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Human Wildlife Conflict in Relation to Human Security in the Gonarezhou National Park, Zimbabwe

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ABSTRACT

An investigation on the impacts of human-wildlife conflict on human security was carried out in three randomly selected communities adjacent to Gonarezhou National Park between 2019 and 2020. The study aimed to establish the impacts of human wildlife conflict on human security, to ascertain the nature of problems or conflicts between people and wildlife, and to identify the wildlife species that are regarded as problematic by local villagers. The research employed a quantitative approach and data was collected using closed questionnaires. The target population of the study were sixty households from the three communities under study and a sample of sixty respondents all completed the questionnaires. One Way Single Factor Analysis of Variance and multiple t tests were conducted on variables under study namely human wildlife conflict experience, nature of experience, frequency of encounters, and dominant PAs. Results showed significant differences ($p = 0.00058$- human wildlife conflict experience, $p = 0.006$- nature of experience, $p = 0.04027$- frequency of attacks.). For attacks with highest frequency, crop damage and livestock attacks were dominant in the Northern and Central community whilst isolated cases of crop damage were recorded in the Northern community which was the control due to its privately owned plots which are protected by electric fences to deter wildlife. The lion was the dominant PA in the Central community whist the elephant was dominant in the Northern community, with the Southern community registering only seven cases of crop attacks by lions. Chi square tests were also conducted to test for relationships between gender and Human-wildlife conflict experience as well as between frequency of encounters and community. The results proved that there was no relationship between gender and human wildlife conflict experience (P chisq = 0.427. There was a strong relationship between community and frequency of encounters (P chisq = 13.85) concluding that human wildlife conflict had negative impacts on human security.

1. Introduction

The concept of human security represents a departure from orthodox security studies, which focused on the security of the state, and now encompasses new non-traditional threats that target the seven elements of human security as put forward by Copenhagen school of thought led by Barry Buzan and others. Human security refers to the approach to national and international security that gives primacy to

human beings and their complex social and economic interactions (Buzan, 1997). According to Buzan (1997), the seven elements of human security are community, health, food, political, economic, environmental, and personal security. If all these elements are secure then the human security is achieved. According to the United Nations Commission on Human Security (UNCHS), human security means protecting fundamental freedoms – freedoms that are the essence of life. It means protecting people from critical (severe) and pervasive (widespread) threats and situations. It means creating political, social, environmental, economic, military and cultural systems that together give people the building blocks of survival, livelihood and dignity (UNCHS, 2003). The UNCHS, in its final report Human Security Now, defines human security as: "…to protect the vital core of all human lives in ways that enhance human freedoms and human fulfilment. Human responses to the interaction are the most decisive factor for the outcomes of the conflicts between humans and wildlife (USGS, 2003).

Although still relatively new, the term is now widely used to describe the complex of interrelated threats to individual human well-being associated with interstate war, civil war, genocide, ethnic cleansing, population displacement, natural disasters and pandemics. Some of the broadest interpretations include aspects of security related to food, health, the environment, communities, politics and human rights. Human security brings together the 'human elements' of security, rights and development. As such, it is an inter-disciplinary concept that displays the following characteristics: people-centred, multi-sectoral, comprehensive, context-specific, prevention-oriented.

Human security is also based on a multi-sectoral understanding of insecurities. Therefore, human security entails a broadened understanding of threats and includes causes of insecurity relating for instance to economic, food, health, environmental, personal, community and political security (UNTFHS, 2016).

Human-wildlife conflict (HWC) is one such non-traditional threat to human security in that it threatens elements which make up human security (Upreti, 1985). HWC occur when human beings take negative actions on wildlife and vice-versa. Conover (2002) defined the term HWC as occurring whenever an action by human or wildlife has an adverse effect on each other. The Kenyan Wildlife Service (KWS, 1996) defined HWC as any and all disagreements or contentions relating to destruction, loss of life or property and interference with rights of individuals or groups that are attributable directly to wild animals. Such conflicts have been recorded thought the world in terrestrial, aquatic, and aerial environments and have involved a wide variety of animal taxa (Torres et al., 2018). Human-wildlife conflicts are a global problem, and are occurring in many countries where human and wildlife requirements overlap (Dickman, 2010).

HWCs are a global problem, and are occurring in many countries where human and wildlife requirements overlap (Dickman, 2010). Conflicts between people and wildlife are encountered by a diverse group of communities, particularly those residing close to protected areas containing large to very large herbivores (buffalo, hippopotamus, rhino, and elephant) and large carnivores (lions, leopards, hyenas). In Africa, large numbers of big mammals, including several thousand wild elephants, and more than 20 000 lions, still roam freely (CPSWM, 2005; IUCN, 2005; CPW, 2015). The communities around these protected areas have to cope with the consequences: damage to and destruction of crops, livestock predation, competition for grazing and water, increased risk of livestock diseases and even direct threats to human life (Baldus, 2008; Packer et al., 2005).

In Zimbabwe, the human-wildlife interactions have not been positive and ideal, as many would have wanted. They have been characterized by despair, anguish and trauma, with people losing their lives in communities that border wildlife conservancy areas (Le Bel et al., 202; Gandiwa et al, 2012). Taking the topical issue of elephants as an example, the problem has become magnanimous because of the unabated growth of elephants against the available space for their upkeep and sustenance. Very little has been done to curtail the growth because of the ban enforced by the Convention on International Trade on Endangered Species (CITES). Furthermore, climate change and a burgeoning wildlife population are unique challenges confronting the Southern African region. HWC, particularly in Zimbabwe is now reaching a tipping point. Saddled with a colossal population of 84 000 elephants against a carrying capacity of around 56 000, the country is battling daily incidences of HWC (CITES, 2019). The problem is not peculiar to Zimbabwe, but extends over much of the Southern African region which has been blighted by adverse weather conditions in the drought plagued 2018-2019 season.

Wildlife is increasingly moving from parched conservation areas to neighbouring communities. Zimbabwe and its neighbours Angola, Botswana, Namibia, and Zambia are carrying the burden that comes with 216 000 jumbos freely migrating within the Kavango-Zambezi Trans Frontier Conservation Area (KAZA TFCA), which is nestled in the heart of Southern Africa. Such a huge population of elephants in addition to other wild animals such as rhinos are already posing a serious threat to human life and the environment, notwithstanding the costs associated in keeping such a huge herd. For instance, the Hwange National Park, which is about 14 700 square kilometres - the size of Belgium - currently has more than 35 000 elephants, yet it can only carry 14 000. With no river flowing through the game park, the national park has to pump more than 550 000 litres of water a day to be used by the wildlife (Bernes et al., 2003).

Even the pressure that such a huge herd puts on the environment is unimaginable, never mind the daily threats to human lives, that has already been catastrophic in recent years. In the last five years more than 200 people have been killed in human-wildlife with over 7 000 hectares having been destroyed in the last five years nationally. It is in light of such unfortunate situations that the region would need to expedite proper conservative initiatives, to avert further loss of lives (Hill et al., 2002). Despite posing great danger to humans, most research done on HWC has been aimed at conserving the wildlife. Very little research has been done through the security lenses, with the aim of promoting human security. It

is therefore through this research that useful contribution to human security is expected to be proffered to ensure that local communities living close to national parks are safe from the threats posed by wildlife. The main aim of this study is to determine the effects of HWC on human security.

2. Materials and Method

This study was conducted in Gonarezhou National Park (GNP) located in Chiredzi district, Masvingo Province, Zimbabwe in order to ascertain the effects of HWC on various aspects of human security. Various human security aspects including health, community, environmental and economic were considered for study during the research. Targeted respondents to the questionnaires were residents in communities adjacent to the national park.

2.1. Study site

The study was conducted in communities surrounding GNP which is part of the Limpopo Trans-Frontier Conservation Area (TFCA) covering Zimbabwe, South Africa and Mozambique (Fig. 1). The GNP was established as a game reserve in the early 1930s but was upgraded into a national park in 1975 under the Parks and Wildlife Act of 1975. The GNP covers an area of 5000 km², and is located between 21° 00' – 22° 15' S and 30° 15' – 32° 30' E. The study area lies in a semi-arid savanna ecosystem and supports a wide variety of large herbivore species, including elephants, hippos, buffalos, giraffes, plain zebra and waterbucks. Large carnivores also found and these include lions, leopards and spotted hyenas. GNP has an estimated animal population of close to 11 000 animals. Local residents in communities adjacent to the GNP practice a combination of subsistence, cash crop farming, and livestock production (Hlambela, 2005). The main crops include maize, sorghum, grown for subsistence utilization as well as for commercial sale as well as cotton. Livestock include cattle, goats, sheep, donkeys, and poultry. The dominant ethnic group in the study area is Shangani. The three communities under study have a total population of 27671 people from 8097 households and covers a total of 6729.04km² according to CRDC (2018). The communities are mainly communal areas with people practicing subsistence farming specializing in maize, sorghum, as well as cotton for commercial purposes. There are several health care facilities in the form of a clinic in each ward and these are usually resourced by both non-governmental organizations (NGOs) and government.

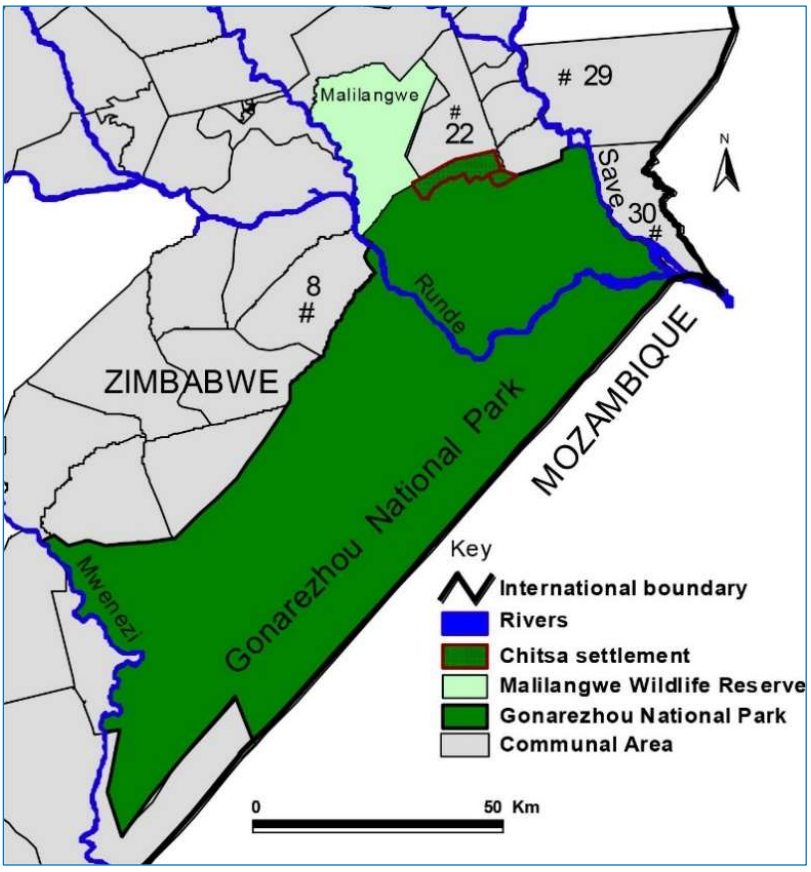

Fig. 1. Location of the Gonarezhou National Park and adjacent areas in southern Zimbabwe (Gandiwa, 2012)

2.2. Sampling method

A reconnaissance survey was carried out in areas adjacent to the national park in order to obtain an impression of the site conditions, to collect information on accessibility and to determine sampling sites and sampling methods to be used for vegetation data collection. Stratified random sampling was used to select study sites were stratification by proximity to the national park. The three communities were located on the northern, central and southern sides of the park respectively. The 3 sites (S1, S2, S3) adjacent to GNP were

selected within which six wards (V1, V2 each) were randomly selected for data collection. Within each ward, 10 households were selected to give a total of 20 households per community under study. A total of 60 households were selected to be part of the study. As illustrated by the research design, S1 represented communities located at the southern part of the game park whilst S2 and S3 represented those communities located at the central and northern part of the game park respectively.

In the southern side, there is the Sengwe wildlife corridor. The corridor links Gonarezhou to the Mozambican side of the Limpopo Trans-Frontier Conservation Area. In this community, Gonakudzingwa ward 12 and ward 14 were selected where the Gonakudzingwa area comprises of private owned farms which are about 100 hectares each and was regarded as the control due to the fact that the privately owned plots there are well fenced to deter wildlife from attacking both crops and livestock. Ward 14 comprises of communal villages only. In the Central Community, Makosiya ward 6, whose villages are located along Lundi River, and Chibwedziva ward 8 were chosen for the study. Finally, in the Northern Community, which generally forms part of the Save area, wards 5 and 22 were selected. The communities were selected for their contrasts both in geography and distances from the park. Questionnaires were used to gather data in each ward and variables to be investigated focused on the aspects of human security namely economic (crop and property damage as well as predation of livestock), personal (cases of injury and death of people), health (cases of diseases).

2.3. Data analysis

Data analysis was conducted using SPSS 2016.

3. Results and Discussion

3.1. HWC experiences

Results from each community with regards to the HWC parameters under study were statistically tested using ANOVA and these included HWC experience/ encounters, nature of HWC encounters, frequency of encounters, attacks with highest frequencies, attacks on people, attacks on livestock, dominant problem animal (PA Cases where p values were less than alpha (0.05) were considered to be of statistically significance difference (Table 1). However, the ANOVA did not identify which community were different from which community. This was then determined in Excel using multiple t-tests (Table 2).

Table 1. Single factor ANOVA results at alpha = 0.05 for HWC parameters across the three communities (mean ± standard error), asterisked p values figures indicate where there were statistically significant differences

Parameter	Southern community	Northern community	Central community	p-value
HWC experience	1.7±0.41	1.211 ± 0.42	1.2 ± 0.41	0.000558 *
Nature of HWC encounter	3.85 ± 1.04	2.37 ± 0.89	2.41 ± 1.19	0.006121 *
Frequency of HWC encounter	3.3 ± 1.18	2.53 ± 1.22	2.4 ± 1.15	0.04027 *
Attacks with highest frequency	3.35 ± 1.09	2.68 ± 0.67	2.0 ± 0.56	0.000012 *
Attacks on livestock	1.45 ± 0.51	2.11 ± 0.94	2.6 ± 0.82	0.000086 *
Attacks on people	1.2 ± 0.52	1.26 ± 0.75	1.35 ± 0.49	0.665
Dominant PA	5.25 ± 2.45	3.16 ± 1.61	2.55 ± 1.76	0.000165 *
Age of respondents	4 ± 3	3.8 ± 2.28	4 ± 2.92	0.91
Gender of respondents	10 ± 2.83	10 ± 2.83	9.5 ± 4.95	0.99

Table 2. Multiple t-tests results at alpha = 0.017, asterisked p value figures indicate where there were statistically significant differences

Parameter	Central Community and Southern Community	Central Community and Northern Community	Northern Community and Southern Community
HWC encounter	P(T<=t) two-tail 0.000952*	P(T<=t) two-tail 0.937249	P(T<=t) two-tail 0.001514*
Nature of encounter	P(T<=t) two-tail 0.02091*	P(T<=t) two-tail 0.9261	P(T<=t) two-tail 0.0086*
Frequency of encounters	P(T<=t) two-tail 0.00002*	P(T<=t) two-tail 0.001381*	P(T<=t) two-tail 0.00283*
Attacks on livestock	P(T<=t) two-tail 0.00001*	P(T<=t) two-tail 0.087219	P(T<=t) two-tail 0.00959*
Attacks on people	P(T<=t) two-tail 0.35496	P(T<=t) two-tail 0.609324	P(T<=t) two-tail 0.71831
Dominant PA	P(T<=t) two-tail 0.00028*	P(T<=t) two-tail 0.268312	P(T<=t) two-tail 0.00334*

Important to note is that before the multiple t-tests were run, adjustments were made for potential type 1 error. The type 1 error is when a significant difference was found when there actually was none. The Bonferroni correction was therefore used to adjust for the potential type 1 error. This meant that the alpha value of 0.05 was divided by the number of t-tests to be run which was three thereby giving a new alpha value of 0.017. Before the t-tests were run F-tests were run to determine whether or not variances between the communities were equal.

3.2. HWC encounters

Respondents were asked about whether or not they had had any personal encounters or experiences with a HWC or with a problem animal (PA) and the responses were restricted to just either yes or no. An ANOVA test showed that the responses varied in the three communities as illustrated in Table 1 ($p = 0.000558$). However, multiple t tests showed that in the Central and Northern communities, the HWC encounters did not statistically differ ($p = 0.937249$). These two communities when each compared with the Southern

community showed statistically significant differences (p = 0.000952 and p = 0.001514 respectively).

Responses no personal encounters or experiences with a HWC or with a problem animal (PA) were restricted to just either yes or no. communities in the Central and Northern parts both had a high incident rate with no significant differences between these two. This can be attributed to poor protection strategies by the locals in relation to the high population of wildlife in the area (Gobosh, 2015). This was also established by Gandiwa et al. (2012) and Fungo (2011) who concurred that poor herding and protection practices led to more cases of crop raids and livestock attacks by wildlife. For example, after the harvesting period, most people tend to scale down on herding their livestock letting them roam around foraging freely. In most cases these livestock stray thereby ending up in harm's way from wildlife (Patterson et al., 2004).

Negative responses were recorded more in the Southern community and the high number of the negative responses in this community were responsible for the significance difference recorded. This was mainly due to the fact that the privately owned plots in this communities are more secured by more effective means like electric fences which aid in keeping away PAs and protecting both crop fields and livestock. This was supported by Gandiwa et al. (2013) when they confirmed that the CAMPFIRE program there funded fencing of crop fields and kraals thereby protecting crops and livestock from PAs in communities around the GNP. Additionally, improved livestock management practices as were practiced in the Southern community, are crucial for reducing HWC involving predators. These include improved group herding practices and kraaling cattle at night in strong enclosures. The construction of boma, the presence of watchdogs, and high levels of human activity around bomas has been associated with lower losses to predators in Laikipia District, Kenya (Ogada et al, 2003).

HWC experiences were also assessed based on gender in each community. The rationale was to establish whether or not there was a relationship between gender and the exposure to HWC experience. To achieve this, the Pearson's Chi Square test for independence was conducted and the results showed that there was HWC experiences were not in any way statistically dependent on gender (P Chi Square=0.427). For the Pearson Chi Square test, if the Pearson Chi Square value is greater than the significance value, the null hypothesis will be rejected meaning that there will be a relationship between the two (2) variables under study. Table 3 shows the Chi Square test results. The Fig. 2 shows the number of males who have experienced HWC against that of males in each of the communities under study.

4.2.3. Nature of HWC experiences

The nature of HWC experiences encountered by respondents varied for each community ranging from attacks on livestock, destruction of crop fields to attacks on the individual respondents or family members by wild animals or PAs. ANOVA results showed that there were significant differences in the nature of experiences amongst the three communities under study (p= 0.006121). The Northern and Central communities however had no significant differences when compared against each other in the multiple tests conducted (p = 0.9261).

Table 3. P Chi square test results

Variables under comparison	Pearson's Chi square value	Significance value	Comment
HWC experience and gender	0.427	0.808	No relationship between HWC experience and gender
Community and frequency of HWC encounters	13.85	0.00098	Strong relationship between community and HWC frequency

Table 4 shows the frequencies of nature of problem or encounters in the three communities under study. Livestock attacks were highest in the Northern community which recorded 70% followed by the Central community which had 40% and 5% cases of livestock attacks were recorded in the Northern community. Crop destructions were highest in the Central community (35%) whilst they were at 25% in the Northern community with the Southern community recording the least cases of crop destructions with 21%. Furthermore, attacks experienced by the respondents or a family member were highest in the Central community (20%), and 5% was recorded in the Northern community whilst in the Southern community there were no such cases.

Table 4. Nature of HWC experiences

Nature of HWC experience	Northern Community	Southern Community	Central Community
Livestock attacks	5%	74%	40%
Crop destructions	25%	21%	35%
Attacks on person	0%	5%	20%
Nil	70%	0%	5%

The results showed that these varied for each community ranging from attacks on livestock, destruction of crop fields to attacks on the individual respondents or family members by wild animals or PAs. The nature of experiences differed significantly amongst the three communities under study and when compared in pairs, both the Central and Northern Communities had significant differences from the Southern Community. However, Northern and Central Communities did not differ in the nature of experiences. The results showed that in Livestock attacks by the wildlife and Crop destructions were highest in the Northern and Central community whilst the Southern Community was dominated by zero cases of HWC.

The responsible PAs for livestock attacks were mostly lions, hyenas, and crocodiles, whilst elephants, buffaloes and hippos raided crop fields in these two communities. This can be explained by the fact that in the Northern community, the carnivores found in large numbers in the area mainly because

of its proximity to the Save River so they live close to the river to access water and usually attack livestock there. The river also houses hippos and crocodiles that also cause problems. Similar results were found by Gandiwa et al. (2012) in Chitsa communities North of Gonarezhou National Park, where a combination of elephants, hippos and buffalos also ravage crop fields extensively. Livestock attacks were also second highest in the Central Community. There is a safari area adjacent to this community which is just by the national park boundary which is a hunting concession for the CAMPFIRE project. It was established that cattle stray into this area in search of grazing pastures thereby becoming vulnerable to both lions and hyenas.

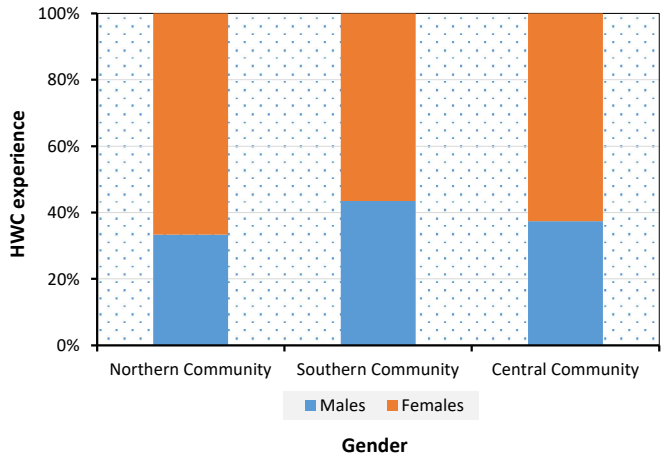

Fig. 2. HWC experience based on gender

Also, Lundi River is infested with crocodiles which prey on livestock as they attempt to drink water. The lowest cases of livestock attacks were recorded in the Southern community and the few cases were attributed to lions that are drawn to the area as they attempt to hunt elephants which are usually found within the Sengwe wildlife corridor which is part of the Limpopo Trans-Frontier Park. The cases here were however on the low side due to the fact that the area is made up of privately owned plots which are about one hundred hectares in size. These plots are more secured as the owners afford tight fencing of their areas compared to their counterparts in the other communities which are communal areas. In fewer instances, the elephants which would have managed to destroy the protective fences erected find their way to raid crop fields.

4.2.4. Frequency of HWC experience

Just as the nature of HWC experience differed with community, so did the frequency of these encounters after ANOVA test ($p = 0.04027$). There were also significant differences in all combinations of communities from the multiple t- tests shown in the Table 2. Table 5 shows the frequencies of personal encounters with HWC recorded by the respondents. In the table, it is shown that the Southern community recorded the most respondents who had not had any experience or personal encounter with HWC or PA (70%), followed by the Central community (30%), and the Central community recording the lowest in that regard (10%). The respondents who encountered the problem less than five times were least in the Southern community as well (15%), whilst in the Northern and Central communities they were 32% and 20 % respectively. However, the Southern community had some respondents who had encountered the problem over ten (10) times (10%) whilst in the Northern community they were 32% with none in the Central community.

To further ascertain whether or on there was any relationship between the type of community and the frequency of HWC encounters, a Pearson Chi Square test was conducted (Table 3). Results from the chi square test supported the ANOVA test and confirmed that there was indeed a strong relationship between HWC frequency and community implying that the frequency of HWC varied depending on community. The relationship corresponds with the fact that in the Southern community (control), where more pronounced and improved measures to deter PAs were adopted unlike in the other two communities. This was also confirmed by Wam et al. (2004) who proved that the improvements in traditional fences with electric wires, which protected cattle from the attack of carnivores in Norway.

Table 5. Frequency of HWC encounters

Frequency of HWC encounters	Northern Community	Southern Community	Central Community
1-5 times	15%	32%	20%
6-10 times	5%	26%	50%
Over 10 times	10%	32%	0%
Nil	70%	10%	30%

Significant differences which were recorded for the frequency of HWC experience when all the three (3) communities were compared were attributed to the sharp contrast in the Southern community where cases of HWC were significantly very low differing from the Northern and Central community. The high frequencies in the Northern and Central community can be attributed to the high population densities in those two (2) areas of wildlife in these two communities compared to the Southern community. It has been reported by Fungo (2011) that factors affecting levels of crop raiding by wild animals include location, crop species grown, season and animal density in the adjacent or inside the protected area. Also explaining the high frequencies of HWC experiences in the Northern and Central communities can be the high populations of both people and wildlife in these area as compared to the Southern community. This was also supported by Edward and Frank (2012) who pointed out that the major causes of human-wild-animals conflict could be attributed to many factors ranging from wild animal population increase to human population increase. More people mean more cultivated land and hence a greater interface between people and wildlife (Osborn and Parker, 2002; Gobosh, 2015).

4.2.5. Crop loss

It should be noted that because of the fact that the research was conducted amid a dry spell and an impending drought. As such little or no planting of crops had been done by the

time of data collection. Against this background, the researcher could only rely on crop loss statistics recorded by Chiredzi Rural District Council (CRDC) for the 2018/19 agriculture season. Table 6 shows the figures of crop loss as was provided for by CRDC. Fig. 3 indicated that the Northern Community had the highest crop loss recording a high of 150 Ha, followed by the Central Community which had a loss of 70 Ha. 29 Ha of crop was lost in the Southern Community.

The data showed that the highest loss was recorded in the Northern Community where a combination of elephants and buffaloes is aided by hippos from Save river, is responsible for the extensive ravaging the crop fields. Imorou et al. (2004) had similar results in the Djona hunting zone in North Benin, where 34 percent of surface crops were destroyed by elephants during the agricultural season of 2001 and 2002. The low values in the Southern Community were due to isolated cases of elephant invasions. The result agreed with Hill (2000) who reported crop damage affects farmers directly through loss of their primary food and cash resource and indirectly through a variety of social costs such as costs for school and hospital. The crop losses recorded in these communities showed similar trends of crop damage by wild animals in Kerala which was surveyed by Veeramani and Jayson (1995) and studies on the human-wildlife conflict in Peppara Wildlife Sanctuary and adjacent areas which were carried out by Jayson (1998).

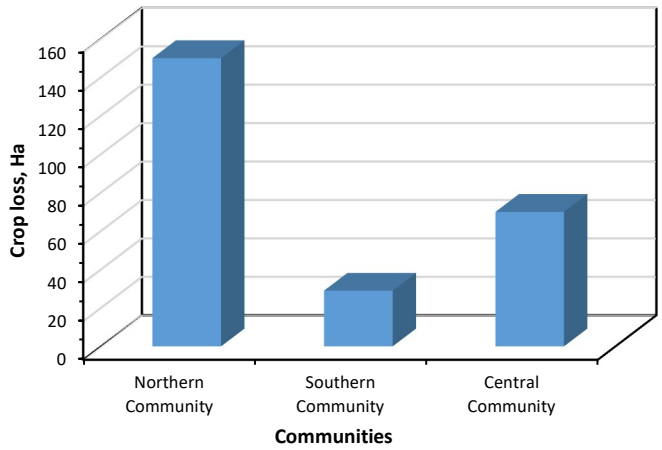

Fig. 3. Crop loss

4.2.6. Attacks on livestock

ANOVA also proved that there was also a statistically significant difference with regards to attacks on livestock by wildlife amongst the three communities under study ($p = 0.000086$). The attacks on animals differed for the Central and Northern communities when they were each compared to the Southern community in the multiple t tests ($p = 0.00001$ and $p = 0.0095$ respectively). Attacks on livestock however did not differ in the Central and Northern communities ($p = 0.087219$). The results show that trends of livestock attacks were similarly high in the Northern and Central communities, differing from Schiess-Meier et al. (2007) who studied the human-carnivore conflict in Botswana and found that predators generally consumed the wild species than domestic animals, when the natural prey was available. It fed on livestock as an alternate food, if the availability of natural prey was low. The existence of Lundi and Save Rivers in the Central and Northern communities also exposed livestock to crocodiles as they attempt to drink water, thereby increasing the number of livestock deaths. This can be supported by Baldus (2005) who established that in the Jukumu Wildlife Management Area in the United Republic of Tanzania, for example, 53 cows were killed and 41 injured by crocodiles in a single year.

4.3. Problem animals

In all the cases of HWC recorded during the study, the problem animals PAs involved were recorded so as to establish the most troublesome PA and the animals which were found to be posing threats to the communities most were lions, elephants, buffaloes, hyenas, hippos, and crocodiles. ANOVA results showed significant differences in the dominant PA in the communities under study ($p = 0.000165$). T tests further established that the Central and Northern communities had no significant differences with regards to the dominant PAs ($p = 0.2683$). The PAs where then categorized according to the threat level they posed in each community. Table 6 shows in descending order the ranks of PAs dominant in each community under study. From Table 6, the lion was dominant in terms of frequency of attacks either on livestock or people in the Central community. In this community, also posing high threats was the hyena, followed by the hippo and then the buffalo. The case was different in the Northern community where the elephant was the dominant PA and its threats are mostly targeted to the crops as well as to people. There are also cases of the buffalo and the hippo as well in this community. The Southern community is dominated by none cases of PA threats although there are few elephant cases here.

The animals which were found to be posing threats to the communities most were lions, elephants, buffaloes, hyenas, hippos, and crocodiles. Also, the PAs dominating both the Northern and Central communities did not have significant differences but however differed significantly with those recorded in the Southern community. The lion was ranked the most dominant in terms of frequency of attacks either on livestock or people in the Central community. In this community, also posing high threats was the hyena, followed by the hippo and then the buffalo, concurring with Yihune (2006) who emphasized that carnivores encounter more domestic animals and humans. This can be explained by the existence of a hunting concession, Naivashi where lions and hyenas prey on stray livestock after other prey like impalas will be concentrated closer to Mwenezi, Lundi, and Save Rivers in search of water. Most livestock that stray end up in Naivashi because of the concession's close proximity to the local community.

Similar findings were established by Girma (2016) that in communities around Chebera Churchura National Park in Ethiopia, carnivores preyed on livestock which strayed towards hunting concessions. The case was different in the Northern community where, owing to its dense population, the elephant was the highest ranked dominant PA and its threats are mostly targeted to the crops as well as to people.

O'Connell-Rodwell et al. (2000) had similar results to the effect that in the densely populated Caprivi region of Namibia, a population of 5 000 elephants-one of the largest free-ranging population of elephants-was responsible for twice as many aggressions as lions in the 1990s, and attacked over a larger area.

There are also cases of the buffalo and the hippo as well in this community. The Southern Community is dominated by none cases of PA threats although there are few elephant cases here. Lamarque et al. (2009) found the same PAs, mainly elephants, buffalo, lions and hippopotamus to be responsible for human deaths and injuries in Cameroon.

Table 6. Cases and ranks of PAs recorded in each community. NB: Nil represents instances where there were no cases of PAs recorded as a result of no cases of HWC

PA	Cases in Northern Community	Rank in Northern Community	Cases Recorded in Southern Community	Rank in Southern Community	Cases Recorded in Central Community	Rank in Central Community
Lion	0	5	0	3	7	1
Elephant	12	1	7	2	4	2
Hyena	0	5	0	3	3	3
Buffalo	1	4	0	3	2	5
Crocodile	4	2	0	3	3	3
Hippo	2	3	0	3	1	6
Nil	0	5	13	1	0	7

4.4. Assistance from government

Cases where either people attacked by wildlife got any form of assistance from either government or the National Park were recorded for the entire research and the Fig. 4 shows that from the 14 cases of attacks on people recorded in all the three communities, nine people did not get any assistance whilst only five got assistance either in cash or kind. For crop and livestock loss, no compensation was issued. This was also noted by FAO (2005) who said that in Mozambique, many deaths go unreported, simply because of the difficulty for many people of getting to a government office. A rough estimate would be around 300 people killed by the crocodiles per year nationwide (FAO, 2005; Blair, 2008).

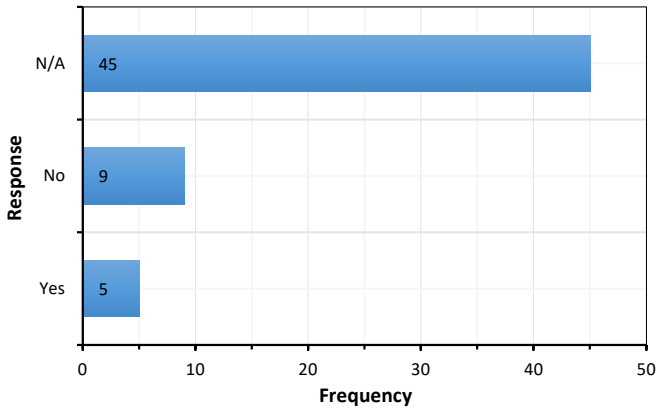

Fig. 4. Cases where victims got assistance from Government

These could be attributed to poor information channels and/or dissemination by the victim or members of the community or reluctance by the authorities to render assistance to victims. The various usual food aid programs from government and Non-Governmental Organizations (NGOs) play a major role in compensating for the losses, not only to HWC but also to drought. Also, to note is the Presidential input scheme which also cushions the locals from the effects of HWC as well as droughts.

4.5. Wildlife to livestock disease transmission

There were no cases of transmission of diseases from wildlife to livestock that were recorded in all the three communities under study. This can be attributed to lack of knowledge of the respondents with regards to livestock diseases. Sciess-Meier et al. (2007) together with WWF (2006) and WWF (2007), state that most t disease transmissions between livestock and wildlife go unnoticed. The CRDC however did report a few cases of foot and mouth disease in 2017.

5. Conclusion

The results from the study led to the conclusion that Human Wildlife Conflicts have an adverse impacts and implications on human security. This can be explained by the extent of crop losses, livestock losses as well as threats on human lives, caused by problem animals, as was established in the communities during the study. A number of aspects of human security are under threat, and these include personal security, food security, economic security, as well as community security.

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