Local Ecological Knowledge and Community-based Management of Wildlife Resources: A Study of the Mumbwa and Lupande Game Management Areas of Zambia

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Abstract

The aim of this study was to investigate the scope of local ecological knowledge (LEK) in the Lupande and Mumbwa Game Management Areas (GMAs) of Zambia and to assess the extent to which such knowledge has been used in the management of wildlife resources in the two areas. Quantitative and qualitative data were gathered through interviews and surveys in the two case-study areas. It was found that LEK in the study areas included taboos associated with the sustainable use of natural resources, traditional teachings that guided the local people as to the correct time to harvest their natural resources and provided knowledge of the natural distribution of plants in the two areas. Finally, it is recommended that, in order to complement modern scientific knowledge in the realisation of sustainable wildlife resource management, greater attention be paid to the LEK possessed by communities.

Keywords: Local ecological knowledge, sustainable utilisation, wildlife resources, Zambia.

Introduction

Local ecological knowledge (LEK) may be defined as the knowledge possessed by indigenous people that is distinctive to a particular culture in society. It is the informal knowledge that a particular group of people has about their indigenous ecosystems and their relationship with the environment (Olsson & Folke, 2001). Some scholars see LEK as the integration of a system of knowledge, innovations, skills and practices, as well as beliefs (Berkes, 1999). This unique knowledge is viewed as an attribute of societies and is characterised by historical continuity in order to maintain practices relevant to the management of natural resources. Consequently, LEK may be seen as the means by which indigenous people interact sustainably with their surrounding environment.

In improving the sustainable use of natural resources by local communities, the transmission of LEK has become an important consideration in natural-resource management, the reason

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being that such transmission ensures the continuation of this unique body of knowledge from one generation to the next. The transmission mechanisms have evolved down the generations by way of adaptive processes as humans exchange information on issues relating to their environment (Berkes, 1999).

LEK is not to be viewed as common knowledge. Rather, it is knowledge that is confined to a specific group of people who disseminate it among the rest of the community. LEK may also be confined to one of the genders. Hunting knowledge, for example, is restricted to men. One aspect of knowledge transmission is knowledge acquisition, which may involve individuals or social groups (Takako, 2003). Knowledge dissemination, as the communication of the acquired knowledge and skills within the community, is another aspect of transmission. In many communities, such as among the Lozi-speaking people of Zambia, LEK was disseminated orally by the older adults in the community to the younger people as they were growing up. It was also acquired through observation (Moonga & Milupi, 2015).

LEK has been seen to play a key role in managing various ecosystems (Berkes, Folke & Gadgil, 1995; Phuthego & Chanda, 2004; Mmassy & RØskaft, 2013). The relevance of LEK for the sustainable management of natural resources such as tropical forests, dry land, and mountain and Arctic ecosystems has been recognised by various academics (Sasaoka & Laumonier, 2012; Mmassy & Roskaft, 2013; Rim-Rukeh, Irerhievwie & Agbozu, 2013), as well as by international agencies, including the World Commission on Environment and Development, the International Union for Conservation of Nature (IUCN), the United Nations Environment Programme (UNEP), and the World Wide Fund for Nature (WWF) (Mmassy & RØskaft, 2013). In India, for example, Rim-Rukeh et al. (2013) observed that forests designated as sacred groves and landscapes were respected and protected from product extraction by the community, and that they were consequently still rich in biological diversity. They also noted that traditional practices such as restrictions against residential settlements close to shrines in India further promoted the conservation of biodiversity, as such restrictions protected the surrounding vegetation. In central Himalaya, too, studies conducted by Negi (2010) and Rim-Rukeh and Irerhievwie (2014) on local resource management and sacred natural sites showed that traditional practices such as taboos contribute to the conservation of habitats and biodiversity. International documents such as the World conservation strategy and Our common future also endorse the relevance of LEK in natural-resource management (Berkes et al., 1995). Both documents stress the integration of local indigenous knowledge in plans for the management of sustainable resources (Dudley, 1999).

LEK is relevant to biodiversity conservation in Game Management Areas (GMAs) because it provides novel insights into sustainable wildlife resource use and offers strategies for preserving cultural and ecological diversity, which are the main purposes and challenges of protected areas (Carvalho & Frazão-Moreira, 2011). LEK can furthermore inform and improve wildlife management decisions in GMAs (Saylora, Kamal, Alsharif & Torres, 2017).

LEK is a product of the accumulation of knowledge through a long series of observations and practice. Such a long-term series of observations could, if free of superstitions, complement the modern scientific management of natural resources, in which strategies are usually based on much shorter series of observations (Gadgil, Berkes & Folke, 1993). Local people are often more

familiar with a given area and the species in it than outsiders, yet may not have the knowledge or means to use valuable scientific methods of enquiry or conservation; hence, combining the two types of knowledge may help in the sustainable management of natural resources. In Arctic Canada and Greenland, for example, LEK has been used together with modern scientific knowledge (MSK) by biologists studying migratory bird species (Gilchrist, Mallory & Merkel, 2005). Scholars such as Barsh (1997) and Ferguson, Williamson and Messier (1988) observe that LEK may be particularly useful when managing wildlife populations in remote locations where extensive scientific studies are unrealistic. Rasalato, Maginnity and Brunnschweiler (2010) further note that LEK could contribute to the knowledge of critical habitats and their fauna in areas where data are inadequate. Besides providing important indicators that help direct scientific investigation, LEK can also be used to develop policies on wildlife research that incorporate cultural values (Gunn, Arlooktoo & Kaomayok, 1988).

However, some scholars, such as Raymond, Fazey, Reed, Stringer, Robinson and Evely (2010), have argued that LEK and scientific approaches to natural-resource management may be difficult to integrate, as they are quite different. MSK encompasses systematic, recorded knowledge or practice which focuses on agreed principles or processes of study, including reliability and validity (Barnhardt & Kawagley, 2005). This is not the case with LEK, which is mostly acquired orally and is therefore not systematically recorded. The critical issues in applying LEK are therefore reliability and validity (Kimmerer, 2002; Maurstad, Dale & Bjørn, 2007). Despite these differences between LEK and MSK, there is growing international recognition that LEK can be a useful source of information to complement MSK in resource management (Chemilinsky, 1991; Berkes, Colding & Folke, 2000; Gilchrist *et al.*, 2005).

In this paper, the aim is to investigate the nature of LEK and the extent to which such knowledge is utilised in wildlife management in the Lupande and Mumbwa GMAs of Zambia. We regard this as important, not only for the reasons outlined above, but because it can also ensure the involvement of local communities in managing wildlife.

Description of Case Studies

In Zambia, GMAs are buffer zones around a national park where subsistence hunting and licensed safari or trophy hunting are permitted (ZAWA, 2007). GMAs are thus communal areas where people coexist with wildlife and practise semi-subsistence agriculture (Bandyopadhyay & Tembo, 2010). The GMAs were selected for this study because they have abundant biological diversity and valued trophy animals, such as roan (*Hippotragus equinus*) and sable (*Hippotragus niger*), lion (*Panthera leo*) and leopard (*Panthera pardus*), among others (Simasiku, Simwanza, Tembo, Bandyopadhyay & Pavy, 2008). Safari hunting is the main commercial activity in the two GMAs (Musumali, Larsen & Kaltenborn, 2007). Through a Community Based Natural Resource Management (CBNRM) Programme, the Zambia Wildlife Authority (ZAWA) shares revenue from hunting licences and wildlife management responsibilities with the communities living in the GMAs (Bandyopadhyay & Tembo, 2010). The ZAWA collects the revenue in respect of licences sold, retains 50% and distributes the rest to the community. Of the 50% allocated to the community, 5% is apportioned to the area chief (ZWA, 1998; 2015) and 45% to Community Resource Boards (CRBs), where

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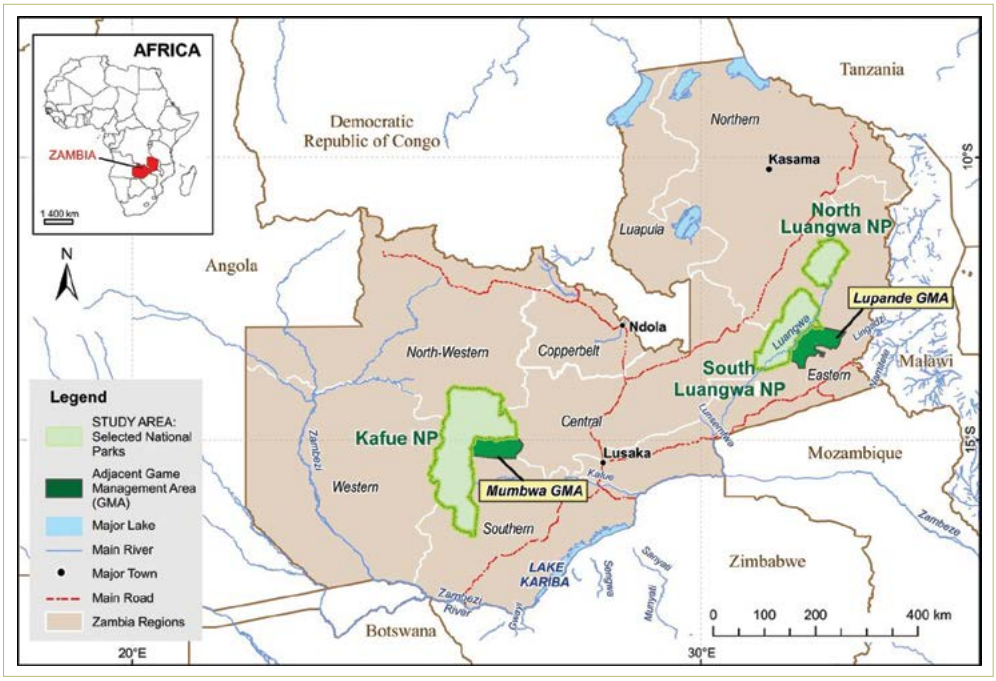
the money is used to pay scouts. Some money is also spent on community-development projects in the chiefdom.

The Mumbwa GMA (Figure 1) is in the Mumbwa district and covers an area of approximately 3 370 square kilometres. It was proclaimed a GMA in 1972. The GMA shares a boundary with the Kafue National Park in the north (Figure 1). The Mumbwa GMA is a prime hunting area where highly valued trophy species such as buffalo (*Syncerus caffer*), lion and leopard are abundant (ZAWA, 2004; Rim-Rukeh & Irerhievwie, 2014). The human population of the Mumbwa GMA was estimated to be 33 500 in 2012 (UNDP, 2012). The Mumbwa GMA community comprises subjects in the three chiefdoms of Chibuluma, Kabulwebulwe and Mulendema, which together form the wildlife management authority for the Mumbwa GMA. Major threats and pressures that have affected the Mumbwa GMA include poaching and human population growth (MTENR, 2007a). Other threats have included charcoal production, illegal fishing when there was a ban on fishing, and agricultural activities. Charcoal production is common in the Mumbwa GMA because of the proximity of the GMA to big cities such as Lusaka where there is a ready market for charcoal.

The Lupande GMA (Figure 1) is located in the Luangwa Valley in the Eastern Province of Zambia (Balakrishnan & Ndhlovu, 1992). The GMA is 120km west of Chipata town, the provincial headquarters. It covers an area of 4 840 square kilometres and is bordered by South Luangwa National Park in the west, the Chipata–Petauke district boundary in the south, and the Chipata–Lundazi district boundary in the north and east. In 2012, the population of the Lupande GMA stood at 68 918 (CSO, 2012).

Figure 1. The location of the Mumbwa and Lupande GMAs within Zambia



The Lupande GMA has six chiefdoms, namely Kakumbi, Mkhanya, Nsefu, Jumbe, Malama and Msoro. The GMA experiences two seasons: a dry season (from May to October) and a wet season (from November to April). The dominant vegetation in the Lupande GMA includes woodlands such as Miombo (*Brachystegia*, *Isoberlinia* and *Julbernardia* species), Mupane (*Borassus aethiopus*) and Munga (*Acacia albida*). The majority of the people of Lupande are subsistence farmers who grow crops such as maize, cotton, millet, sorghum, beans, pumpkins, and sweet potatoes (Nyirenda, Myburgh, Reilly & Chabwela, 2013). Other crops grown in the area include cassava, groundnuts and rice.

Methodology

The study was based on secondary and primary data collected from June to August 2014. Secondary data were derived from published materials and policy documents, whereas primary data were collected through two ethnographic methods, namely household surveys and key-informant interviews, as outlined below. Ethical clearance for this work was received from the University of Pretoria (EC 140514–046).

Secondary data analysis provided a better understanding of: the relationship between LEK and wildlife resource management and how LEK is used in wildlife resource management; the transmission mechanisms of LEK and how LEK promotes the management and sustainability of natural resources; and the possible compatibility of LEK and MSK in the management of wildlife resources. In the present study, journal papers, the ZAWA Act, the Forest Act, the Fisheries Act and government records such as the national environmental policy were examined. These documents provided background information for the research and allowed for assessment of the suitability of the project before conducting interviews (Dvora, 2007 – as cited in Owen, 2014).

Household surveys

Household surveys generated quantitative data through the structured, researcher-administered questionnaires, which comprised both closed and open-ended questions. The sampling unit for the two GMAs was the household, with the target respondent being the household head. Households were randomly selected. In total, 349 household heads from the Mumbwa and Lupande GMAs were interviewed – 76 in Mumbwa and 173 in Lupande. Both men and women were interviewed during the survey. Of the respondents interviewed in the Mumbwa GMA, 63.1% were males, while 36.9% were females; and, in the Lupande GMA, 58.4% were males, while females constituted 41.6% of respondents.

Three chiefdoms, namely Kabulwebulwe, Mulendema and Chibuluma, were covered in the Mumbwa GMA, while, in the Lupande GMA, four chiefdoms were considered, namely Kakumbi, Mkhanya, Nsefu and Jumbe. To ensure that the questionnaire was suited to the context, a pretest was conducted in one of the chiefdoms in the Mumbwa GMA.

The households were interviewed as regards the following aspects of LEK:

- The sources of LEK, that is, where they acquired knowledge on how to manage natural resources such as the plants and animals in their areas;

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- The nature of LEK prevalence, for example taboos related to the sustainable use of natural resources such as plants and animals;
- Traditional teachings that directed the local people as to the best time to harvest natural resources such as plants and animals;
- Knowledge of plant distribution and the favourable conditions for plants to grow or flourish; and
- The extent to which LEK is used in wildlife management, particularly if the ZAWA is using local knowledge in the management of wildlife resources in the two GMAs.

Key-informant interviews

Key informants, including ZAWA officials and traditional chiefs from the Mumbwa and Lupande GMAs, were interviewed. The ZAWA officials were interviewed in English, while the traditional chiefs were interviewed in their respective local languages, which included Kaonde, Lamba, Kunda and Chewa. The responses of the traditional chiefs were transcribed and then later translated into English with the help of research assistants used in the study areas. The chiefs were specifically asked questions about their role in wildlife resource management, and the ZAWA officials were asked about the performance of the CBNRM Programme in the two GMAs in relation to community involvement and the use of LEK in wildlife resource management.

Quantitative data were coded and processed using Statistical Package for Social Sciences (SPSS) software to generate the frequencies of responses. Cross-tabulation of some variables was done to establish relationships between them.

Below, we report the results of the study, highlighting the nature of LEK found, as well as assessing how such knowledge is used in wildlife management and its role in the sustainable management of wildlife resources.

Results

As reflected in Figure 2, most of the respondents (58%) revealed that their source of LEK was older adults, who included parents and grandparents. Other interviewees (24%) said they acquired LEK from the ZAWA, while fewer than 10% of respondents stated that traditional leaders were also a source of LEK in their area. Less than 1% of respondents said that LEK was gained in schools or from books.

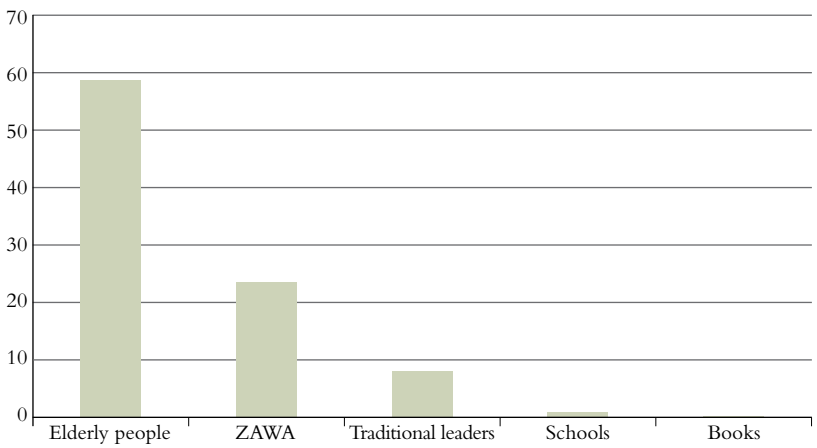
The nature of LEK prevalent in the Mumbwa and Lupande GMAs

The local people in the two study areas, especially the elderly, have developed certain taboos regarding the sustainability of natural resources, as described below:

- The Tonga tradition in the Mumbwa GMA considers animal species such as lion and elephant (*Loxodonta africanas*) as totems, and, therefore, the Tonga may not hunt and kill them because the lion and the elephant symbolise the clan. One of the clans among the Tonga-speaking people for whom a lion is a totem and may consequently not be killed, is the Bachindu. In this way, the animals are protected.

- The Lozi tradition considers the eland (*Taurotragus oryx*), locally known as Pofu, as the animal of the king and chiefs. Thus, eland may not be hunted without authorisation from them. This is common in the Western Province of Zambia where Paramount Chief Litunga controls all matters related to hunting in his area.
- Elephants have been hunted for ivory and used by chiefs as a symbol of power. This means that any elephant hunting had to be authorised by the king or the chief and the ivory was then taken to his house.
- The myths associated with hunting lions have served to safeguard the species. For example, only strong men were said to be eligible for hunting lions and only the chief or king of the area could own the skin as a symbol of power or greatness.
- Animals with perceived attractive skins, such as leopards, cheetah (*Acinonyx jubatus*) and other rare species, belong to the king or chief when killed. This provides these species with a form of protection.

Figure 2. Responses regarding the sources of knowledge used to manage natural resources in Mumbwa and Lupande (percentage)



Traditional teachings on the time to harvest natural resources

In both the Mumbwa and Lupande GMAs, the traditional teachings guiding the local residents as to the right time to harvest plants or animals appear to be similar. It is believed that these teachings help to conserve natural resources and save them from depletion.

Traditional teachings concerning plants

Respondents observed that there are restrictions on when to harvest plants. For example, appearance (e.g. colour) and the season are used to guide them as to the right time to harvest. Medicinal plants are not allowed to be cut down, as they are used to treat different types of ailments, for example *mululwe* is used for malaria and *musamba* for stomach problems, whereas *mukuyu* and *musombosombo* are used as blood boosters in the Mumbwa GMA. Trees that bear fruit are also not allowed to be cut down, nor are young and flowering plants. To respondents,

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young plants are the future forest. Plants near the village and those found in places such as cemeteries are not allowed to be cut down because these are considered sacred places. In general, it is believed that cutting down trees will disturb the pattern of rainfall. These restrictions and beliefs of the local community help them to conserve and use the natural resources in a sustainable manner.

Traditional teachings concerning animals

There are restrictions on animal harvesting that prevent animal stocks from being depleted. For example, there are restrictions on hunting gear. Only spears are allowed when hunting. This is intended to reduce the numbers of animals that are harvested or killed. Killing animals using snares is prohibited. The time to hunt is also restricted to times of important traditional ceremonies. Further, there are restrictions on the type of animal to be killed. For instance, female animals are not allowed to be killed, especially those that are pregnant or are suckling young ones. These teachings have positive conservation implications, in that the local communities in effect practise selective hunting.

Knowledge of plant distribution

The local people in both the Mumbwa and Lupande GMA also have extensive knowledge of the distribution of plants in their area, as reflected in the information provided by them (see Tables 1 and 2).

The tables indicate the LEK that the community possesses regarding the distribution of plants in the Mumbwa and Lupande GMAs. Since vegetation provides a habitat and food for animals, this knowledge is critical in wildlife management and assists in determining animal distribution in the two GMAs.

Table 1. Plant species distribution in the Mumbwa GMA

Plant species	**Distribution**
Mumososmoso (*Vangueriopsis lanciflora*)	Found mostly in sandy areas
Mululu (*Entandrophragma caudatum*)	Found in woodlands and in thickets
Mubanga (*Pericopsis angolensis*)	Woodland habitat
Mubuyu (*Adansonia digitata*)	Commonly found near anthills and thickets
Mulala (*Borassus aethiopum*)	Usually found in woodlands
Mukwa (*Pterocarpus angolensis*)	Woodland habitat
Musamba (*Lannea stuhlmannii*)	Found in thickets and sometimes on anthills

Source: Field data (2014)

Table 2. Plant species distribution in the Lupande GMA

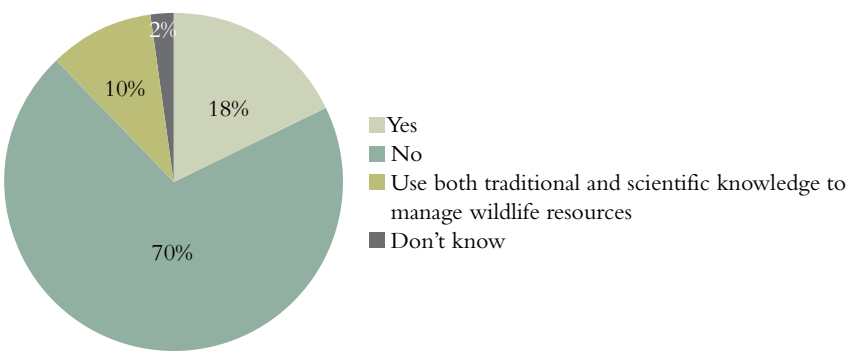
Plant species	Distribution
Mopane (*Colophospernum mopane*)	Found in the Luangwa Valley
Mutondo (*Julbernardia globiflora*)	Commonly found in sandy areas and escarpment soils
Mubombo (*Brachystegia floribunda*)	Commonly found in the plateau area
Mpapa (*Afzelia quanzensis*)	Commonly found in Kalahari sand and also occasionally in the highlands and hills
Msuku (*Uapaca kirkiana*)	Commonly found in woodlands
Msolo (*Pseudolachynostylis maprouneifolia*)	Commonly found in the plateau area
Mpundu (*Parinari curatellifolia*)	Found in the plateau area

Source: Field data (2014)

Extent to which LEK is used in wildlife management in the GMAs

Figure 3 indicates that the majority of respondents were of the opinion that the ZAWA is not using LEK to manage wildlife resources. Of the remaining respondents, 18% said that the ZAWA uses LEK to manage wildlife resources, 10% said that the ZAWA uses both LEK and scientific methods, and 2% did not know. Respondents' answers depended on the area where they lived. In the Lupande GMA, local people are sometimes employed by the ZAWA to help guide officials to where animal species may be found, as well as to provide information on the plant species present and on the general condition of the environment. This helps the ZAWA to determine and monitor animal distribution in the Luangwa GMA and the nearby national park without using expensive scientific methods such as aerial surveys.

Figure 3. According to respondents, does the ZAWA use LEK to manage wildlife resources?



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The seven chiefs who were interviewed (three from the Mumbwa GMA and four from the Lupande GMA) all said that the ZAWA is not using LEK to implement and manage sustainable wildlife resources in the two case study GMAs. We believe this is because the ZAWA officials do not consult the traditional leaders in either of the GMAs about using LEK for wildlife management. The chiefs further commented that the ZAWA is more involved in enforcement than in using LEK for environmental conservation and the sustainable management of wildlife resources in the GMAs. They did mention the application of LEK by the ZAWA in determining the distribution of animals in the GMA, especially in the Lupande GMA, but regarded this use as minimal.

Key respondents from the ZAWA confirmed that very little LEK is used by their institution in the sustainable management of wildlife resources in the Mumbwa and Lupande GMAs and in Zambia in general. They explained that the ZAWA is not using LEK because the organisation is seeking to become more business-oriented by making use of what officials believed to be 'less expensive' methods of monitoring animal and plant species, such as aerial and ground survey methods that do not necessarily involve local inhabitants.

Policy provision/position on the use of LEK

Information from policy documents that were examined, such as the ZAWA Act and the National Policy on Environment (MTENR, 2007b), stipulates explicitly that the local community should be involved in the planning and establishment of CRBs, but does not offer insights into the role of LEK in the GMAs. The policy therefore does not make provision for the use of LEK in these areas.

Discussion

The aim of this study was to describe LEK and assess its use in wildlife management in the Lupande and Mumbwa GMAs in Zambia. The study revealed the scope of LEK, ranging from taboos and restrictions on natural-resource use to in-depth knowledge of where plants and animals occur.

The taboos and restrictions that emerged can be drawn on for the sustainable management of wildlife resources. For instance, local knowledge about flora and fauna could help to flag situations that affect the environment and guide the development of responses so as to prevent further degradation of natural resources. This knowledge could then be incorporated in wildlife management programmes, along with the MSK that is currently being used by the ZAWA, and possibly strengthen the sustainable utilisation of wildlife resources.

The study shows that the nature of LEK in the two GMAs could contribute to the sustainable harvesting of wildlife populations and the protection of rarer species. For example, the taboos among the Tonga- and the Lozi-speaking people ensure that wildlife resources are only harvested at the appropriate time. Furthermore, the practice of traditional teachings concerning plants and animals (by parents and grandparents) in the Mumbwa and Lupande GMAs indicates that LEK would contribute to the use of wildlife resources in a sustainable manner (see Chemilinsky, 1991; Berkes *et al.*, 2000).

Based on these findings, we would argue that LEK could serve as a useful source of information to complement scientific approaches to resource management. For example, LEK on plant distribution in the two areas could enhance biodiversity conservation and consequently lead to sustainable utilisation of wildlife resources (Johannes, 1998), particularly in remote areas where adopting standard scientific approaches may be impossible. By drawing on both LEK and MSK for wildlife management, local communities could be more actively involved in the sustainable management of wildlife resources.

Finally, LEK on plant distribution in the two study areas, if utilised in wildlife management, could help in guiding tourists and hunters. The local guides rely on their ecological knowledge and knowledge of plant distribution to locate animal species in their natural habitats. Further, although perhaps not as reliable, using LEK could be much cheaper than using MSK to locate and count animals. The consequence of using LEK would be active involvement of the local community in wildlife resource management, and this may improve wildlife resource management in general. The main implication of LEK exhibited in both GMAs is that the local communities practise sustainable utilisation of natural resources, which has positive conservation implications.

Conclusion

There are various forms of LEK in the Mumbwa and Lupande GMAs. These range from taboos that are associated with the sustainable use of natural resources, to traditional teachings that guide the local people in determing the time to harvest their natural resources, to traditional signs of environmental degradation, and to knowledge of the natural distribution of plants in the two areas. This range of LEK, if used in wildlife management along with MSK, could foreseeably encourage greater involvement of local communities in wildlife management and, therefore, promote sustainable management of wildlife resources.

Based on policy documents such as the ZAWA Act, the Forest Act, the Fisheries Act and the National Policy on Environment, the Zambian government regards community participation in natural-resource management as important. For example, the National Policy on Environment (MTENR, 2007b) stipulates that the local community should be involved in the planning and establishment of CRBs. The policy does not, however, explain how the local community should be involved and does not make provision for the use of LEK in the GMAs.

This study identified a considerable body of LEK possessed by communities in the Mumbwa and Lupande GMAs, and it is strongly recommended that greater attention be paid to this knowledge as a useful source of information to complement scientific approaches to wildlife resource management. The diverse LEK systems identified in the study carry strong conservation messages and could all be used as entry points into sustainable wildlife resource utilisation and management. Doing so would ensure the involvement of the local communities in wildlife management and promote sustainable management of wildlife resources, which would have positive conservation implications. It is further recommended that policymakers consider including the use of LEK in the design and management of GMAs, something that is not presently provided for.

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Professor Willem Ferguson is the retired Director of the Centre for Environmental Studies at the University of Pretoria, South Africa, but continues as a lecturer and postgraduate supervisor. He has published widely on environmental matters in southern Africa.

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