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# Protected areas and community costs: A comparative study of cases from Zimbabwe

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**Abstract**
Communities adjacent to protected areas worldwide endure various costs from conservation areas. This study compared livelihood costs from the Mahenye community-conserved area and the Malilangwe private wildlife reserve in south-eastern Zimbabwe to the Mahenye and Chizvirizvi communities respectively. Both quantitative and qualitative approaches were used in undertaking primary research in the case study communities. Among the livelihood costs common to both the Mahenye and Chizvirizvi residents from the two conservation areas included loss of land and curtailed access to traditionally used resources. Additional livelihood costs peculiar to Mahenye residents included the devouring of crops and livestock by wild animals, loss of human life or injury by wildlife and the spreading of wildlife diseases to livestock. With the exception of quelea birds infesting fields of small-grained crops, an electric fence around Malilangwe has eliminated most livelihood costs from the private protected area's wildlife to Chizvirizvi. The identified livelihood costs from the two conservation areas have further been aggravated by lack of compensation to affected households. Measures should be taken to strengthen problem animal control in Mahenye, while both conservation areas should come up with some compensation criteria to cover affected households.

**Keywords:** CAMPFIRE, community-conserved area, livelihood costs, human-wildlife conflict, private-protected area

## 1. Introduction

In spite of the enormous and growing international support for socially just conservation since the second half of the 20th century, the situation on the ground does not reflect much of such support [1, 2, 3]. The effect of national parks and various other protected areas on their human neighbours is arguably the most controversial debate in conservation policy [1, 4].

Many communities continue to endure forced eviction, fear and torture, and lack of access to resources from protected areas [5, 6, 7, 2, 3, 8, 9]. Examples of people who have been forced to relocate from their lands in order to make way for protected areas abound. In Botswana, more than a thousand San were relocated from the Central Kalahari Game Reserve in 1997 to settlements outside the reserve [10]. The Twa people were evicted to make way for the Kahuzi-Biega National Park in eastern Democratic Republic of Congo [11] and now live in squatter camps around the park, with a rise in malnutrition and disease reported [12]. In India, the forest department and the police forcefully dislocated 81 families from the Kolengere tribal settlement in Nagarhole National Park to a new site at the fringes of the park [13].

Protected area personnel have tortured and intimidated people to enforce policies [2, 9, 14]. Ethnic minorities in or near protected areas are especially vulnerable to such tactics, particularly when the enforcers are from a dominant group [2]. Many innocent people in Mozambique, Zambia, Namibia and Botswana have been tortured and/or killed by game guards [15]. Such force or torture may be used during 'negotiations' over protected areas [2]. For example, in 1991 government officials threatened to imprison community leaders if they did not cooperate with a proposal concerning Khunjerab National Park in Pakistan [2, 16].

Access to resources has often been restricted following the creation of most protected areas thereby creating difficulties for people that have relied on such resources for their livelihoods [1, 17, 3, 9, 18]. The establishment of most Tanzanian national parks, for example, has resulted in restriction of access to lands and resources [19], while approximately 23% of land in India had been turned to state parks by 1980 resulting in the loss of land rights by millions of rural resource users [20]. Other policies stop or limit land cultivation, hunting, grazing, and access to migrating wildlife [2, 18]. For example, the creation of Khunjerab National Park in Pakistan eroded traditional rights of the Wakhi to graze domestic animals and hunt wildlife [16], while the creation of Chobe National Park in Botswana blocked the access of the Ts'exa to seasonal migrations of wildlife [21]. While restricted access to resources can be an effective way to protect biodiversity, it can cause immense suffering to affected communities who had always relied on such resources for a livelihood [17, 2, 3]. Measures should therefore be adopted so as to allow for some sustainable use or for the provision of alternative livelihood support mechanisms for affected communities. Compensation for denied access to resources could be in the form of park employment, social services provision, fuelwood plantations, production and marketing assistance for agricultural commodities among other initiatives [22, 23, 24, 25, 26].

Human-wildlife conflicts are also among the challenges faced by communities located close to protected areas. Large-bodied mammals such as large carnivores, ungulates, primates and elephants are particularly prone to conflicts with humans as their expansive home-range needs force them to directly compete with people for limited space and resources [27, 8].

They possess the capacity to cause considerable harm to humans and damage to their property (such as crops and livestock), which may exacerbate the poverty profiles of affected communities [8, 28]. Wildlife may also transmit diseases such as foot and mouth, anthrax and rabies, among others, to livestock and humans, in addition to increasing competition for grazing and costs of foregone opportunities when land is used for wildlife [23]. The above livelihood costs or losses from wildlife are exacerbated by lack of compensation and often lead to the development of negative attitudes towards wildlife and protected areas by affected communities [25].

Human-wildlife conflicts often spur retaliatory killing and/or poaching, which may be major threats to some wildlife species [8, 29]. For example, most of the 265 elephants that died in Assam between 1994 and 2006 were killed by angry villagers in retaliation for destroyed crops using poison-tipped arrows and poison-laced food [22]. Similarly, lions have been killed in the Amboseli-Tsavo ecosystem in Kenya by Maasai pastoralists either in retaliation for livestock killed or in defense of livestock [30]. Other communities around protected areas have resorted to poaching in retaliation for the various inconveniences from wildlife. The above retaliatory activities by communities adjacent to protected areas may lead to massive reductions or even extinctions of affected wildlife populations.

The above scenarios present a strong argument for protected areas to take measures so as to reduce livelihood costs from wildlife to adjacent communities. This will in turn create positive attitudes towards conservation areas by local communities. Local communities adjacent to national parks and protected areas are indeed increasingly perceived as having a substantial role in achieving conservation and sustainability goals [31]. An increasingly popular strategy for reducing human-wildlife conflict has been the erection of fences to separate protected areas from surrounding human populations, even though fencing protected areas to promote conservation has been viewed as a contentious issue [32, 33]. While fencing may be helpful in reducing human-wildlife conflicts, recent studies have shown that fences have ecological costs through the blocking of migration routes and restriction of biodiversity range use which may result in overabundance, inbreeding and isolation [34, 32, 33]. Damage compensation may also be used as a tool with which to distribute the costs between those who benefit from conservation and those who must suffer the costs of damage [22, 25]. Compensation schemes can be arranged in two different types: either as ex-post compensation, where the damage is compensated after it has occurred; or as compensation in advance (ex-ante), where payments are based on an estimation of the expected loss and are received independently from its actual occurrence [25]. Literature evidence indicates that compensation for wildlife damages can be relatively cheap to implement in poverty-stricken areas and is readily accepted by local communities [22].

Zimbabwe is no exception to the above noted livelihood costs to local communities from protected areas. In fact, an increase in such costs to adjacent communities from the country's protected areas has been noted [35, 36], especially after the controversial 'fast track' Land Reform Programme of 2000 which saw some people being allocated, or occupying, land in game safaris and sections of some national parks [36]. For example, 27 people were killed by wild animals in Zimbabwe, whilst 15 others sustained injuries, just in the first quarter of 2015. In addition, 12 elephants, 5 lions and 14 hippo were killed in retaliatory defence during the same time period [37]. It is also worth noting that most protected areas in Zimbabwe were established in the colonial era through the eviction of indigenous local communities who were then relocated to the peripheries of the newly established conservation areas, with resource use in the protected areas strictly prohibited. However, the boundaries of the protected areas were not well secured, leading to constant conflicts between wildlife and nearby communities. The above scenario has attracted the attention of various researchers [35, 36, 38, 39, 40] seeking to provide solutions to human-wildlife conflicts within and around the country's protected areas. However, to date, no previous researchers have compared livelihood costs from different conservation approaches to adjacent communities in Zimbabwe. This study compares the livelihood costs from a community-conserved area (Mahenye) and a private protected area (Malilangwe) in south-eastern Zimbabwe to adjacent communities.

## 2. Methodology

### 2.1 Study Sites

Mahenye ward is located at the southern tip of Chipinge District in Manicaland Province (Figure 1). It is bordered by Gonarezhou National Park to the south-west in Chiredzi District of Masvingo Province. To the east, the ward shares a boundary with a different country, Mozambique. The major livelihood occupation for the residents of Mahenye is subsistence crop and livestock production which, however, is heavily constrained by aridity.

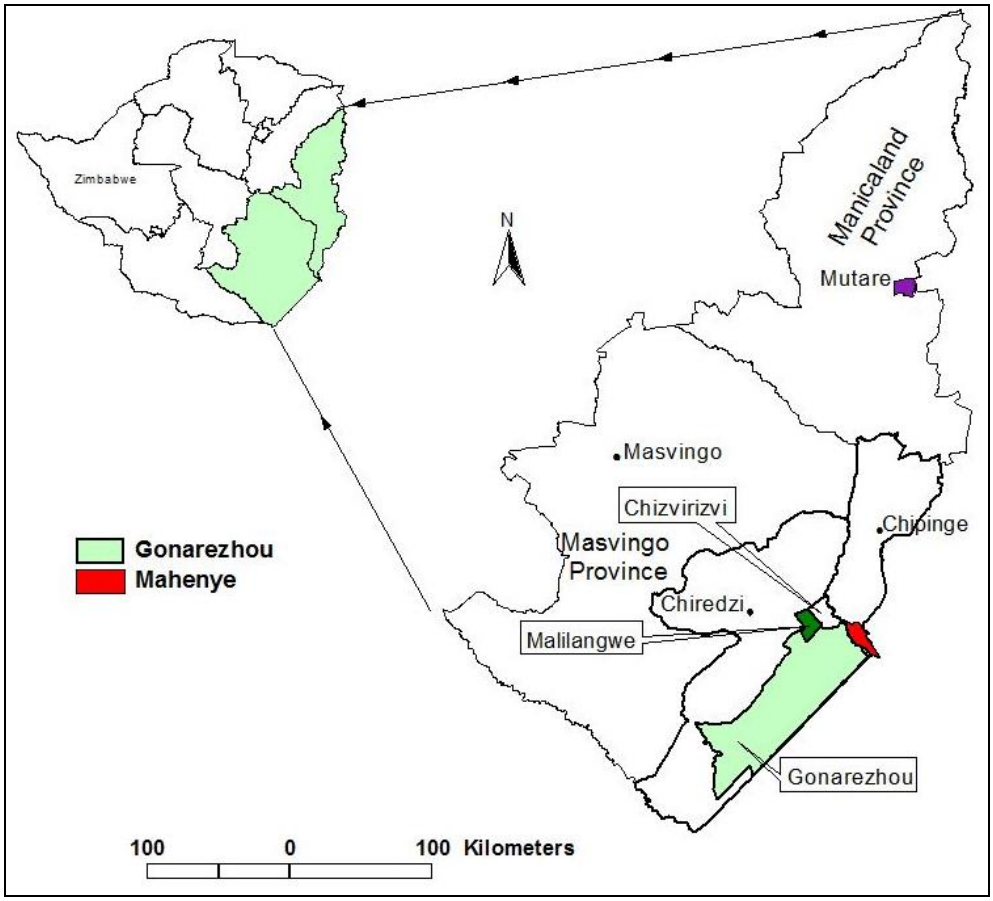


**Fig 1:** Location of Mahenye, Malilangwe and the Chizvirizvi community

Mahenye ward was one of the earliest rural communities to embark on the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), a nationwide community-based natural resources management initiative aimed towards the sustainable utilisation of resources by communities bordering public protected areas in Zimbabwe. CAMPFIRE came as a result of the amendment of the Parks and Wildlife Act of (1975) in 1982, which resulted in the devolution of appropriate authority to manage, and accrue benefits from, wildlife from central government to rural district councils on behalf of local communities hosting the wildlife. The major revenue generating activities in CAMPFIRE areas are photographic and safari hunting. The CAMPFIRE financial model stipulates that rural district councils will hand down 51% of the revenue generated from wildlife activities to the wildlife producing wards and villages, take 15% as levy and retain the other 26% for wildlife management activities. The revenue accruing to local communities from wildlife is crucial in the sense that it makes the people view wildlife not just as a nuisance destroying their crops and livestock but also as a source of revenue.

Malilangwe private wildlife reserve is located in Chiredzi District of Masvingo Province (Figure 1). The wildlife reserve is one of the largest private protected areas in Zimbabwe. It was formed in 1994 by the Malilangwe Trust following the merging of two huge cattle ranches. Persistent droughts in the south-east lowveld in the 1980s saw many large scale commercial farmers shifting from cattle ranging to wildlife production.

Malilangwe's focus is on harmonising conservation activities, commercial eco-tourism and sport hunting, and community development outreach programmes. Immediately to the east of Malilangwe is the Chizvirizvi community. To the south, Malilangwe is bordered by Gonarezhou National Park, the second largest national park in Zimbabwe. The Chizvirizvi community was selected as a case for assessing the livelihood costs of Malilangwe to nearby communities due to its proximity to the private protected area.

### 2.2 Data collection and analysis

Both quantitative (questionnaire) and qualitative (interviews, group discussions and observation) data collection techniques were used in gathering primary data for the study. Mixed methods research or triangulation enables the use of multiple methods in data collection which paves way for collecting credible, reliable and valid data. The questionnaire targeted the residents of Mahenye and those of Chizvirizvi, and solicited information on livelihood costs from the Mahenye community conservation area and Malilangwe private wildlife reserve respectively. Mahenye ward has an approximate household population of 1000 while Chizvirizvi has 300 households. 150 households were selected for questionnaire interview from each of the two communities through simple random sampling.

Various key informants were also interviewed so as to collect in-depth information on livelihood costs from the two

conservation areas. In Mahenye, the key informants included the CAMPFIRE Committee chairperson and committee members, the chief resource monitor, the traditional leadership, the sister in charge at Mahenye Clinic and school heads. In Malilangwe, individuals in management positions were the targets for personal interviews, while in Chizvirizvi the traditional leadership, the Agricultural Research and Extension Officer, the sister in charge at Chizvirizvi Clinic and School heads were interviewed. The key informants were selected through purposive or judgemental sampling.

To obtain further in-depth information on livelihood costs from the conservation areas, a group discussion was held in Mahenye and another in Chizvirizvi. Each of the two group discussions had a total of 10 participants, chosen carefully so as to assure representativeness in terms of gender, age, level of education and socio-economic status.

Observation was also crucial in getting first-hand information on the livelihood costs from the conservation areas to the case study communities. Information was collected as it happened or as it had happened, for example concerning human-wildlife conflicts. Quantitative data was converted into percentage frequencies and tables, while qualitative data was analysed thematically.

## 3. Results and discussion

The study sought to establish the livelihood costs being incurred by the residents of Mahenye and Chizvirizvi from the Mahenye community conserved area and the Malilangwe private wildlife reserve respectively. These are presented and discussed below using the constant comparative approach.

Table 1 summarises livelihood costs to the residents of Mahenye and Chizvirizvi from the two conservation areas. The majority of the questionnaire respondents in Mahenye (54.7%) and Chizvirizvi (98%) indicated that the conservation areas had curtailed their access to resources they had traditionally accessed and used in the past. In addition, 83.3% of the respondents in Mahenye and 70% of the respondents in Chizvirizvi indicated that the conservation areas had led to loss of land and livelihoods. This is in agreement with conservation literature stating that most communities adjacent to conservation areas historically predate the protected areas, have pre-existing rights to resources in them and have often been adversely affected by their designation [31]. As noted earlier, the setting up of most protected areas in Zimbabwe has resulted in the displacement and resettling of the people who originally inhabited these areas [41, 42].

**Table 1:** Costs to the community from living near conservation area (in %): multiple responses

| Conservation costs to community | Mahenye (n=150) | Chizvirizvi (n=150) | Total (n=300) |
|---|---|---|---|
| Curtailed access to traditionally used resources | 54.7 | 98.0 | 76.3 |
| Loss of land and livelihoods | 83.3 | 70.0 | 76.7 |
| Destruction of crops by wildlife | 100 | 30.7 | 65.3 |
| Human harassment by wildlife | 100 | 15.3 | 57.7 |
| Harassment by conservation enforcement agents | 31.3 | - | 15.7 |
| Competition for water and grazing in dry season | 48.0 | - | 24.0 |
| Cannot expand agricultural land | 11.3 | - | 5.7 |

It is important to note that both the Mahenye community-based conservation area and the Malilangwe private wildlife reserve have been established in areas that were once inhabited by people. In the case of Malilangwe, the area now occupied by the private conservation area was once settled by the people who now stay in Chizvirizvi. The people were displaced and resettled during the colonial period in the 1920s and the responses in Table 1 are a clear indication that such memories are still fresh in their minds. One interviewed resident of Chizvirizvi indicated that:

> *The land now occupied by Malilangwe was stolen from our ancestors by colonialists*.

Some respondents further indicated that the soils in Malilangwe private wildlife reserve were slightly more fertile compared to those in Chizvirizvi. This was confirmed in an interview with the Agricultural Research and Extension Officer for the area. However, some respondents said that they were no longer bitter about the lost land as, with the help of Malilangwe, they have been able to get the relatively large pieces of land, averaging 74 hectares each, they now occupy.

In the case of Mahenye, the setting aside of 15 000 hectares of land by the community for the establishment of the wilderness area for use as a safari and photographic hunting concession also represents loss of land and livelihoods and curtailed access to traditionally used resources. In addition, about one hundred people were moved from Ngwachumene Island in the middle of the Save River to the mainland, leaving this prime wildlife habitat free from human occupation. The island is now part of the wilderness area. The people of Mahenye agreed to establish the wilderness area in anticipation of benefiting from conservation activities under the national CAMPFIRE initiative. However, many respondents in Mahenye noted with concern that, since 2000, they were no longer benefitting from the CAMPFIRE programme as much as they used to during the early phases of the community conservation programme. Negative political and economic developments in the country since 2000 have adversely affected the CAMPFIRE programme mainly through reduced tourist arrivals into the country especially from western countries. This has resulted in reduced safari and photographic hunting activities in the community hunting concession.

Residents of Mahenye have small landholdings averaging about 2.3 hectares per household, a situation which has further been exacerbated by the poor fertility of the soils and aridity. With this in mind, it was therefore not surprising when 11.3% of questionnaire respondents in the area indicated that one of the livelihood costs they were incurring from conservation was that they cannot expand their agricultural land. The 15 000 hectares set aside for wildlife conservation could certainly make a huge difference for these people in terms of

access to land. With approximately 1 000 households in Mahenye, each household could add another 15 hectares of arable land to what they already have if the wilderness area were to be divided among the residents. CAMPFIRE should therefore provide enough benefits to offset such huge opportunity costs associated with wildlife conservation such as foregone agricultural production and collection of forest products.

Questionnaire respondents in both Mahenye and Chizvirizvi were asked whether they required access into the protected areas for various resources or activities (Table 2). The responses showed that some people were willing to access Malilangwe and the Mahenye wilderness area for various resources and activities. There were, however, more respondents in Mahenye requiring access into the protected area for various resources and activities than in Chizvirizvi. This was most probably due to the fact that residents of Chizvirizvi had larger landholdings which enabled most people to meet their resource needs than those in Mahenye.

**Table 2:** Whether respondents required access into protected area for various resources/ activities (in %): multiple responses

| Resource/ activity required in conservation area | Mahenye (n=150) | Chizvirizvi (n=150) | Total (n=300) |
|---|---|---|---|
| Livestock grazing | 54.0 | 12.7 | 33.3 |
| Recreation | 83.3 | 82.0 | 82.7 |
| Food gathering | 88.7 | 16.7 | 52.7 |
| Hunting | 58.7 | 16.7 | 37.7 |
| Fishing | 68.7 | 19.3 | 44.0 |
| Cultivation | 26.7 | 12.7 | 19.7 |
| Fuelwood collection | 43.3 | 16.7 | 30.0 |
| Collection of thatching grass | 66.7 | 16.7 | 41.7 |
| Fetching of water | 27.3 | 16.7 | 22.0 |
| Cultural/ social activities | 82.0 | 44.0 | 63.0 |

The responses in Table 2 confirm those in Table 1 where the majority of the questionnaire respondents in both Mahenye and Chizvirizvi had indicated that the setting up of the conservation areas had resulted in loss of land and the curtailment of residents from accessing traditionally used natural resources. The conservation authorities in both conservation areas however indicated that no one was allowed access into the protected areas for any activities, except for recreation in Malilangwe. However, authorities in Malilangwe further indicated that local residents willing to visit the protected area for recreation were treated the same way as any other visitors in terms of access fees, with no special favours.

Questionnaire respondents in Mahenye and Chizvirizvi were further asked whether they sometimes illegally collected resources from the protected areas (Table 3). In Mahenye, 31.3% of the respondents admitted that they sometimes illegally collected resources from the wilderness area. However, most of those who admitted that they sometimes illegally collected resources from the wilderness area indicated that they started doing so as a reaction to dwindling community benefits from the CAMPFIRE project. They further noted that mismanagement of CAMPFIRE-generated funds by most elected CAMPFIRE committees, especially after 2000, was partly to blame for the decline in benefits and, therefore, poaching was, in a way, an expression of their displeasure towards these developments in the community conservation-development project. There were no respondents in Chizvirizvi who indicated that they sometimes illegally collected resources from Malilangwe. The Chizvirizvi residents noted that the security around Malilangwe was too tight to allow them to sneak in and poach for resources.

**Table 3:** Whether respondents sometimes illegally collected resources from protected area (in %)

| Illegal collection of resources in conservation area | Mahenye (n=150) | Chizvirizvi (n=150) | Total (n=300) |
|---|---|---|---|
| Yes | 31.3 | - | 15.7 |
| No | 68.7 | 100 | 84.3 |
| Total | 100 | 100 | 100 |

Interviews with resource monitors for the wilderness area in Mahenye confirmed that poaching increased after 2000 as benefits from CAMPFIRE started to decline. This was further confirmed by other key informants who noted that there was no strong incentive anymore for people not to collect resources from the wilderness area as they were no longer getting any meaningful benefits from the Mahenye CAMPFIRE project. This explains why 31.3% of the respondents in Mahenye indicated that they were being harassed by conservation enforcement agents or resource monitors. This was due to their poaching activities. Asked whether they would report poachers to the conservation authorities, only 34% of questionnaire respondents in Mahenye said yes against 69.3% of the respondents who also said yes in Chizvirizvi. This clearly reflects a decline in the popularity of the CAMPFIRE project among the residents of Mahenye as a result of declining benefits. Appropriate measures need to be taken in Mahenye so as to revive the CAMPFIRE project and its benefits to residents if poaching is to decline to pre-2000 levels.

All questionnaire respondents in Mahenye and 30.7% of the respondents in Chizvirizvi indicated that their crops were frequently destroyed by wild animals from the conservation areas. Various researchers across the world [43, 22, 44] have

identified crop damages by wildlife as one of the main challenges faced by communities living adjacent to protected areas, with elephant raids in Cameroon reported to having destroyed up to 70% of family production [22]. Considering the fact that farming is the main livelihood occupation for the majority of households in the study areas, the destruction of crops by wild animals from the conservation areas represents a major livelihood cost. The situation was worse in Mahenye as there is no fence separating people's fields or homesteads from the wilderness area. In addition, there is also no fence to separate the Mahenye community from the nearby Gonarezhou National Park, the main source of wildlife for ecotourism and sport hunting activities in the Mahenye wilderness area. The main problem animals identified by residents in Mahenye in the destruction of their crops were elephants, monkeys and baboons, bush pigs, bush bucks, hippos and porcupines among other wild animals. Many respondents in Mahenye indicated that sometimes they do not harvest anything from their fields due to the wild animals. One interviewee in Mahenye noted that:

> *We are now farming for elephants. The elephants usually come when our crops are just about to mature. What pains us most is that nothing is being done about it by CAMPFIRE.*

Destruction of crops in Chizvirizvi by wildlife from Malilangwe was not as severe as in Mahenye. This was mainly because the private wildlife reserve has an electric fence around its whole perimeter. The ecologist for Malilangwe indicated that only a few breaks by bull elephants can take place and, due to constant surveillance around the fence, most such breaks are detected and prevented. He, however, further noted that other nearby conservation areas such as Gonarezhou National Park, Chiredzi River Conservancy and Save Valley Conservancy, among others, had no electric fences around them which allows many wild animals to escape and destroy crops in surrounding communities, including Chizvirizvi. Information gathered through interviews and group discussions in Chizvirizvi, however, identified quelea birds (*Quelea quelea*) from Malilangwe as a major threat to small-grained crops such as sorghum, millet and rapoko. This was also confirmed by the ecologist for Malilangwe who indicated that the private conservancy provided excellent habitat for approximately 400 bird species including quelea birds. Small grains are favoured by the farmers in Chizvirizvi as they are more resistant to drought compared to large-grained crops such as maize. Unfortunately, the small grains are also a favourite for birds. As indicated earlier, aridity is one of the major challenges to farming in the area. The destruction of crops by birds and other wild animals can significantly reduce already low yields thereby exacerbating poverty and food insecurity among the affected households. One group discussant in Chizvirizvi lamented that:

> *I was supposed to harvest at least 5 bags of sorghum from my crop last year but I only managed to get 3 bags due to quelea birds.*

With as much as 40% of the harvest being lost to quelea birds, the above scenario highlights the magnitude of the crop losses being incurred by the residents of Chizvirizvi due to the bird infestations from Malilangwe. This has important implications on people's livelihoods as farming is their main economic activity and survival strategy. Also, the destruction of crops by wildlife may cultivate negative attitudes towards biodiversity conservation among the adjacent communities.

Interviewees in Mahenye indicated that residents were not receiving any compensation from CAMPFIRE for crop damages by wild animals. An interview with the CAMPFIRE chairperson indicated that the community had not yet come up with a comprehensive compensation policy for damages incurred by residents from wildlife. While problem animal control was being conducted in the area, it was not effective due to several reasons. The Chief Resource Monitor indicated that there were currently only 4 resource monitors against a recommended total of 12. In addition, the resource monitors were poorly equipped for them to effectively confront and deter problem wild animals such as elephants and lions. Responsibility for the payment of resource monitors has also persistently remained a grey area in the Mahenye CAMPFIRE project. While Chipinge Rural District Council, as the appropriate authority for wildlife management in the district, retains 26% of gross CAMPFIRE hunting revenue for the management of wildlife in Mahenye, the money is not being used for its intended purpose. The Mahenye community is currently paying for problem animal control from its own CAMPFIRE revenues. Respondents of Chizvirizvi also noted that they were not receiving any compensation from Malilangwe private wildlife reserve for crop losses incurred due to quelea birds.

Competition for water and grazing, especially in the dry season, was also identified as another livelihood cost by 48% of questionnaire respondents in Mahenye. It is worth noting that, besides subsistence crop production, pastoralism is also a major livelihood occupation for Mahenye residents. The people of Mahenye were traditionally nomadic pastoralists, whose way of life was affected by the advent of colonialism [45]. The constant mixing of livestock with wild animals poses another livelihood threat to Mahenye residents - disease transmission to livestock. Interviews with residents revealed that there were some suspected cases of foot and mouth in the area in 2012 which were reported to the Veterinary Department. Other diseases that can potentially be transmitted from wildlife to livestock in the area include anthrax and rabies. The transmission of diseases from wildlife to livestock has been recognised as a major challenge for communities living adjacent to conservation areas [23, 8]. Such diseases have the potential to inflict huge livelihood loses to livestock-dependent rural households through direct mortality, reduced productivity or reduced marketing opportunities [46]. Some of the diseases can also potentially be transmitted to humans, especially through consumption of flesh from infected livestock. Wildlife has been confirmed as a source of major emerging pandemics such as H5N1 or SARS during the last decades, and communities living adjacent to conservation areas are therefore particularly at risk of infection from emerging pathogens [46].

Wild animals such as lions, leopards, crocodiles and hyenas

were also reported to having attacked livestock in Mahenye. Studies from across the world have identified predation on livestock by wildlife as a major livelihood concern for communities living at the periphery of protected areas [30]. For example, studies in eastern and southern Africa revealed that annual losses due to livestock predation ranged from 1% to 25% of potential revenue [22]. Stock losses to carnivores can be particularly damaging on communal lands where livestock production is an important economic activity [30, 28]. There were no reports of disease transmission from wild animals to livestock or humans, or attacks of livestock by wild animals in Chizvirizvi. However, the ecologist at Malilangwe noted that there had been several outbreaks of wildlife diseases in the conservation area, particularly anthrax. These disease outbreaks were, however, being prevented from spreading to surrounding communities from the private protected area due to the electric fence.

In addition to the destruction of crops by wildlife, all questionnaire respondents in Mahenye and 15.3% of the respondents in Chizvirizvi indicated that wildlife was also threatening people in these areas. An interview with the Chief Resource Monitor for the Mahenye CAMPFIRE project revealed that at least eight people had been killed by wildlife since the start of the CAMPFIRE project in 1990, while several others had sustained some injuries. Animals that constantly attacked people included elephants, crocodiles and snakes. A woman working in her field was attacked and killed by an elephant on 22 September 2012 living her three months old baby unattended for hours until police arrived at the scene. Literature on human-wildlife conflicts identifies attacks on humans by wildlife as a major concern worldwide. For example, human deaths due to confrontations with elephants rose to 300 between 2000 and 2004 and to 605 between 1994 and 2006 in the Indian states of Jharkhand and Assam, respectively [22]. When a person is injured by a wild animal, CAMPFIRE gives US$40 as clinical assistance for the treatment of the person at the local clinic. However, as indicated by the sister-in-charge at Mahenye clinic, the clinic has limited capacity to attend to serious cases of animal attack. If the injury is critical, CAMPFIRE additionally provides transport or pays for transport costs for the injured person to be transported to hospitals in nearby towns. When a person is killed by a wild animal, CAMPFIRE only assists with funeral expenses. There is thus no compensation for the injury or death of a person from wildlife. The injury or death of persons due to attacks by wild animals can have significant livelihood impacts for affected households, especially where the affected person was the main livelihood provider for the household. No reports confirmed any wildlife-related deaths or injuries in Chizvirizvi. However, interviews with some school authorities in Chizvirizvi indicated that some children who stayed far from school often absconded or arrived late due to fear of attacks by wild animals that would have been spotted in the community.

Another livelihood cost that was indicated by residents in both Mahenye and Chizvirizvi involved foregone development assistance from various agencies operating in nearby areas. Respondents in both Mahenye and Chizvirizvi noted that, very often, they were side-lined by other rural development organisations which argued that these communities were already getting enough development assistance from CAMPFIRE and Malilangwe respectively. Yet, as the residents in the two study areas put it, they were not getting as much conservation-related livelihood benefits to warrant exclusion from benefitting from other development initiatives. One respondent in Mahenye noted that in this case,

> *CAMPFIRE has now become a curse rather than a blessing by alienating our community from other development agencies.*

## 4. Conclusion and Implications

The study has shown that the Mahenye community conservation initiative and the Malilangwe private wildlife reserve have brought various livelihood costs to the Mahenye and Chizvirizvi communities respectively. Among the livelihood costs include loss of land and livelihoods, failure to expand agricultural land, destruction of crops and livestock by wildlife, human threats by wildlife (including deaths) and a heightened risk of the spread of wildlife diseases to livestock. The two communities also lamented that they were occasionally side-lined by various rural development agencies who perceive them to be receiving conservation-related livelihood benefits. There were more livelihood costs from conservation among the Mahenye residents compared to those in Chizvirizvi. This can be attributed to the electric fence around Malilangwe which has almost eliminated interaction between wildlife and adjacent communities, with the exception of quelea bird infestations on small-grained crop fields. In addition, residents of Chizvirizvi have access to large landholdings which they acquired with some help from Malilangwe. The livelihood costs from the conservation areas have further been exacerbated by lack of compensation. The conservation areas therefore need to come up with measures so as to reduce the livelihood costs being incurred by the local residents.

Destruction of crops and livestock and human harassment by wildlife from the Mahenye community conservation area, which has been worsened by weak problem animal control, could be solved by improving problem animal control so as to deter and scare away wild animals from fields, livestock grazing areas or homesteads. The 26% of gross CAMPFIRE hunting income being retained by Chipinge Rural District Council as wildlife management levy should be released to the Mahenye community for use in problem animal control. The money could be used for buying guns and ammunition, communication devices and uniforms for resource monitors, in addition to increasing the numbers of the resource monitors. This is because wildlife management happens at the local community level where the animals interact daily with the people and therefore there is no reason why Chipinge Rural District Council should hold on to these funds. Alternatively, the wildlife management levy could be used to erect a fence so as to separate the homesteads, livestock grazing areas and fields of Mahenye residents from the safari and photographic hunting concession. This would significantly reduce interaction between people and wildlife, thereby eliminating most of the above noted livelihood costs from wildlife, in addition to making wildlife monitoring by the resource monitors easier and more efficient.

The infestation of small-grained crops by quelea birds was identified as one of the main livelihood costs from Malilangwe to Chizvirizvi residents. Malilangwe could solve this problem by promoting the growing of small-grain crop varieties that are not eaten by birds. The existence of such varieties was confirmed in an interview with the Agricultural Research and Extension Officer for the area and includes NS5511, Smile and Red Swazi varieties for sorghum.

With improved problem animal control in Mahenye, the need to compensate villagers for losses incurred from wildlife damages would greatly be reduced. However, where and when such losses occur there should be prompt compensation so as to cushion affected households. This entails that both Malilangwe and the Mahenye CAMPFIRE project should come up with comprehensive compensation policies covering various categories of loss ranging from crop damage, devouring of livestock by wildlife, injuries and deaths of people from wild animal attacks among other losses. There might be need for conservation areas to put identification marks on their wildlife so as to make it easy in assigning compensation responsibilities as problem animals would now be traceable to specific conservation areas. This would be particularly important in Chizvirizvi where, while Malilangwe is the closest conservation area to the community, most, if not all, of the wild animals seen in the area are not from Malilangwe but come from other nearby conservation areas such as Save Valley Conservancy, Chiredzi River Conservancy and Gonarezhou National Park with no electric fences to prevent the escape of wild animals.

The possibility for the spread of diseases from wildlife to livestock from the Mahenye wilderness area and Malilangwe has been found to be very real in both Mahenye and Chizvirizvi, respectively. The study has shown that, while wildlife rarely escapes from Malilangwe due to the electric fence, the wildlife in the conservation area occasionally experiences disease outbreaks. In the event of breaks by infected wild animals from Malilangwe, the spread of diseases to the livestock in Chizvirizvi and other surrounding communities is thus highly probable. There were also two suspected cases of foot and mouth in Mahenye in 2012. With assistance from the Veterinary Department, the conservation areas could take some preventative measures so as to effectively stop the possible spread of wildlife diseases by funding the vaccination of livestock in communities closest to them against the endemic wildlife diseases in these areas. In addition, the conservation areas could facilitate the setting up of livestock dipping facilities within adjacent communities so as to eliminate vectors responsible for the spread of wildlife diseases to livestock.

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