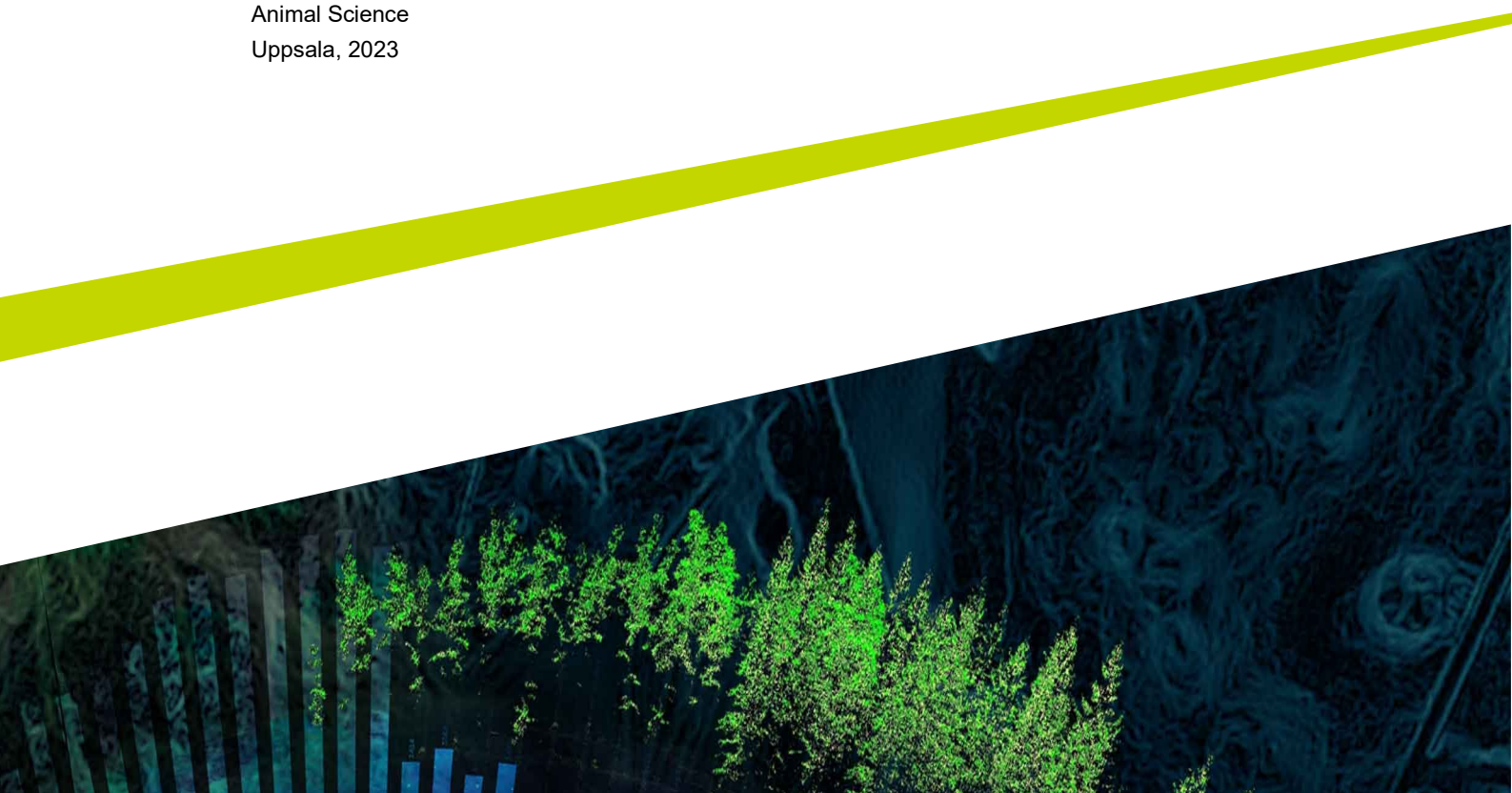# Sustainable management of the African elephant - stakeholder solutions to a human-wildlife conflict

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Sustainable management of the African elephant – stakeholder solutions to a human-wildlife conflict

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Abstract

Densities of African elephants have increased in southern Africa, reaching a population size of 45000 in some protected areas such as Hwange National Park, which is beyond the estimated carrying capacity of 15000. The overpopulation of elephants at Hwange National Park has stimulated considerable debates among stakeholders about the effective and sustainable approach to managing elephants. Thus, sustainable elephant management in Hwange National Park has emerged as a critical issue that requires a multidisciplinary approach. The aim of this thesis is to reveal the primary conflicts of opinion among stakeholders, their underlying causes and achieve a sense of which of the management options, either alone or in combination, might be most acceptable. The objective is to ensure the long-term survival of elephant populations while balancing the needs of both wildlife and human populations. Semi-structured interviews and a questionnaire were used to collect data from different categories of stakeholders. The thematic analysis of interviews and questionnaires highlighted important aspects of the role played or can play in sustainable management of elephants at Hwange National Park such as lobbying for more allocation from CITES, and also give adjacent communities right to derive benefit from these elephants such as equal sharing of meat among stakeholders. Animal rights groups should fund projects such as boreholes for local people. There is also a need for reviewing of wildlife policies so that they suit the current situations. The views of the stakeholders indicate that sustainable management of elephants in Hwange National Park is a complex issue requiring multiple approaches. Researchers, policy makers, community members and other stakeholders must work together to implement effective and sustainable management strategies to ensure the continued survival and wellbeing of elephant populations in the park.

Keywords: Sustainability, hunting, stakeholders, meat, bees, chillies, climate change

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Abbreviations

IFAW	International Fund for Animal Welfare
CITES	Convention of International Trade in Endangered Species
CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
HNP	Hwange National Park

1. Introduction

Densities of African elephants have increased in southern Africa, reaching concentrations of 3/km2 in some protected areas such as Hwange National Park (HNP) (Blanc et al. 2007). The current carrying capacity at HNP for elephants is 15000 yet the current population as of 2014 is around 45000 (Zhongming Z et al., 2018). A consequence of high elephant abundance may be more elephants straying outside of protected areas in search of forage and water. This phenomenon is exacerbated because the fences in HNP that constrained movement have fallen into disrepair resulting in induced human animal conflict, which is detrimental to both human and animal welfare, health, safety and generate economic- and social costs (Ogada et al. 2003). A particular concern is that human-animal conflicts have the potential to cause considerable food insecurity to the affected subsistence farmers through crop damage by elephants (Nyirenda et al. 2018). It can also be detrimental to elephants if they are killed or injured to protect people and crops. The responsibility is on humans, as a species with major influence on global development, to implement sustainable management systems for life on earth, ourselves included (Thulin et al. 2015).

Studies conducted in HNP suggest that managing surface water may offer an appealing elephant management strategy in some places (Owen-Smith et al. 2006; Chamaillé-Jammes et al. 2007). By acting on the number and distribution of suitable water holes (i.e., retaining water during the dry season) through changes in artificial water supply, managers may be able to influence the abundance and distribution of elephants within parks. This, however, requires developing an understanding of the dynamics of elephant distribution inbetween water holes. Moving the animals to other areas and use of contraception has also been proposed as management solutions. However, these methods have been hampered by lack of funds and also a limit on the number of places to which they can be moved (Van Aarde et al. 2007). Before 1995, culling was used to control elephant numbers in HNP and this was achieved by culling families of elephants to keep the populations at carrying capacity. However, due to public opposition about it being inhumane and unnecessary (McNeal, 1998) the international politics of elephant management through the CITES process along with extensive costs, stopped culling in Hwange (Owen-Smith et al. 2006). The problem being faced at HNP is multifaceted. It is

therefore imperative to extract consensus solutions from stakeholders by testing how they feel and think about the situation and potential solutions (cf. Jones, 2000).

The overpopulation of elephants at HNP has stimulated considerable debates among stakeholders about the effective and sustainable approach to manaing elephants in the park. Sustainable elephant management in HNP has emerged as a critical issue that requires a multidisciplinary approach. The preservation of the park's ecological balance and biodiversity, animal welfare and the socio-economic development of communities around the park are all essential factors that need to be considered. Successful management of elephant populations in HNP can serve as an important model for other conservation efforts involving large wildlife species around the world.

1.1 Literature review

The balance of the Hwange ecosystem was deliberately changed by introducing artificial water supplies to increase the number of water-dependent large mammals and make the park more attractive to tourists and thus generate revenue. To date they are 74 solar powered boreholes that provide water in the park. "*Artificial water sources allow more extensive dry season ranging, allowing elephants to use, and potentially overexploit vegetation in areas that would have been otherwise inaccessible to them except in the wet season*" (Loarie et al. 2009). Crop damage outside HNP by elephants occurs every year and hence it is a perennial problem. It is a source of conflict between local communities and wildlife. Elephants are known to wander out of the park in search of food and when they encounter agricultural fields, they can cause significant damage to crops.

The main crops affected by elephant damage include maize, sorghum and cotton, which are the primary subsistence and cash crops of the people living in and around the park. When elephants enter a field, they can devastate an entire plot within a short time, leaving farmers with significant losses that can negatively impact their lives.

The use of bees to keep elephants from straying outside a national park has been tested in a 43-month study in Kenya (King et al, 2017). The results showed that 80% of the 253 approaching elephants were deterred from the protected farms. An additional benefit was that farmers got revenue from selling honey. However, Kline et al. (2020) argues that since farmers usually plant monocultures (mostly maize on their farms, this results in poor health for the bees becuase of the limitations in nutrient sources. The use of chilli peppers has been successfully tested in Tanzania

whereby farmers around Mikumi National Park have been erecting sisal string fences soaked in used engine oil mixed with crushed chilli peppers around ripening crops (Changá, 2016). Fences can also function as a deterrent however, in which they restrict the free movement of elephants and locally increases the pressure on their resources and vegetation (Loarie et al. 2009). The use of wildlife corridors can help to reduce human-elephant conflict and increase connectivity by directing animals through designated safe passage routes (Green et al. 2018). It is therefore imperative to study elephant behaviour prior to corridor creation to serve such a purpose (Lapoint et al. 2013) as no studies have thus far quantified corridor function for elephants from empirical data (Green et al. 2018). In addition, corridor creation needs people to move from their homes. Consequently, they should be compensated, but the repayment is unavailable because the responsible authorities mainly rely on donor funds.

Elephants can be translocated from HNP to private game reserves, but this is very costly. Translocation also results in increased gene flow and can have adverse consequences, such as outbreeding, reduced local adaptation and decreased fitness (Lebas, 2002). In 1992, a large-scale translocation of both families and adult males was performed in Zimbabwe. About 470 elephants were moved from Gonarezhou National Park in Zimbabwe to other parks within the country, and 200 more elephants were translocated to Madikwe Reserve in South Africa (Coetsee, 1996). However, there are no published reports on how these elephants thrived in the new areas (Garai and Carr, 2001), and in general very little post-translocation monitoring of other large-scale translocations of elephants has been published. Reports on the behavior of the elephants after translocation, and on the financial benefits of these exercises, may assist in provision of useful advice to improve future management actions and help decide whether translocations are indeed appropriate and economically sound (Pinter-Wollman, 2012).

Hunting concessions around HNP deals with 500 elephants per year and its mainly for trophy hunting (Ndlovu, 2015). The main reason for the limited quota is that continuous hunting results in the remaining elephants becoming more aggressive (Nelson et al., 2013). Legal ivory trade is currently not allowed by CITES and in Zimbabwe tusks from hunting concessions are stoke-piled. The local communities are also expected to get the meat from hunting expeditions and hence where trophy hunting is well managed, the revenue and employment generated give local people an incentive to suppress poaching and keep animals alive. However, these benefits do not always go to people as intended (Nelson et al., 2013).

The increasing elephant population has led to various ecological, social and economic challenges which include habitat degradation, human-elephant conflict and socio-economic impacts on local communities. Consequently, there is

decreased tolerance towards elephants amongst local communities and inhabited areas around the park. These challenges have spurred considerable research and management interventions in recent years to achieve sustainable management of elephant populations in the park.

Population management has been identified as a key strategy for sustainable elephant management, given the park's carrying capacity. As mentioned above, various population control measures such as culling, translocation and contraception have been considered and further research is required to explore the effectiveness of these measures in HNP.

Community-based conservation has also been identified as a critical strategy for sustainable elephant conservation in HNP. Engaging local communities in conservation activities such as ecotourism and education can foster a sense of ownership and promote sustainable land use practices, mitigating human-elephant conflict and reducing the socio-economic impacts on local people.

Figure 1. Zimbabwe trophy hunting areas (Source: Safari Operators Association of Zimbabwe SOAZ)

1.2 Study location (Hwange National Park, Zimbabwe)

Zimbabwe is a noncoastal country in southern Africa known for its dramatic landscape and diverse wildlife, much of it currently within parks, reserves and safari areas. It has a human population of approximately 15 million (Nyoni and Bonga, 2017). HNP covers 14 600 km2 at the northwest border of Zimbabwe (19°00′ S, 26°30′ E). Vegetation is typical of southern African dystrophic wooded savannas with patches of grassland. Surface water becomes scarce during the dry season, as the river network and most natural pans dry up. In addition to the few natural water holes retaining water throughout the dry season, artificial water holes can maintain water availability year-round through ground water pumping.

Hwange has been managed since 1930, initially with the objective of increasing populations of large herbivores for tourism (Jones, 2000). Activities focused on the development of artificial game water supplies; extensive use of early dry season fire to improve grazing; and the killing of large carnivores to increase the number of herbivores so as to make it more attractive for tourists (Jones, 2023). From the early 1960's, management entered a second phase during which culling was introduced to reduce the impacts of large herbivores on park habitats. Some artificial water supplies were closed to reduce herbivore concentrations. Steps were taken to reclaim degraded landscapes; and the use of fire was reduced. Due to increased surface water availability, the elephant population has increased since the creation of the park and has been controlled through culling up until 1986 (Jones, 2000). Presently, authorities in the southern African country estimate that the number of the elephants stands at slightly more than 100,000 – up from 84,000 in 2014, when the last census was conducted – for an estimated carrying capacity of about 45,000 (Muchinjo, 2021).

Carrying capacity is the margin of the habitat's ability to provide the resources necessary to sustain elephant life. Elephants have an enhanced impact on vegetation dynamics in natural ecosystems worldwide, consequently influencing ecosystem processes (Hobbs 1996) and species diversity and composition (Olff and Ritchie 1998). The intensity and heterogeneity of these effects are determined by a spatiotemporal hierarchy of factors associated with behavioural decisions, from landscape use by elephants to finer-scale intake mechanisms (Bailey et al. 1996). A classic example of spatial heterogeneity in habitat impact by elephants is the development of utilisation gradients around water sources in arid and semi-arid savannas, where grazing intensity (and trampling) increase with a decrease in distance to water. This phenomenon, known as a 'piosphere' effect (Lange, 1969), has implications for nutrient cycling (Turner 1998), vegetation dynamics and

composition (Todd, 2006), animal diversity (James et al., 1999) and feedback to herbivore population dynamics (Derry, 2004). As water is a primary determinant of elephant distribution, it constrains other mechanisms and processes that create heterogeneity at finer scales (Bailey et al. 1996).
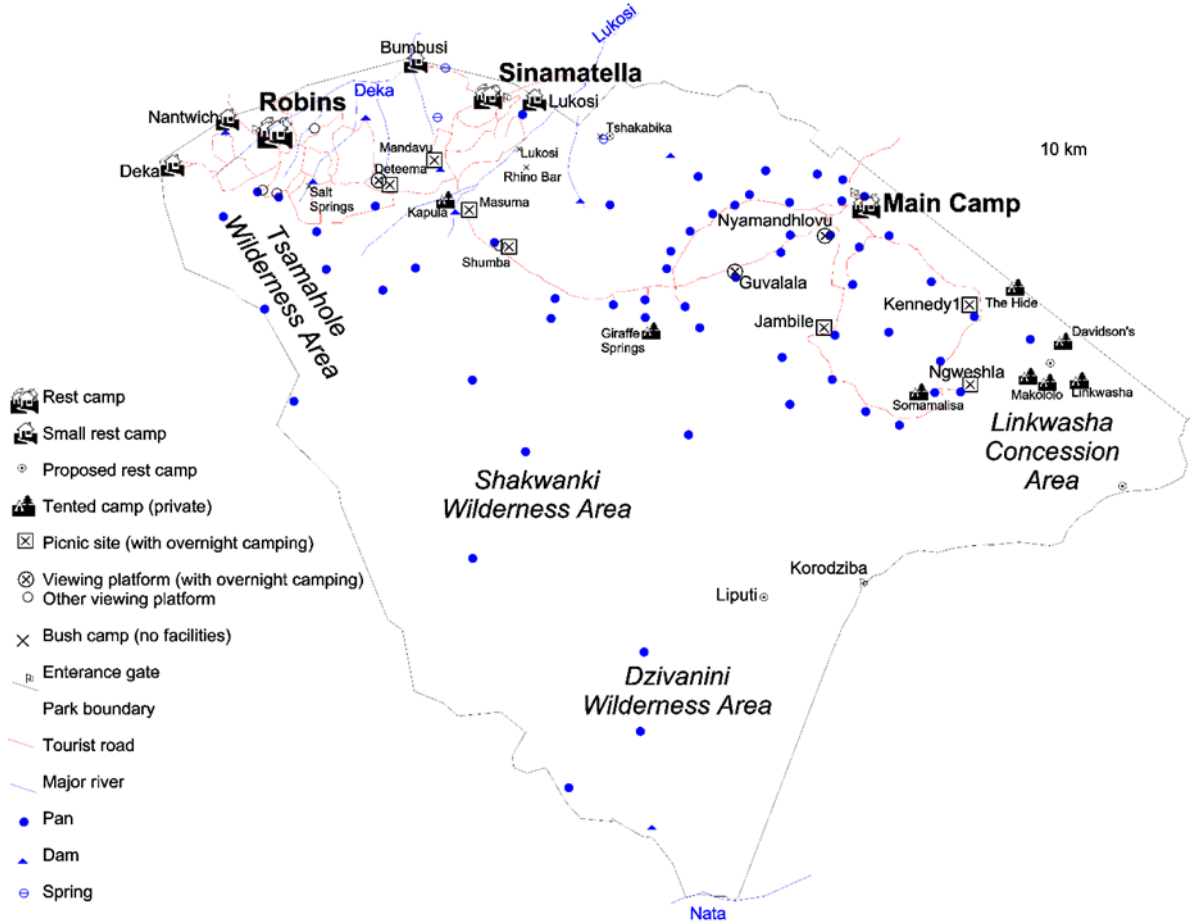
Figure 2. Extent and infrastructure of Hwange National Park (Babakathy)

1.3 Study animal

The African elephant, scientifically known as *Loxodonta Africana*, is the largest land mammal on earth, weighing up to 6000 kg and measuring up to four meters in height.

Figure 2. Photo credit: Sipho Ndlovu

They are slightly larger than Asian elephants and are easily identifiable by having larger ears, longer tusks and longer legs.There are two species of the African elephant i.e., the savanna (*Loxodonta africana*) and forest elephants (Loxodonta cyclotis) (Roca et al. 2001). Savanna elephants are larger and are mainly found in sub-Saharan Africa, while forest elephants are smaller and mainly found in West and Central Africa (Roca et al. 2001). The International Union for the Conservation of Nature (IUCN) lists the savanna elephants as endangered and the forest elephants as critically endangered.

African elephants are keystone species, meaning they play a critical role in their ecosystem. Also known as "ecosystem engineers," elephants shape their habitat in many ways (Bond, 1994). During the dry season, they use their tusks to dig up dry riverbeds and create watering holes as a result other smaller water dependent

animals can also benefit. Their dung is full of seeds and, as a result, they help with seed dispersal and shape the landscape throughout the environment as they move long distances. As elephants move through the forest, they eat trees and shrubs thereby creating pathways for smaller animals to move through. In the savanna, they uproot trees and eat saplings, which helps keep the landscape open for zebras and other plains animals to thrive.

Owen-Smith (1987) has suggested that the extinction of large herbivores (animals above 1000 kg), such as elephants, at the end of the Pleistocene might be the reason there was a collapse of mammalian diversity in the Americas and Europe. Amboseli in Kenya is a current classic example of how biological diversity is affected when elephants are removed from an area (Western, 1989). Due to fewer elephants because of poaching, the basin vegetation is now dominated by one tree species, the yellow-barked acacia, a fast-growing tree forming dense stands over 25 m tall. As a result, woodland groves became so dense that little light penetrated to the understorey, and consequently a few species of light tolerant herbs invaded the woodland floor (Western, 1989).

Elephants are fond of water and enjoy showering by sucking water into their trunks and spraying it all over themselves. Afterwards, they often spray their skin with a protective coating of dust. Their ears radiate heat to help keep these large animals cool, but sometimes the African heat is too much and they need reliable water sources. Hence, availability of abundant water is imperative for the life of an elephant. Consequently, manipulating water availability in a protected area such as in a park can easily be used as an elephant management tool.

Elephants eat roots, grasses, fruit, and bark. An adult elephant can consume up to 150 kg of food in a single day. Hungry specimens may roam great distances while foraging for the large quantities of food that they require to sustain their massive bodies. The roaming elephants are increasingly encountering humans. In search for food, an elephant can destroy an entire season of crops in a single night. Several conservation programs work with farmers to help them protect their crops and provide compensation when an elephant does raid them with strategies mentioned above.

Elephants are social animals and live in family groups led by a matriarchal female who is the oldest and most experienced member of the group. Elephants communicate through vocalizations, such as trumpeting, rumbling and grunting, as well as through body posture and touch.

Elephants die of various natural causes such as old age, diseases, accidents and injuries. However, studies have shown that the leading cause is old age as they

become more susceptible to diseases such as arthritis or joint-problems which can ultimately lead to their death (Whyte et al., 1998). Additionally, older elephants may have a harder time finding food or water in times of drought, leading to malnutrition, dehydration or infections. Elephants usually live up to 60 – 70 years in the wild, and their lifespan can vary based several factors such as their environment, diet, health and human activities such as poaching and habitat loss. They have six sets of teeth, with each set lasting approximately 10 years. As each tooth wears away, the next set moves forward and replaces it, and when they reach old age, their last set falls out making feeding difficult. Additionally, elephants often form strong social bonds and may suffer from depression and stress if they experience the loss of an important member of their family unit.

Figure 4. A herd of elephants drinking at a watering hole. Photo:Varwi Jacob Tavaziva

1.4 Aim and research question

The purpose of this study is to explore management methods that could facilitate a sustainable coexistence between elephants and humans. The intention is to instigate community-based stakeholder participation and have them provide possible solutions as they have direct contact and experience with the elephants.

   The study is based on the following research question: What are the most effective community-based conservation strategies for promoting the sustainable management of elephant populations at HNP? The aim is to uncover the primary conflicts of opinion among stakeholders and their underlying socio-economic and cultural causes. I also assess, either alone or in combination, which of the management options might be most acceptable to the various stakeholders. The ojective is to ensure the long-term survival of elephant populations while balancing the needs of both wildlife and human populations, and ultimately to achieve a healthy and thriving elephant population while promoting socio-economic development and environmental sustainability for local communities and for future generations.

1.5 Assessed solutions

Listed below are the possible solutions tested among the relevant stakeholders;

Adopt Swedish hunting managment

The Swedish hunting system for larger mammals such as moose and brown bear is characterized by a quota system, where a certain number of animals are allowed to be hunted each year, and the use of controlled hunting as a means of population control. Ways in which HNP could potentially use the Swedish hunting system to sustainably manage the elephant population would be to introduce a quota system for elephant hunting in collaboration with local communities. The quota system could be established based on the elephant population size. The quota system would be reviewed regularly and adjusted as needed to ensure sustainable elephant population management in an adaptive manner (Swedish Environmental Protection Agency). Quotas are formulated around reproduction seasons and environmental factors. Also that they dictate sex, age and other factors affecting population health.

Controlled hunting could be another approach to control elephant population. Protective hunting can be used to remove specific individuals that are problematic or causing excessive competition between males and promote a more peaceful social structure that could create a conducive environment for the entire population. The use of revenue from hunting permits could be directed towards conservation efforts and community-based conservation programs, as is done in the Swedish system (Willebrand, 2009). This revenue could be used to fund research projects aimed at enhancing our understanding of elephant behavior and ecology.

The Swedish hunting system can only be successful if it is well-regulated, controlled and integrated into other conservation approaches. Its success will depend on careful planning, effective regulation, and open communication with local communities and stakeholders.

Periodic culling

Culling is a practice done to sustainably control the population size of a species through removal of excess numbers in as humane a fashion as possible and then distributing the resources throughout the community for a positive all around (McNeal, 2012). It is the fastest way to control overpopulation of elephants in protected areas (Njerekai and Mabika, 2016). It is typically carried out by wildlife managers or government officials who determine that a particular animal population needs to be reduced in order to prevent overpopulation or manage conflicts between wildlife and humans. It is generally viewed as a last resort and should only be used when other management options have been exhausted.

Hunting, on the other hand, typically involves individuals or groups targeting specific animals for personal or commercial purposes, such as obtaining meat or

trophies. Hunting is often regulated by governments through licensing and permits and is done in a sustainable way to avoid overexploitation of the species.

The key difference between culling and hunting is the purpose and approach. Culling is a management tool used to control animal populations and mitigate conflicts between wildlife and humans, while hunting is a recreational or commercial activity that is regulated to ensure sustainable use of wildlife resources.

Regulate water supply

The presence of artificial water supply is the reason why the numbers of elephants has increased at HNP. Consequently, manipulating the availability of water will have a significant effect on the population size of elephants. Artificial water supply plays an important role in the management of the elephant population. During the dry season, natural water sources can become scarce, which can cause elephants to migrate long distances in search of water, a process that can be extremely dangerous and stressful for them. Artificial water supply has both negative and positive impacts on the elephant population. On one hand, it has prevented many elephants from dying from dehydration during the dry season. This, in turn, has allowed the elephant population to increase beyond the natural carrying capacity of the ecosystem (Jones, 2023). Consequently, they are more elephants in the park than it can naturally support.

The provision of artificial water boreholes has also allowed for closer monitoring of the elephant population in the park. This monitoring has helped park rangers to track population movements, behaviors and health, which has, in turn, enabled the park to develop more effective conservation and management strategies.

However, the provision of artificial water sources has also led to negative consequences for the elephant population. For example, the concentration of elephant populations around water sources leads to increased competition for resources and increased incidencies of aggression between elephants. Overpopulation of elephants also leads to overuse of particular areas within the park, damaging vegetation, and results in erosion. Moreover, some experts believe that the artificial water supply has contributed to a decline of other wildlife species in the park due to overgrazing.

The ethical consequences of supplying water artificially and then cutting off water without considering the consequences is an unethical intervention that goes against the principles of percieved responsibility, while some may argue that this is necessary to help maintain biodiversity. By removing the water sources, humans are putting the elephants' lives at risk without providing any alternatives. This amounts to inhumane treatment of the animals, who are victims of human

encroachment on their habitat. The removal of artificial water sources can also lead to distrust and hostility towards humans, as elephants may associate humans with the negative consequences of their actions (Szott et al., 2019). This can create long-term consequences for human-elephant coexistence in the area.

Contraception

The use of contraception as a means of population control has been successfully applied to elephants in various conservation areas worldwide. It is a humane approach that avoids culling, and it can help to manage overpopulation in a sustainable manner. One form of contraception that has been successfully used in elephants is immunocontraception, which involves administering a vaccine to females that causes an immune response that prevents fertilisation. This method has been applied in African elephants at Kruger National Park in South Africa (Whyte et al. 1998). It has been found to be effective in reducing birth rates without adverse effects on the elephants.

It should be noted that for contraception to be effective at HNP, there should be a comprehensive database on the population structure and reproductive behavior of elephants. This would be essential to develop effective plans and to track the outcome of contraception programs. Moreover, there would need to be trained personnel who have experience in administering the vaccine and monitoring its impact. It also requires careful planning, effective implementation, monitoring and collaboration between different stakeholders including wildlife managers, conservationists and local communities.

Translocation

Translocation is the process of moving animals from one location to another with the aim of ensuring the long-term survival and sustainability of the species. This approach has been used in many conservation programs as one strategy for managing wildlife populations. Translocation could be a possible means of managing the elephant population at HNP.

Translocation of elephants from the park to other areas in Zimbabwe, or even other countries in southern Africa, could help alleviate the pressure of overpopulation and ensure a sustainable population. In addition, translocation may help to establish new elephant populations in areas where they have been historically absent or endangered.

Translocation programs should be planned carefully and monitored to ensure that the process does not cause harm or undue stress to the animals. Due diligence should be taken beforehand to ensure its success. It would be essential to conduct a thorough assessment of the suitability of the destination site, which could include factors such as habitat, food availability, and social grouping opportunities.

Translocation can be a costly and time-consuming process, and hence might not be the best solution for every scenario. Elephants being very socially attached to their families might suffer being translocated to new groups with unknown individuals, new cultures and even different "languages". However, it could be a valuable strategy when other approaches such as contraceptives, habitat management or controlled hunting are no longer sufficient options.

Translocation could be a potentially effective way of managing elephant population at HNP. Translocation, as part of a larger, integrated approach to elephant management, could help ensure the long-term sustainability of the species in Zimbabwe and beyond.

Combined approach

Integrated sustainable management of elephants at HNP could involve the combined use of the above-mentioned conservation strategies that work together to ensure the long-term survival of the elephant population while also benefiting local communities and the natural environment.

An integrated approach to elephant management requires collaboration and cooperation among various stakeholders such as government agencies, local communities, conservation organisations and wildlife managers. In addition, it requires the multiple conservation strategies working together in a complementary and coordinated way. The use of diverse conservation strategies could ensure that the elephant population is protected, while ensuring that local people benefit through job opportunities and that a conducive ecosystem is maintained.

2. Methodology

2.1 Approach

Semi-structured face-to-face interviews were used to collect qualitiative data from all the stakeholders. The semi-structured format availed both the interviewer and interviewee the ability to focus on relevant subjects and points that came up. As the topics examined could be rather complex and multi-faceted with many different perspectives that may be difficult to fully analyse in a more structured interview formats (Barriball and While, 1994). Voice recorders and notepads were the key data collection instruments for the semi-structured interviews for the key informants.

I also handed out a questionnaire in paper form to further understand local perspective on elephant management, their opinions and, their knowledge about elephants. Most important however was to understand their relationship with the elephant by seeing how they would like to live with and/or manage them. Questionnaires can help to collect more detailed and accurate data in a short amount of time because they can be distributed to many individuals at once. This can help to supplement and enrich the data collected from semi-structured interviews. Questionnaires also cover specific topics that are not necessarily mentioned in interviews or by all interveiwees.

The interviews and questionnaire were aimed at exploring different stakeholder perspectives and aspects of understanding within elephant management for analysis and for future in-depth research. By combining both semi-structured interviews and questionnaires, we can get a comprehensive understanding of the research topic and ensure a more robust and reliable study.

2.2 Interview and questionnaire participants

Local community (Dete)
Local farmers and people live in Dete, a small village of around 3000 people just outside HNP where they have direct contact with elephants. They suffer seasonal

crop losses as elephants eat their produce in the fields. In addition, Zimbabwe, through CAMPFIRE (Communal Areas Management Programme for Indigenous Resources) programs has implemented policies that promote community-based conservation, where local communities are actively involved in protecting elephants. CAMPFIRE programs are community-based conservation efforts that were initially in Zimbabwe in the 1980s. Through community-based conservation, locals can receive revenue sharing benefits from the wildlife in their areas, promoting a sense of ownership and protection. These programs were designed to empower local communities living near wildlife reserves and give them incentives to manage natural resources sustainably. CAMPFIRE programs were based on the idea that by sharing the benefits of wildlife reserves with local communities, people would be incentivized to conserve these natural resources (Frost and Bond, 2007).

Tourism (hunter) managers/guides
Those responsible for organizing hunts and safaris on behalf of clients could be professional hunters or ordinary tourists without hunting licenses. They are involved in creating and implementing ecotourism policies that promote responsible tourism practices in elephant habitats. This involves working with national parks and other wildlife management agencies to ensure that tourism activities do not harm elephant populations. These policies are designed to ensure that tourists behave responsibly, do not interfere with elephant behavior or habitat. They also ensure that tourists are not involved in illegal poaching of elephants.

Wildlife and Parks management
An official governmental organisation that issue hunting licenses and permits. They are also the custodian of all wildlife in Zimbabwe. Consequently, they are responsible for the maintenance and management of HNP.

Village heads
In Zimbabwe rural communities where there are elephants, village heads play a significant role in the conservation and management. They act as a critical link between the community and the government. They act as the custodians of local knowledge and traditions regarding wildlife conservation. Due to their intimate knowledge of the local environment, they can provide essential information on traditional ways of managing and conserving elephants that has been passed down through generations. Village heads are involved in local conservation projects, such as creation of wildlife sanctuaries, installation of beehives and fencing. Lastly, they have another important role of promoting eco-tourism as an alternative source of income for the community. By encouraging the community to participate in eco-tourism activities such as safari rides, game viewing and bird watching.

Consequently, they help to diversify the sources of income for the local community while promoting the conservation of elephants.

Tourists

Important stakeholders as they come and pay to watch or hunt wildlife. Wildlife tourism is an important part of sustainable management of elephant populations. Tourists visiting national parks generate revenue that can be used to support conversation programs and promote the sustainable management and protection of the elephant population.

Researchers

Selected scientific researchers who are involved in wildlife research with particular interest to elephants. Reasearchers conduct studies aimed at understanding the behavior and ecology of the elephant population to inform better management practices. This has been an approach that has been adopted to sustainably manage the elephant population in Zimbabwe.

2.3 Data collection

The questionnaire in the form of yes and no answers, ticking options in boxes and writing out short answers was handed out to the participants (see appendix 1). A more in-depth semi-structured interview with select respondents was conducted after the questionnaire. Respondents were selected due to special knowledge and their proximity and interest to HNP. For the local community and village heads, I asked for permission from the elders of each village before conducting the exercise. A total of 15 local people and one village herdman responded to my interview and questionnaire. I also applied and was granted a research permit by the wildlife and parks management (ZimParks). I managed to interview seven park rangers at HNP main camp. All of them managed to respond to the questionnaire. An active researcher who has vast experience with wildlife management in southern Africa, granted me an interview and was also able to complete my questionnaire. In total, I interviewed three researchers, and responded to the questionnaire, including some who work for ZimParks. I interviewed five workers of three different safari lodges. A total of ten people from three different safari lodges responded to the questionnaire. I also managed to interview five tourists who were staying at the above-mentioned safari lodges. In addition, eight tourists responded to the questionnaire (see Table 1 and 2).

Table 1. Questionnaire respondents

Stakeholder	Number of respondents
Wildlife and Parks management	7
Local community	15
Village headman	1
Tourism managers	10
Researchers	3
Tourists	8

Table 2. Semi-structured interview respondents

Stakeholder	Number of respondents
Wildlife and Parks management	7
Local community	12
Village headman	1
Tourism managers	5
Researchers	3
Tourists	5

2.4 Data analysis

Questionnaire and interview transcripts comprise the primary data in the analysis. At first, the analysis was exploratory to fully understand the material. Exploratory analysis is a method of data analysis used to investigate, summarize and understand the characteristics of the dataset. This analysis was done to identify patterns and trends that maybe present in the data without necessarily making any specific assumptions or hypotheses upfront. A thematic analysis approach was used to analyse the data. Thematic analysis is used as a way of identifying patterns and themes within the dataset (Braun and Clarke, 2006). By using this approach with this dataset, I was able to focus on interesting and relevant findings within the data post-interview. As part of the analytical process, a mind map was created to frame and connect themes brought up in the interviews. This mind map was used to structure and clarify themes and subjects for further analysis (see Figure 5). Yellow represents the assessed solutions, red represents problems being faced whilst black represents the suggested solutions.
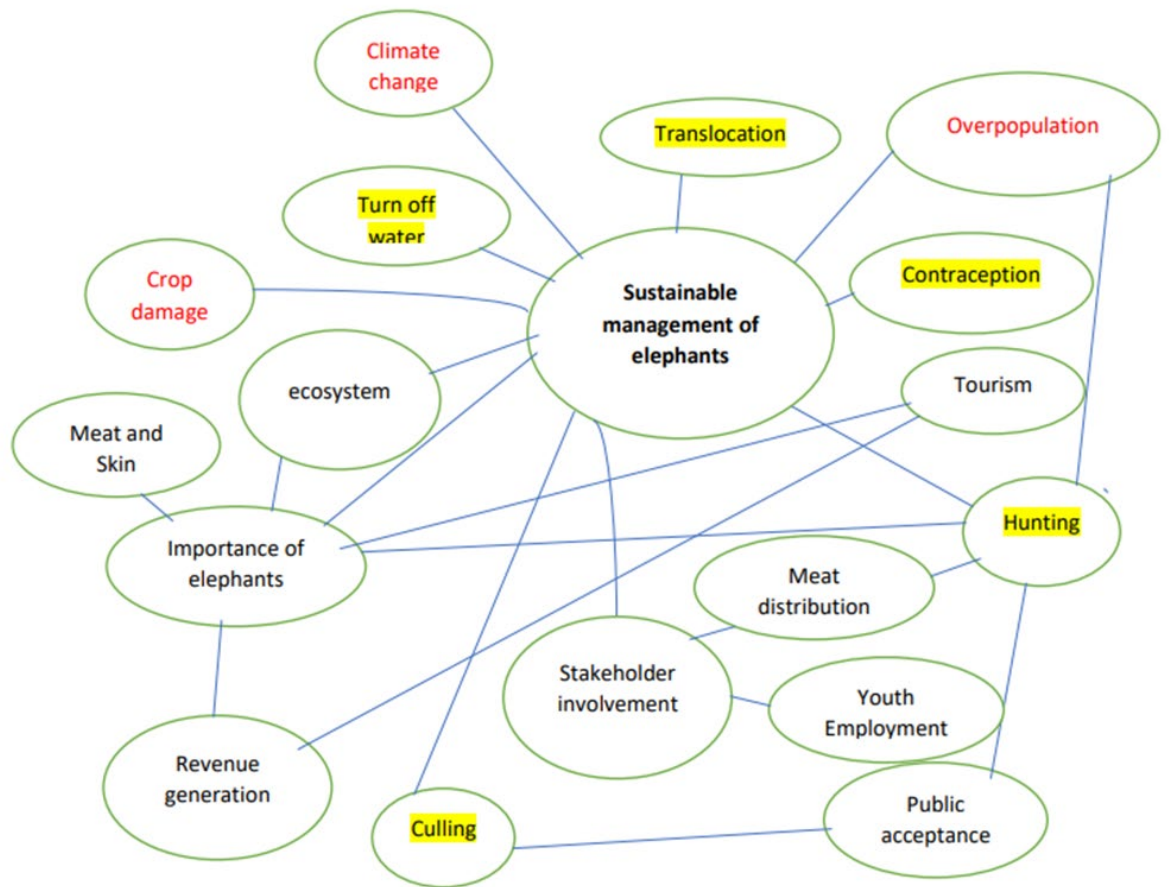
Figure 5. Conceptual map was used to structure and clarify themes and subjects for further analysis. Yellow represents the assessed solutions, red represents problems being faced whilst black represents the suggested solutions.

2.5 Link of study to sustainable development goals (SDGs)

The SDGs are a set of global goals established by the United Nations to promote sustainable development worldwide (https://sdgs.un.org/goals). The sustainable management of elephants in HNP is linked to several of these goals:

Goal 8: Decent work and Economic growth: The sustainable management of elephant populations can create jobs for the local community through conservation and tourism activities. The tourism sector can also generate revenue while also promoting sustainable development.

Goal 12: Responsible Consumption and Production: The sustainable management of elephant population can provide a sustainable source of food for local communities through controlled hunting, thus contributing to responsible consumption and production.

Goal 11: Sustainable Cities and Communities: Sustainable management of elephant populations in HNP can promote harmonious coexistence between wildlife and human populations, creating sustainable and healthy communities.

Goal 13: Climate Action: Effective management of elephant populations can help to mitigate climate change by preserving the natural ecosystem, which stores carbon and reducing human-wildlife conflicts that may occur when elephants are forced to venture outside their habitat.

Goal 15: Life on Land: This goal is aimed at protecting terrestrial ecosystems and biodiversity. The sustainable management of elephant populations is essential to achieve this goal.

It is essential to link conservation efforts to wider development goals and to ensure that the approach is collaborative and socially responsible, that engages local communities in enhancing sustainable development in contributing to sustainable economic growth. Forestalling the increasing human-wildlife conflicts and ensuring harmonious coexistence further guarantees a stable living and conducive environment for communities to thrive.

2.6 Ethical considerations

A verbal agreement was obtained from the Hwange district council before carrying out the study. Expectations, discretion, and anonymity was clarified to all respondents. Prior to the beginning of the data collection, research permission was sought from traditional leaders from the wards visited as well asfrom the rural district council. A research permit was also obtained from the Wildlife and Parks management (ZimParks) as they are responsible for the HNP. Each participant was asked about their consent and was given control over their own data and contribution. Respondents could withdraw their consent at any point and could retract certain statements.

3. Results

The thematic analysis of the interview and questionnaire data highlighted many important aspects of the role played or that can be played by the stakeholders in the sustainable management of elephants at HNP.

3.1 Adaptive hunting management

Local hunting initiatives similar to Swedish hunting could be an option in the sustainable management of elephants at HNP in the following ways:

1. Regulation of hunting: The Swedish hunting system provides strict regulations for hunting, including quotas, hunting seasons and methods and specific hunting areas. Adopting a similar system for HNP can ensure that hunting is done sustainably and responsibly and prevent over-harvesting of elephants. There is need for CITES to adapt the granting of quotas and ensure that they inline with what is actually happening on the ground so as to ensure that there is sustainable management of elephant populations. An example would be to increase the number of animals listed on the quota system.

"They are hunting concessions which are issued out every year under the quota system and 500 elephants are targeted for hunting, this exercise is controlled by CITES. These quotas are mostly used by foreign tourists" Park ranger 1

"The animals killed are used for supplying rations for ZimParks staff. The meat is also supplied to vulnerable communities such as old people in old people's homes. The meat is also used for government functions" Park ranger 2

"Quota system is not effective as it is governed by CITES, only 500 elephants are allowed to be hunted each year and the recommendation is that the allocation should be increased from 500 to at least 1000 elephants each year as there is a 5 % increase of elephant population every year" Researcher 1

2. Promotion of ethical hunting: The Swedish hunting system emphasizes ethical hunting practices, such as fair chase, humane killing methods and respect for the animals being hunted. Promoting such practices in elephant hunting can reduce the risk of animal suffering and ensure that hunting is done with respect for the animal and its role in the ecosystem.

"Killing elephants is inhumane and unethical" Tourist 1

3. Collaboration with local communities and revenue generation: In Sweden, hunting rights are provided to areas where hunting teams operate and hunting is seen as a way to manage wildlife populations in a sustainable way. Adopting a similar approach in HNP, by involving local communities in the management of elephant populations, sharing meat equally and regulating hunting to prevent over-harvesting, can create a sense of cooperation and shared responsibility for the sustainable management of the park. Hunting permits in Sweden are sold at high prices, generating significant revenue for the government and the local communities. This revenue can be used for conservation efforts such as anti-poaching programs and drilling of community boreholes for use by the locals. Consequently, this ensures that sustainable hunting practices contribute to long-term conservation goals. Relevant authorities should ensure that meat is distributed equally amongst all the stakeholders. They should also ensure that local communities derive meaningful benefit from the sale of hunting concessions, for example, as mentioned above, drilling more community boreholes in areas were they live. Improved communication channels between the local community and the ZimParks officials is required to ensure prompt response to problematic animal management. This might help to mitigate elephant-human conflict.

"We are not benefitting anything from these quota systems and asked for the relevant authorities to advocate for them so that they directly benefit from the sale of hunting concessions" Local person 1

"We get meat when there is a problem animal control exercise, however most of the meat is taken by police officers, ZimParks officers and members from the forestry commission" Local person 3

"When elephants stray into our fields from the park, at times the park rangers do not respond promptly and at times they do not come" Local person 4

The Swedish hunting system can provide valuable insights and guidance in the sustainable hunting and management of elephants in HNP. By emphasising regulation, ethics, community involvement and revenue generation. It should however be noted that the Swedish hunting system was introduced as a case study to the respondents by the interviewer.

3.2 Periodic culling

Almost everyone conceded that culling should be re-introduced to sustainably manage the elephant population at HNP. The Park rangers mentioned that there is a 5 % increase of elephant population each year, and this translates to 2500 elephant population increase. and therefore hunting concessions are not enough to reduce the numbers of elephants as only 500 elephants are allowed to be killed through hunting each year. They also mentioned that it has not been scientifically proven that elephants become more aggressive if some members from their herds are killed. CITES should not only consider the numbers of elephants in Africa when determining the numbers that should be kept but rather be country-specific because when looking at Africa as a continent, the number of elephants is decreasing. However, in the case of Zimbabwe as a country, there is an increase in numbers of elephants. Local people were in the favour of culling as this helps to reduce human-elephant conflict. When managed properly, culling can provide a valuable source of revenue for park conservation efforts. With the sale of ivory banned in most countries, revenue can be generated through the sale of meat as well as hunting permits sold to interested parties. The park can involve local communities in the culling process through education outreach. By promoting the benefits of periodic culling for sustainable elephant conservation, the park can help to reduce human-elephant conflict while at the same time providing economic opportunities to the community through the distribution of meat from culled elephants.

”CITES should not only consider the numbers of elephants in Africa when determining the numbers that should be kept but rather be country-specific because when looking at Africa as a continent, the number of elephants is decreasing. However, in the case of Zimbabwe as a country, there is an increase in numbers of elephants.” Researcher 1

“Elephants are a resource which is ever increasing and so should be utilized so as to get proceeds which can improve the livelihoods of people. Resource utilized is worth protecting. There should be lobbying for more allocation from CITES, and also give adjacent communities right to derive benefit from these elephants.” Park ranger 2

“Elephants are eating our crops and therefore their numbers should be reduced through culling” Local person 4

Tourists, tourism managers and other researchers argue that culling of elephants is inhumane and can cause pain and suffering to the animals. When carrying out periodic culling, ethical guidelines must be strictly followed to ensure that the process remains humane and restricts suffering for the animals. Promoting the importance of such guidelines to the local community and visitors, as well as ensuring those who carry out culling or hunting activities receive proper education and training can help to maintain ethical practices and ensure the sustainability of

the activity. However, this method of management must be carefully considered and weighed against alternative methods to ensure it is the most effective, ethical and sustainable approach for elephant conservation in the park.

"Culling should be avoided as it is inhumane and unethical." Tourist 1

"Culling causes unnecessary pain and suffering to the animals." Researcher 2

"Elephants attract tourists from around the world and so culling should be avoided but rather use other control strategies." Tourism manager 4

3.3 Regulate water supply

Reducing elephants' dependence on artificial water, the animals will naturally seek out natural sources of water such as rivers, streams, wild springs and waterholes. This will promote the natural movement of elephants in search of water. Artificial water sources can also sometimes cause overgrazing in specific areas, vegetation can recover and the habitat will have better chances of returning to its natural state. By turning off water sources, nature-based tourism can be promoted, particularly for tourists interested in natural processes and wildlife movement in their natural habitats. This can attract tourists seeking an unplugged safari adventure who are interested in wildlife habitats without additional support systems.

"Turn off some of the boreholes so as to promote trans-boundary movement of elephants to avoid the effects of habitat destruction through overgrazing" Park ranger 3

While turning off artificial water sources can have several positive impacts, there are also potential negative consequences that must be considered. They will be increased competition for natural water sources, elephants will naturally seek out natural sources of water. However, this could lead to increased competition between elephants and other wildlife for naturally occurring water sources. This could result in a situation where other wildlife are pushed out of the area or unable to access water, leading to a decline in biodiversity. Turning off artificial water sources could potentially lead to dehydration and stress for elephants particularly during the dry season when natural water sources may be limited. This can negatively their health and survival.

"Argued that turning off some of the boreholes would disadvantage some of the water dependent animal species as elephants are dominant animals and therefore will occupy the remaining watering holes thereby depriving other animals of water" Park ranger 2

Turning off water sources may affect the potential for nature-based tourism in the park. Tourists expecting to see elephants at artificial water sources may be

disappointed, resulting in decline in tourism revenue and livelihoods supported by tourism.

"Turning off water will negatively impact tourism" Tourism manager 1

3.4 Contraception

All interviewees withheld that it is unclear how the use of contraception can be implemented as it has never been tried before at the park. One of the researchers suggested that it can be experimented upon as this has been tested at Kruger National Park in South Africa. So it can be used successfully then it will help to control.

"At Kruger National Park, they use the vaccine PZP (Porcine Zona Pellucida) which works by stimulating the production of antibodies that prevent sperm from fertilizing the egg, thus preventing pregnancy in elephants" Researcher 1

"The prolonged use of contraceptives could have negative impacts on elephant behaviour and social structures" Researcher 1

Some park rangers suggested that use of contraception is humane and that it will help to regulate the population of elephants.

"The use of contraception can reduce population growth rates and reduce the risks of overgrazing and habitat destruction" Park ranger 3

"It is an expensive exercise considering the number of elephants currently occupying the park, external funding is necessary to carry out such a program" Park ranger 1

"If contraception is successfully used then this might help to reduce human-wildlife conflict" Park ranger 2

3.5 Translocation

According to some park rangers, translocation of elephants is a very expensive exercise and currently they are no funds to carry out such an exercise. The suggested solution was that animal rights groups and other international organizations should help with funding such activities. Trans-boundary movement of elephants is there, and they normally move at night through settlements at night. Researchers suggested that translocation can promote genetic diversity and depopulate HNP, in the process, elephants will occupy new habitats. Local people believe that translocation will reduce human-elephant conflict.

"Translocation of elephants is an expensive exercise, animal rights groups and CITES should help with funding of such activities" Park ranger 4

"Translocation can also help promote genetic diversity to other areas and elephants can also occupy new habitats". Researcher 1

"If elephants are moved to other areas, the incidence of our crops being eaten will reduce" Local person 7

However, some researchers argued that translocation may lead to separation of elephants from their families and that it is a temporary measure, it is more like transferring the problem to other areas.

"Translocated elephants may exhibit changes in behaviour, such as becoming more aggressive due to stress of the process and new environment" Researcher 1

"Translocated elephants may carry infectious diseases that can be transmitted to other animals" Researcher 2

"Separation from families can affect the social hierarchy of the elephants resulting in stress and trauma" Researcher 1

"It is better to deal with the root cause of overpopulation rather than transfer the problem to other areas" Tourism manager 2

3.6 Combined approach

Engaging the local community living near HNP is essential in sustaining elephant management in the park. It aims to encourage local communities to champion elephant conservation while also benefitting from the different programs that promote community-based tourism and other incentives such as bee keeping that can help sustain their living conditions as well as preserve their crops, natural resources and wildlife that surround their area

"The community is encouraged to plant peppers during the growing season so as to deter the elephants from eating their crops. The ZimParks in collaboration with IFAW and local people have an ongoing beehive project to help keep the elephants from straying from the Park's boundary" Park ranger 4

Researcher 1: "There is need to consider contraception, culling and translocation at the same time, this might help in reducing the elephant population" Researcher 1

Most of the youths in Dete are unemployed and they have no source of income, as a result it is easy for them to be lured into illegal activities such as poaching.

Poaching remains one of the biggest challenges faced in HNP. Anti-poaching measures that are proactive can be put in place to minimize the number of poaching incidents that occur in the park. Adopting best practices in the management of parks will go a long way in reducing human-wildlife conflict and also solving the issue of unemployment. In areas with limited natural resources, innovative technologies can be used to monitor wildlife populations and track animal movements. Such as using drones to map the park and monitor anti-poaching activities.

Local person 6: "ZimParks and safari lodges should employ their workers from towns which are surrounding the Park, as this might help in stopping poaching activities" Local person 6

"ZimParks rangers should promptly attend to human-animal conflict" Local person 4

Restoration of habitats negatively impacted by elephants is imperative. Creation of more transfrontiers which encourage migration of elephants might help to regenerate vegetation and restore water sources in the park. This would provide elephants with an improved habitation area that is more sustainable and natural. A transfrontier is a large landscape or ecological network that spans national borders, where wildlife is allowed to move freely between countries (Muntali, 2007).

Park ranger 2: "There is also need to create more trans frontiers, countries such as Angola have low numbers of elephants so as to restore habitat in the park" Park ranger 2

There should be lobbying for more allocation from CITES, and also give adjacent communities right to derive benefit from these elephants. Animal rights groups should fund projects such as boreholes for local people. There is also a need for reviewing of wildlife policies so that they suit the current situations.

"CITES should not only consider the numbers of elephants in Africa when determining the numbers that should be kept but rather be country-specific because when looking at Africa as a continent, the number of elephants is decreasing. However, in the case of Zimbabwe as a country, there is an increase in numbers of elephants." Researcher 1

4. Discussion

4.1 Adaptive hunting management

Sustainable elephant management at HNP requires the involvement and cooperation of different stakeholders including the park management authority, the government, local communities, researchers and hunters. An inclusive management plan that incorporates the Swedish hunting system must consider the following:

a) Consultation with local communities: Local communities must be involved in any decision-making processes that affect their livelihoods and their relationship with elephants. They should be consulted and provided with appropriate information and knowledge about the benefits and challenges of the Swedish hunting system to help them make informed decisions. They should also directly benefit by getting meat, skin for making shoes and handbags.

b) Education and awareness-raising programs: Education programs geared towards informing stakeholders about the Swedish hunting system can be organised. This can include the creation of awareness campaigns that inform all stakeholders, including local communities, about the importance of sustainable elephant management. And the importance of elephants to the community so as to minimise poaching

c) Collaboration with stakeholders: Collaboration between ZimParks, the government, local communities, conservationists, and hunters is essential for the development and implementation of a sustainable elephant management plan. The ideas of hunters who adopt the Swedish hunting system can be combined with those of conservationists to create a more robust and inclusive management plan.

d) Capacity building: Capacity building is necessary for all stakeholders to equip them with the knowledge, skills and resources required to implement the Swedish hunting system adequately. Efforts should be made to provide

training and build capacity among all stakeholders to ensure that the management plan achieves its objectives. There is also a need for routines for handling meat. A future benefit is the potential addition of other species.

e) Transparency and accountability: Clear and reliable reporting mechanisms must be put in place to ensure transparency and accountability in the implementation of the Swedish hunting system. This could include regular progress reports, independent audits, and the involvement of independent experts to ensure compliance with regulations and standards. A difficulty is to avoid bribes.

f) Develop an emergency response plan: Establish an emergency protocol to respond effectively to any aggressive elephant interactions. This would include trained personnel/hunter equipped to deal with the situation and evacuate visitors to safety.

4.2 Periodic culling

The issue of culling elephants in Zimbabwe is highly controversial and the interviewed stakeholders have different views and opinions regarding it.

Proponents of culling elephants such as local people, park management personnel, government argue that it is necessary to control their population in areas with limited resources such as HNP. Culling can also help to minimize human-wildlife conflict and prevent habitat destruction. They claim that elephants consume a large amount of vegetation and their overpopulation can lead to ecological imbalances, affecting other wildlife species and the ecosystem as a whole. Some stakeholders also cite the economic benefits of selling ivory and trophies. It also helps to provide the local people with meat.

On the other hand, opponents such as tourists, tourism managers and some researchers, of culling elephants argue that it is unethical and inhumane, and there are better and more humane ways to manage their populations. They claim that culling can cause immense pain and suffering to the elephants, and it also negatively impacts their social behavior and family dynamics. Furthermore, they contend that it is more effective to use alternative methods such as contraception or translocation to manage population growth.

4.3 Regulate water supply

Turning off artificial water supplies at HNP to manage elephants sustainably is a controversial issue that has generated various opinions and views among the stakeholders involved.

The approach of temporarily turning off artificial water sources in the park aims to manage elephants' population density by limiting their access to water and their mobility within the park. Proponents of this approach, such as park management authorities and conservationists argue that it can help reduce the amount of damage to vegetation and increase the park's carrying capacity for elephants.

However, opponents of the idea suggest it could have negative consequences, particularly for animals' welfare especially during drought periods. Some stakeholders argue that ending the provision of artificial water to elephants could cause immense harm and dehydration can lead to disease and death for the animals. They also argue that the approach could threaten the survival of other species who have to rely on the artificial water sources in the park.

Tourism managers have criticised the idea of turning off artificial water arguing that it is a harmful tactic that would leave elephants in distress or accelerate their migration to other regions where they are likely to face extirpation. They further contend that this approach could negatively impact tourism, an essential source of revenue for the park and local communities.

Further consultative and cooperative management plans need to be devised that take into account scientific evidence as well as local perceptions of the impact of such a move.

4.4 Contraception

The use of contraception generated varying opinions and views among the stakeholders involved.

Those for the approach, such as some researchers and park management authorities, assert that contraception can help regulate elephant population by preventing females from reproducing and increasing the carrying capacity of the park. They also suggest that this is a humane approach to controlling any harm to the animals. It can also reduce human-wildlife conflicts and improve the survival of other wildlife.

Those against the idea, however, suggest that contraception could have unintended consequences on the behavior, health and social dynamics of the

elephant populations. Some stakeholders argue that the use of contraceptives could interfere with the natural behavior of the animals, potentially leading to aggression and social instability within the population. Others are concerned about the possible side effects of the drugs on the elephants' health and well-being.

Some respondents such as researcher 1 have also criticised the idea of using contraceptives, arguing that it could potentially involve invasive and painful procedures for the elephants, and may not address underlying ecological imbalances that contribute to the elephant overpopulation in the park. Park rangers mentioned that it is an expensive exercise which might require external funding.

The use of contraception must take into account the ecological, economical and ethical implications, as well as the opinions and interests of all stakeholders involved.

4.5 Translocation

Proponents of translocation, such as park management authorities, researcher and the local community argue that it could help reduce overpopulation of elephants in the park and prevent environmental degradation and excessive competition or resources. They suggest that translocations could also help to establish new elephants habitats and promote genetic diversity among elephant populations. It will also reduce human-wildlife conflicts.

However, those against the idea, such as researchers, tourists and tourism managers argue that translocations could be stressful and potentially harmful to the elephants, particularly if not properly executed with the best interests of the animals in mind. They also assert that translocations could result in family separations and social and ecological disorientation, among other negative effects.

Some researchers also argue that translocations may only be a temporary solution and that without addressing the root causes of overpopulation, such interventions may need to be repeated indefinitely, thereby, ultimately doing more harm than good.

Any decision to translocate elephants should therefore be grounded in scientific evidence and involve collaboration with all stakeholders and experts to achieve maximum benefits while minimising negative impacts such as costs.

4.6 Combined approach

The integrated sustainable management of elephants in HNP is an approach that brings together various strategies such as artificial water supply management,

contraception, translocation, culling and controlled hunting. This is done to maintain a healthy elephant population while avoiding negative ecological impacts.

Proponents of this approach such as park management authorities, researchers and tourism managers, argue that it offers a comprehensive strategy that can address the complex ecological, social and economic challenges of managing elephant popualtions sustainably. They suggest that by combining different approaches, the negative impacts of each approach can potentially be mitigated while simultaneously producing multiple benefits, such as maintaining ecological balance, promoting tourism and protecting the welfare of wildlife.

Those against the approach, however, argue that it may not be practical or effective in addressing the unique situations that HNP faces concerning elephant overpopulation, human-wildlife conflict and environmental degradation. They are concerned that implementing multiple strategies may be costly and resource-intensive and that the impacts of the different practices may not be thoroughly understood. Other researchers also expressed concerns that integrated management approaches may not put the welfare of the animals first and could potentially harm their physical and mental wellbeing.

Any decision to use integrated management must consider the views of all stakeholders and proactively work to address their concerns while ensuring the well-being of the elephants, balanced environmental impact and the economic development of local communities.

Humans can play many roles in the life of an elephant, both positive and negative. By understanding the potential consequences of our actions, we can work towards ensuring that our interactions with elephants are positive and promote their well-being.

5. Conclusion

Regarding adaptive hunting management, it is imperative for CITES to reconsider how they give out their quota allocations to Zimbabwe. They should not only consider the numbers of elephants in Africa when determining the numbers that should be kept but rather be country-specific because when looking at Africa as a continent, the number of elephants is decreasing. However, in the case of Zimbabwe as a country, there is an increase in numbers of elephants. Consequently, an increase of the quota allocation from 500 to about 2500 elephants would suffice. This can always be revised downwards when the population size has been reduced to manageable levels. The local community should derive more benefit from the sale of hunting concessions, that is, there should be equal sharing of resources such as meat amongst all stakeholders by dealing with corruption. There is also need to protect the habitat where elephants live by allowing controlled culling but this should be done in a manner which does not significantly affect the social structure of elephant herds. Controlled culling might also help to mitigate human-elephant conflict. Even though turning off water might help to regulate the elephants' populations, it is considered as being cruel to elephants as they die painfully and miserably due to dehydration. The closure of artificial waterholes may also impact the local communities, as many individuals rely on the park for tourism and employment opportunities, and the economic value of the park may be considerably affected. Contraception should be also be tested at HNP as it has been successfully tested in South Africa at Kruger National Park. However, external funding for such a program is necessary. Translocation should be done but through use of trans frontiers, i.e. more channels should be created to allow the natural movement of elephants to other protected areas. However, this might prove to be limited by the availability of water at HNP throughout the whole year. A combined approach might help to mitigate the negative effects of each tested solution but is only feasible if the money is available.

Based on the different views of the stakeholders, it is evident that sustainable management of elephants in HNP is a complex issue requiring multiple approaches. Researchers, policy makers, community members and other stakeholders must work together to implement effective and sustainable management strategies to ensure the continued survival and wellbeing of elephant populations in the park.

The available evidence indicates that population management, habitat restoration and community based conservation are essential components of any approach to manage elephant populations sustainably in the park. However, the unique context of HNP requires a context-specific approach that addresses the local challenges and opportunities to optimize the benefits of any management strategy.

To achieve this goal, ongoing research is essential to understand the impacts of individual and combined management tools and ensure that they produce the desired effect while minimizing harm. Future research can focus on identifying the most effective methods of population management, ecological impact and animal welfare from a context-specific and multi-disciplinary perspective. The research could also explore how to optimize habitat restoration and identify innovative ways to ensure community engagement, including socio-economic benefits, to enhance their willingness and capacity to participate in conservation activities.

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6. Popular Science Summary

Hwange National Park (HNP), located in Zimbabwe, is home to more than 40 000 elephants. There is an overpopulation of elephants in HNP as the carrying capacity is 15 000. The overpopulation along with the elephants need for water and extensive amounts of forage, up to 150 kg per day, can drive them to a relentless search for food and water that, in turn, expose them to humans and human interests in the landscape. The management of these elephants is crucial to ensuring their survival and the sustainability of the ecosystem they inhabit. Their management is also important to avoid human-elephant conflict. Here we explore management methods that could facilitate a sustainable coexistence between elephants and humans by inquiries and interviews with community-based stakeholders in the Hwange area with first-hand experience of elephants. The aim is to identify a best practice approach towards sustainable elephant management in general, and Hwange in particular. Participants were found through hunting organizations and the snowballing method. Data collection was qualitative and took place in iterative stages that allowed for a more informed approach to the study area of sustainable elephant management. By combining both semi-structured interviews and questionnaires, we can get a comprehensive understanding of the research topic and facilitate more robust and reliable results. Each of the stakeholders expressed priorities or baselines that affect their opinions of management methods, whether it is economic possibilities, survival/personal provision, or tourism. The thematic analysis of interviews and questionnaires highlighted 1) increased CITES allocation for culling and exploitation, and 2) increased rights for local communities to derive benefits such as meat and tourist exploits. In addition, stakeholders expressed that animal rights groups and conservations should fund projects such as water boreholes for local people.

Acknowledgements

Appendix 1

Questionnaire

1.   Tick a box which describes who you are

Tourist

Conservationist

Wildlife and parks management

Local farmers

Village head

Government official

Tourism manager

Active researcher

Other (please describe): _____

2.   Have you had an encounter with an elephant in and around Hwange National Park?

Yes

No

3.   If yes, how long ago?

0 – 3 months

3 – 6 months

6 – 12 months

>12 months

4.   What do you think about the current population of elephants at Hwange National Park? (Tick box)

Should be maintained

Should be increased

Should be decreased

5.   How do you think the numbers of elephants should be regulated? (an answer box was provided)

6.   On a scale of 1 – 10, with 10 meaning extremely important, how do you rate the importance of elephants to the ecosystem?

7.   On a scale of 1 – 10, with 10 meaning extremely good, how do you view elephants?

8.   What is your age?

15 or younger

16 – 35

36 – 60

61 – 75

76 or older

9.   How experienced are you in elephant management, on scale of 1-10, with 10 meaning extremely experienced

10.   If yes, are the current management methods sustainable?

Yes

No

11.   How can current management be improved (box for answering was provided)

12.   Should hunting of elephants for meat, ivory and skin be allowed?

Yes

No

13.   Give reasons for your answer

14.   Are you benefitting from the presence of elephants in and around Hwange National Park?

Yes

No

15.   If yes or no, explain how (box for answering was provided)

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