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Livestock 'killing' and depredation by wildlife and its implications on the livelihoods in Mangwe Rural District, Matebeleland South Province, Zimbabwe.

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Abstract— Mangwe Rural District which is situated in ecological region 4 and 5 of Matebeleland South Province Zimbabwe has 17 wards and 65 villages, 13 806 households and a population of of 67 005 people that are threatened with food insecurity, hunger and poverty as a result of the destruction of their crops, fields, infrastructure, depredation of their livestock, physical injury and potential loss of life due to wildlife. The District community also encounters big and venomous snakes which enter their homes and at times bite their pets and eat their chickens. With a community that has a lot of young children this is a precarious situation as they are endangered thereby altering their activity patterns. The District is a beneficiary of the Command agriculture program, Pfumvudza program and the Presidential input scheme in a bid to ameliorate the effects of climate change. However, these noble initiatives are greatly threatened by Human-Wildlife Conflict which bedevils Mangwe Rural District. The District is faced by 9 Problem Animal Species which range from Baboons (*Papio cynocephalus*), Elephants (*Loxodonta africana*), Kudu (*Tragelaphus strepsciceros*), Jackal (*Canis aureus linnaeus*), Hyena (*Crocuta crocuta*), Bushpig (*Potamochoerus larvatus*), Quelea birds (*Quelea quelea*) and several Snake species. The data was obtained from the Human-Wildlife Conflict reports submitted to Mangwe Rural District Council and the Zimbabwe National Parks Plumtree office that deals with Problem Animal Control (PAC). These reports on Human-Wildlife Conflict incidences in every ward were collected and collated on an *ad libitum* basis. The implications of each problem animal species (PAS) on food security and livelihoods of the Mangwe district communities were highlighted and a *Human-Wildlife Conflict* mitigation framework was proposed in the promulgation of mitigation strategies. It can be concluded that the *Human-Wildlife Conflicct* in Mangwe Rural District requires urgent attention and requisite policies promulgated and mitigation strategies employed to curb a potentially catastrophic situation. It is quite clear that a holistic approach in addressing this scenario is critical as both the animal and ecosystems need the appropriate management that will then ultimately bring a balance which will ensure that the lives and livelihoods of the humans are secured in conserving wildlife to bring a peaceful co-existence to Mangwe Rural District communities and wildlife.

Key Words Index Terms— food security, livestock, depredate, households, *Human-wildlife Conflict*, co-existence

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INTRODUCTION

Human wildlife conflict is a global phenomenon and is becoming more prevalent as the natural resource requirements between humans and wildlife overlap. *Human-Wildlife Conflict* (HWC) is encountered in all communities ranging from border towns (Kariba, Victoria Falls Chirundu, and Beitbridge), communities close to protected areas, urban towns and communal areas alike. *Human-Wildlife Conflicts* can take various forms, including carnivores attacking and killing livestock or humans, species' raiding crops, competition for game and/or resources, disease exchange between livestock and wildlife, carcass poisoning, and retaliation killing [32][16]. The conflict involves a variety of mammals, birds, fish, insects, and reptiles [24]. The Mangwe Rural District communities face relentless crop raiding by primates and large herbivores as well as livestock depredation by carnivores. Mangwe Rural

District has no policy or management program that covers or deals with small game (Baboons, Jackals, Bushpigs, snakes and Quelea birds) and primates that are problematic in those communities. This makes the villagers to be susceptible to impoverishment as their crops, infrastructure, livestock and livelihoods are destroyed. This paper therefore seeks to highlight the implications *Human-Wildlife Conflict* has on the livelihoods of the villagers in Mangwe District and come up with a mitigation strategy to deal with this challenge and try to promulgate resolutions that are holistic that will bring about a harmonious coexistence between villagers and wild game.

Communities in Mangwe Rural District suffer huge losses from the *Human-Wildlife Conflict* they encounter daily. The communities' livelihoods are threatened by Baboons (*Papio cynocephalus*), Elephants (*Loxodonta africana*), Kudu (*Trage-*

laphus strepsciceros), Jackal (*Canis aureus linnaeus*), Hyena (*Crocuta crocuta*), Bushpig (*Potamochoerus larvatus*), Quelea birds (*Quelea quelea*) and several Snake species. Of all these species baboons (*Papio cynocephalus*) are posing a more severe challenge as they are highly adaptable to any kind of community and environment and can pose a serious problem as evidenced in Mangwe District where they are wrecking havoc.

To our knowledge there are no previous studies on baboons that clearly follow the international and sustained primatological protocols in Zimbabwe, apart from the limited research on baboons in the Timber Producing Industry as exhibited by [14]. Habitat utilisation, ecology and nutrition as well as how the baboons interact with their highly fragmented environment have not been researched in Zimbabwe [18][19][20]. Investigating the different strategies that baboons employ within the different ecosystems that we find in Zimbabwe provides important information for *Human-Wildlife Conflict* mitigation and management plans to be employed by conservation and local authorities [18][19][20].

Both baboons (*Papio cynocephalus*) and Vervets (*Chlorocebus pygerythrus*) are social animals with complex social systems which make them particularly difficult to deal with as they are intelligent and can adapt to any strategies that may be imposed to control them [18][19][20]. However, they pose a serious threat to the food security of some communities by raiding homes, digging up planted seed and raiding and foraging on planted crops in the fields of the villagers in Mangwe Rural District [18][19][20]. Primate populations shape the ecosystem through seed dispersal and knowing how they relate to the environment in which they live helps us in controlling them before they become pests. The fulcrum of primate research is based on the interaction among food availability, diet, movement patterns, and sociality [13]. The world is faced with climate change and global warming resulting in huge changes in microclimates, this is further compounded by habitat fragmentation and increasing pollution, making it essential to understand the basic mechanisms animals use to adapt in their interaction with the environment. Animals (baboons: [3][6]: vervets: [4][5] are strongly linked to habitats within which they spend their time. Space-use by animals reveals their habitat preferences and knowing what strategies baboons use to find what, where and when in different habitats constitutes an invaluable contribution on the management of the species [21][18]. Habitat utilisation of animals is linked to many variables which include the nutritional requirements and constraints upon the species' physiological make up, the availability and spatial distribution of resources, population density, and competition with conspecifics and other species [10][26].

Understanding home range and dietary patterns is useful for models of primate behavioural ecology and quantifying the spatial and ecological needs of social groups, as it has important implications for the conservation and management of primate populations, particularly those found in small isolated habitats as is the situation for many primates today[30].

Feeding ecology is a central component of species biology [13]. Hence, knowledge of the dietary requirements of baboons and the plant communities within which their food sources occur could assist in making decisions on the implementation of effective management programmes of these species [21]. Studies of diet, ranging patterns, and habitat utilisation are useful

for understanding the habitat requirements that allow mantainance of viable populations, and may also contribute to our comprehension of the population dynamics and carrying capacity of an area [13]. Knowledge of the dietary patterns of primates may assist in designing management strategies to reduce *Human-Wildlife Conflict* [13]. According to [23], animals shift their ranges in response to prevailing environmental and climatic conditions, for instance, the glacial changes in the forest line [33] or human induced vegetational changes such as deforestation or the designation of nature reserves.

Habitat utilisation, ecology and nutrition as well as how the primates interact with their highly fragmented environment have not been researched in Zimbabwe [18]. The strategies that animals employ in order to access and utilise food components, the parts they utilise, their nutritional value and availability are largely unknown [18]. Investigating the different strategies that baboons employ within the different ecosystems that we find in Zimbabwe provides important information for *Human-Wildlife Conflict* mitigation and management plans to be employed by conservation and local authorities [18][19][20].

The environment, that is the habitat, the climate and seasonality, can also be a potential stressor to the baboon populations and may act as an important ecological constraint [18]. These ecological constraints can affect the day length as is the case in winter when the animals must meet their thermoregulatory requirements due to low temperature [12][24]. This period also coincides with limited food availability where animals have to resort to under storage organs which take longer to process [1][21].

Human-Wildlife Conflict research with primary focus on baboons (*Papio cynocephalus*) seeks to understand how habitat fragmentation due to urban sprawl, rapid urbanisation and rural communal areas expansion due to population growth, food and nutrient availability influences habitat utilisation by free ranging baboons [18]. Considering climate change and various anthropogenic influences [11], information on the changes in habitat, climate, and food availability is vital to assist our understanding of baboon behaviour in these areas.

It is also important to understand how they are affected by climatic stress factors and how they adapt their travel patterns, activity budget and diets, as they interaction with the environment. An understanding of the ecological importance of fall-back foods could assist in explaining the movement and foraging strategy and effort of baboons and other wildlife thereby aiding in improving the management and conservation of primate populations in Zimbabwe [21]. As fall-back foods are frequently the primary determinant of primate carrying capacity, determining whether the baboons have such foods, and if so, what management strategies can be implemented to aid the conservation of the baboons and mitigate *Primate-Human Conflict* in the country.

Human-Wildlife Conflicts have escalated because of changes in land use, arable farming and the expansion of communal areas and urban sprawl due to increases in population [7]. Zimbabwe is an agrarian based economy and land ownership is critical, this causes a demand in land as the population increases. In the case of Mangwe Rural District, the population focast by [26] shows that the majority of the population falls within the age group 0-19 years [18]. This will mean that there

will be increased *Human-Wildlife Conflict* in the future as these age groups progress into adulthood (See Table 1) [18].

The situation in Mangwe Rural District is critical as the communities face relentless livestock killing and depredation by baboons, elephants and carnivores. This research seeks to:

❖ Determine the Problem Animal Species (PAS) that kill and depredate livestock in Mangwe Rural District.
❖ Determine how the livelihoods and households in Mangwe District are impacted by livestock killing and depredation.
❖ Generate a science-based *Human-Wildlife Conflict* Mitigation Policy that can possibly be used to advocate for the promulgation of an Act of Parliament to deal with this critical challenge on a long-term basis.
❖ Promulgate resolutions that are holistic and bring about a harmonious coexistence between villagers and wildlife.

2 METHODOLOGY

2.1 Research Site

Mangwe Rural District has 17 administrative wards and 65 villages, with a total population of 67 005 people [34]. The population consists of 13 806 households of which 31 478 are males and 35 527 are females [34]. The population structure shows that the majority fall within the age group of 0-19 years [34]. Most of the households are headed by females and these consist of girls aged 15 and below and those whoare above 75 years old [34]. Mangwe Rural District is agro-based and is in the semi-arid Matebeleland South Province of Zimbabwe. Most of the inhabitants are poor, and the district lies within the ecological region 4 and 5 which experiences erratic rains and extreme dry spells. It is an area that has felt the adverse effects of climate change and resorts to the cultivation of drought resistant small grains for the alleviation of hunger and poverty.

2.2 Methods

The data were collected from the *ad libitum Human-Wildlife Conflict* cases reported in Mangwe Rural District spanning the period between 2017 and 2021. This consists of 14 recorded cases obtained from both the Parks and wildlife Authority Problem Animal Control (PAC) and the Mangwe Rural District Council Natural Resources Office. The data were then collected and collated to ascertain the nature of conflicts existing in the different wards wihin Mangwe Rural District. The data were then consolidated for the purposes of coming up with a short communication on the threat that is posed by baboons (*Papio cynocephalus*), elephants (*Loxodonta africana*) and Kudus (*Tragelaphus strepsciceros*), Jackal (*Canis aureus linnaeus*), Hyena (*Crocuta crocuta*), Bushpig (*Potamochoerus lavartus*), Quelea birds (*Quelea quelea*) and several snake species on the food security of the villagers in Mangwe district.

3 RESULTS

The year 2020 was used as the base year to look at the projected population structure for Mangwe rural district [34]. The district has a majority population of the most vulnerable age groups, i.e. those who are of school going age (0-19 years, see

Table 1). The [28], Zimbabwe, does not have provisions for direct compensation for losses from wildlife this therefore means that local communities that are exposed to *Human-Wildlife Conflict* suffer a double edged sword thereby impacting mostly the vulnerable members of the society and the girl child in particular. The 2032 projection (Table 1) shows that the population is going to continue to increase and this will put further pressure on scanty land resources thereby escalating the *Human-Wildlife Conflict* [11].

Table 1. The projected population structure for Mangwe District using 2020 as a base year [34].

Age	2020 Population Projection			2032 Population Projection		
	Male	Female	Total	Male	Female	Total
0-4 yrs	5 692	5 350	11 042	5 612	4 759	10 371
5-9 yrs	6 243	5 907	12 150	7 161	6 147	13 308
10-14 yrs	5 909	5 569	11 478	6 967	5 973	12 940
15-19 yrs	5 741	4 300	10 041	6 789	4 563	11 352
20-24 yrs	3 048	2 571	5 619	3 521	2 652	6 173
25-29 yrs	1 524	1 765	3 289	1 880	1 769	3 649
30-34 yrs	1 126	1 723	2 849	1 485	1 661	3 146
35-39 yrs	961	1 567	2 528	1 171	1 597	2 768
40-44 yrs	966	1 595	2 561	1 049	1 874	2 923
45-49 yrs	969	2 224	3 193	1 245	2 224	3 469
50-54 yrs	861	1 031	1 892	1 518	1 808	3 326
55-59 yrs	713	1 199	1 912	1 282	1 752	3 034
60-64 yrs	527	1 114	1 641	790	1 085	1 875
65-69 yrs	554	955	1 509	763	955	1 718
70-74 yrs	372	994	1 366	466	994	1 460
75-79 yrs	349	684	1 033	392	907	1 299
80+ yrs	452	1 120	1 572	452	1 149	1 601
Total	36 007	39 668	75 675	42 544	41 869	84 413

The majority of the populations in Mangwe district are females as compared to males (Table 1), this implies that in cases where children have to guard fields to prevent crop raiding by baboons it would be the girl child that will be affected the most. The observation also means that the school going children would need to be accompanied to and from school as they may be in danger of marauding wild animals.

3.1.1 Livelihoods in Mangwe

According to [34], most households with size 2-7 are headed by females as compared to those headed by males in Mangwe District (Table 2). This is an interesting observation given the nature of Problem Animal Species that are encountered in Mangwe District. This suggests that the female headed households are prone to the highest impact and vulnerability to the results of *Human-Wildlife Conflict* (Table 2).

Table 2. The household sizes and number of households in Mangwe District [34].

Household Size	Number of Households Headed by:				Total	
	Male	Percent	Female	Percent	Number	Percent
1	946	15.0	430	5.9	1376	10.2
2	621	9.8	795	11.0	1416	10.4
3	691	10.9	1179	16.3	1870	13.8
4	817	12.9	1250	17.3	2067	15.2
5	806	12.8	1148	15.9	1954	14.4
6	739	11.7	858	11.9	1597	11.8
7	510	8.1	611	8.4	1121	8.3
8+	1185	18.8	969	13.4	2154	15.9
Total	6315	100	7240	100	13555	100

The household size 4 had the highest number of female heads and the highest proportion of households is headed by females (Table 2). This could probably be to the fact that many males (Husbands and fathers) may be in the neighbouring South Africa of countries or may not be around for various reasons. This makes these households highly vulnerable to the effects of *Human-Wildlife Conflict* as the cattle, goats and donkeys will require minding to prevent depredation by carnivorous problem animal species.

3.1.2 Livelihoods in Mangwe

Mangwe district has some households that are headed by children who are less than 15 years old and most of them being girls (Table 3). This is meaning that the girl child is more vulnerable in this situation as their livelihoods are destroyed by the damage to their crops, killing of their chickens and the depredation of their goats and cattle by wildlife. This also means that they may have to skip school as they go and guard their fields from raids by baboons during the day, whilst the same crops will be raided by elephants during the night, and whilst livestock is killed either during the day or night as well.

Table 3. The age groups sex of the household heads in Mangwe District [34].

Age Group	Number of Households Headed by:			Percent household headed by:		
	Male	Female	Total	Male	Female	Total
< 15	42	51	93	45.2	54.8	100
15 - 19	283	268	551	51.4	48.6	100
20 - 24	354	426	780	45.4	54.6	100
25 - 29	413	503	916	45.1	54.9	100
30 - 34	564	554	1118	50.4	49.6	100
35 - 39	577	597	1174	49.1	50.9	100
40 - 44	529	599	1128	46.9	53.1	100
45 - 49	483	609	1092	44.2	55.8	100
50 - 54	571	648	1219	46.8	53.2	100
55 - 59	559	655	1214	46.0	54.0	100
60 - 64	433	538	971	44.6	55.4	100
65 - 69	453	450	903	50.2	49.8	100
70 - 74	343	430	773	44.4	55.6	100
75 +	709	904	1613	44.0	56.0	100
NS	2	8	10	20.0	80.0	100
Total	6315	7240	13555	46.6	53.4	100

Females who are in the 75+ age group tend to head the highest number of households in Mangwe, this could suggest that they could be grandmothers staying with their grandchildren or maybe be widows staying with their children [34]. These eledery women are prone to malnutrition and are vulnerable to *Human-Wildlife Conflict* effects as they have to provide food and take care of their families. However, the draught power for fetching water, ploughing and transportation is being depredated by hyenas thereby affecting their activity scheduling. The eledely women are also threatened with malnourishment as their protein and calcium source is killed and depredated by Jackals, hyenas, baboons and elephants.

There is an urgent need to monitor the dynamics and nature of the *Human-Wildlife Conflicts* occurring in the different wards and a requisite strategy implemented [18][19]. This should then be coupled with a government policy that will deal with these cases in a comprehensive, holistic, robust and sustainable manner [18]. The population projection for 2032 (Table 1)

[34] shows a continued increase in the population structure of the school going age group (0-19 years). This implies that there is going to be increased pressure on natural resources between people and animals soon, which if not addressed may reach catastrophic levels [34]. This signals increased competition on space and space use, water resources, forest food resources, an increase in crop raiding and livestock depredation and human loss [18][19][20].

3.1 Human-Wildlife Conflicts in Mangwe

The Problem Animal Species (PAS) affect all the wards in Mangwe District [18] (Table 4) and all the wards are affected all year round. The diversity and distribution of plants form the premise of understanding how animals utilise space in their home range as they interact with their environment to meet their basic needs, including sleeping sites, food, water and mates [7]. The identification, detailed description, classification and mapping of vegetation is fundamental for land use planning and management [8]. Habitat structure can influence many of the components that determine both potential energy gain and predation risk [15][9][21]. This might explain why baboons might be encroaching into human habitats.

Table 4. The Ward populations, Wards that experience *Human-Wildlife Conflicts* and the Problem Animal Species involved.

Ward	Nomendenture	Males	Females	Total
1	Empandeni	1840	2159	3999
2	Izimnyama Communal	1853	2199	4052
3	Madabe	2101	2432	4533
4	Tshitshi	2437	2936	5373
5	Mphoengs	1487	1680	3167
6	Sanzukwi	2617	3017	5634
7	Brunapeg	1381	1610	2991
8	Maninji	977	1119	2096
9	Mambale	1035	1330	2365
10	Bango	2339	2765	5104
11	Marula	2119	1481	3590
12	Izimnyama Small Scale	1302	1411	2713
13	Embakwe	1624	1777	3401
14	Ngwanyana	996	1114	2110
15	Makhubu	2886	2916	5802
16	Hobodo	2664	3492	6156
17	Makorokoro	1820	2139	3999
		31478	36527	67005

Key: Partly, Critical

Animal species involved in Human-Wildlife Conflict in each Ward: Baboon, Buffalo, Elephant, Hippo, Hyena, Jackal, Kudu, Leopard, Lion, Snakes, Birds, Warthog.

Human-Wildlife Conflict Mitigation requires a holistic approach which factors all ecological aspects and ecosystems conservation management which encompasses the animal behavioural and nutritional ecology, the habitat and plant communities [21][17][5][6][7] and the human habitats [18]. This therefore means that the livelihoods in every ward must be considered and the implications of *Human-Wildlife Conflict* in each ward then factored in coming up with mitigation meausres.

3.2 Human-Wildlife Conflicts in Mangwe Wards

It is evident that the villagers in Mangwe District (Table 4) are in a precarious situation as all wards are affected by *Human-Wildlife Conflict* cases. This therefore requires that the situation be addressed as people lose their crops, infrastructure, and livestock, and their lives also are threatened by elephants, snakes and hyenas. Six Problem Animal Species (PAS) are problematic to the villagers all year round (Jan-Dec) (Table 4) thereby threatening the food security of the villagers. They are a problem from planting to harvesting time; they dig up the

planted maize seed (Baboons; [18][19][20]) and forage on the crops till harvest time. They also raid chikens and prey on goats, cattle and donkeys (Baboons; [18][19][20]). There is a probable scenario that seems to suggest that baboons (*Papio cynocephalus*) find comfort and safety from predation in and around or near human settlements (Baboons; [18][19][20]). All wards that are heavily populated seem to have a challenge with baboons and experience more *Baboon-Human Conflicts* in Mangwe district (Table 4).

3.2.1 Human-Wildlife Conflicts in Empandeni Ward

Empandeni ward 1 has a population of 3 999 people [34] of which 1 840 are males and 2 159 are females. The ward consists of 5 villages namely Makhaya, Kwite, Empandeni east and Mhlotshana villages which are exposed to *Baboon-Human Conflicts, Elephant-Human Conflict, Hyena-Human Conflict, Kudu-Human Conflict, Bushpig-Human Conflict and Snake-Human Conflicts*. The period that the *Human-Baboon Conflicts* are at their peak coincide with ripening of the agricultural crops and harvest time, hence the vilagers do suffer losses due to crop raiding and also affects their daily routines as they are now compelled to guard their fields on a daily basis. The villagers also lose cattle and donkeys to hyenas and elephants (Marisa et al 2022c) whilst they lose goats to hyena, jackal and baboon depredation. Snakes pose a danger to the ward as (+/-) 10 people are bitten every year [18][19][20], whilst approximately (+/-) 100 kids (goats) are lost to Pythons. The communities also lose their chickens to snakes with about (+/-) 200 chickens being lost per year [18][19][20].

3.2.2 Human-Wildlife Conflicts in Izimnyama communal Ward

Izimnyama Communal ward 2 consists of Vaka, Sosombana, Osabeni and Mapulula villages. The ward has a population of 4 052 people [34] of which 1 853 are males and 2 199 are females. The ward is exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*), whilst the hyenas and jackals depredate their cattle, donkeys and goats.

3.2.3 Human-Wildlife Conflicts in Madabe Ward

Madabe ward 3 consists of Dukwe, Madabe, Mapholisa and Kahlu villages with a population of 4 533 people [34] of which 2 101 are males and 2 432 are females. The ward has a big number of households that are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*), whilst the hyenas and jackals depredate their cattle, donkeys and goats.

3.2.4 Human-Wildlife Conflicts in Tshitshi Ward

Tshitshi ward 4 consists of Makuzeze, Mzila, Sikwali, Bambanani and Guqukani villages with a population of 5 373 people [34] of which 2 437 are males and 2 936 are females. The ward has a big number of households that are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*), whilst the hyenas and jackals depredate their cattle, donkeys and goats.

3.2.5 Human-Wildlife Conflicts in Mpoengs Ward

Mpoengs ward 5 consists of Patse, Ingwizi, Bulu, and Matsota villages with a population of 3 167 people [34] of which 1 487 re males and 1 680 are females. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. This ward is also greatly affected by the Quelea birds that destroy their small grain crop fields [18][19][20]. The livelihoods of the villagers are greatly affected, and their food security greatly threatened [18][19].

3.2.6 Human-Wildlife Conflicts in Sanzukwi Ward

Sanzukwi ward 6 consists of 5 villages which include Keme, Matshongwana, Mkhubazi, Togotswewu and Matiwana villages. The ward has a total population of 5 634 people [34] of which 2 617 re males and 3 017 are females. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. The livelihoods of the villagers are greatly affected, and their food security greatly threatened [18][19][20].

3.2.7 Human-Wildlife Conflicts in Brunaperg Ward

Brunaperg ward 7 consists of 3 villages which include Newline, Oldline and Phathisanani villages. The ward has a total population of 2 991 people [34] of which 1 381 re males and 1 610 are females. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. A woman was injured by an elephant in this ward which clearly indicates that women are the most vulnerable to *Human-Wildlife Conflict*. This ward is also greatly affected by the *Quelea* birds that destroy their small grain crop fields [18][19][20]. Their livelihoods are greatly affected, and their food security greatly threatened [18][19].

3.2.8 Human-Wildlife Conflicts in Maninji Ward

Maninji ward 8 consists of 2 villages which include Ngulubeni and Maninji villages. The ward has a total population of 2 096 people [33] of which 977 are males and 1 119 are females. The ward has very few men compared to females and this makes the villagers very much susceptible to *Human-Wildlife Conflict* and danger especially if they encounter dangerous animals like elephants, carnivores and venomous snakes. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. Women are the most vulnerable to *Human-Wildlife Conflict* and the ward is also greatly affected by the *Quelea* birds that destroy their small grain crop fields (Marisa et al 2022b). Their

livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.2.9 Human-Wildlife Conflicts in Mambale Ward

Mambale ward 9 consists of 2 villages which include Mambale and Matshamhlophe villages. The ward has a total population of 2 365 people [33] of which 1 035 are males and 1 330 are females. The ward is susceptible to *Human-Wildlife Conflict* and danger especially if they encounter dangerous animals like elephants, carnivores and venomous snakes. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. Their livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.2.10 Human-Wildlife Conflicts in Bango Ward

Bango ward 10 consists of 5 villages which include Mbome, Ntali, Makubazwibi, Tshibako and Matanka villages. The ward has a total population of 5 104 people [33] of which 2 339 are males and 2 765 are females. The ward is susceptible to *Human-Wildlife Conflict* and danger especially if they encounter dangerous animals like elephants, carnivores and venomous snakes. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. Their livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.2.11 Human-Wildlife Conflicts in Marula Ward

Marula ward 11 consists of 1 village, Marula ICA village. The ward has a total population of 3 550 people [33] of which 2 119 are males and 1 431 are females. The ward has more males than females which is quite an interesting observation in Mangwe district. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. Their livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.2.12 Human-Wildlife Conflicts in Izimnyama smallscale Ward

Izimnyama smallscale ward 12 consists of 3 villages which include Small scale farming area, Sikhulu and Macingwana village. The ward has a total population of 2 713 people [33] of which 1 302 are males and 1 411 are females. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and

jackals depredate their cattle, donkeys and goats. Their livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.2.13 Human-Wildlife Conflicts in Embakwe Ward

Embakwe ward 13 consists of 4 villages which include Embakwe, Empandeni West, Silima and Mzaza villages. The ward has a total population of 3 401 people [33] of which 1 624 are males and 1 777 are females. The ward is susceptible to *Human-Wildlife Conflict* and encounter dangerous animals like elephants, carnivores and venomous snakes. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. Their livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.2.14 Human-Wildlife Conflicts in Ngwanyana Ward

Ngwanyana ward 14 consists of 3 villages which include Zibanani, Batanani and Madlazwiduli villages. The ward has a total population of 2 110 people [33] of which 996 are males and 1 114 are females. The ward has the least number of males in all the wards in Mangwe District., threbey meaning that women in this ward are the most vulnerable to *Human-Wildlife Conflict*. The ward is susceptible to *Human-Wildlife Conflict* and encounter dangerous animals like elephants, carnivores and venomous snakes. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. Their livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.2.15 Human-Wildlife Conflicts in Makhubu Ward

Makhubu ward 15 consists of 4 villages which include Mabuledi, Nkedile, Makhubu and Simelamela villages villages. The ward has a total population of 5 802 people [33] of which 2 886 are males and 2 916 are females. The ward is susceptible to *Human-Wildlife Conflict* and encounter dangerous animals like elephants, carnivores and venomous snakes. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. Their livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.2.16 Human-Wildlife Conflicts in Hobodo Ward

Hobodo ward 16 consists of 7 villages which include Rosscommon (Mlambo), Dayintambo, Thekwane, Lumane, Nkwizi, Nswililinswili and Khalanyoni villages. The ward has a total population of 6 156 people [33] of which 2 664 are males and 3 492 are females. The ward has the largest population of villages, total population of people and women in the district. The ward is susceptible to *Human-Wildlife Conflict* and encoun-

ter dangerous animals like elephants, carnivores and venomous snakes. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. Their livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.2.17 Human-Wildlife Conflicts in Makorokoro Ward

Makorokoro ward 17 consists of 4 villages which include Makorokoro, Mbanjana, Mkologwe and Newdam villages. The ward has a total population of 3 959 people [33] of which 1 820 are males and 2 139 are females. The ward is susceptible to *Human-Wildlife Conflict* and encounter dangerous animals like elephants, carnivores and venomous snakes. The ward households are exposed to *Human-Wildlife Conflicts* that are similar to ward 1 (section 3.2.1) and the villagers lose their crops and garden produce to crop raiding by baboons (*Papio cynocephalus*) and elephants (*Loxodonta africana*), whilst the hyenas and jackals depredate their cattle, donkeys and goats. Their livelihoods are greatly affected, and their food security greatly threatened (Marisa et al 2022b) [18][19].

3.3 Implications of Human-Wildife Conflicts on the villagers' diet and nutrition in Mangwe

Mangwe Rural District communities are faced with a deep impending food insecurity crisis soon that may be precipitated by *Human-Wildlife Conflict*. Many households grow crops and maintain small gardens inorder to ensure their food security and bolster their nutritional status. Home gardening is an inexpensive, maintainable long-term scheme to balance supplementation and food fortification programmes and nutrition education [30]. Home gardening yields crops for domestic intake to improve the value, assortment and nutrient content of foods and the excess harvest can be traded for profits to procure other foodstuffs to supply various nutrients [30]. This means that when the fields and household gardens are raided by animals, the nutrition status of the inhabitants is greatly affected since in most households, the crops are sold for profits to buy more food. This is supported by [26] when he mentions that the battle with wildlife can cause direct material and financial injury to crops. The depredation of the livestock from chickens to cattle means the protein source is also depleted thereby compounding the factors that contribute to malnutrition in the poverty and hunger-stricken villagers. The dimensions of a farm play a key role when animals invade expansively, the smaller the portion of the cultivated land, the more prone the family will be to food insecurity [28]. This implies that if a family has little land and the animals raid their crops, the family is bound to harvest nothing, leaving each member hungry and children malnourished and nutritional deficient. This is further corroborated by [2] who point out that crop raiding by wild animals, and related indirect costs, have an adverse bearing on agricultural development and food security in communities at forest boundaries. Moreover, it was reported that in some cases children had to abandon going to school altogether to meet the mandate for labour to protect crops [2] which is a similar sit-uation in Mangwe where some households are headed by children particularly girls under the age of 15 (Table 3).

4 CONCLUSION

Mangwe Rural District households are faced with a deep food insecurity crisis that is precipitated by *Human-Wildlife Conflict* particularly inflicted by elephants (*Loxodonta africana*) and baboons (*Papio cynocephalus*) and carnivorous PAS. This negatevely affects the livelihoods of the villagers as their source of wealth, protein and milk as well as draught power is killed by wild animals. It is also clear that it is the female headed and more importantly the girl child headed households that are worst affected. A holistic approach that will result in the safeguarding of the households from hunger and poverty yet managing the ecosystems in a sustainable manner is urgently required in Mangwe District. The Mangwe Rural district Council (MRDC) has to craft a policy and come up with a funding regime to cushion the villagers whose livelihoods are destroyed particularly the girl child and elderly women who are more vulnerable. A deliberate well coordinated behavioural change, response and adaptation of the communities to wildlife is also necessary to shape a positive view of wildlife in them. There is also need for the promulgation of a *Human-Wildlife Conflict* policy, law and management document that will bridge the gap between the communities, local authorities, regulatory authorities and wildlife for a sustainable peaceful co-existence.

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