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Human-Wildlife Conflict (HWC), a food security threat and livelihood crisis faced by the communities in Bulilima Rural District, Matebeleland South Province, Zimbabwe.

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Abstract—Bulilima Rural District which is situated in ecological region 4 and 5 of Matebeleland South Province Zimbabwe has 22 administrative wards, 19 761 households and a population of of 101 251 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 *Human-Wildlife Confict*. 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 agricultural input scheme in a bid to ameliorate the effects of climate change, poverty and hunger. However, these noble initiatives are greatly threatened by *Human-Wildlife Conflict* which bedevils Bulilima Rural District. The District is faced by 8 Problem Animal Species which range from Baboons (*Papio cynocephalus*), Buffalo (*Syncerus caffer*), Elephants (*Loxodonta africana*), Hippopotamus (*Hippopotamus amphibus*), Hyena (*Crocuta crocuta*), Jackal (*Canis aureus linnaeus*), Leopard (*Panthera pardus*) and Lion (*Panthera leo*). The data was obtained from the *Human-Wildlife Conflict* reports submitted to Bulilimangwe 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 each and every ward were collected and collated on an *ad libitum* basis by 22 ward Natural Resources Monitors working with the Village Natural Resources Monitors. The data consists of 400 *Human-Wildlife Conflict* repoted cases of which only 173 (43.3%) were attended to. A total of 113.3 ha of cultivated field crops were destroyed by wildlife presenting a huge food insecurity crisis. The implications of each problem animal species (PAS) on food security and livelihoods of the Bulilima district communities was highlighted and a *Human-Wildlife Conflict* mitigation Strategy was proposed in the promulgation of mitigation strategies. The PAS control strategies applied by the communities were highlighted and discussed. It can be concluded that the *Human-Wildlife Conflicct* in Bulilima Rural District presents a dire situation 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, Problem Animal Species, Human-wildlife Conflict, Co-existence, livelihoods

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][20]. The conflict involves a variety of mammals, birds, fish, insects, and reptiles [26]. The situation in Bulilima Rural District is critical as the communities face relentless crop raiding by primates and large herbivores as well as livestock depredation by carnivores especially in the wards and villages that fall within the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) program. Bulilima does have a structured and funded Problem Animal Control (PAC) program. Despite Bulilima Rural District being under the CAMPFIRE program, the district has no 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 research therefore seeks to come up with a mitigation strategy to deal with this gap and try and promulgate resolutions that are holistic and bring about a

harmonious coexistence between villagers and wild game.

Communities in Bulilima Rural District suffer huge losses from the *Human-Wildlife Conflict* they encounter on a daily basis. The communities' livelihoods are threatened by Baboons (*Papio cynocephalus*), Buffalo (*Syncerus caffer*), Elephants (*Loxodonta africana*), Hippopotamus (*Hippopotamus amphibus*), Hyena (*Crocuta crocuta*), Jackal (*Canis aureus linnaeus*), Leopard (*Panthera pardus*) and Lion (*Panthera leo*). 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 Bulilima and Mangwe District where they are wrecking havoc.

To our knowledge there has been 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 [18]. Habitat utilisation, ecology and nutrition as well as how the baboons interact with their highly fragmented environment have not been researched in Zimbabwe. The strategies that baboons employ in order to access and utilise food components, the parts they utilise, their nutritional value and availability are largely unknown. 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.

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. However, they pose a serious threat to the food security of the some communities by raiding homes, digging up planted seed and raiding and foraging on planted crops in the fields of the villagers in Bulilima Rural District. 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 [17]. 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: [2][7]: vervets: [3][4] 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 [23][22]. 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[14][28].

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[31].

Feeding ecology is a central component of species biology [17]. 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 [23]. 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 a particular area [17]. Knowledge of the dietary patterns of primates may assist in designing management strategies to reduce human-wildlife conflict [17]. According to [25], 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 [22]. 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 [22]. 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 [22].

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 [22]. These ecological constraints can affect the day length as is the case in winter when the animals have to meet their thermoregulatory requirements due to low temperature [16][27]. This period also coincides with limited food availability where animals have to resort to under storage organs which take longer to process [1].

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 [22]. In light of climate change and various anthropogenic influences [15], 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 [23]. 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 [8]. Zimbabwe is an agrarian based economy and land ownership is key, this causes a demand in land as the population increases. In the case of Bulilima Rural District, the population focast by [28] shows that the majority of the population falls within the age group 0-19 years [22]. This will mean that there will be increased Human-Wildlife Conflict in the future as these age groups progress into adulthood (See Table 1) [22].

The situation in Bulilima Rural District is critical as the communities face relentless crop raiding by Primates (Baboons (*Papio cynocephalus*) and Vervets (*Cercopithecus athieops*)) and large herbivores as well as livestock depredation by carnivores. This research seeks to:

- Determine the Problem Animal Species (PAS) and the nature of *Human-Wildlife Conflicts* that occur in Bulilima Rural District.
- Monitor the *Human-Wildlife Conflicts* as a result of baboons' behaviour and the attending ecological and anthropogenic factors.
- Come up with an ecological model that will be used to forecast *Human-Wildlife Conflicts* in each and every ward and the requisite mitigation strategies.
- 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.
- A theoretical framework for *Human-Wildlife Conflict* mitigation strategies will be crafted and promulgate resolutions that are holistic and bring about a harmonious coexistence between villagers and wildlife.

2 METHODOLOGY

2.1 Research Site

Bulilima Rural District has 22 administrative wards, with a total population of 101 251 people [34]. The population consists of 19 761 households of which 47 374 are males and 53 877 are females [34]. The population structure shows that the majority fall within the age group of 0-19 years (Table 1) [34]. Bulilima Rural District is agro-based and is located in the semi-arid Matebeleland South Province of Zimbabwe. The majority 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

Bulilima Rural District has 22 Ward Natural Resources Monitors and Village resources monitors in each and every village within each ward. These Natural Resources Monitors were used to collect *Human-Wildlife Conflict* data in each ward. The data was collected from the *Human-Wildlife Conflict* cases reports spanning a period between January 2018 and December 2021. This data consists of 400 reported cases of *Human-Wildlife Conflict* in Bulilima Rural District. The data were collated with the *Human-Wildlife Conflict* cases reported to the Parks and wildlife Authority Problem Animal Control (PAC) and the Bulilima Rural District Council Natural Resources Office. The data were then collected and collated to ascertain the nature of *Human-Wildlife conflicts* existing in the different wards wihin Bulilima Rural District. The data were then consolidated for the purposes of coming up with a short communication on the food threat and livelihood crisis that is posed by Baboons (*Papio cynocephalus*), Buffalo (*Syncerus caffer*), Elephants (*Loxodonta africana*), Hippopotamus (*Hippopotamus amphibus*), Hyena (*Crocuta crocuta*), Jackal (*Canis aureus linnaeus*), Leopard (*Panthera pardus*) and Lion (*Panthera leo*) in Bulilima Rural District.

2.2.1 Problem Animal Control PAC

All the cases that were attended to by the Problem Animal Control (PAC) during the period 2018-2021 are recorded and the mitigation strategies implemented were documented. The itigation strategies also employed by the villagers are documented and addressed in this paper.

3 RESULTS

The year 2020 was used as the base year to look at the projected population structure for Bulilima 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 [30], 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* [15].

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

	Bulilima District 2020 Projection			Bulilima District 2032 Projection		
Age	Male	Female	Total	Male	Female	Total
0-4 yrs	7 504	7 317	14 821	7 137	6 485	13 622
5-9 yrs	8 343	8 120	16 463	9 233	8 419	17 652
10-14 yrs	7 758	7 388	15 146	8 824	7 896	16 720
15-19 yrs	7 631	5 833	13 464	8 706	6 167	14 873
20-24 yrs	3 848	3 527	7 375	4 289	3 625	7 914
25-29 yrs	1 936	2 439	4 375	2 305	2 436	4 741
30-34 yrs	1 353	2 256	3 609	1 721	2 167	3 888
35-39 yrs	1 199	2 187	3 386	1 409	2 221	3 630
40-44 yrs	1 192	2 295	3 487	1 249	2 687	3 936
45-49 yrs	1 286	2 214	3 500	1 594	3 152	4 746
50-54 yrs	1 122	1 593	2 715	1 909	2 783	4 692
55-59 yrs	928	1 644	2 572	1 611	2 392	4 003
60-64 yrs	752	1 582	2 334	1 088	1 534	2 622
65-69 yrs	684	1 558	2 242	909	1 552	2 461
70-74 yrs	545	1 122	1 667	658	1 478	2 136
75-79 yrs	480	1 025	1 505	521	1 354	1 875
80+ yrs	812	1 777	2 589	707	1 816	2 523
Total	47 374	53 877	101 251	53 870	58 164	112 034

The majority of the populations in Bulilima 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 chil-

dren would need to be accompanied to and from school as they may be in danger of marauding wild animals as was the case with a 14 year old boy who was mauled and injured by a hippo in KoGonde village in Masendu ward 7. A similar case is that a 9 year boy was also killed by an elephant in Chihanga village in Nyele Ward 4.

This means that 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 (Figure 1). This should then be coupled with a government policy that will deal with these cases in a comprehensive, holistic, robust and sustainable manner [22].

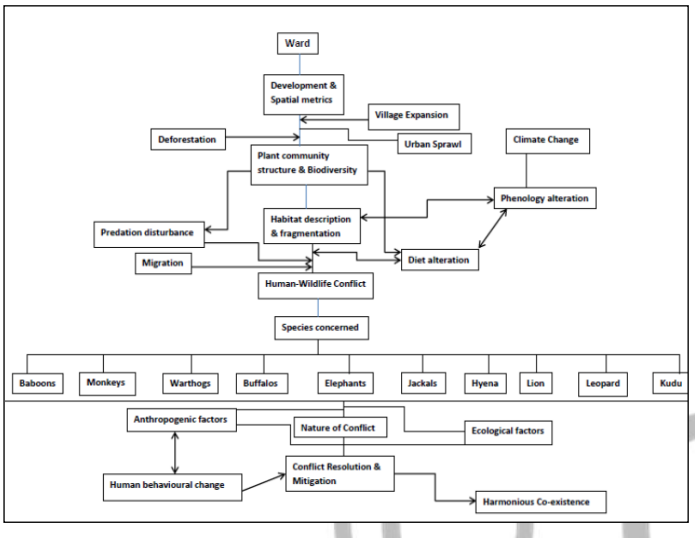


Figure 1. The theoretical framework for mitigating *Human-Wildlife Conflicts* in Zimbabwe.

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 in the near future, 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. The habitats baboons [2][7] and vervets [3][4] utilise are related to their diets and the structural complexity of patches within habitats affects choice of foraging location [10]. One way in which animals balance the conflicting demands between food acquisition and predator avoidance, is through their strategic use of habitats [12], which is amplified seasonally by seasonal variation of resources and resultant changes in home range size, or the use of different habitat types [5][29][13][6]. The *Human-Wildlife Conflicts* may increase as the wildlife habitats shrink with encroachment of people into forests as communal areas expand [22]. An increase in households will also mean an increase in anthropogenic factors that will further fuel *Human-Wildlife Conflicts*, a robust *Human-Wildlife Conflict* mitigation policy is urgently necessary in Bulilima Rural District and Zimbabwe at large.

3.1 Human-Wildlife Conflicts in Bulilima

There is an interesting trend that is observable in Bulilima District that tends to suggest a link between *Baboon-Human conflicts* with *Leopard-Human conflicts* (Table 2). This seems to suggest a probable scenario where baboons seem to find comfort and safety from predation in and around or near human settlements which in turn attracts leopards to these settlements. When leopards then get close to human settlements they then find easy or alternative prey species in the form of livestock thereby resulting in serious loss of livestock due to depredation by leopards (*Panthera pardus*). This therefore raises the question seeking redress:

Q1: "Does baboon management have implications on the redress of livestock depredation by leopards?"

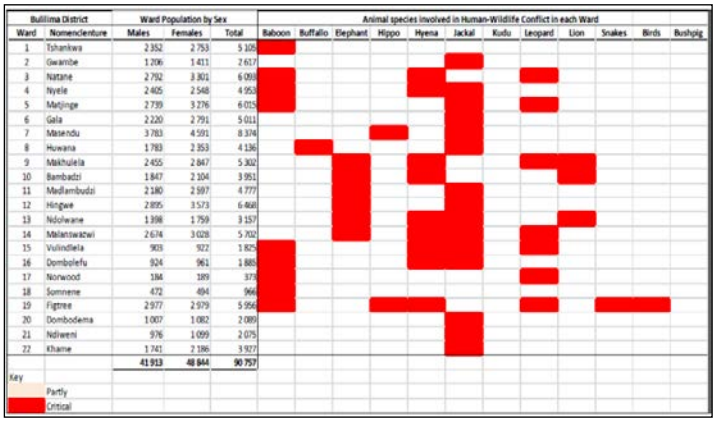
Another notable observation was the occurrence of *Hyena-Human Conflicts* in areas where *Baboon-Human Conflicts* and *Leopard-Human Conflicts* occur, which also suggests that the presence of a predator in a particular ward seems to feed into a particular food chain that is initiated or based on the *Predator-prey dynamics* and *Predator-Predator* behavioural ecology. This therefore means that *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 [23][21][4][7][8] and the human habitats [22].

The same observation is noticed in the Wards that experience *Elephant-Human Conflict*, the same wards also experience *Lion-Human Conflict* suggesting that lions (*Panthera leo*) tend to range in areas that elephants (*Loxodonta africana*) range in. This implies that elephants (*Loxodonta africana*) may act as motivation and facilitator for the lions (*Panthera leo*) to access and explore particular habitats (Wards). As the lions (*Panthera leo*) then get close to human settlements in pursuit of elephants (*Loxodonta africana*) then then get access to easy prey in the form of cattle which then results in huge cattle depredation. This raises an important second question:

Q2: *"Are Predator-prey relations key in the mitigation of Human-Wildlife Conflicts?"*

This question is important because it is interesting to note that wherever *Elephant-Human Conflict* is experienced we find *Lion-Human Conflicts* also occurring in Bulilima district (Table 2).

Table 2. The Ward populations, Wards that experience *Human-Wildlife Conflicts* and the Problem Animal Species involved.



Bulilima District		Ward Population by Sex			Animal species involved in Human-Wildlife Conflict in each Ward											
Ward	Nomenclenture	Males	Females	Total	Baboon	Buffallo	Elephant	Hippo	Hyena	Jackal	Kudu	Leopard	Lion	Snakes	Birds	Bushpig
1	Tshankwa	2 352	2 753	5 105												
2	Gwambe	1 206	1 411	2 617												
3	Natane	2 702	3 301	6 003												
4	Nyele	2 405	2 548	4 953												
5	Matjinge	2 739	3 276	6 015												
6	Gala	2 220	2 791	5 011												
7	Masendu	3 783	4 591	8 374												
8	Huwana	1 783	2 353	4 136												
9	Makhulela	2 455	2 847	5 302												
10	Bambadzi	1 847	2 104	3 951												
11	Madlambudzi	2 180	2 597	4 777												
12	Hingwe	2 895	3 573	6 468												
13	Ndolwane	1 398	1 759	3 157												
14	Malanswazwi	2 674	3 028	5 702												
15	Vulindlela	903	922	1 825												
16	Dombolefu	924	961	1 885												
17	Norwood	184	189	373												
18	Somnene	472	494	966												
19	Figtree	2 977	2 979	5 956												
20	Dombodema	1 007	1 082	2 089												
21	Ndiweni	976	1 099	2 075												
22	Khame	1 741	2 186	3 927												
		41 913	48 844	90 757												
Key																
	Partly															
	Critical															

Table 3. The *Human-Baboon Conflicts* experienced in all the wards of Bulilima District.

					Period of the year when Conflict is at its peak											
Ward Name	Ward Number	WOI	Affected Village	Nature of conflict	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tshankwa	1		All	Crop foraging, raiding												
Gwambe	2		All	killing chickens, goats												
Natane	3		All	digging up planted												
Nyele	4		All	seeds												
Matjinge	5		All													
Gala	6		All													
Masendu	7		All													
Huwana	8		All													
Makhulela	9		All													
Bambadzi	10		All													
Madlambudzi	11		All													
Hingwe	12		All													
Ndolwane	13		All													
Malanswazwi	14		All													
Vulindlela	15		All													
Dombolefu	16		All													
Norwood	17		All													
Somnene	18		All													
Figtree	19		All													
Dombodema	20		All													
Ndiweni	21		All													
Khame	22		All													

The Problem Animal Species (PAS) affect the wards in Bulilima District differently hence the holistic mitigation strategy highlighted in Figure 1 and the philosophy highlighted in [22] is vital. PAS have specific wards they prefer which could be driven by their behavioural, nutritional, foraging ecology as well as habitat selectivity [23]. 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 [8]. The identification, detailed description, classification and mapping of vegetation is fundamental for land use planning and management [9]. Habitat structure can influence many of the components that determine both potential energy gain and predation risk [19][11][24]. This might explain why baboons might be encroaching into human habitats.

3.1.1 Human-Baboon Conflicts in Bulilima

The baboons (*Papio cynocephalus*) are problematic to the villagers all year round (Jan-Dec) (Table 3) thereby threatening the food security of the villagers. The baboons (*Papio cynocephalus*) are a problem from planting to harvesting; they dig up the planted maize seed and forage on the crops till they are harvested. They also raid chikens and prey on goats. Tshankwa, Natane, Nyele, Matjinge, Vulindlela, Dombolefu, Norwood, Somnene and Figtree are the worst affected wards (Table3). 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. All wards that are heavily populated seem to have a challenge with baboons and experience more *Baboon-Human Conflicts* in Bulilima district (Table 3).

The worst affected wards are highlighted in red under the Ward Of Importance (WOI) column (Table 3). The villagers report *Human-Baboon Conflicts* to ZimParks Authority Problem Animal Control (PAC), however, the ZimParks is under resourced hence they are unable to attend to all the cases reported. The villagers are in a distressful situation as the strategies they use of chasing and scaring away baboons seem futile. The *Baboon-Human Conflicts* are at the peak throughout the year (Jan-Dec; Table 3) including the planting, weeding and harvesting periods, hence the vilagers suffer huge losses due to crop raiding, livestock killing and alteration of their daily routines as they are now compelled to guard their fields on a daily basis.

3.1.2 Human-Elephant Conflicts in Bulilima

Elephants (*Loxodonta africana*) destroy crops, infrastructure and kill people. The *Elephant-Human Conflicts* are at their peak during Mar-Aug which also coincides with the harvesting season (Table 4). The same period coincides with winter where they migrate in search for food and water. During this same period they also raid granaries and their ranging in human habitation endanger the villagers. The phytosociology of the wards in Bulilima Rural District can reveal the factors that influence the elephants (*Loxodonta africana*) ranging patterns in human settlements as is the case with baboons where fruit species found in those wards drive habitat preference and baboons (*Papio cynocephalus*) tend to prefer certain plant communities over others and they prefer fruits to other foods in their diet [19][7][17].

Table 4. The *Human-Elephant Conflicts* experienced in all the wards of Bulilima District.

Ward Name	Ward Number	WOI	Affected Village	Nature of conflict	Period of the year when Conflict is at its peak											
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tshankwa	1		All	Crop foraging, raiding												
Gwambe	2		All	granaries, killing cattle												
Natane	3		All	injuring and killing												
Nyele	4		All	people, raid gardens												
Matjinge	5		All	destroy infrastructure												
Gala	6		All	and fences.												
Masendu	7		All													
Huwana	8		All													
Makhulela	9		All													
Bambadzi	10		All													
Madlambudzi	11		All													
Hingwe	12		All													
Ndolwane	13		All													
Malanswazwi	14		All													
Vulindlela	15		All													
Dombolefu	16		All													
Norwood	17		All													
Somnene	18		All													
Figtree	19		All													
Dombodema	20		All													
Ndiweni	21		All													
Khame	22		All													

The worst affected wards are highlighted in red under the Ward Of Importance (WOI) column (Table 4). A boy was killed by elephants (Loxodonta africana) and the villagers reported the *Human-Elephant Conflict* to ZimParks' Problem Animal Control section, however, when they attended to the case the elephants had already crossed back to conservation areas and the law does not allow the PAS to be shot once they leave human settlements. This poses a serious challenge and the law needs to be revised to make sure that such PAS are eleiminated as they will come back and another loss of life may be encountered again. In all the cases that were reported by the villagers only a handful were attended to and 3 elephaants were eliminated in 2020 and 2 others in 2021. However, this lethal strategy of control does not eliminate the problem as elephants still come into the area and inflict more damage as they kill cattle, destroy fences, crops and infrastructure.

3.1.3 Human-Hyena Conflicts in Bulilima

Hyenas (*Crocuta crocuta*) depredate cattle, donkeys and small livestock in all the wards in Bulilima District. They kill cattle, donkeys and goats. This is a huge impact to the livelihoods of the communities as cattle and goats are wealth investment and also a source of meat which greatly augment their nutritional status as a protein provision. The donkeys are important as donkeys are used for draught power and transportation in pulling scotch carts. Hyenas (*Crocuta crocuta*) are a challenge through out the year but their peak is between March and October (Table 5). The peak of the Hyena-Human Conflict coincides with time when livestock is not penned as most villagers will have harvested their crops and will be waiting for the next cropping season which starts during the rainy season. It will be therefore imperative that the villagers pen their livestock daily to avoid losses.

Table 5. The *Human-Hyena Conflicts* experienced in all the wards of Bulilima District.

Ward Name	Ward Number	WOI	Affected Village	Nature of conflict	Period of the year when Conflict is at its peak											
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tshankwa	1		All	Kill goats, cattle and												
Gwambe	2		All	donkeys												
Natane	3		All													
Nyele	4		All													
Matjinge	5		All													
Gala	6		All													
Masendu	7		All													
Huwana	8		All													
Makhulela	9		All													
Bambadzi	10		All													
Madlambudzi	11		All													
Hingwe	12		All													
Ndolwane	13		All													
Malanswazwi	14		All													
Vulindlela	15		All													
Dombolefu	16		All													
Norwood	17		All													
Somnene	18		All													
Figtree	19		All													
Dombodema	20		All													
Ndiweni	21		All													
Khame	22		All													

The worst affected wards are highlighted in red under the Ward Of Importance (WOI) column (Table 5). The communities do report all *Hyena-Human Conflicts* to the ZimParks Problem Animal Control (PAC) section. However, not all cases are attended to due lack of resources. The communities also employ their own control strategies which include chasing and scaring the hyenas with dogs, use of snares and poisoning. A holistic approach would definitely assist in ensuring that a peaceful co-existence between the communities and the hyenas (*Crocuta crocuta*) is attained.

3.1.4 Human-Jackal Conflicts in Bulilima

Jackals (*Canis aureus linnaeus*) are a huge problem as they depredate small livestock in all wards in Bulilima District throughout the year (Jan-Dec; Table 6). The Jackals (*Canis aureus linnaeus*) kill goats and results in the villagers incurring huge thereby affecting their livelihoods. Goats are used in batter trade in rural communities and for meat.

Table 5 The *Human-Jackal Conflicts* experienced in all the wards of Bulilima District.

Ward Name	Ward Number	WOI	Affected Village	Nature of conflict	Period of the year when Conflict is at its peak											
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tshankwa	1		All	Kill goats												
Gwambe	2		All													
Natane	3		All													
Nyele	4		All													
Matjinge	5		All													
Gala	6		All													
Masendu	7		All													
Huwana	8		All													
Makhulela	9		All													
Bambadzi	10		All													
Madlambudzi	11		All													
Hingwe	12		All													
Ndolwane	13		All													
Malanswazwi	14		All													
Vulindlela	15		All													
Dombolefu	16		All													
Norwood	17		All													
Somnene	18		All													
Figtree	19		All													
Dombodema	20		All													
Ndiweni	21		All													
Khame	22		All													

The worst affected wards are highlighted in red under the Ward Of Importance (WOI) column (Table 6). The communities do report all *Human-Jackal Conflicts* to the ZimParks Prob-

lem Animal Control (PAC) section, however, lack of resources results in most cases not being attended to. The communities also employ their own control strategies which include chasing and scaring the jackals with dogs, use of snares and poisoning. A holistic approach would definitely assist in ensuring that a peaceful co-existence between the communities and the jackals is achieved.

3.1.5 Human-Leopard Conflicts in Bulilima

Leopards (*Panthera pardus*) depredate cattle and small livestock in all the wards in Bulilima District. They kill cattle and goats. This is a huge impact to the livelihoods of the communities as cattle and goats are kept for milk, meat and are a source of income which they sell for cash. Leopards (*Panthera pardus*) are a challenge through out the year (Jan-Dec) and impose a huge blow to the communities (Table 7).

Table 7. The *Human-Leopard Conflicts* experienced in all the wards of Bulilima District.

Ward Name	Ward Number	WOI	Affected Village	Nature of conflict	Period of the year when Conflict is at its peak											
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tshankwa	1		All	Kill goats and cattle												
Gwambe	2		All													
Natane	3		All													
Nyele	4		All													
Matjinge	5		All													
Gala	6		All													
Masendu	7		All													
Huwana	8		All													
Makhulela	9		All													
Bambadzi	10		All													
Madlambudzi	11		All													
Hingwe	12		All													
Ndolwane	13		All													
Malanswazwi	14		All													
Vulindlela	15		All													
Dombolefu	16		All													
Norwood	17		All													
Somnene	18		All													
Figtree	19		All													
Dombodema	20		All													
Ndiweni	21		All													
Khame	22		All													

Leopard-Human Conflict is experienced where *Baboon-Human Conflict* is rife, this is because leopards (*Panthera pardus*) preffered prey species are baboons (*Papio cynocephalus*), hence when baboons (*Papio cynocephalus*) shift their home ranges into human settlements leopards (*Panthera pardus*) also follow where they then encounter easy prey in the form of goats and cattle. The worst affected wards are highlighted in red under the Ward Of Importance (WOI) column (Table 7). The *Leopard-Human Conflict* cases are reported by the communities to the ZimParks Problem Animal Control (PAC) section, however, lack of resources results in most cases not being attended to. A holistic approach would definitely assist in ensuring that a peaceful co-existence between the communities and leopards is achieved.

3.1.6 Human-Lion Conflicts in Bulilima

Lions (*Panthera leo*) depredate cattle and donkeys in some wards in Bulilima District (Table 2; Table 8). They kill cattle and donkeys and this is a huge impact to the livelihoods of the communities as cattle are kept for milk, meat and are a source of income which they sell for cash. The donkeys are used for draught power for land preparation during the cropping season and transportation. Lions (*Panthera leo*) are a challenge during the period March-October and impose a huge blow to the communities (Table 8).

Table 8. The *Human-Lion Conflicts* experienced in all the wards of Bulilima District.

Ward Name	Ward Number	WOI	Affected Village	Nature of conflict	Period of the year when Conflict is at its peak											
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tshankwa	1		All	Kill cattle and donkeys												
Gwambe	2		All													
Natane	3		All													
Nyele	4		All													
Matjinge	5		All													
Gala	6		All													
Masendu	7		All													
Huwana	8		All													
Makhulela	9		All													
Bambadzi	10		All													
Madlambudzi	11		All													
Hingwe	12		All													
Ndolwane	13		All													
Malanswazwi	14		All													
Vulindlela	15		All													
Dombolefu	16		All													
Norwood	17		All													
Somnene	18		All													
Figtree	19		All													
Dombodema	20		All													
Ndiweni	21		All													
Khame	22		All													

The worst affected wards are highlighted in red under the Ward Of Importance (WOI) column (Table 8). The *Lion-Human Conflict* cases are reported by the communities to the ZimParks Problem Animal Control (PAC) section, however, when they responded the lions had crossed back to Botswana. In this case in point, the lions had killed 15 cows and 9 donkeys. A holistic approach and promulgation of a requisite *Human-Wildlife Conflict* policy by Bulilima District Council would definitely assist in ensuring that a peaceful co-existence between the communities and lions is achieved.

3.1.7 Human-Hippo Conflicts in Bulilima

Hippopotamus (*Hippopotamus amphibus*) destroy and forage on crops, injure and kill humans in Bulilima District. A hippo attacked a 14 year old boy going to school in KoGondee village in Masendu ward 7. The majority of the population of the villagers in Bulilima district are children of the school going age (0-19 years), this means that young children are endangered and requisite strategies to ensure their safety is urgently required. There was also a threat to human life in Figtree dam village in Figtree ward 19, Hippopotamus (*Hippopotamus amphibus*) is one of the most dangerous animals in Zimbabwe as exhibited by the nature of conflict it poses to the villagers in Bulilima which are always life threatening. All the *Hippo-Human Conflict* cases were attended to and the PAS were eliminated.

3.1.8 Human-Buffalo Conflicts in Mangwe

Buffalo (*Syncerus caffer*) injure and kill humans in Bulilima District. Four buffaloes threatened human life in Ngwana village in Huwana ward 8 and Mangarama village in Matjinge ward 5. The majority of the population of the villagers in Bulilima district are children of the school going age (0-19 years), this means that young children are endangered and requisite strategies to ensure their safety is uregently required. Buffalo (*Syncerus caffer*) part of the big 5 and is one of the most dangerous animals in Zimbabwe as exhibited by the nature of conflict it poses to the villagers in Bulilima which are always life threatening. All the *Buffalo-Human Conflict* cases were attended to and all the four buffaloes were eliminated.

3.2 The damage inflicted by Problem Animal Species (PAS) on crops in Bulilima

Baboons (*Papio cynocephalus*), elephants (*Loxodonta africana*) and Hippopotamus (*Hippopotamus amphibus*) are the Problem Animal Species (PAS) that diretly destroy and forage on crops in Bulilima rural district (Table 9).

Table 9. Problem Animal Species (PAS) that destroyed crops thereby threatening the food security of Bulilima District villagers.

		Nature of Human-Wildlife Conflct and Damage inflicted		
Year	Problem Animal Species (PAS)	Field crops (ha)	No. of Gardens	Fence (Km)
2018	Baboon	6,0	0,0	0,0
	Elephant	25,0	2,0	35,0
	Hippo	0,0	0,0	0,0
	Total	**31,0**	**2,0**	**35,0**
2019	Baboon	5,0	0,0	0,0
	Elephant	45,0	1,0	65,0
	Hippo	0,0	0,0	0,0
	Total	**50,0**	**1,0**	**65,0**
2020	Baboon	3,0	0,0	0,0
	Elephant	15,0	2,0	25,0
	Hippo	0,0	0,0	0,0
	Total	**18,0**	**2,0**	**25,0**
2021	Baboon	4,0	0,0	0,0
	Elephant	10,0	0,0	40,0
	Hippo	0,3	0,0	0,0
	Total	**14,3**	**0,0**	**40,0**

A total of 113.03 ha of field crops were destroyed between the periof od 2018-2021 by elephants (*Loxodonta africana*), baboons (*Papio cynocephalus*) and Hippopotamus (*Hippopotamus amphibus*). In all the years (2018, 2019, 2020 and 2021) elephants (*Loxodonta africana*) inflicted the most damage followed by baboons, whilst Hippopotamus (*Hippopotamus amphibus*) had the least impact (Table 9). The year had the least impact by all the tree species. Elephant (*Loxodonta africana*) also destroyed most of the gardens and fences during the 4 year period. The management and mitigation of this situation holistically is the only best solution for the sustainable conservation of wildlife whilst securing the livelihoods of the villagers in Bulilima District.

3.3 Response to Human-Wildlife Reports in Bulilima

The reported Human-Wilife Conflict cases in Bulilima Rural District during the period 2018-2021 were analysed and rated based on percentage response or attendance of the cases by the Problem Animal Control (PAC) team.

3.3.1 2018 Response to Human-Wildlife Reports

A total of 105 *Human-Wildlife Conflict* cases were reported in 2018. Of these cases the highest number of cases were *Jackal-Human Conflict* (30 cases) whislts the least were *Leopard-Human Conflict* (2 cases) (Table 10).

Table 6 The *Human-Wildlife Conflict* cases incurred in Bulilima Rural District, 2018.

		Human-Wildlife Conflict Cases			
Year	Problem Animal Species (PAS)	Reported	Attended	% Attended	Rating
2018	Baboon	26	9	35	
	Elephant	25	11	44	
	Hippo	0	0	0	
	Hyena	13	8	62	
	Jackal	30	10	33	
	Leopard	2	0	0	
	Lion	9	5	56	
	Total	**105**	**43**	**41**	

The rating depicted by the deep green colour is regarded the best (>50%) whilst the worst rating is indicated by the red colour (<50%). It is sad that the highest cases of *Jackal-Human Conflict* which resulted in a lot of goats being killed had the least percentage of attandnce by the PAC team. This creates an impression on the villagers that the losses they are incurring are not being prioritised which fuels tensions amongst the villagers and wildlife. The predator cases of *Hyena-Human Conflict* and *Lion-Human Conflict* were prioritised (Table 10). The *Baboon-Human Conflict* which has a larger bearing on the food security of the villagers had a low percentage attendance (35%) which is quite disturbing given the fact that baboons are problematic all year round and raid fields from planting to harvesting time. This might mean that the noble causes of Command agriculture, Pfumvudza and the Presidential agricultural input scheme which seek to bring about food security amongst the Bulilima villagers are seriously compromised by *Human-Wildlife Conflict* particularly by *Baboon-Human Conflict*.

3.3.2 2019 Response to Human-Wildlife Reports

A total of 113 *Human-Wildlife Conflict* cases were reported in 2019. Of these cases the highest number of cases were *Elephant-Human Conflict* (31 cases) whislts the least were *Leopard-Human Conflict* (6 cases) (Table 11).

Table 11. The *Human-Wildlife Conflict* cases incurred in Bulilima Rural District, 2019.

		Human-Wildlife Conflict Cases			
Year	Problem Animal Species (PAS)	Reported	Attended	% Attended	Rating
2019	Baboon	20	4	20	
	Elephant	31	24	77	
	Hippo	0	0	0	
	Hyena	15	9	60	
	Jackal	18	5	28	
	Leopard	6	2	33	
	Lion	23	17	74	
	Total	**113**	**61**	**54**	

The rating depicted by the deep green colour is regarded the best (>50%) whilst the worst rating is indicated by the red colour (<50%). The *Elephant-Human Conflict* had the higest response by the PAC in 2019 (77%). This is commendable for

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elephants are the most problematic animal species that threaten the food security of the villagers in Bulilima as they destroy crops, kill cattle and destroy gardens. However, it is notable that only 20% of the *Baboon-Human Conflict* cases were attended given that *Baboon-Human Conflict* has a larger bearing on the food security of the villagers. This is quite disturbing given the fact that baboons are problematic all year round and raid fields from planting to harvesting time.

3.3.3 2020 Response to Human-Wildlife Reports

There was a drop in the reported cases of *Human-Wildlife Conflict* from a total of 113 cases in 2019 to a total of 87 cases in 2020. Of these cases the highest number of cases were *Baboon-Human Conflict* (25 cases) whislts the least were *Hippo-Human Conflict* (1 case) (Table 12).

Table 12. The *Human-Wildlife Conflict* cases incurred in Bulilima Rural District, 2020.

		Human-Wildlife Conflict Cases			
Year	Problem Animal Species (PAS)	Reported	Attended	% Attended	Rating
2020	Baboon	25	5	20	
	Elephant	15	7	47	
	Hippo	1	1	100	
	Hyena	12	4	33	
	Jackal	20	5	25	
	Leopard	4	0	0	
	Lion	10	2	20	
	Total	**87**	**24**	**28**	

The rating depicted by the deep green colour is regarded the best (>50%) whilst the worst rating is indicated by the red colour (<50%). The *Hippo-Human Conflict* had the higest response by the PAC in 2019 (100%). This could be informed by the nature of the *Human-Wildlife Conflict* posed by Hippopotamus (*Hippopotamus amphibus*) which is always life threatening apart from destroying and foraging on crops in Bulilima District. Apart from an encouraging response to cases on *Hippo-Human Conflict* and *Elephant-Human Conflict* there was generally poor response to *Human-Wildlife Conflict* cases particularly a high number of cases reported on the *Baboon-Human Conflicts*. This is quite disturbing and may discourage the villagers from reporting any future cases given the fact that baboons are problematic all year round and raid fields from planting to harvesting time.

3.3.4 2020 Response to Human-Wildlife Reports

There was a slight increase in the reported cases of *Human-Wildlife Conflict* from a total of 87 cases in 2020 to a total of 95 cases in 2021. Of these cases the highest number of cases were *Elephant-Human Conflict* (30 cases) whislts the least were *Lion-Human Conflict* (1 case) (Table 13).

Table 7. The *Human-Wildlife Conflict* cases incurred in Bulilima Rural District, 2021.

		Human-Wildlife Conflict Cases			
Year	Problem Animal Species (PAS)	Reported	Attended	% Attended	Rating
2021	Baboon	26	7	27	
	Elephant	30	26	87	
	Hippo	3	2	67	
	Hyena	15	6	40	
	Jackal	20	4	20	
	Leopard	0	0	0	
	Lion	1	0	0	
	Total	**95**	**45**	**47**	

The rating depicted by the deep green colour is regarded the best (>50%) whilst the worst rating is indicated by the red colour (<50%). The *Elephant-Human Conflict* had the higest response by the PAC in 2019 (100%). This could be informed by the nature of the Human-Wildlife Conflict posed by Elephants *(Loxodonta Africana)* which is always life threatenig apart from destroying and foraging on crops in Bulilima District. Despite an increase in the *Baboon-Human Conflict* there still generally poor response to high number of cases reported on the *Baboon-Human Conflicts* (Table 13). This is quite disturbing and may discourage the villagers from reporting any future cases given the fact that baboons are problematic all year round and raid fields from planting to harvesting time.

4 Conclusion

Bulilima Rural District communities 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*). 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 Bulilima District. There is need of comprehensive research that factor in the behavioural ecology and ecosystem services of the Problem Animal Species (PAS). 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. The lack of funds to respond to Human-Wildlife Conflict cases reported by the villagers may seriously damage the confidence of the villagers in the regulatory and local governemnt authorities, which may result in cases not being reported at all. 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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