HWC. The human-wildlife conflict policy strongly advocates for compensation for livestock losses. This is crucial because this study concluded that 83% of the respondents were not satisfied because of the lack of a compensation scheme during the time of study. The HWC policy recommends that mitigation measures be put in place to prevent conflict incidents. In this regard, ENP requires maintenance of the Park fence, especially on the northern boundary as suggested by respondents (57%).

1.1.1 MANAGEMENT OF HWC, SUPPORT SYSTEMS AND POLICY ISSUES SURROUNDING HWC

The respondents affected by HWC engaged in a variety of activities in order to mitigate human-wildlife conflict. They used physical barriers that included, but were not limited to, herding and kraaling livestock, erecting kraals and fences, maintaining fences and creating buffers. Farmers said that it was important to erect strong kraals and fences that prevent predators from entering. This was a very important HWC prevention and management practice along the borders of ENP. It is interesting to note that the structure of kraals at cattle posts in general had evolved to reduce livestock losses with escalating intensity of HWC along the boundaries of ENP (Figure 20).

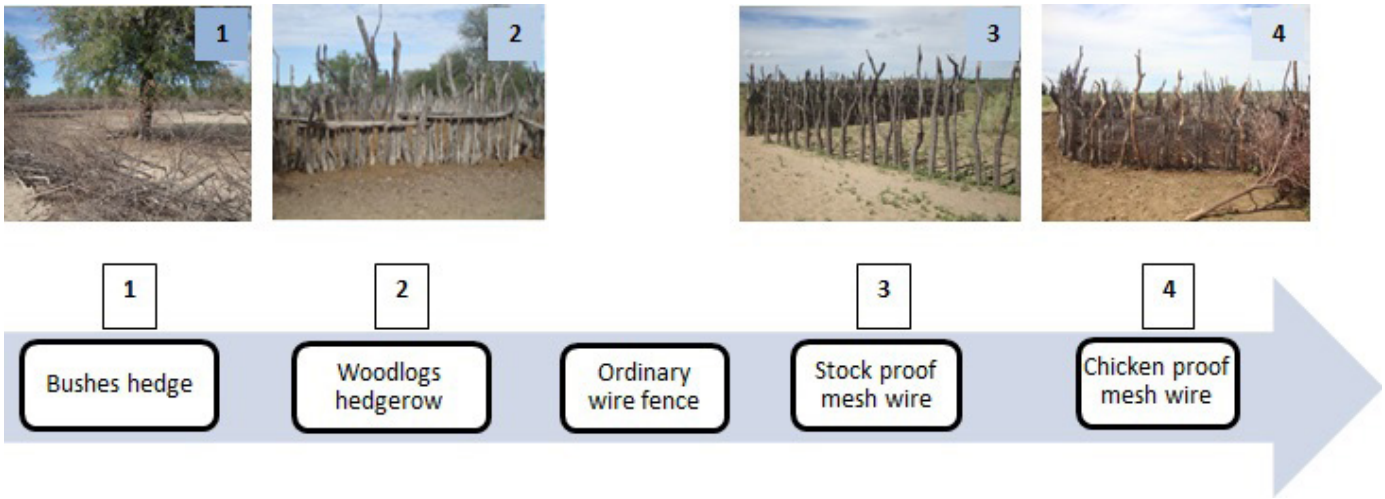

Figure **20: Progression of change of structure of kraals at cattle posts along ENP**

During a study on HWC in the northern borders of ENP, Mfune et al. (2005) noted that most people at cattle posts kept their cattle in bush hedge kraals. This was partly because they did not keep cattle for long periods as was being practised at the time of this study. They only brought cattle close to ENP during dry seasons when grazing was not easy around the settlements. A few people, though, had kraals made from wood-logs, and

even fewer had log-wired kraals. However, with time and with increase in human population, many people had now settled close to ENP. It is interesting to observe the evolution of the kraal structures and the materials with which they were made. About 10 years later, during the 2010 study on HWC, the researchers noted almost no kraal made of bushes. The majority of kraals were made of wood, and of different types of wire, including stock and chicken proof wire, to prevent predators, especially lions, hyenas, jackals and caracul, from entering the kraals. This strong securing of kraals has evolved partly because most cattle were now kept and left at cattle posts almost all year round. This is why at the time of this study some households consisted mainly of young men employed to herd the livestock.

By the time of this study, it had become common for farmers to herd livestock during the day and collect them for kraaling at dusk to reduce the HWC incidents in conservancies, cattle posts and villages. Commercial farmers mainly patrolled and maintained the fences of the camps of their farms to reduce livestock losses. During these patrols, commercial farmers also patrolled and fixed the fences of ENP to reduce the escape of predators into their farms. Commercial and cattle post farmers also indicated that they created buffer expanses between their livestock farming areas and ENP. In the case of cattle posts, livestock grazed some distance away from ENP to reduce HWC casualties. Similarly, commercial farmers subdivided their farms in order to allocate the camps directly bordering ENP to game farming. Game farming acted as a buffer to livestock losses due to depredation for farmers bordering ENP directly. These practices helped to prevent and mitigate HWC. Farmers also employed a number of local measures to manage and prevent HWC (Table 5).

*Table **5**: Four most common mechanisms used to manage HWC among communal and commercial farmers bordering ENP*

Communal farmers	%	**Commercial farmers**	%
Scaring off wildlife	39	Maintenance of fences	20
Herding livestock	17	Trapping/poisoning/killing predators	37
Collecting and kraaling livestock	25	Changing grazing lands	8
Patrolling farm camps and ENP fence	12	Patrolling farm camps and ENP fence	11

The farmers used disturbance methods to mitigate HWC. They beat drums or anything that could produce noise while those with firearms occasionally shot in the air to scare off wildlife. They also kept dogs to scare away wild animals from their farms, although MET banned the keeping of dogs closer to the ENP. The farmers stated that they also used traps or poison or they shot to kill problem animals, especially predators. Some farmers reported HWC incidents or problem animals in their communities to MET and collaborated with them on the best ways to avoid livestock losses. Commercial farmers did not encourage the breeding of problem animals on their farms, thereby preventing further increase of these problem animals.

Although farmers used different mitigation strategies against HWC, the majority (77%) were not sure if these methods were effective at all. This suggests that despite the different methods community members used, HWC continued to escalate. The local farmers received the brunt of HWC more when they were inadequately empowered to deal with the conflict.

Farmers had different views on how MET, the responsible government institution, handled HWC issues in the surroundings of ENP. More people within villages felt that the response of MET was generally adequate, although some said that they were not fully satisfied with the response. On the contrary, the majority of farmers from conservancies, commercial farms and cattle posts alluded to the inadequate response from the MET officials after HWC cases had been reported to them. However, some farmers in these areas did indicate that the response of MET officials to the reported cases was adequate. Those in the conservancies also felt that MET did not respond to most of the reported cases. The increase in ungulate wildlife species in the conservancy areas (NACSO, 2012) attracted the presence of predators and this was likely to increase HWC incidents. High numbers of ungulates and the presence of predators in conservancies made it difficult for MET to respond on time and effectively to reported cases. Despite conservancies being wildlife management

areas, the rules and procedures in dealing with problem animals were not different from those of a normal village. This was a frustrating situation for the farmers in conservancies and villages when they faced serious and especially life threatening wildlife conflict situations.

3.3.3. COMMUNICATION FLOW BETWEEN FARMERS ALONG BORDERS OF ENP AND MET

Participation of stakeholders including farmers in decision-making and management of HWC is crucial for resolving emerging and continuing problems. In particular, regular and effective communication between MET and farmers could influence positive attitudes and perspectives among farmers towards wildlife.

Overall, the majority of respondents (65%) in the study area indicated that they had direct access to MET officials whenever there was a need to report a HWC incident. Whenever there was a HWC incident, farmers from the villages (78%) and commercial farmers (75%) reported to or directly contacted MET (Table 6). In contrast, fewer farmers at commercial farms (47%) and at cattle posts (56%) indicated that they reported any HWC incident to MET directly. At cattle posts, this was mainly due to the remoteness of where they herded and kraaled the cattle where there was no instant communication channels, such as telephone, to contact MET. Hence, the majority of respondents stated that instead of reporting HWC to MET, they reported to the headman, the police, or the owner of the cattle. Farmers in conservancies reported HWC incidents at the conservancy offices or to conservancy game guards.

Table 6: Communication flow between MET and farmers

Land-use type	Yes (%)	No (%)
Village	78	17
Cattle post	56	38
Commercial farm	75	16
Conservancy	47	45

3.3.4. THE ROLE OF MET

One of the most important measures that MET implements in order to address HWC is to strengthen management approaches within ENP to reduce escape of wildlife from the Park. These mainly include regular patrols. ENP estimated that the Park fence is about 58 years and only about 55% effective. The ENP fences consist of a 250 km stock proof fence in the northern part and a game proof fence in the southern part. The distance covered by the stock- and game-proof fences is short. These sections of the ENP fence, especially the game-proof fence, are very expensive and hard to repair. In addition, the MET staff from ENP regularly check availability of sufficient amounts of water at water points and they repair broken ones. MET also monitors wildlife both inside and outside the Park and track down predators around the Park. In order to lure or direct problem animals back into ENP, MET staff use any of the following methods either separately or combined with other methods:

- use carcasses of herbivores, mainly ungulates, to attract predators back to the Park;
- capture and translocate by working together with experts in darting and caging from the veterinary department of the Ministry of Agriculture, Wildlife and Forestry;
- use helicopter;
- use fire shots.

MET staff also work very closely with local communities surrounding the Park in order to foster a good working relationship, which is important in the management of HWC. MET staff members hold regular meetings with community members to educate and raise awareness on the behaviours and nature of problem animals as well as on the HWC policy. They discuss with local communities and other stakeholders the problems they encounter and provide them with relevant information regarding HWC. In addition, MET maps out HWC risk

areas, provides training to some community members on how to deal with HWC and encourages local level wildlife management such as the establishment of conservancies in communal areas where there are no such arrangements.

The current conservancies have local monitoring systems in place, known as the "event book system". An event book system is a management tool that is developed to monitor natural resources at local level in conservancies. Information on other factors such as poaching incidents, predators or veldt fires, mortality and reproductive successes will also be obtained from secondary sources such as the event book system (Stuart-Hill, Diggle, Munali, Tagg & Ward, 2005). The event book is an important source of essential information on the movement of problem animals and the nature of HWC within communities. MET officials use information from this system to address HWC and to identify needs and challenges of the community members. MET staff in ENP confirmed at the time of this study that they now gave more rapid and effective responses to reported incidents of HWC. MET established the Southern Boundary Forum for commercial farmers to serve as a forum to discuss the ENP boundary and HWC issues. This forum was, however, inactive at the time of the study and needed to be revived to improve communication between MET staff in ENP and surrounding farmers. MET identified some mechanisms that could play an important role in managing HWC such as:

- Generation of more data to understand behaviour and distribution of predators in the area;
- Understanding translocation of problem animals;
- Analysing and using data from the event book system records from conservancies to understand problem animals and types of incidents in communal areas;
- Joint patrols of Park fences by MET staff and community members.
- Encouraging local level wildlife management such as establishment of conservancies in communal areas and game farms in commercial areas.

3.3.5. MAIN CHALLENGES MET FACES IN DEALING WITH HWC

The Ministry of Environment and Tourism faces the following main challenges in dealing with human-wildlife conflict:

- Responding to HWC cases by MET local officials is delayed by decisions that are taken at MET head office in Windhoek (Local MET staff have limited powers to make decisions on HWC incidents);
- Increasing cases with limited officials and logistics such as transport;
- Community members not cooperating sufficiently (sometimes providing false information or reporting cases too late);
- Lack of skills and required experience among MET staff to deal with HWC;
- Lack of adequate funds for local MET officials to manage HWC adequately. (The lives of MET officials are always in danger when handling HWC cases due to absence of required tools);
- Farmers not implementing necessary measures to avoid HWC (such as looking after their livestock properly or reducing livestock numbers);
- At times, community members make their own decisions, such as killing problem animals, before MET advice;
- Inadequate information or data on HWC occurrences around ENP; and
- Unclear information on compensation of losses to farmers .

4.0. CONCLUSION AND RECOMMENDATIONS

4.1. CONCLUSION

Investigation of the nature, characteristics and management of human-wildlife conflict along the boundaries of ENP has provided new understanding of HWC dynamics between national parks and adjacent communities. A number of conclusions that are relevant for both policy and management interventions were made from this study.

The study revealed that the majority of households in villages, cattle posts and commercial farms along the boundary of ENP were male headed. In particular, it was noted that cattle posts were headed by unmarried males, mainly employed young men who looked after cattle. Few cattle post owners lived on the cattle posts to care for their livestock.
Communities adjacent to ENP that were targeted for this study also showed the lowest education levels, except commercial farms. These low levels of education may compromise the capacity of farmers to participate meaningfully in HWC governance and management.

It is clear from the study, that both communal and commercial farmers highly value the agricultural production, which is the main livelihood activity around ENP. Crop and livestock production contributes to food security, cash income and cultural fulfilment. The value attached to agricultural production differs according to land-use type. As such, farmers in commercial areas, cattle posts and communal areas along the western boundary of ENP value livestock, while villages in and outside the conservancies along the northern boundary value both crop and livestock production. Furthermore, the natural environment around ENP provides ecosystem services that are essential for the communities' livelihoods. Farmers benefit from the use of their land and resources therein such as grazing land, fertile soil, land for cultivation, and water availability for livestock, crops and household use. Additionally, hunting, tourism and game farming were only mentioned as nature-based benefits in the commercial farm land-use type.

As the human and livestock populations along ENP increase, the demand for agricultural land and ecosystem services also intensifies. This defeats the historical co-existence between human and wildlife in the area as they are now competing for the same resources. The study concludes that wild animals escaping ENP are causing the following problems: (i) damage to gardens and loss of crops by mainly elephants; (ii) damage to property/infrastructure such as water points especially by elephants; (iii) death/loss of small stock (goats and sheep) and large stock (cattle, donkeys, horses) by predators, mainly lions, hyenas and jackals; and (iv) threat, injury and loss of human life due to predators such as lions. There was a wide variation in what respondents indicated as the most predated livestock and other animals. At cattle posts, cattle were reported to be most predated while the most livestock lost to predators at commercial farms were goats, followed by sheep and cattle. In villages and in conservancies, most losses were experienced in goats followed by cattle.

Wildlife species that were causing damages and losses to farmers were viewed as problem animals leading to HWC. In this study, hyenas, lions, jackals and elephants were reported to be the most problematic wildlife involved in HWC along the borders of ENP. Lions and hyenas were the most problematic wildlife at cattle posts where local communities kraaled and grazed their animals, while hyenas, jackals, cheetahs, caracul and lions were reported to be the dominant problem wildlife to commercial farms. Elephants were the most problematic animals for conservancies, villages and cattle posts located in the eastern and northern parts of ENP, because this was a known route of migrating elephants in ENP.

This study showed that grazing livestock close to the ENP fence that was broken in many sections led to problem animals escaping ENP to raid livestock. It was noted that waterholes that were located outside but closer to the fence of ENP also attracted wildlife to escape out of the Park in search of water. Proximity of settlements and grazing areas to the Park increased the HWC incidents. The settlement patterns might have encroached into migratory ranges of elephants, especially on the northern boundary of ENP. The absence

or presence of herding and kraaling of livestock may reduce or increase HWC incidents, particularly in communal areas. It was noted that within communal areas (cattle posts, conservancies and villages), the type of kraaling associated with herding of livestock had improved the management of HWC at household level, whereas within commercial farms patrolling and maintenance of the fence had an impact on the management of HWC at farm level. The absence of a buffer zone between the Park and adjacent communities also had an effect on the HWC incidents.

The farmers had the correct perception that increasing livestock population and decreasing prey population in the Park had implications on the escalation of HWC incidents and the management thereof. The respondents affected by HWC engaged in a variety of activities in order to mitigate human-wildlife conflict. They used physical barriers that included, but were not limited to, herding and kraaling livestock, erection of kraals and fences, maintenance of fences and creating buffers. For instance, commercial farmers created buffers by subdividing their farms in order to allocate the camps that directly border with ENP to game farming. Other efforts to mitigate HWC incidents included beating drums, firing gun shots, lighting fires to scare off predators or, in worst cases, killing the problem animal.

In order to address HWC, it is also important to understand the biology and ecology of problem animals and factors that may escalate this conflict. Understanding the temporal and spatial ranges as well as population dynamics of problem animals could inform the management of HWC.

4.2. RECOMMENDATIONS

The study recommends that in order to manage HWC effectively, there is a need to strengthen existing management efforts. These efforts include the following:

- Improve communication and information flow between ENP/MET officials and farmers.
- Identify capacity needs of all stakeholders that can be attended to in order to improve management of HWC.
- Encourage establishment of land-use types that would strengthen management approaches to HWC. Such land-use types include conservancies or concessions between ENP and cattle posts/villages as well as game farms within commercial farms.
- Conduct regular research and monitoring to improve the understanding of the socio-economic, ecological and political factors that are likely to play a role in either mitigating or intensifying the HWC.
- Identify policy gaps and opportunities to include all HWC typologies that may exist in the country.
- Classify vulnerability of different communities such as those living along protected areas.

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