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Forest and wildlife resource-conservation efforts based on indigenous knowledge: The case of Nharira community in Chikomba district, Zimbabwe

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ABSTRACT

Forest and wildlife resources are indispensable for the provision of ecosystem goods and services; as well as spiritual and cultural values in rural areas. In most unprotected areas, these resources are increasingly under threat prompting indigenous communities to apply their local knowledge in an effort to conserve them. Therefore, this study documents how the Nharira community of Chikomba district, Zimbabwe is using indigenous knowledge to conserve forest and wildlife resources. Qualitative methods involving interviews and focus group discussions with villagers were used to gather data. The participants were purposively selected by the traditional leaders on the basis of their rich indigenous knowledge and participation in cultural ceremonies and rituals. The study found wide use of (a) customary rules and regulations, (b) customs and rituals, (c) taboos and totems, and (d) metaphors and proverbs applied in forest and wildlife resource conservation. These forms of indigenous knowledge constitute the social and religious values of the Nharira community that are used in conserving the human-environment system.

1. Introduction

For centuries, rural communities have relied on their local knowledge to conserve their environments (Ens et al., 2015). Through learning from experiences, imitating and observations, rural people have developed a body of knowledge on forest and wildlife conservation. The term conservation in this context refers to the processes of maintaining, protecting and managing forest and wildlife resources (Diawuo and Issifu, 2015). Forests are indispensable for the provision of ecosystem goods and services, spiritual and cultural values, and nutrient cycles (Fisher et al., 2014; Porter et al., 2014). Biodiversity is the key source of many of these goods and services. Cooney et al. (2018) state that wild animals are an essential part of biodiversity and a source of food and recreation. However, forest and wildlife resources are disappearing at an alarming rate across the globe. Mohebalian and Aguilar (2018) reported that 70 million hectares of primary forests were lost in the world between 1995 and 2015. While vast tracts of forests are being destroyed to supply thriving timber industries (Mohebalian and Aguilar, 2018), other forests are under threats to wildfires (Stevens-Rumann et al., 2018). The degradation of forests has gradually led to losses in biodiversity, aesthetic view of landscapes, and ecological functions including the provision of goods and services for human needs. The decline in biodiversity adversely affects rural livelihoods and threatens food, energy and health security of nearby communities (Pudyatmoko et al., 2018). Drivers of biodiversity loss may also exacerbate land degradation, loss of habitats for migratory species, decline in soil fertility and may lead to loss of tourism opportunities (Fisher et al., 2014).

However, some forest and wildlife conservation practices based on indigenous knowledge (IK) continue to sustain rural livelihoods without endangering the biodiversity, morphological and functional integrity of forests, and their associated ecological systems (Reniko et al., 2018). Different bodies including the Intergovernmental Panel on Forests and the Intergovernmental Forum on Forests recognise the contributions of traditional knowledge to forest resource conservation (Humphreys, 2016). The Convention on Biological Diversity and the United Nations Convention to Combat Desertification also embraced IK practices in the conservation of biological diversity (Park and Yeo-chang, 2012). Scientific interest in the application of IK in forest and wildlife conservation is also growing despite some criticisms by other modern science and policy circles (Schroeder and González, 2019; Verma et al., 2016). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has been providing policymakers with IK practices relevant for the conservation of biodiversity (IPBES, 2018b).

The management of forest and wildlife resources is not a new phenomenon for indigenous people. On the contrary, it is part of their

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culture, history and spirituality. Indigenous people worldwide are active in the conservation of biodiversity due to their strong ties to flora and wildlife (Camacho et al., 2015; Lee and Bond, 2018). For example, the Yi people in China have traditional forest management practices interwoven into their religious activities, folklore, songs and burial rituals (Jinlong et al., 2012). Because traditional practices connect culture with nature, they aim at balancing ecosystems services. Satellite modelling shows that indigenous communities manage 11% of the earth's biodiversity (Schroeder and González, 2019). The application of IK practices has significantly improved biodiversity conservation around the world. This has enhanced the provision of goods and services derived from biodiversity, thereby benefitting different stakeholders including forest owners, timber industries, tourists, religious and environmental groups and state institutions (Carlsson et al., 2015). The African continent is endowed with rich IK useful in solving environmental problems (Boafo et al., 2016). The IPBES acknowledges the wealth of IK in Africa as a strategic asset for its sustainable natural resource conservation (IPBES, 2018a).

In Zimbabwe, most forests and woodlands within communal areas are thriving under the oversight of traditional leaders who base their conservation strategies on their local knowledge (Mawere, 2014). Investing in IK can help to ensure that forest resources continue to provide a variety of goods and services on sustainable basis. Conventional strategies of conserving wildlife and forest resources through fencing the protected areas or imposing fines on trespassers usually creates disputes between locals and the forest and wildlife management authorities, especially if the former are dependent on forest goods and services (Nizam et al., 2019). When compared to conventional strategies, the IK approach is better as it avoids such conflicts and requires less state resources for enforcing laws to protect wildlife and forest resources. However, IK has been lost over the years since it is usually communicated through oral stories of the past, legends, myths and songs (Mavhura et al., 2013). In many countries including China, the loss IK has been partly caused by governmental policies and promotion of 'scientific' forest and wildlife management practices (Jinlong et al., 2012). In Latin America, Asia and Oceania IK studies have focused on climate change, environmental and disaster risk management (Chun, 2014; Islam et al., 2018; Schroeder and González, 2019). While west African IK studies have concentrated on forest and wetland conservation (Adams, 2017; Houehanou et al., 2011), in southern Africa, they have focused on weather-related hazards (Ngara et al., 2014; Tanyanyiwa, 2018). There is a limited amount of studies with a double lens of forest and wildlife resource conservation. As reported by the IPBES (2018b), the existing IK on biodiversity conservation appears to be declining in some parts of Africa. In response to this gap, this study documents how IK is used to conserve forest and wildlife resources in Nharira community of Chikomba district, Zimbabwe.

2. Indigenous knowledge and the conservation of forest and wildlife resources

The term indigenous knowledge is generally understood as local or traditional knowledge that is acquired over long period of time to guide human interactions with their environment (Mafongoya and Ajayi, 2017). Other terms that are used interchangeably with IK include indigenous technical knowledge, peasants knowledge, traditional environmental knowledge and folk knowledge (Mavhura et al., 2013; Tharakan, 2015). IK is rooted in local culture more or less collectively by a community to inform its interpretation of the world (Sillitoe, 2017). It is held as a body or system of skills, knowhow, information and practices developed by specific communities in response to stressors in particular geographic localities (Ayaa and Waswa, 2016). IK is transmitted to successive generations orally or through imitation and demonstration, making it a dynamic archive of knowledge endowed by a community (Hilhorst et al., 2015). The preservation and survival of IK partly depends on the memories of certain individuals and their cultural practices and interactions with their environment (Tharakan, 2015).

The use of IK in forest and wildlife conservation has ever been held with high esteem by indigenous communities (Getahun, 2016). For example, Tesfaye et al. (2010) posit that communities living near Ethiopian forests have a deep understanding of the traditional ways of managing their flora and fauna. In Kenya, the Teso community developed rules that ensure the sustainability of wildlife and vegetation in their places (Ayaa and Waswa, 2016), while in Ghana IK is embedded in cosmological beliefs, taboos and totems (Adom et al., 2016). Both totems and taboos act as strategies for reducing over-exploitation of plant and animal species (Ayaa and Waswa, 2016; Mafongoya and Ajayi, 2017). The term totem has its epistemology in vegetables or animals believed to have spiritual significance in specific clans (Adu-gyamfi, 2011). Totems are therefore emblems that serve as the symbol of a clan. Indigenous communities believe in close relationships between totem emblems and their clans. They view totemic animals as protecting agents that deserves respect and veneration. As such they do not eat, kill or trap animals and birds representing their totems (Ayaa and Waswa, 2016). In a similar way, taboos consist of restrictions which result from social customs that are declared sacred by specific clans (Boafo et al., 2016). They form the unwritten social rules that govern human-environment interactions. Depending on the community, taboos may be imposed on certain day(s) of the week, season(s), age groups, gender or social status of individuals (Boafo et al., 2016). Most taboos come into effect following certain observations in the provisioning and functioning of ecosystems services. For example, when an animal or plant species is on the verge of extinct, traditional leaders may enact new rules to protect the animal or plant. Nimachow et al. (2011) noted that the Akas community in India refrained from cutting down the Banyan tree that was observed to be on the danger of extinction. The Akas community believed that anyone who violates this taboo would be prone to a dreadful disease.

IK is also held in form of customs and rituals as well as metaphors and proverbs (Kandari et al., 2014). On the one hand, customs and rituals are specific social behaviors, practices and ceremonies proactively performed on regular bases by communities, or as a response to a threat (Boafo et al., 2016). Both customs and rituals are viewed as a duty that has to be fulfilled in order to access certain ecosystem goods and services. For example, the Ifugao community in Philippines maintains that every individual who harvest a tree should replace it with at least two seedlings (Camacho et al., 2015). In Zimbabwe, the Shangwe community conduct rainmaking ceremonies under the *mubvumira,* (*Kirkia acuminate*), *muchakata* (*Parinari curatellifolia*) and *musasa* (*Brachystegia speciformis*) trees that are believed to house the rain gods (Ngara et al., 2014). As such, the community refrain from cutting down such trees. On the other hand, communities use metaphors and proverbs figuratively. The validity of using metaphors and proverbs is largely based on their wide recognizance and acceptance as a mode of expression. For example, the Maori people of New Zealand have more than one expression to understand their local perspectives on ecosystems, their components and functional units (Harmsworth and Awatere, 2013). The Maori communities believe in a natural order and balance of systems in the environment through interrelationships of the inanimate and animate things. As such they have proverbs that recognise such interactions including the need to preserve the forest and wildlife resources (Harmsworth and Awatere, 2013). In many cultures, indigenous proverbs exist that instill conservation ethics and values for protecting the various forms of biodiversity within forests. Due to the fear that their ancestors can hold them accountable for natural resource depletion, communities strive to use such resources sparingly (Dickson Adom, 2016).

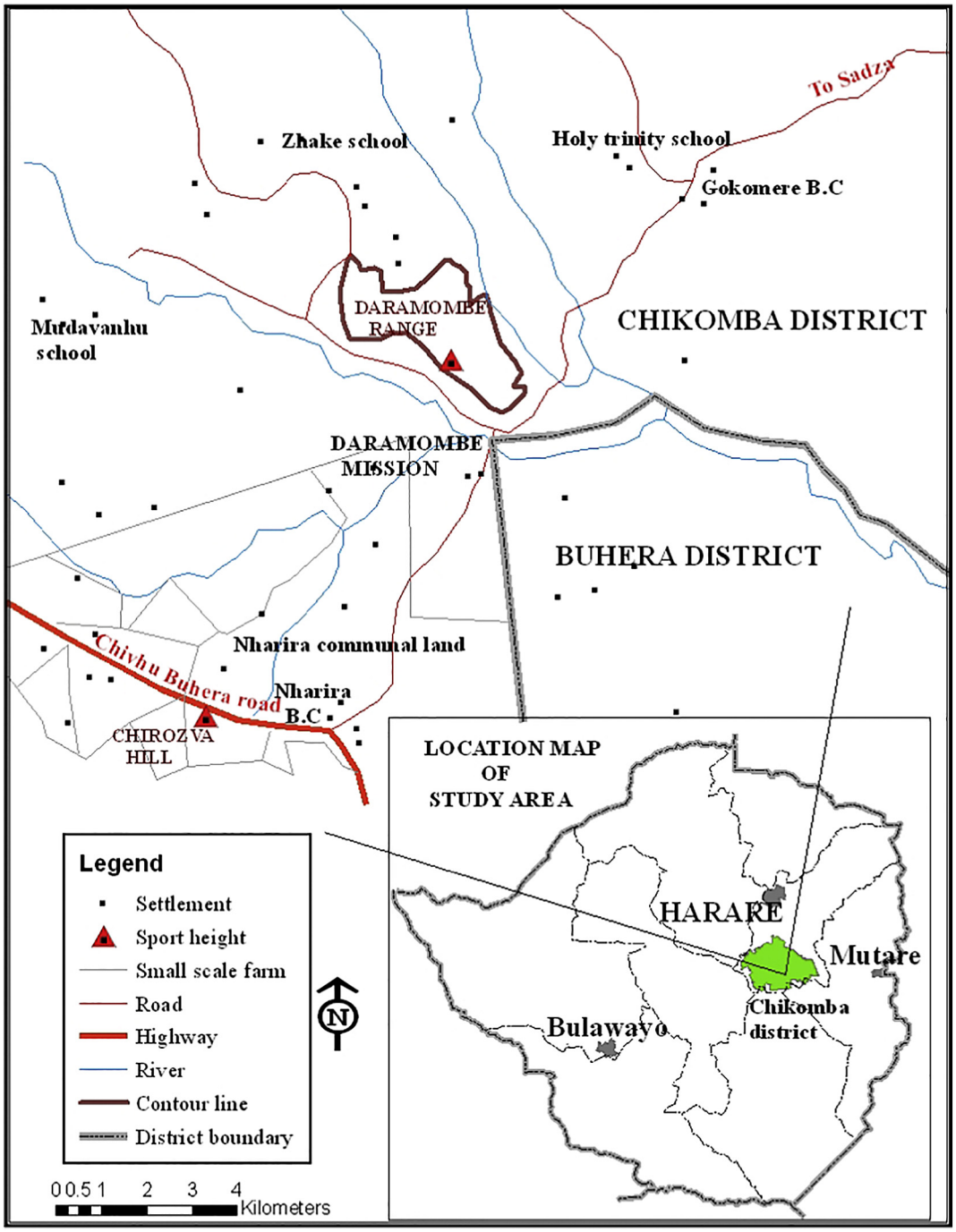

Fig. 1. Study area: Nharira Communal Land.
(*Source:* Own compilation)

3. Methods

3.1. Study area

The study was conducted in Nharira communal lands of Chikomba district, located about 170 km southeast of Harare, Zimbabwe (Fig. 1). The community is in agro-ecological region III, characterized by infrequent rainfall between 570 and 750 mm a year and high temperatures 15–30 °C (Mukwada and Manatsa, 2013). Mid-season dry spells are common during the rainy season (December to March). Most of the soils are poor sandy of granite origin. Rain-fed smallholder farming is the major livelihood in Nharira communal lands. Crops grown include maize, groundnuts, sugar beans and sorghum. The smallholder farmers also practice livestock production and horticulture on a small scale (Kabiti, 2017). Small gardens are located near streams or in wetlands where vegetables and sweet potatoes are grown.

Nharira community is endowed with forest and wildlife resources that are economically and cultural important. Most of these resources are found in two sacred places: Chirozva and Daramombe Mountains situated about 1400msl. When compared to Daramombe Mountain, Chirozva is a small hilly forest. The two mountain forests have been kept in their pristine state for generations through IK practices. Although there is significant biomass to support veldt fires, there are limited incidences of wild fires in the forests. Likewise, there is very minimum deforestation and overgrazing of the forests. The forest resources are characterized by bush savanna grassland and deciduous

trees such as *muchakata (Parinari curatelifolia), musasa* (*Brachystegia spiciformis*), *munondo (Julbernardia globiflora), mupfuti (Brachystegias bohemia)* and *mutondo (Jubernadia globiflora)*. There are also pockets of indigenous fruit trees including *mutohwe (Azanza garckeana), muhute (Syzygium cordatum)* and *mutsubvu (Vitex payos)*. The forest resources are a source of timber products, medicine, reeds, fuel wood, non-timber products (*e.g.* honey, edible insects and thatching grass) and environmental services (Feresu, 2010). The forests also provide spiritual value to the community, play an important role in protecting soils and catchment areas, and provide habitats for wildlife. They occur in a range of ecosystems including indigenous forests, woodlands and grasslands. The major threat to these resources include clearance of land for agriculture, veld fires, harvesting of firewood and over-exploitation of some valuable species (Feresu, 2010). Just like any communal land in Zimbabwe, wildlife resources in Nharira are also under threat from the loss of habitat and uncontrolled hunting. Given that most of the smallholder farmers in the area depend on natural products extracted from these resources to sustain their livelihoods, the on-going loss of woodlands, forests and wildlife resources is a cause for concern.

3.2. Data collection

Qualitative research methods were used to collect data on the use of IK in conserving forest and wildlife resources. The methods involved an interpretive approach that recognises the importance of subjective human creation of meaning (Oltmann, 2016). The study adopted an interpretive position on the assumption that social reality on IK use is constructed by the individuals who participate in it. The task has been to interpret the range of constructions and meanings in participants' knowledge and experiences (Aveling et al., 2015). In order to achieve that, the study used a case study design that yielded rich information on conservation of forest and wildlife resources using IK. The data was gathered through key informant interviews and focus group discussions (FGD). Both interviews and FGD were tape-recorded after having been granted verbal consent to do so by the respondents. The respondents opted for verbal consent because they were talking to local researchers whom they regarded as their children. Interviews were the primary sources of data because of their epistemological tenet that respondents' lived experiences can be understood better through their expressed subjective narratives (Arsel, 2017). The interviews proved useful as they gave voice to villagers' lives and experiences in conserving biodiversity.

The target population was approximately 800 villagers surrounding Chirozva hill and Daramombe Mountains. This includes smallholder farmers in Bungu, Zvavamwe and Nhidza villages. Bungu village is purely a *vaNjanja* (local clan) settlement whose ancestors were buried in the caves of the sacred hills. A sample of 47 key informants were purposively selected from the villages to participate in the interviews. Twenty-seven of the key informants were females, while the remaining 20 were males. The dominance of female informants was a result of more women than men of advanced ages who were knowledgeable about IK practices in forest and wildlife conservation. The sample included the chief of the area, 6 village heads and 40 other elderly villagers. The average age of the key informants was 50 years. Although, the interviews initially started with the chief and 6 village heads who are custodians of both IK and the sacredness of the hills, the process continued through snowballing until a sample saturation level of 47 was reached. The snowballing technique targeted elderly people of the local clan who had been living in the community for decades. Saturation level was attained when there were no more additional (new) data emerging from the key informants (Saunders et al., 2018). At that time, we began to hear the same customs, taboos, experiences and customary regulations on biodiversity conservation. Then we stopped conducting additional interviews. The interviews provided the informants with the freedom to expand and qualify their points (Oltmann, 2016). The interview data was triangulated with information from focus groups.

Six focus group discussions were held with villagers surrounding the two hills. The participants were 28 men and 36 women aged between 40 and 75 years. They were purposively selected by the traditional leaders on the basis of their rich IK and participation in cultural ceremonies and rituals. Each group had an average of 10 participants, males and females. The inclusion of both males and females in each group followed the traditional practice when holding the cultural ceremonies and rituals. As a result, rich information was gathered on the conservation of wildlife and forest resources. The 10 participants in each group constituted a manageable number because a large group could have turned unwieldy and hard to manage, denying a voice to inarticulate members when disagreements arose. The focus groups yielded a rich collective view that could not be obtained from straightforward interviews. It also produced more filtered, socially controlled and more neutral findings (Silverman, 2013). This enhanced the credibility and dependability of the findings (Cohen et al., 2011).

3.3. Data analysis

The data analysis procedure started with data transcription, a process of reproducing spoken words from interviews and focus groups into written form (Mcgrath et al., 2018). In this study, we employed verbatim transcription - a word-for-word reproduction of verbal data. The transcription was done in order to identify key themes, similarities, differences and respondents' experiences (Vaismoradi et al., 2016). The process yielded a large amount of data that was necessary to answer the main research question. Four themes emerged: a) customs and rituals; b) rules and regulations; c) taboos and totems; and d) metaphors and proverbs. At this level, we conducted a content analysis by counting the number of times such phrases appeared in the transcription. This enabled us to determine the extent of the practice(s) in conserving forest and wildlife resources. Participants' response and narratives were categorised into the four themes that allowed us to make sense of shared meanings and experiences of the community. The thematic analysis proved useful because all the relevant data provided a collective answer to the use of IK in the conservation of forest and wildlife resources. To improve trustworthiness of the data, this study used member checking by conducting debriefing sessions with key informants and FGD participants on the transcripts. This process enhanced our interpretation of IK use in the conservation of biodiversity (Mcgrath et al., 2018).

4. Results

4.1. Customary laws and regulations

The use of customary laws and regulations in conserving biodiversity is very common among the communities surrounding the Chirozva and Daramombe hills. All the key informants and focus groups recognise the hills as the birth and burial places of the *vaNjanja* ancestors. They claim that supernatural powers of the *vaNjanja* clan reside in the hills. This makes the hills sacred places from which neither trees, grass nor wild fruits could be gathered without first performing rituals. Key informants revealed that failure to conform to these laws can anger *midzimu yevaNjanja* (ancestral spirits of the *vaNjanja* clan) resulting in huge misfortunes including droughts or long dry spells and reduced crop yields. Because both droughts and reduction in crop yields affect the entire community, the villagers do their best to observe the laid down rules and regulation. One of the key informants who is a respected elder in the community reported:

> *"No one is allowed to cut down trees or climb the Chirozva and Daramombe hills without ancestral permission. Children and aliens are forbidden to visit the hills."*

Focus groups identified 15 tree species and wild fruits that are protected from over-harvesting or deforestation by simply forming part

of the Chirozva and Daramombe hills. Notable examples include the *muzhanje/mushuku* (*Uapaca kirklania*), *mushuma* (*Diosphyros mespiliformis*) and *mutohwe (Azanza garckeana)*. Interviewees revealed that poaching in the hills is a punishable offence by ancestors. They asserted that the poacher might be chased away by bees, wild animals or by snakes, in some instances. In other instances, mishaps such as prolonged dry spells and reduction in crop yields may befall the entire community. When asked if there were any ferocious wild animals in the hills, the key informants expressed ignorance of any known dangerous animals in hills. However, they explained that due to the sacredness of the places, such animals could appear to the individuals violating the laid down rules. They further narrated stories of people who were chased away by hyenas and lions when they went on a poaching mission in the hills. Key informants further reported that the convicted individuals are forced to pay fines in form of a livestock (cattle or goats) or buckets of grain to the traditional leaders. These fines are then used for future rainmaking and thanksgiving ceremonies. The amount of grain paid is determined by the extent of the offence and or if it is a first or repeated offence. There are contrasting views regarding the fines charged by traditional leaders. About 45% of the key informants felt that charging livestock for simply violating customary laws was a harsh punishment. As a result, they narrated stories of villagers who appealed to state judiciary system against such sentences. Yet about 55% of the informants supported the sentences as they act as a deterrent to others.

4.2. Customs and rituals

The use of customs and rituals in conserving forest and wildlife is popular among the Nharira community. Focus groups revealed that *mukwerera* and *matatenda* (rainmaking and thanksgiving ceremonies respectively) are conducted in the hills on annual basis. They asserted that the rainmaking ceremony is held between September and October to mark the beginning of the rainy season and most importantly to ask ancestral spirits of the *vaNjanja* to intercede to *Musikavanhu* (God) for plentiful rains. At the end of the rain season (April or May), a thanksgiving ceremony is conducted to express gratitude to God for a fruitful harvest. A cow or bull from the chief's kraal is slaughtered during any one of these ceremonies. The rainmaking and thanksgiving ceremonies further contribute to the sacredness of the Chirozva and Daramombe hills. As such, their forests are held in high esteem, with no cases of poaching and illegal wildlife trade, deforestation and veldt fires. The focus group participants further revealed that each household from the surrounding villages contributes a small bucket of sorghum that is used for brewing traditional beer for either the rainmaking or thanksgiving ceremonies. Before holding the ceremonies, a delegation comprising the local chief, headmen, village heads and other elderly men and women who are past the child-bearing age, go to the enclosure of the hills to collect water from one of the many sacred wells there. The water is collected in traditional clay or wooden pots. This is usually done a week or two prior to the actual date of the ceremony. According to key informants, no metal objects are allowed in the hill. This water is used to brew beer, which is then offered to their ancestors through pouring part of it in the caves. After the offerings, the celebrations commence at an identified place under a *muchakata* tree *(Parinari curatelifolia)*. This tree is believed to be associated with the rain god, making it sacred among the *vaNjanja* community. The rainmaking ceremony is believed to bring abundant rains that promote ecosystems service production including growth of various plant species.

The key informants further reported that villagers refrain from cutting down all sacred trees. They explained that certain trees from Chirozva Forest and Daramombe mountains are used for ritual purposes. The *mutarara (Lacaniodiscus Fraxinifolinus)* or Duuke-berry/Kudu-berry *(Pseudolachnostylis maprouneifolia*) locally known as *mutsonzowa* trees were cited as common trees used for rituals. Their branches are used to clean graves soon after burial and during the traditional unveiling of the tombstones. Thereafter, the tree branches are placed on the grave sites. It is strongly believed that these trees appease the spirits of the dead. In this way, these trees are spared from deforestation and other forms of over-exploitation. Other informants pointed to the *mukamba* (pod mahogany) and *muonde* (fig tree) which usually provide big canopies that are used as *dare* (courtyards) where traditional leaders settle domestic problems. In this way, the trees are protected from key threats including firewood, unsustainable harvesting of timber and non-timber products, veldt fires and deforestation. As a result, the Chirozva Hill Forest and Daramombe Mountain Range provide a refuge for plant and animal species, which would otherwise have been extinct.

4.3. Taboos and totems

The existence of taboos and totems has significantly influenced the conservation of forest and wildlife resources within Chirozva and Daramombe mountains. Focus groups revealed that the hills are home to a dozen of medicinal plants, wild fruits and herbivores. One of the trees commonly used for medicinal therapy is bloodwood *(Pterocarpus erinaceus sensu auct*) (locally known as *mubvumaropa)*. When asked how their taboos were linked to conservation of plant species in the hills, the focus groups explained that traditional healers and herbalists only extract part of the root system and tubers from plants when they search for medicine. The traditional healers and herbalists then cover the exposed plant roots with soil. When using tree barks, they extract certain sections of tree trunks only. Where leaves are needed, they usually take a few leaves of an identified plant instead of uprooting the whole plant. All these practices ensure the revegetation process to take place from the same plant. An elderly woman who uses herbs to treat snakebites explained the significance of these practices in this way:

> "*After collecting herbal tubers and roots we cover the root systems with soil so that the plants can regenerate. With respect to tree barks, we only extract the eastern and western barks so that the tree keeps on living".*

Key informants reported that it is considered taboo to get firewood from both the Chirozva and Daramombe hills. They explained that tree species such as *muzhanje/mushuku* (*Uapaca kirklania*), *mushuma* (*Diosphyros mespiliformis*) and *mutohwe (Azanza garckeana)* were not used as firewood on the pretext that they produce a lot of smoke that cause total blindness. Furthermore, they narrated other forms of mishaps that are associated with the use of fuelwood from such trees including drought episodes, reduction in crop yields and losing field crops to baboons. Yet from the nutritionist perspective, the three trees [*muzhanje/mushuku* (*Uapaca kirklania*), *mushuma* (*Diosphyros mespiliformis*) and *mutohwe (Azanza garckeana)*] are a source of wild fruits to the community. Hence the need to protect them from rampant destruction. *Muzhanje/mushuku* (*uapaca kirklania*) bear nutritious fruits during December and January when other wild fruits are in short supply. In drought periods such wild fruits become an alternative source of food as the tree survive long periods of dry spells.

The informants further asserted that it is taboo for women of the childbearing age to visit the hills during their menstrual period. Groups of traditional leaders accompanied by elderly women visit the hills during the rainmaking and thanksgiving ceremonies or other rituals. This helps in protecting the plant species because villagers are dissuaded from approaching the sacred hills. Taboos also promotes the survival of many plants and enable essential natural processes such as the nitrogen cycle to take place without any human intervention. The key informants indicated that utmost care is taken to observe these taboos, failure of which an omen of death or disaster may come upon the whole village.

Similarly, villagers' totems play an important role in preserving wild animals. Focus groups explained that totems have for years, been viewed as a traditional wildlife conservation strategy in their area. One village head explained: *"Respecting the sacredness of our totems has contributed to the conservation of wild animals*". Certain clans do not eat

specific game meat or internal organs of birds and animals. The focus groups cited ten totems including the *Moyo Sinyoro, Nzou Samanyanga, Soko Mukanya, Tembo Mazvimbakupa* and the *Humba.* The *Moyo Sinyoro* people do not eat hearts of any animal. They discourage other villagers from killing wildlife thereby increasing animal population. Coincidentally, the *Moyo Sinyoro* villagers are the custodians of the Chirozva and Daramombe hills. They even enact rules and regulations that support totems of their neighbours, thereby conserving many animals. The *Nzou Samanyanga* or *Mhukahuru* clan views elephants as their protecting agents or gods against other ferocious animals in the forest. As a way of protecting their god from extinction, the *Nzou Samanyanga/Mhukahuru* clan does not eat flesh from elephants. The clan prohibits the killing or hunting of elephants for ivory trade or recreation.

The *Soko Mukanya* people view baboons and monkeys as sacred animals. This clan does not only eat flesh from baboons and monkeys, but also prohibits the trapping and killing of such animals even when they invade and destroy crops. The *Soko Mukanya* community strongly believe that human beings evolved from apes that resemble baboons and monkeys. Therefore, killing baboons or monkeys is equated to killing human beings, a thing that can anger their ancestral spirits resulting in huge misfortunes. Even motorists avoid running over baboons or monkeys crossing roads. The community also understands that baboons and monkeys survive on crops from people's fields because they are more like human beings. In this way, the baboons and monkeys are spared from extinction. Likewise, the *Tembo Mazvimbakupa* clan does not trap or kill zebras. They consider zebras as the most beautiful of all wild animals that deserves respect. Hence, they regard their women (popularly known as *Madhuve*) as smart and most beautiful women among other clans. In this way, the *Tembo Mazvimbakupa* people have developed deep reverence for zebras. The *Humba*, also known as *Nguruve* people do not eat pock because they view swine, pigs or wild boars as sacred. Other totemic groups include *Mhofu Yemukono* who do not eat flesh of elands, *Chikonamombe* and *Nyati* who look after impalas and buffalos respectively. The totemic practices have contributed to the conservation of wildlife in areas surrounding Nharira community.

4.4. Metaphors and proverbs

Key informants admitted that the use of metaphors and proverbs in Nharira mostly pertains to words of caution that villagers instil in their children and peers about the sacredness of forests in Chirozva and Daramombe hills. They narrated that community folklore make villagers aware of the need to protect the forests. One key informant, a village head noted that the sacredness of Chirozva is embedded in the *Moyo Sinyoro* poem of praise that partly say:

'…Vazukuru veshiri,
Zienda nomudenga,
Vane hama dzakaperera Chirozva,
Mazvita vaSena, maita Moyo…'.

This translates to *'grandchildren of the bird which flies in the sky whose relatives perished in Chirozva, Thank you Moyo'.* It is through such praise that villagers can associate themselves with their relatives who are said to have perished in the hills. This could possibly give justification as to why they regard forest resources from the two hills with reverence and consequently adhere to their tradition. Focus groups also explained the meaning of certain proverbs linked to the conservation of plant species. Notable examples include: (a) *Kuyevedza kwemaruwa kunobva mumidzi* (The beauty of flowers come from the roots.); (b) *Totenda maruva tadya chakata.* (We can only believe in the fruit tree after we have seen its fruits.); and (c) *Ruva rasvava harikwedzi uchi* (A wilting flower does not attract bees). The first expression discourages the uprooting of flowering plants, as this will lead to their wilting. This mostly applies to traditional healers who use medicinal therapies. The second proverb encourages all people to wait for plants to mature, instead of extracting their roots, barks, leaves or fruits before maturity. The last proverb instils a culture of avoiding practices that lead to wilting of plants as they deprive plants from pollination and multiplication. However, two focus groups raised concerns on the effectiveness of the metaphors and proverbs among the younger generation. They argued that most young people preferred using English in their daily communication, instead of Shona, their mother language. In this way, they miss rich local expressions that emphasise the conservations of wildlife and forest resources.

5. Discussion

This study has established four ways in which IK is used to conserve forest and wildlife resources in Nharira community, Zimbabwe. The four ways can be categorised into (a) customary laws and regulations; (b) customs and rituals; (c) taboos and totems; and (d) metaphors and proverbs. These forms of IK constitute the social and religious values of the community that are generally respected for the conservation of human-environment system (Bortolamiol et al., 2018). Notable customs are the annual rainmaking and thanksgiving ceremonies, and rituals that are conducted following the death of a person. The annual ceremonies are not only revered by villagers but also serve to maintain the sacredness of Chirozva and Daramombe hills which consequently ensure biodiversity conservation. There are also stories, folklore and totemic praises which emphasise the link between man and his natural environment with a strong bias towards biodiversity protection. These practices and actions are common in most rural communities in Zimbabwe. Traditional leaders and healers are known for performing rites and rituals that are strongly believed to be acts of pacifying their gods before the onset of rains, during a dry spell or to thank them for a bumper harvest (Chemhuru and Musaka, 2010). The places where the rites and rituals are conducted are usually sacred and therefore, spared from any form deforestation, wildfires and degradation in general.

The case of Chirozva and Daramombe hill forests are among the many African and Asian woodlands and forests that are thriving under the auspices of traditional leaders who use taboos, totems, rituals and customs to conserve them. Mawere (2014) documents how the Norumedzo Forest of Bikita district, Zimbabwe, has been conserved through IK for decades. The forest, locally referred to as *jiri* because of the abundance of *mazhanje/mashuku* (*Uapaca kirklania*) wild fruits, is a natural indigenous forest of about 7km^2. It is home to many forms of biodiversity such as bees, *mazhanje/mashuku* (*Uapaca kirklania*) wild fruits and edible stinkbugs: *harurwa (Encosternum delegorguei)*. These insects are rich in vitamin C and proteins. Because both the edible stink bugs and *mazhanje/mashuku* (*Uapaca kirklania*) fruits are used by the Norumedzo people as food and source of livelihoods, the community protect them from over exploitation through taboos and *mukuro* (harvesting) ceremonies (Risiro and Tshuma, 2013). Likewise, Chikona and Bvuma hills in Zaka district, Zimbabwe are well forested because the two constitute cultural centres for rainmaking making ceremonies in the district (Risiro and Tshuma, 2013). The Bvuma forest is also conserved through *Shumba* (lion) totem and associated taboos. In a similar way, rural communities in Ghana conserve their forest and wildlife resources using taboos and totems (Adom et al., 2016; Boafo et al., 2016; Diawuo and Issifu, 2015). Many wildlife species have a sociocultural significance in the tribes that adhere to them. Accordingly, different meanings are ascribed to such totemic symbols. Furthermore, the conservation of the Fengshui forest in China is based on IK orally passed on from one generation to another (Juanwen et al., 2012). There are many rules and regulations designed and enforced by the locals for the conservation of Fengshui forests.

However, the rapid socio-economic changes occurring within communities are eroding indigenous practices used for forest and wildlife conservation. Christianity, Islam and western culture are taking a leading role in the social life of most communities (Zinhiva and Chitakira, 2012). Many people are abandoning many of the traditional

taboos, customs and rituals in favour of Christianity. Manyena (2014) observed that some chiefs in Binga district, Zimbabwe were rebranding to maintain their relevance to modern societal demands by embracing Christianity, instead of sticking to their traditional rites. Christianity regards some of the IK practices as pagan rites. As a result, burial rituals and the annual rainmaking and thanksgiving ceremonies are losing significance in many rural communities (Veland et al., 2013). Instead of conducting rainmaking ceremonies, some households are opting for Christian gatherings where they pray for rains. Some traditional dances and funeral rites are incorporating Christian symbols and content, thereby eroding the IK practices that conserve biodiversity. The in-and out-migration of people with different beliefs and customs contributes to the dilution and erosion of some IK practices (Jinlong et al., 2012). For instances, the *Dziva* totemic group in Zimbabwe initially believed that anything that comes from water including fish, crocodiles and hippopotamus was sacred and therefore, could not be eaten. However, this has since changed. Today the *Dziva* clan believes in a certain type of sea fish, possibly the shark or whale as sacred. Indigenous therapies are also on the verge of collapse as many people opt for treatment from medical institutions. Additionally, although customary laws and regulations are largely observed, people violating them can appeal to the parallel state judicial system against the sentences imposed by traditional leaders. Some of the metaphors and proverbs no longer have their sentimental appeal to younger generations, who prefer using English as a medium of communication. The loss of local knowledge may seriously affect both forest and wildlife resource in rural communities. In view of these threats and others, there is need streamline the powers and authority vested in traditional leaders so that the fines they charge are aligned to those of the judicial system.

Many of the IK forms used in conserving biodiversity are environmentally friendly. They promote interdependencies between human beings and their environment as ecosystems (Harmsworth and Awatere, 2013). The customs and rituals undertaken by traditional communities are seriously considered as a duty that has to be fulfilled for one to access certain ecosystem services and goods on sustainable basis. Respecting the taboos, rituals and customs can be a good step towards community dialogue and participation in the preservation of natural resources. This calls for consultations between policy makers and traditional communities when deciding developmental programmes in rural areas. Already there are efforts to apply IK in climate change management (IPCC, 2014; Mafongoya and Ajayi, 2017). For example, the Maori model of IK enhanced natural resource management from an indigenous perspective, and integrating traditional knowledge into scientific models of sustainability (Harmsworth and Awatere, 2013). As argued by Ayaa and Waswa (2016), IK is a key resource with the potential to increase efficiency and sustainability of environmental conservation programs. This is because local communities, over the years have come to understand the best management strategies of their environment. However, the IK practices are fragile. They face marginalization, dilution, transformation or even being forgotten among rural communities in many lands. There is therefore the need to document IK forms and mainstream them in the teaching and learning curricular. Notwithstanding these challenges many IK practices remain intact especially the forestry practices that enhance sustainable forest management (Camacho et al., 2015).

Although the results of this research cannot be generalized to the global community, the case study has revealed the need to embrace various forms of traditional knowledge embedded in different cultures, cosmological beliefs, taboos and totems that can promote natural resource conservation in other similar settings. The participants to this study expressed their views based on their traditional practices and customs that vary from one community to another one, or with time in the same community. In view of this, there is need for further research using remote sensing data to track the changes in forest cover of the Chirozva and Daramombe hills over relatively long time. This will validate the claims that IK is effective in conserving the forest. Further research is also needed on how other communities employ IK in conserving biodiversity in their contexts before mainstreaming them in the teaching and learning curricular.

6. Conclusion and policy implications

IK is locally based in communities where it provides the information necessary for the survival of people and conservation of forest and wildlife resources within a particular context. The IK forms are context-specific to communities and include but not limited to customs, rituals, regulations, taboos, totems and various proverbial expressions. The meanings ascribed to these forms vary from one community to another. This makes IK dynamic. It is influenced by the human-environment interactions, thereby facilitating communication and decision-making within a community. In view of this, the present study recommends the empowerment of traditional leaders as custodians of forest and wildlife resources in their specific localities. A participatory approach that includes traditional leaders may go a long way in conserving local resources. In lands where the national constitutions do not recognise traditional leaders, sections of the law could be amended to accommodate their role in forest and wildlife resource conservation. In order to prevent the marginalization of IK, the study recommends its infusion or mainstreaming in development and teaching and learning curricular. This may ensure that both traditional and scientific strategies of conserving forests and wildlife resources are embraced concurrently. Because IK is context-specific, there is need to document all traditional practices and technologies so that the present and future generations can compare and imitate practices essential for conserving their resources. This will guide against loss of information over time.

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