



Baboon-Human Conflict (BHC), an emerging crisis faced by the residents of Munyati Power Station in Zimbabwe.

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Abstract—Munyati Power Station is a small area with a small community that offers residential area to 149 workers that make up the high density, medium and low density of the residential area. The station consists of about 150 households that are faced with a crisis of *Baboon-Human Conflict* where the safety of women and children is endangered. The *Baboon-Human Conflict* also results in their crops, fields, infrastructure and livestock being destroyed. The area is surrounded by riverine area and dense vegetation marked by intermittent farmlands and is home to Baboons (*Papio cynocephalus*) which pose a threat to human livelihoods and endangers the safety and lives of young children and women. The data were obtained from the *Human-Wildlife Conflict* reports submitted to the Zimbabwe National Parks central region office that deals with Problem Animal Control (PAC). These reports on *Human-Wildlife Conflict* incidences were collected and collated on an *ad libitum* basis. The implications of *Baboon-Human Conflict* on food security and livelihoods of the Munyati Power Station residents were highlighted and *Human-Wildlife Conflict* mitigation Strategy was proposed and must be incorporated in the promulgation of mitigation strategies. It can be concluded that the *Human-Wildlife Conflict* at Munyati Power Station presents a precarious situation which 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 the Munyati Power Station residents and wildlife.

Key Words Index Terms— Crisis, Problem Animal Species, Human-wildlife Conflict, Co-existence, residents, Baboons.

INTRODUCTION

Human-Wildlife Conflict (HWC) is defined as "any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment." [63]. HWC is a global phenomenon and is becoming more prevalent as the natural resource requirements between humans and wildlife overlap [38]. 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 [42]. As urban and suburban areas expand at Munyati Power Station (MPS) due to increased demand in residential space, an increasing number of urban cases of HWC are also being reported [17][35][59]. In Africa, with rapidly expanding urbanization as well as increased population growth, the number of cases of urban HWC is expected to increase [57]. HWC is encountered in all communities ranging from border towns (Kariba, Victoria Falls Chirundu, and Beitbridge) [57], communities close to protected areas, urban towns and communal areas alike [38][39][40][41]. HWC 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 [58][40]. The conflict involves a variety of mammals, birds, fish, insects, and reptiles [47]. The situation at MPS is critical as the communities and residents face relentless crop raiding by baboons. MPS has no formal baboon management plan and strategy, and this makes the residents susceptible to *Baboon-Human Conflict* (BHC) as their crops,

infrastructure, livestock and livelihoods are destroyed.

MPS residents suffer huge losses from the HWC they encounter on a daily basis. The communities' livelihoods are threatened by baboons (*Papio cynocephalus*) which are posing a severe challenge as they are highly adaptable to any kind of community and environment thereby wrecking havoc. To our knowledge the BHC in small power stations has limited if any documentation in Zimbabwe. There is also limited if any 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 [38]. Habitat utilisation, ecology and nutrition as well as how the baboons interact with their highly fragmented environment have not been researched in Zimbabwe [38]. 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 small communities in mining or industrial areas.

Baboons (*Papio cynocephalus*) 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 some communities by raiding homes, digging up planted seed and raiding and foraging on planted crops in the fields [38][39][40][41]. Baboon populations shape the ecosystem through seed dispersal [56] and knowing how they relate to the environment in which they live help 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 [37]. Animals (baboons: [5][12]: vervets: [6][7] 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 [44][43]. 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 [30][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].

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 [44]. Studies of diet, ranging patterns, and habitat utilisation are useful for understanding the habitat requirements that allow maintenance of viable populations, and may also contribute to our comprehension of the population dynamics and carrying capacity of a particular area [37]. Knowledge of the dietary patterns of primates may assist in designing management strategies to reduce *Human-Wildlife Conflict* [37].

According to [60], animals shift their ranges in response to prevailing environmental and climatic conditions, for instance, the glacial changes in the forest line [60] 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 [38]. 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 in Zimbabwe [38]. 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 [38].

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 [38]. 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 [46][27]. This period also coincides with limited food availability where animals have to resort to under storage organs which take longer to process [2].

BHC research seeks to understand how habitat fragmentation due to urban sprawl and rapid urbanisation influences habitat utilisation by urban baboons [38]. Considering climate change and various anthropogenic influences [34], information on the changes in habitat, climate, and food availability is vital to

assist our understanding of baboon behaviour in these areas.

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 [39].

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 BHC in the country. HWC has escalated because of changes in land use, arable farming and the expansion of communal areas and urban sprawl due to increases in population [13]. The situation at MPS is tragic and this paper seeks to:

- ❖ Determine the nature of *Baboon-Human Conflicts* that occur at MPS.
- ❖ Forecast the impacts and implications of the *Baboon-Human Conflict* occurring at MPS 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 MPS residents and baboons.

2 METHODOLOGY

2.1 Research Site

Munyati Power Station (MPS) is a coal-fired power station was built in 1938, and is situated in Munyati (18°38'59.99" S ; 29° 46' 59.99" E) (Figure 1) which is a small town in Midlands province in Zimbabwe [65]. MPS is located about 29 km north of Kwekwe on the main Harare-Bulawayo road; it has a few shops for regular shopping, a primary and secondary (high) school and football pitch. MPS is a thermal station that originally had a capacity of 120MW but currently operates at a capacity of 100MW. Water for the MPS is drawn from the Sebakwe River through a 23-kilometre long canal and the Munyati Weir through a 3-kilometre pipeline. Munyati Power Station currently has a staff complement of 147 employees, most of who are accommodated by the station. The station has a clinic for all employees and their dependents, a primary school for 600 pupils, a secondary school for 300 pupils, and a library [65][66].



Figure 1. Satellite image of the Location of MPS.

2.1 Methods

The data were collected from the *Human-Wildlife Conflict* reports spanning a period between 2019 and 2021 (Jan-Dec). These data consists of approximately 25 reported cases of *Human-Wildlife Conflict* at MPS. The data were collated with the *Human-Wildlife Conflict* cases reported to the Parks and wildlife Authority Problem Animal Control (PAC) and the Kwekwe Parks central region office. The data were then consolidated for the purposes of coming up with a short communication on the *Baboon-Human Conflict* crisis that is posed by Baboons (*Papio cynocephalus*) at MPS. Zimbabwe Power Company (ZPC) runs two schools in Munyati, a primary and secondary school. The schools have a total enrolment of 1025 pupils and do not only serve ZPC employees' children but also those living in the surrounding communities as well [65][66].



Figure 2. An aerial google earth image of the MPS.

2.2.1 Problem Animal Species (PAS)

Baboons are large semi terrestrial monkeys that occupy a wide range of habitats across the African continent [4][31][33]. Plants are their most important source of nutrients, with invertebrate and vertebrate animals contributing relatively little in terms of calories and protein to their diet [1].



Figure 3. A female Chacma baboon (*Papio ursinus*).

Baboons play a crucial role in the ecosystems they occupy as their ecological and behavioural flexibility enables them to utilize a diverse array of plant species available within their ecosystems and habitats that include forests, deserts, savannas and grasslands [27][20]. This flexibility is facilitated by a high degree of selective omnivory [3], relatively large social groups and non-seasonal reproduction [3]. They play a crucial role in ecosystem engineering and structuring of plant communities through the dispersal of seeds from various plant species which they forage on within their home range [56]. The foraging strategy of baboons enable them to achieve relative dietary stability by being able to utilise a large array of plant species and parts throughout the year, selectively exploiting foods as they become available [1]. Chacma baboons rely heavily on fruits and grasses where they consume both the underground storage organs and leaves [54][51][48][61][15][3] with a concomitant supplement of invertebrate and vertebrate animals in food limiting seasons [1]. Baboons are of significance in ecosystem research as they are highly mobile within individual home ranges that vary in size between baboon troops [42].

2.2.1 Problem Animal Control PAC

All the cases that were attended to by the Problem Animal Control (PAC) during the period 2019-2021 are recorded and the mitigation strategies implemented were documented. The mitigation strategies also employed by the residents are documented and addressed in this paper.

3 RESULTS

The MPS has a majority population of the most vulnerable age groups, i.e. those who are of school going age (0-19 years. The [53], Zimbabwe, does not have provisions for direct compen-

sation for losses from wildlife this therefore means that the residents that are exposed to BHC suffer a double-edged sword thereby impacting mostly the vulnerable members of the society and the girl child. The population is going to continue to increase and this will put further pressure on scanty land resources thereby escalating the BHC [64].

Most of the populations in affected by HWC are females as compared to males [38][39][40], this implies that in cases where children must guard homes to prevent invasion by baboons it would be the girl child that will be affected the most [41]. 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 baboons that chase them and raid bags for food [38][39][40][41]. There is an urgent need to monitor the dynamics and nature of the *Baboon-Human Conflicts* occurring at MPS and a requisite strategy implemented.

A continued increase in the population structure of the school going age group (0-19 years) 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 [64]. This signals increased competition on space and space use, water resources, forest food resources, an increase in tensions between humans and baboons.

The habitats baboons [5][12] and vervets [6][7] utilise are related to their diets and the structural complexity of patches within habitats affects choice of foraging location [23]. One way in which animals balance the conflicting demands between food acquisition and predator avoidance, is through their strategic use of habitats [29], which is amplified seasonally by seasonal variation of resources and resultant changes in home range size, or the use of different habitat types [7][55][30][11].

The *Baboon-Human Conflicts* may increase as the wildlife habitats shrink with encroachment of people into forests as the town expands [38]. An increase in households will also mean an increase in anthropogenic factors that will further fuel *Baboon-Human Conflicts* at MPS; hence a robust *Baboon-Human Conflict* mitigation policy is urgently necessary.

3.1 Human-Wildlife Conflicts in Munyati

Extensive research has been undertaken on *Papio* species in savanna habitats, and they have been shown to be ecologically flexible omnivores which are highly selective in their dietary choice and habitat utilisation [7][29][4][26][62]. The Chacma baboons in Zimbabwe are expected to exhibit significant selection or preference to certain habitats as an adaptation to times of scarcity within their home range. Food availability is highly variable in savanna habitats or biomes, hence food availability acts as an ecological constraint on the baboons, prompting them to compensate with different foraging strategies [4][8]. Temporal variations in food availability in an animal's habitat may force it to modify its home range size as a behavioural adaptation [37][7]. The study of an animal's home range enables an understanding of the distribution and utilisation of resources in time and space [18][21] and is expected to correspond to the distribution of resources that the animals need to use.



Figure 4. An aerial view of a high density area at MPS.

There is an interesting observation on the *Baboon-Human conflict* cases reported at MPS, the low-density areas have the least number of households and have bigger yards where they can grow bigger orchards of fruit trees, gardens and set up other small backyard projects [64](Figure 5). The same wards comprise the wealthy residents with affluent lifestyles which mean that they may be having more organic waste which may attract baboons to those areas.



Figure 5. An aerial view of low density housing area at MPS

These baboons also seem to find comfort and safety from predation in and around or near human settlements. Efficient space use is a critical challenge for foraging animals as they rely on resources that are stationary [50]. Navigating large territories is energetically costly and animals are expected to

develop strategies to reduce energy expenditure [25]. Animals use various strategies to navigate through their landscapes to reduce travel costs and avoid predators, including the selection of topographic features, and the repeated use of paths or travel areas (home ranges) [50]. 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 [13]. The identification, detailed description, classification and mapping of vegetation is fundamental for land use planning and management [16]. Habitat structure can influence many of the components that determine both potential energy gain and predation risk [39][24][45]. This might explain why baboons might be encroaching into human habitats.

3.2 Human-Baboon Conflicts in Kwekwe urban District.

The baboons (*Papio cynocephalus*) are problematic to the residents during July-December thereby threatening their security, food and nutritional security of the residents. The baboons (*Papio cynocephalus*) destroy infrastructure, raid gardens, and raid orchards, pollute the environment and mess roofs and windows and make general noise in the neighbourhoods.

The *Baboon-Human Conflicts* seem to be seasonal peaking during the cold dry season and the hot dry season till the onset of the rainy rainy season when people grow crops and fruit trees like mangoes ripen. Baboons have an eclectic diet but have a selective preference for fruits compared to other items and utilise a wide array of plant resources like leaves, roots, bulbs and corms [37][11][28][62][42]. Considering the seasonal shifts posed by climate change, phenological monitoring is important as it aids in the management of wildlife and enables reserve managers to distinguish shifts in phenophases, for example onset of leafing, flowering or fruiting and the implications this could have to the food availability to the baboons. Baboons have a dietary flexibility that enables them to adjust their diet to the habitat structure of the environment they live in, allowing them to utilise a wide variety of plant species ranging from a single plant part to multiple parts including flowers, seeds and leaves [62][11]. Baboons do however show a preference for fruits as mentioned previously, hence the importance to note that habitat choice is driven by the presence of woody plant fruit species [11][37][42].

3.2.1 General nuisance

The baboons are a general annoyance to the residents as their presence is often associated with potential loss of gardens crops and fruits from orchards and noise. The residents therefore report their presence to the ZimParks Problem Animal Control (PAC) team.

3.2.2 House breaking

Baboons respond to food scarcity in different ways, but they always adapt to any situation to ensure that they survive. For instance, summer months were characterised by a very strong reliance on fruit, with a small-to-moderate contribution of green seed pods [42]. Pods remained a relatively consistent contributor to monthly feeding allocations until October, alt-

hough in winter it was their seeds that were harvested, but the marked decline of fruit by May was primarily compensated for by a corresponding increase in USOs and seeds, as well as by the initiation of foraging on invertebrates [42]. Overall, the dry season, not surprisingly, was characterised by the use of durable food items obtained from a smaller range of changing species [42]. November, as the transition month, was distinguished by the fact that flowers and leaves, along with invertebrates, provided the bulk of the diet, only to disappear in December, when fruit once again predominates [42].

3.2.3 Destruction of infrastructure

Most of the residents and business owners have been tormented by the baboons to the extent that they will be very happy and relieved if the baboons could be removed from the area. The community sees no value from the baboons, but they feel that the primates are only there to cause havoc and destruction to their property. The asbestos roofs are broken by baboons as they play on roof tops, they also break windows, fences and durawalls which results in residents incurring expenses. In some cases, the baboons have even damaged cars which results in expensive repairs to the owners.

3.2.4 Depredation of chickens

Baboons kill and eat the chickens that are kept for domestic consumption and small business by the residents. The baboons also raid and eat eggs thereby negatively affecting both the chicken and egg businesses of the residents. The residents 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 residents are in a distressful situation as the strategies they use of chasing and scaring away baboons seem futile. A holistic approach would assist in ensuring that a peaceful co-existence between the residents and the baboons is attained.

3.2.5 Stealing

Baboons invade homes and steal food and some house utensils which then then destroy. Some groceries are stolen from pantries and destroyed. The normal household lives have been greatly affected as residents can no longer leave their windows open for fresh air as they fear that baboons would invade their houses.

3.2.6 Chasing children & women

Baboons at MPS can distinguish between a woman, child and grown man as they discriminately chase women and children if they happen to come across them in their foraging. This is affecting children as they go to school because their lives can be in danger.

3.2.7 Raiding groceries

Baboons have reportedly seen raiding shops for food, and they also raid women and children whom they encounter coming from shopping. It is however interesting to note that it is the adult males with large and sharp canines that have been observed to be chasing women and children. This is a bad situation because baboons' range in residential areas which necessi-

tate that those children and women take extra cautious measures to be safe.

3.2.8 Raiding gardens

Baboons raid gardens and home gardening yields crops for domestic intake to improve the value, assortment and nutrient content of foods [41]. The excess harvest can be traded for profits to procure other foodstuffs to supply various nutrients [41]. This means that when the fields and household gardens are raided by baboons, the nutrition status of the residents is greatly affected since in most households, the crops are sold for profits to buy more food. 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 [40].

3.2.9 Raiding orchards

Baboons generally exhibit a high monthly turn-over in the use of particular food species as 'eclectic omnivores' [62], they are able for the most part to shift the species structure of their diet in order to sustain an optimal diversity centred in the wetter months on fruit, while allowing for a shift to more 'durable' sources (invertebrates, pods, seeds, underground storage organs) during the drier months when fruit is not available [42]. This is reflected in the negative relationship between foraging effort and the number of different species used in each month. As preferred foods disappeared from the list of possible options, the animals compensated by diversifying their diet [42] and this includes raiding foods in residential areas. The *Baboon-Human Conflict* coincides with the peak of the dry cold winter months where there is a shift in baboon diet due to the disappearance of fruit, and persists until the wet season brings a return of preferred fruits? The dry season results in loss of dietary diversity and any delay in spring rain would require a greater reliance on foods proffered by the gardens of the which might be reduced in significance once young leaves, flowers and fruits are available.

3.2.10 Raiding bins

Waste management by the residents may act as a motivation for the baboons to visit the houses to raid the waste like what was happening with elephants in Chirundu [57]. In this case the waste needs to be sorted and collected in baboon proof bins both at homes and in the public places.

3.2.11 Messing roofs and yards

Baboons jump onto roofs of houses breaking the asbestos roofs thereby exposing the residents to unplanned expenses and costs. The baboons also have managed to read the patterns of residents and visit the homes when the owners are not around thereby wrecking havoc. This has resulted in residents having to alter their daily schedules and guard their homes to scare away the baboons.

3.2.12 Noise

Baboons are generally social animals which vocalise through out their interactions during the day; this may include an alarm call, play, and vocalisations of submission, aggression, fighting or copulation. These vocalisations can be very loud, and the noise is an irritation to the residents. When they fight, they can chase each other around making continuous loud noises in their dominance interactions and this may involve running and jumping onto roof tops. This is a notable irritant to the residents that stay in flush and affluent suburbs of Redcliff.

3.3 Response to Human-Wildlife Reports at MPS

It is sad that all the highest cases of *Baboon-Human Conflict* reported by the residents do not get 100% attendance by the PAC team from ZimParks. This creates an impression on the residents that the losses they are incurring are not being prioritised which fuels tensions amongst the residents and baboons. The *Baboon-Human Conflict* which has a larger bearing on the food security of the residents had a low percentage attendance [40]. This is quite disturbing and may discourage the residents from reporting any future cases given the fact that baboons are problematic on a daily basis during their peak time.

3.4 Implications of BHC on Policy & laws

Since MPS is the surrounded by farming communities and areas and is almost an urbanised area there could be a high waste generation rate of organic waste which maybe attracting baboons. This means also that more and more area could be converted into farmlands resulting in loss of the plant dietary food species prompting the baboons to explore the residential areas at MPS. The conversion of forest areas to residential stands and other forms of development results in habitat fragment that greatly impairs the baboon dietary repertoire thereby making them shift to the breaking into houses to explore alternative high calory foods in residential areas. This therefore means that all future development will fragment the baboon habitats causing loss of their dietary diversity and erosion of their fallback foods which also comprise of underground storage organs USO as most of the landscape gets paved up. It is therefore necessary that all developmental projects that require an Environmental Impact Assessment (EIA) be inclusive of the baboon management aspect to minimise the *Baboon-Human Conflict* crisis in the future. A complete revision of the EIA policy needs to be done and to further empower the Environmental Management Agency (EMA) to be able to enforce compliance. The MPS municipality also needs to adopt developmental strategic mitigation strategies that factor in baboon behaviour and ecology, for instance baboon proof bins, waste sorting and management and making sure residents roof their homes with material that can withstand baboon damage to avert costs in the future.

4 CONCLUSION

MPS residents are faced with a crisis that is precipitated by *Baboon-Human Conflict*. A holistic approach that will result in

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the safeguarding of the households from loss of their properties and crops yet managing the ecosystems in a sustainable manner is urgently required. 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 residents to baboons is also necessary to shape a positive view of the baboons in them. The lack of funds to respond to *Baboon-Human Conflict* cases reported by the residents may seriously damage their confidence in both the MPS, the regulatory and government 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 residents, local authorities, regulatory authorities and wildlife for a sustainable peaceful co-existence.

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