

Chapter

Towards Sustainable Community Conservation in Tropical Savanna Landscapes: A Management Intervention Framework for Ecotourism Projects in a Changing Global Climate

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Abstract

Community-based conservation embedded in the Communal Areas Management Programme for Indigenous Resources, as exemplified by the Mahenye ecotourism project, faces numerous challenges due to climate change. It, therefore, becomes imperative to adopt community-based conservation models for the changing global climatic dynamics. The specific objectives of the research were to do the following: (i) identify the shocks emanating from climate change at Mahenye ecotourism project, (ii) indicate adaptations to make the ecotourism model at Mahenye more resilient in the face of shocks emanating from climate change, and (iii) develop a management intervention framework for ecotourism projects in a changing global climate. We approached the research from a qualitative perspective. The shocks emanating from climate change at the Mahenye ecotourism project included a shortage of water and forage for wild animals during drought years, flood-induced damage of buildings and roads due to increased incidence and severity of tropical cyclones, reduced bioclimatic comfort due to temperature rises, and increased theft of flora and fauna due to climate change-related socio-economic deprivation. The adaptations include recalibrating variables ranging from amenities, income streams, marketing, and linkages. The research results could inform environmental planners on strategies for ensuring the sustainability of community ecotourism in a changing climate.

Keywords: adaptations, climate change, community-based conservation, ecotourism, sustainability

1. Introduction

Tropical savanna landscapes in Sub-Saharan Africa are endowed with enormous biological and cultural diversity, however, this endowment is under increasing ecological and social challenges as exemplified by the case of the Mahenye community ecotourism project, southeast Zimbabwe [1]. The Mahenye community

ecotourism project is facing innumerable challenges ranging from climate change, increasing resource demands, gender imbalances, cultural changes, socio-economic decay, global uncertainties, and health shocks such as the coronavirus (COVID-19) pandemic [1–5]. Community ecotourism is a subtype of Community Based Natural Resources Management (CBNRM) and involves having fun while supporting the protection of natural and cultural resources. It also involves maintaining a low visitor impact and providing the local community with socio-economic benefits [6]. The community ecotourism industry in Sub-Saharan Africa tropical savanna landscapes is mostly nature-based, with wildlife and other natural and cultural attractions being fundamental to its development. Community ecotourism is embedded in the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in Zimbabwe and has the potential to significantly contribute to local community development and environmental sustainability [7].

Global climate change presents an extensive existential shock to the resources upon which community ecotourism relies on to thrive in tropical savanna landscapes [8–11]. Global climate change is epitomized by increasing incidences of droughts, heatwaves, tropical cyclones, and floods as well as changing weather patterns. Some of these extreme weather events that are characteristic of climate change have a negative effect on the bioclimatic comfort of ecotourists. Further, climate variability and change pose significant threats to the biophysical environment, which in turn undermines the ecological capability to ensure sustainable wildlife survival in the form of flora and fauna [12]). This is fundamental as wildlife is the drawcard of the ecotourism economy in the African tropical savannas. Climate change also leads to socio-economic deprivation as agricultural yields fall leading to increasing overexploitation of natural resources upon which ecotourism relies [5].

Lindsey et al. [13] highlighted systemic flaws in current conservation models in Africa in the face of COVID-19 pandemic and socio-economic shocks and suggested opportunities to restructure for greater resilience. It is therefore imperative to adopt community-based conservation models to make them more robust and resilient in the face of global climate change. A research gap also exists as few research has been done on the shocks emanating from climate change and possible adaptations to the stresses at CAMPFIRE projects across Zimbabwe. The specific objectives of the research were to: (i) identify shocks emanating from climate change at the Mahenye community ecotourism project, (ii) indicate adaptations to make the ecotourism model at Mahenye more resilient in the face of shocks emanating from climate change, and (iii) develop a management intervention framework for community-based ecotourism ventures in a changing global climate.

2. Methods

2.1 Study area

The Mahenye community ecotourism project is situated in Chipinge District (**Figure 1**), in the remote but biologically and culturally diverse southeast boundary area of Zimbabwe with Mozambique. Mahenye Ward had a total population of 3671 and the number of households was 707 in 2012 [14]. Mahenye is the land of the Shangaan people, also known as the Tsonga or Hlengwe [15]. The tradition and culture of the Mahenye community have remained strong as the Shangaan are ethnically discrete within the Chipinge District. All the other wards of Chipinge District comprise primarily Shona-speaking Ndau peoples [2]. Thus, Mahenye is characterized by discreteness and isolation.

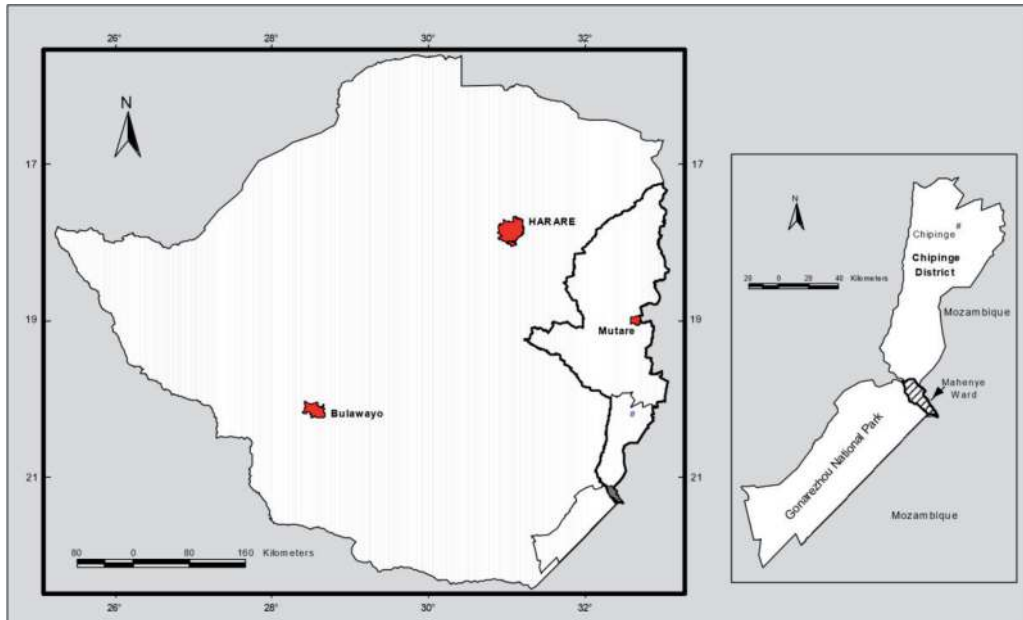


Figure 1.
Location of Mahenye in Southeast Zimbabwe (Source: Authors).

The Mahenye ecotourism is a community-based project initiated in 1982 to promote both biophysical conservation and socio-economic development in the Ward. The ecotourism project is owned by the whole Mahenye community and its secretariat is under the Jamanda Community Conservancy and Trust, whose office bearers are elected by the community. The Mahenye ecotourism project started as a community-driven initiative in partnership with the then Department of National Parks and Wildlife Management, now Zimbabwe Parks and Wildlife Management Authority in 1982 thereby making it the birthplace of CBNRM programmes in Sub-Saharan Africa. This arrangement was officially endorsed when the central government granted appropriate authority over wildlife to Chipinge Rural District Council in 1991 [2]. The Mahenye ecotourism project receives substantial donor funding, however from the year 2003 to 2015 some donor fatigue was experienced. Currently, the Mahenye ecotourism is a community private partnership between the community and a business corporate, River Lodges of Africa which runs Chilo Lodge for the purpose of accommodating visitors to the Ward [16]. River Lodges of Africa has a lease agreement with the Mahenye community and it makes direct financial payments to the Jamanda Community Conservancy and Trust.

The Mahenye community ecotourism project was chosen as it served as one of the early models for the development of the CAMPFIRE in Zimbabwe and the Community Based Natural Resource Management (CBNRM) approach in Sub-Saharan Africa [2, 17], and has been able to remain resilient in the face of significant challenges throughout its operational phase [1]. Mahenye is also within the Great Limpopo Transfrontier Conservation Area (GLTFCA). The Transfrontier Conservation Areas (TFCAs) initiatives seek to promote and facilitate regional peace, tourism, biophysical conservation, cooperation, and socio-economic development in Southern Africa [18, 19].

Mahenye is characterized by teeming tropical savanna biogeography. The average monthly maximum temperatures are 25.9°C in July and 36°C in January. The average monthly minimum temperatures range between 9°C in June and 24°C in January [20]. The annual average rainfall is low ranging between 400

and 600 mm and supports little rain-fed crop farming, thus making ecotourism an important non-agricultural source of livelihood [2]. A wide variety of animal species are also found at Mahenye including the African elephant (*Loxodonta africana*), leopard (*Panthera pardus*), buffalo (*Syncerus caffer*), giraffe (*Giraffa camelopardalis*), zebra (*Equus quagga*), hippopotamus (*Hippopotamus amphibius*), wildebeest (*Connochaetes taurinus*) and kudu (*Tragelaphus strepsiceros*). Mahenye is also mainly covered by mixed mopane (*Colophospermum mopane*) and combretum (*Combretum*) woodland but a dense riverine forest is found along the Save River supporting a broad range of floral, fish, and avian species [2].

The main ecotourism activities or products at Mahenye are both consumptive such as trophy hunting and fishing and non-consumptive comprising game drives, a photographic safari, birdwatching and identification, canoeing, village tours, scenic views for example, at Chivilila Falls along the Save River and lodges [21]. The other main economic activities in the study area are crop farming and livestock husbandry. There is also community gardening, marketing crafts to ecotourists, and selling traditional beer brewed from Ilala palms (*Hypheneae petersiana*). Other local residents are also involved in low-paying jobs at the Chilo Lodge which houses ecotourists. Some local residents have also been trained as natural resource monitors and game scouts. Further, some local residents also perform traditional dances to ecotourists at cultural festivals [21].

2.2 Data collection and analysis

The research was approached from a qualitative perspective basing the study on data mining and key informant interviews using cellphone calls, e-mailing, and social media platforms. The study was also based on field observations undertaken in May 2019 and the researcher's prior knowledge about Mahenye having carried out research in the area from 2008 to the present. The study also used the case-study approach.

Key information was sought from an environmental management professional at the Environmental Management Agency (EMA) headquarters in Harare, hereafter referred to as Expert 1. A key informant interview was carried out with a senior official at the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), hereafter referred to as Key Informant 1. Other key informant interviews were carried with officials at the Zimbabwe Tourism Authority (ZTA) in Harare and Chipinge Rural District Council (RDC), hereafter referred to as Key Informant 2 and Key Informant 3. Further, key informant interviews were carried with 3 key informants with experience in the Mahenye community ecotourism project, hereafter referred to as Key Informant 4, Key Informant 5, and Key Informant 6. These 3 key informants are residents of Mahenye Ward and have experience in working for the community-based ecotourism project as CAMPFIRE committee members and employees of the Jamanda Community Conservancy. The research engaged 7 key informants as qualitative aspects work with saturation. Engaging more research participants from Mahenye was also problematic given poor access to virtual technologies in the remote community. The key informant interviews were conducted virtually between June and December 2020. The interviews were carried out virtually due to human movement restrictions and social distancing requirements being used as COVID-19 health containment measures. The respondents were informed of the academic purposes of the study and gave their informed consent to participate.

A combination of content and thematic analysis was used to sort the large volumes of collected data into focused and meaningful information for the purpose of addressing the research objectives [22–24]. Data analysis also included identifying

and documenting the shocks emanating from climate change at the Mahenye community ecotourism project. The adaptations that can make the ecotourism model at Mahenye more resilient in the face of climate change were determined from the author's field experiences, strategies mentioned in the academic documents, and from key informants. The information obtained from data analysis and authors' field experiences was then used to develop the management intervention framework for community-based ecotourism ventures in a changing global climate. The management intervention framework was adapted from the Sustainable Livelihoods Approach (SLA) [25, 26]. The SLA has been successfully used to understand and promote sustainable rural development [27]. The SLA is a diagnostic tool that provides a framework for understanding and improving the sustainability of livelihood in the face of biophysical, socio-economic, and health shocks.

3. Results and discussion

3.1 Shocks emanating from climate change at the Mahenye community ecotourism project

The shocks emanating from climate change at the Mahenye community ecotourism project were found to be a shortage of water and forage for the wild animals during drought years, flood-induced damage of buildings and roads due to increased occurrence and severity of tropical cyclones, reduced bioclimatic comfort due to temperature rises and increased theft of flora and fauna due to climate change-related socio-economic deprivation.

3.1.1 Shortage of water and forage for the wild animals during drought years

Climate change has resulted in increased incidences of drought leading to shortages of water and forage for the wild animals at Mahenye. According to Key Informant 4 drought negatively impact the survival of wild animals and vegetation upon which community ecotourism relies on. This is worsened by the challenges encountered in pumping underground water for the wild animals such as fuel shortages and poorly serviced pumps due to failure to acquire spare parts as noted by Key Informant 1. Key Informant 3 also noted that the trophy hunting quotas were not achieved during drought years due to wild animal decimation resulting in lower revenues accruing to communities, for example, from trophy elephants. Further, Expert 1 noted that due to drought-induced nutritional shortages some wild animals in southeastern Zimbabwe were wasting away in terms of appearance for most of the year thereby reducing their esthetic value for ecotourists.

Other studies have also noted the negative effect of increasing drought incidences on vegetation production and wildlife populations in tropical savanna ecosystems [28–32]. Increasing drought incidences also have potentially adverse impacts on ecosystem integrity as wild animals concentrate on dwindling perennial watering points triggering erosion and siltation [33]. Further, drought conditions and aridification have altered the migratory patterns of game in the Kgalagai Transfrontier Park in Southern Africa and the Etosha National Park in Namibia as animals have to travel considerably further between wetland and dryland grazing areas [34]. As Namibian tourism is heavily reliant on game viewing and trophy hunting, such migratory behavior has negative impacts on the industry [34]. However, some rangers argue that low forage during drought years allows ecotourists to view game animals with ease [12].

3.1.2 Flood-induced damage of buildings and roads

Climate change has resulted in increased occurrence and severity of tropical cyclone events leading to heavy rainfall downpours and flood-induced damage of buildings and roads at Mahenye. Key Informant 5 noted that the Mahenye Safari Lodge, which is located on Gayiseni Island in the middle of the Save River, has not been operating since 2008 as it was extensively damaged by flooding after a cyclone hit the area leaving only Chilo Lodge operating. Six (6) key informants also attributed the poor state of the roads in the study area to the damage caused by heavy rainfall downpours. Observations also showed that the gravel road linking Mahenye to the main Birchenough Bridge-Chiredzi- Ngundu Highway has been badly damaged in some sections partly due to heavy downpours that have been exacerbated by poor maintenance. Further, some sections of the highways linking Mahenye to major cities such as Harare and Bulawayo and other touristic centers such as Victoria Falls, Kariba, Nyanga, and Great Zimbabwe were damaged by heavy rainfall experienced during the 2020–2021 crop growing season. This makes driving difficult and a risk for ecotourists visiting Mahenye on their travel itineraries. This has the potential to negatively impact the attractiveness, marketability, and income streams of the Mahenye community ecotourism.

Climate change-induced flooding has also damaged ecotourism infrastructure in Botswana [35], South Africa [12, 36, 37], and Nigeria [38]. Darkoh et al. [35] noted that climate change-induced floods resulted in the complete isolation of the Moremi Game Reserve in the Okavango Delta, Botswana thereby leading to business losses and retrenchment of tourism employees. Other researches in the Okavango Delta of Botswana have also shown that climate change-induced flooding has the potential to result in crocodiles and hippopotamus moving into human-populated areas and increase the prevalence of malaria and cholera [35, 39, 40]. However, high rainfall totals associated with tropical cyclone events can boost primary production thereby making more forage available for some wild animals such as grazers like zebra and wildebeest.

3.1.3 Reduced bioclimatic comfort due to temperature rises

Temperature rises at Mahenye have resulted in reduced bioclimatic comfort for ecotourists. According to Expert 1 incidences of heatwaves are increasing across Zimbabwe including Mahenye in the southeast lowveld. Further, extremely high temperatures often lead to violent summer thunderstorms in the tropical savannas. These temperature rises are associated with an increase in greenhouse gases. Key Informant 5 noted that ecotourists at Mahenye have experienced thermal discomfort during incidences of heatwaves in 2016 and 2019. Thermal discomfort results in ecotourists not feeling relaxed and satisfied. Key Informant 1 also noted that the increase in extremely hot days in southeast Zimbabwe including Mahenye has made it difficult to conduct some of the slotted afternoon game drives during some summer months as wild animals would be hiding under bushes to avoid the intense heat and ecotourists would not be eager to do outside activities due to fear of sunburn.

Temperature rises have also negatively affected the hospitality industry in other touristic areas in Zimbabwe such as Victoria Falls [10] and Hwange National Park [41]. Similarly, other studies have shown the negative impacts of temperature rises on bioclimatic comfort in the Okavango Delta, Botswana [11], Namibia [34], Lesotho, Swaziland and Zambia [42], Kruger National Park, South Africa which is also part of the GLTFCA [12] and Nigeria [38]. Further, the temperature rises at a time when rainfall totals are decreasing have potential to result in quick grass vegetation loss in tropical savanna touristic landscapes of the GLTFCA [12]. This

is so as persistent droughts reduce the grass fuel load for natural wildfires that are essential for the growth of fresh grass vegetation and curbing bush encroachment [12]. Furthermore, due to increased temperature and diminishing rainfall, the sour veld was reportedly translocating nutrients to the roots faster. This potentially negatively affects the health of grazing animals such as the buffalo and rhinoceros in the GLTFCA [12]. However, the influence of high temperatures on tourists' discomfort is often relative to the perceived temperatures of a destination [43]. Further, temperature rises can potentially attract adventure and extreme sport tourism as some people are either keen to conquer or watch athletes competing in the blistering heat.

3.1.4 Increased theft of flora and fauna due to climate change-related socio-economic deprivation

Climate change-related socio-economic deprivation is resulting in increased theft of flora and fauna at the Mahenye community ecotourism project. Key Informant 5 and Key Informant 6 noted that Mahenye is facing climate change-related issues such as increased poaching of wild animals and timber during drought years. Drought and flooding events associated with climate change have led to increased food insecurity and poverty, leading to the Mahenye community relying more on natural resources. This poses a heightened threat to biodiversity as communities engage in illegal hunting for bushmeat and tree cutting for wood fuel. Cases of human-wildlife conflicts also increase as communities go out into the wilderness in search of natural resources. Other studies have also noted food shortages and poverty as the drivers of illegal hunting in Zimbabwe [44, 45] and Tanzania [46].

3.2 Adaptations to make the ecotourism model at Mahenye more resilient in the face of shocks emanating from climate change

Adaptations to make the ecotourism model at Mahenye more resilient in the face of climate change include promoting climate change compatible ecotourism development and applying as well as lobbying for funds to mitigate climate change effects from international conservation agencies. Climate-proof ecotourism can be achieved by pumping underground water to ensure sufficient water for the wild animals during drought years and constructing climate-smart buildings and roads. Broadening sustainable livelihood options is also another way of mitigating climate change-induced deprivation. Expert 1 noted other livelihood options that can be promoted at Mahenye as sustainable beekeeping, fisheries, selling of traditional wild foods and beverages, crafts, oils, and natural healthcare products. Therefore, resources need to be channeled towards the diversification of livelihood options and community empowerment. This can be kick-started by creating a Livelihood Diversification Fund using proceeds from ecotourism.

Further, adaptations may include the forging of partnerships between Mahenye community ecotourism project and universities to undertake research on climate change mitigation and developing strategies that will ensure sufficient water and forage for the wild animals so important to ecotourism during periods of extreme climatic events. The research can also explore the development of other options for ecotourists in case wildlife declines due to climate change. Climate change mitigation research can also integrate indigenous knowledge systems with modern scientific climate know-how taking advantage of Mahenye community's strong adherence to traditional customs. The utility of local ecological knowledge in adapting and coping with climate change has been shown by some research in the Middle Zambezi Biosphere Reserve [47].

The other adaptation strategies to drought include rainwater collecting [48], rainwater rituals and prayers, and seeking drought relief from external agencies [49]. Consumption adjustment strategies such as turning to drought-resistant traditional foods are another way of adapting to drought. At Mahenye the community can turn to the *hoka* meal. *Hoka* is a drought-resistant long grass with seeds that are soaked, dried, and then ground into a meal. Further, to adapt to climate change in the most advantageous way Németh [50] suggests policymakers should increase local power over resources through the devolution of authority over natural property to grassroots structures at the sub-district level, ensure fair ecotourism benefit distribution, safeguard the inevitable livelihood transition and channel financial capital into reducing vulnerability.

Further, adaptation strategies to temperature rises that have resulted in reduced bioclimatic comfort for ecotourists include constructing more swimming pools and shaded areas as well as planting more trees. In addition, the bioclimatic comfort of ecotourists during periods of intense heat can be improved by providing a greater number of air conditioners and ensuring that cool drinks and refreshments are always available. These adaptation strategies were being implemented in Botswana [51, 52]. Ecotourism businesses in Botswana had also readjusted the timing of game drives and walking trails to cooler times of the day to ensure that human comfort levels are maintained [52]. The readjustment of the timing of outdoor ecotourist activities to ensure human bioclimatic comfort has also been suggested for the Kruger National Park in South Africa [12].

3.3 Management intervention framework for community-based ecotourism projects in a changing global climate

Given the scenario of a changing global climate, it becomes imperative to develop a management intervention framework for community-based ecotourism projects such as Mahenye in order to ensure that the ventures are more resilient to the shock. Our proposed management intervention framework for community-based ecotourism projects in a changing global climate (**Table 1**) shows the shocks affecting ventures and possible adaptations at local and higher levels. The management model also shows the livelihood outcomes that may result from undertaking various adaptations in response to shocks.

Climate change shock	Management adaptations at the local level	Management adaptations at higher levels	Livelihood outcomes
Shortage of water and forage for the wild animals during drought years	Short-term <ul style="list-style-type: none"> • Rainmaking rituals and prayers • Rainwater harvesting • Selling natural resources Long-term <ul style="list-style-type: none"> • Applying and lobbying for funds to mitigate climate change effects from international conservation agencies • Pumping underground water to ensure sufficient water for the wild animals during drought years • Broadening sustainable livelihood options 	Short-term <ul style="list-style-type: none"> • Seeking drought relief • Channeling financial capital into reducing vulnerability Long-term <ul style="list-style-type: none"> • Increasing local power over resources by devolving authority over natural property to grassroots structures • Ensuring fair ecotourism benefit distribution • Safeguarding the inevitable livelihood transition 	<ul style="list-style-type: none"> • Reduced vulnerability to shock • Increased community well-being

Climate change shock	Management adaptations at the local level	Management adaptations at higher levels	Livelihood outcomes
Flood-induced damage of buildings and roads	Short-term <ul style="list-style-type: none"> • Applying and lobbying for funds to mitigate climate change effects from international conservation agencies • Renovating damaged ecotourism infrastructure Long-term <ul style="list-style-type: none"> • Constructing climate-smart ecotourism infrastructure • Broadening sustainable livelihood options 	Short-term <ul style="list-style-type: none"> • Channeling financial capital into reducing vulnerability Long-term <ul style="list-style-type: none"> • Increasing local power over resources by devolving authority over natural property to grassroots structures 	<ul style="list-style-type: none"> • Reduced vulnerability to shock • Increased community well-being
Reduced bioclimatic comfort	Short-term <ul style="list-style-type: none"> • Readjusting of the timing of game drives and walking trails to cooler times of the day • providing a greater number of air conditioners • Ensuring availability of cool drinks and refreshments Long-term <ul style="list-style-type: none"> • Applying and lobbying for funds to mitigate climate change effects from international conservation agencies • Applying and lobbying for funds to mitigate climate change effects from international conservation agencies • Ensuring climate-compatible accommodation is available • Retrofitting of old buildings and infrastructure to ensure they are climate compatible • constructing more swimming pools • Providing a greater number of shaded areas • Planting more trees 	Short-term <ul style="list-style-type: none"> • Channeling financial capital into reducing vulnerability Long-term <ul style="list-style-type: none"> • Promoting research on strategies to ensure bioclimatic comfort for ecotourists at all times through the provision of climate-compatible accommodation 	<ul style="list-style-type: none"> • Reduced vulnerability to shock • Increased attractiveness to ecotourists • Increased community well-being
Increased theft of flora and fauna	Short-term <ul style="list-style-type: none"> • Applying and lobbying for funds to mitigate climate change effects from international conservation agencies Long-term <ul style="list-style-type: none"> • Broadening sustainable livelihood options 	Short-term <ul style="list-style-type: none"> • Channeling financial capital into reducing vulnerability Long-term <ul style="list-style-type: none"> • Increasing local power over resources by devolving authority over natural property to grassroots structures • Ensuring fair ecotourism benefit distribution • Safeguarding the inevitable livelihood transition 	<ul style="list-style-type: none"> • Reduced vulnerability to shock • More sustainable use of natural resource base • Increased community well-being

Source: Authors.

Table 1.
Proposed management intervention framework for community-based ecotourism projects in a changing global climate.

4. Conclusions

Based on this study, the shocks emanating from climate change at the Mahenye community ecotourism project are not substantially different from those found in ventures of a similar nature and circumstances as revealed by literature. The shocks range from shortage of water and forage for wild animals during drought years, flood-induced damage of buildings and roads due to increased incidence and severity of tropical cyclones, reduced bioclimatic comfort due to temperature rises, and increased theft of flora and fauna due to climate change-related socio-economic hardships. The adaptations to make the Mahenye community ecotourism project more resilient in the face of these shocks include recalibrating variables ranging from amenities, income streams, marketing, and linkages. However, the effective restructuring of these variables at Mahenye may be negated by the constrained macro-economic situation in Zimbabwe. It is hoped that the proposed management intervention framework may enable similar ecotourism projects to continue benefiting humans and wildlife for generations in the face of climate change.

Conflict of interest


The author declares no conflict of interest.

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