



# Striving for sustainable wildlife management: the case of Kilombero Game Controlled Area, Tanzania

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*The sustainability of wildlife resources in Africa is threatened by poaching for trophies and meat as well as changes in land use. In order to motivate local people for sustainable wildlife management, efforts to transfer decision-making power as well as benefits from central to local level have been made in several countries. Such efforts have not yet been seen in Kilombero Game Controlled Area, which is the area covered by the present study. The paper documents the importance of wildlife to local people, explores local people's perceptions on wildlife management and identifies constraints to sustainable wildlife management. A total of 177 household interviews in 5 villages and 129 interviews of pupils in schools have been conducted. The majority of pupils reported that their latest meal of meat was from a wild animal, and the most common species was buffalo. Apart from availability of cheap wildlife meat, advantages from living close to wildlife include the use of various parts of animals for, e.g. medical and ritual uses, and various plant products from wildlife habitats. Disadvantages include damages to crops, predation on livestock, and injuries to humans. The estimated loss of yield due to raiding by wildlife amounted to 21.9 and 47.8% of the harvest of rice and maize, respectively. Traditional wildlife management in Kilombero includes few rules to avoid resource depletion, because depletion has traditionally not been a problem due to low hunting technology and low human population. Government management includes strict rules, with hunting quotas as the main instrument, but the government has failed to enforce the rules. Ongoing discussions on new approaches to wildlife management like co-management and community-based management were largely unknown to the villagers in the area. Both poaching and agricultural expansion threaten the sustainability of Kilombero Game Controlled Area. It is suggested that transfers of decision-making power and benefits to local people is necessary in order to achieve sustainable management.*

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## Introduction

During the pre-colonial time, sustainable utilisation of wildlife in East Africa was ensured by a low level of hunting technology as well as by cultural norms and customs (Baldus, 1994). Hunting was controlled or regulated by village elders such that hunting could be suspended temporarily when animals were

scarce (Marks, 1984). The establishment of wildlife protected areas in the colonial time caused social and economic hardship to rural people by restricting resource use in the areas (Ghimire and Pimbert, 1997). As a consequence of colonial powers taking control of the areas, the pre-colonial system of sustainable management and utilisation of wildlife by indigenous people dissociated. Indigenous people developed a negative attitude and resentment towards wildlife conservation and the instituted system of wildlife management, resulting in

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widespread and uncontrolled poaching threatening the sustainability of wildlife resources. After independence the new governments adopted the management systems established in the colonial period, so that national parks and game reserves continued being established and managed without much consideration of the rights and needs of local people (Baldus, 1994).

The sustainability of wildlife populations in protected areas such as Kilombero Game Controlled Area (KGCA) is threatened by several factors including commercial poaching for trophies, local people's poaching for meat and other wildlife products for household consumption, unsustainable levels of hunting quotas, and habitat destruction as a result of changed land use. The concept of wildlife management will in this paper include all attempts by humans to control these factors in order to make the wildlife resources sustainable. Wildlife management is sustainable to the extent that it is successful in conserving the ecosystems that include wildlife for the future. On that basis, the overall objective of this paper is to explore the problem of sustainable wildlife management in a context where people traditionally depend on wildlife and wildlife habitats for their livelihood. Using the case of Kilombero Game Controlled Area, the specific objectives are therefore:

- To document the importance of wildlife to local people.
- To explore local people's perception on wildlife management.
- To identify the constraints to sustainable wildlife management.

## Conceptual framework

The sustainability of wildlife resources in Africa is threatened by several factors. One factor is commercial poaching for trophies that fetch high prices on the illegal international markets. The high prices encourage this kind of poaching. The fact that these species are endangered, and thereby few and short in supply, may increase the market prices of the trophies further, giving increased incentives for further poaching and thereby pushing the species further in the direction of extinction. This kind of poaching is a serious threat to a limited number of species with valuable trophies, notably the rhino and the elephant. Prins *et al.* (1994) reported that the population of elephants in Lake Manyara National Park in northern Tanzania declined from

about 500 individuals in 1984 to about 150 in 1988 and only 60 in 1991, due to poaching.

Another kind of poaching is performed with the objective of providing meat and other wildlife products for household consumption and for the local markets. Over time, population growth will increase the demand for these wildlife products, thereby increasing their local price and give incentives to increased harvesting. If the harvest exceeds maximum sustainable yield, the wildlife stock will decrease over time and so will the supply of wildlife products, which may again increase the prices in the local markets and thereby motivate increased harvesting intensity. Caro *et al.* (1998a) found that poaching activity in Tanzania was high in areas used by legal hunters, but not patrolled by guards. Poachers move into such areas after the end of the hunting season.

Even legal hunting may pose a threat if hunting quotas are set too high. Caro *et al.* (1998b) found that while the majority of species in Tanzania are hunted at a level that can be sustained, certain species are exploited at dangerously high levels. These are 'eland, and possibly small antelope, principally duikers, bushbuck, both species of kudu and reedbuck, and perhaps lion and leopard'. Caro *et al.* (1998b) also argue that the hunting quotas should be reduced for some species with restricted geographical ranges, among them the puku.

Yet another factor is habitat destruction as a result of changed land use, notably clearing of forest for expanding agricultural land. Even this factor is triggered by population growth, which over time increases the need for agricultural production.

If the above factors are allowed to operate unchecked, it appears obvious that the wildlife resources will be depleted, both because maximum sustainable yield will be exceeded and because the wildlife habitats will diminish.

Several case studies document the conflicts between smallholder agricultural settlements on one hand and the protection of wildlife on the other hand. Fiallo and Jacobson (1995) surveyed settlements both inside and adjacent to Machalilla National Park in Ecuador. The majority of the respondents were opposed to the park and believed that the land should be used for agriculture. Those respondents who perceived personal benefits from the park, however, had a more positive attitude and pointed out that the increased tourism created jobs. Fiallo and Jacobson (*op. cit.*) found that the negative attitudes towards the park depended mainly on three factors. Firstly, there was a lack of involvement of local people in the establishment and management of the park. Secondly, the majority of

respondents did not perceive any benefits from the park. Thirdly, there had been a long history of confrontations between local people and the park staff.

Naughton-Treves (1998) and Naughton-Treves *et al.* (1998) studied crop damage by wildlife around Kibale National Park in Uganda. Four to seven percents of planted fields within 500 m from the park boundaries were damaged by wildlife, and 85% of the damage was attributed to 5 species: baboons, bush pigs, red tail monkeys, chimpanzees and elephants (Naughton-Treves, 1998). Naughton-Treves *et al.* (1998) suggested that forests can be separated from agriculture by non-palatable plant barriers or by electric fences in cases where dangerous or destructive wildlife species forage on densely settled subsistence farmland. At the same time, Naughton-Treves (1988) suggested means to increase people's tolerance for wildlife. Direct monetary compensation was suggested only in limited cases, and only in cases of losses to elephants since elephants by far have the highest capacity to damage large amounts of crops in a single raid. Efforts should also be made to channel economic benefits of wildlife such as tourism revenue, employment opportunities, conservation trust funds, and access to game meat to local people.

Gillingham and Lee (1999) surveyed four villages along the northern boundary of the Selous Game Reserve in Tanzania and found that the majority of villagers thought it was important to conserve wildlife. The most recognised benefits from wildlife were the earning of foreign exchange from tourists and the harvesting of wildlife products. In spite of that, majority of respondents did also report problems associated to living close to the game reserve. By far, the most frequently mentioned problem was crop damage by wild animals.

Recent innovations in improving the sustainability of wildlife management focus on the transfer of power and responsibility from central government to local people. Such developments are most often referred to as community based management or co-management. According to Colfer *et al.* (1999), co-management is a wildlife management approach 'designed to manage conservation areas in close cooperation with local people'. McCay and Acheson (1987) define co-management as the right of communities to share management power and responsibility with state. That means, while the concept of community based management gives emphasis to the local community as the decision-making level, co-management has its focus on the co-operation and interactions between the state and the local community. In the literature the two concepts are

however often used synonymously to cover all efforts to transfer authority to manage wildlife as well as monetary and other benefits deriving from wildlife from central government to local institutions.

Well-documented cases of community based wildlife management are found in widely different cultural and physical settings, like in Sarawak, Malaysia (Horowitz, 1998) and Quebec, Canada (Pearse and Wilson, 1999). The most famous case, however, is the CAMPFIRE (Communal Areas Management Program for Indigenous Resources) in Zimbabwe. CAMPFIRE has transferred management responsibility as well as the authority to collect fees from tourist hunters from the central government to the local level. The principles that communities should have full choice in using wildlife revenues and that functions should not be performed at a higher level when a lower level can perform them are considered as two of the pillars of CAMPFIRE (Child, 1996).

CAMPFIRE is thought by many to be a success, and even a replicable success. The programme has made achievements in terms of rural development, by making incomes from hunting fees available for local development projects and making local people responsible for their own development efforts. It is also seen as a success in terms of sustainable wildlife management. In spite of increased hunting quotas, the total number of animals killed per year has been reduced, as a result of reduced poaching and reduced killing of destructive animals. It appears that wildlife has become so valuable to local people that they are willing to tolerate some level of crop destruction rather than killing a highly valued animal like an elephant that could have earned US\$ 10 000 from a trophy hunter.

Recently other African countries have also made efforts to share the benefits from wildlife with local communities. Uganda is probably the country where such sharing has the strongest institutionalisation. In accordance with a constitutional reform in 1995 the Uganda Wildlife Authority channels 20% of tourist park entry fees to local communities (Naughton-Treves, 1999).

Gillingham and Lee (1999) report from a community wildlife management project in villages adjacent to the Selous Game Reserve in Tanzania. In this project, a Village Wildlife Committee was selected and involved in consultations on land use and demarcation of wildlife management areas. These areas were patrolled by locally appointed village scouts. Benefits to the local people were in the form of wildlife meat quotas and financial support for village development projects.

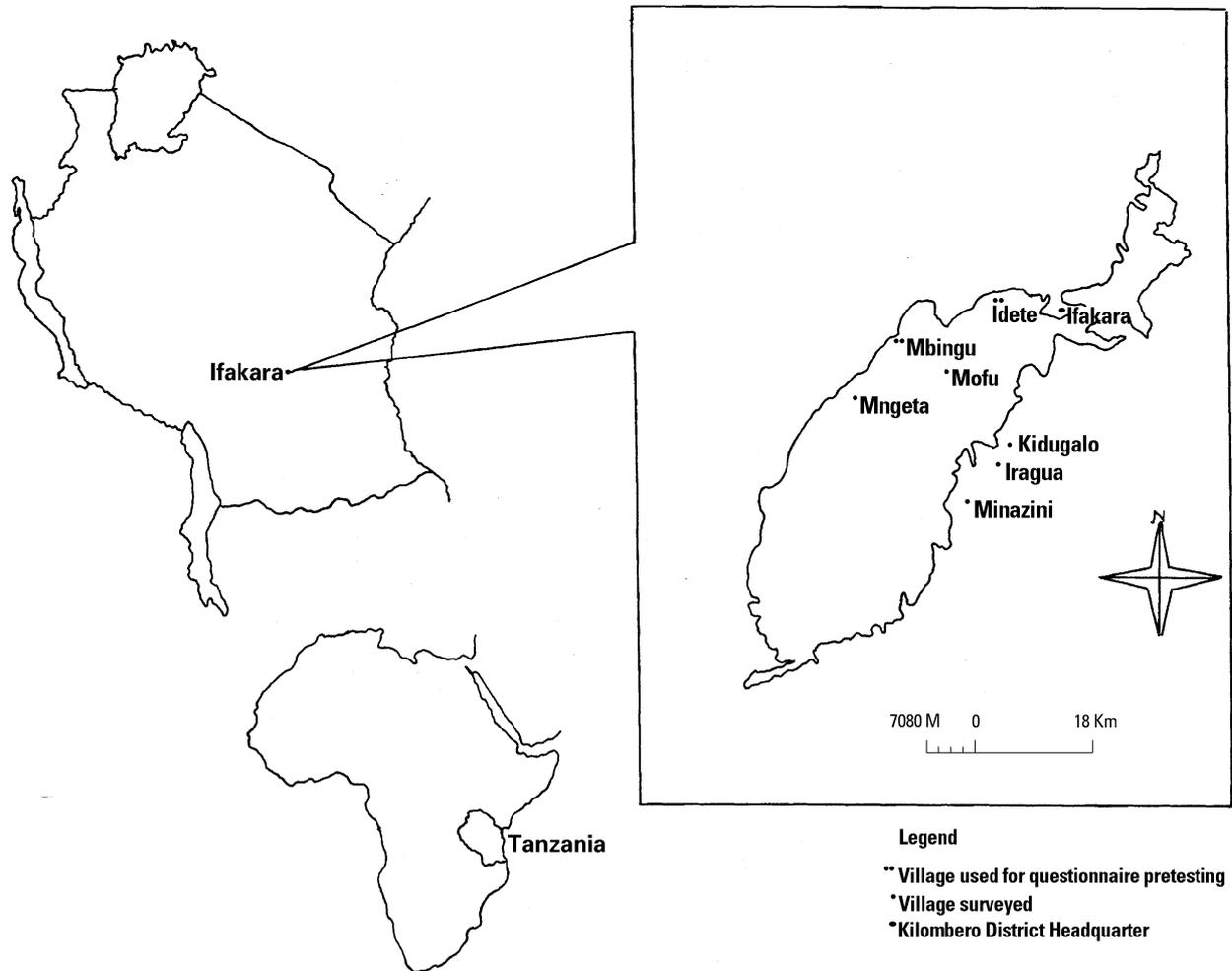
Forty-three percent of the respondents expressed a positive attitude to the project, while an almost equally large fraction seemed unaware of the project and a small minority held negative perceptions. Those who gave positive answers, mentioned game meat, assistance to village development projects and assistance in protecting village land from wildlife as the benefits from the project. Access to game meat did not include everyone in the village, and those who received such meat were generally much more positive to the project and to protection of wildlife in general than those who did not receive it.

Based on his study of the need for wildlife corridors and buffer zones around Lake Manyara National Park in Tanzania, Mwalyosi (1991) also advocated the need for a new strategy in wildlife conservation. He suggested that rural populations adjacent to the national park should be integrated

in decision-making on conservation, including establishment of proposed corridors and the buffer zones around them. They should also be allowed to exploit some resources from the park when this does not conflict with conservation interests, such as dead fuelwood, sand for building purposes, and fish. Mwalyosi (*op. cit.*) further suggested that compensation for crops and property damaged by wild animals should be considered.

### The study area

Kilombero Game Controlled Area (KGCA) is located in the districts of Ulanga and Kilombero in Morogoro region of Tanzania (Figure 1). KGCA covers a total area of 6500 km<sup>2</sup>, including a large part of Kilombero Valley, which is one of Africa's



**Figure 1.** The location of Kilombero Game Controlled Area and the villages surveyed. Location of Ifakara is 08°05'S 36°42'E.

largest wetlands and is recognised by IUCN as being of global importance (World Wildlife Fund, 1992). KGCA is one of 49 Game Controlled Areas in Tanzania. The status as Game Controlled Area means that unauthorised hunting is prohibited (Act 1974 no. 12). The legislation does however not protect the area against changes in land use.

The area's altitude ranges from 400–1000 meters above sea level. The valley is a rift valley running from southwest to northeast. In northeast, KGCA is bordered by Selous Game Reserve. Temperatures are in the range of 22°C–41°C. Mean annual rainfall ranges from 1000–2000 mm within the area. Rainfall pattern is unimodal and the rainy season lasts for at least 4 months, from November to April (World Wildlife Fund, 1992). The valley has a unique network of meandering rivers, of which Kilombero River is the largest. There are mainly two vegetation types, wooded grassland and miombo woodland. Multi-layered evergreen forest with high biological diversity is found within a smaller area. The area contains the largest population of wildlife outside national parks and game reserves in the country (World Bank, 1993). Kilombero valley is the home of Tanzania's only viable population of a mammal known as puku (*Kobus vardonii*), and two new marshland species of birds, previously unknown to science, have recently been discovered within the area. The Kilombero valley river system is an important habitat for fish, in terms of commercial fisheries and food for local people as well as in terms of high biological diversity.

A total of 75 registered villages are located within or at the borders of KGCA. In addition, there are a number of smaller villages, hamlets and fishing camps. Population within and around the Kilombero valley is estimated at 180 000–200 000 (World Wildlife Fund, 1992). Smallholder agriculture is the main economic activity. Subsistence crops include rice, sorghum, maize, cassava, beans, pumpkins and potatoes. Use of agricultural inputs is low. Cash cropping is rare, due to poor market access caused by poor roads and long distances to market centres. Livestock production is also very limited due to high risks of predation by wild animals. Main sources of animal protein are therefore fish and poached wildlife. Some development projects exist in the area. Kilombero Sugar Company cultivates about 2000 ha of sugar cane. A rice scheme has been established as a joint venture between the Tanzanian and Korean government. Two prison farms operate in the floodplain. Other activities in the area include ruby mining, a large hydroelectric scheme, a macadamia (nut fruit) project and a teak plantation.

## Materials and methods

Apart from various secondary data sources, the study is based on household interviews, interviews of pupils in schools, checklist interviews and field observation conducted between July and December 1996.

The questionnaire for household interviews included basic household data, agricultural activities, and attitudes towards wildlife. Photographs of wild animals and photocopies of pictures of animals from the field guidebook by Haltenorth and Diller (1977) were used for facilitating discussion. A multi-stage random sampling procedure was employed. Out of a total of 75 villages bordering and located in Kilombero Game Controlled Area, five villages were selected randomly. Within each village, 6–92% of the ten cell units<sup>1</sup> were selected randomly for the study. Within each ten-cell unit, 20% of the households were randomly selected for household interviews. This procedure gave a total of 177 household interviews. The questionnaire was first pre-tested in two non-sample villages within Kilombero district (Mbingu and Idete). After the pre-test, adjustments were made in the questionnaire before the main survey was conducted in the five sampled villages, namely Iragua, Kidugalo, Minazini, Mofu and Mngeta.

School survey was held in three primary schools (Mahimbo primary school situated in Minazini village, Iragua primary school and Mofu primary school) within the sampled villages and one secondary school (Kilombero Day Secondary situated in Ifakara town). A total of 129 pupils were interviewed. The respondents in primary schools were from seven to thirteen years old, while the respondents in secondary school were from thirteen to eighteen years old. A questionnaire was designed to understand how the pupils' daily lives were affected by wildlife and what perceptions they had towards wildlife. The main reason for conducting pupil interviews was that the responses given by household heads regarding availability of meat from wildlife were notoriously unreliable. Adults considered questions on meat from wildlife to be sensitive because such meat originated from illegal hunting; consequently they tended not to admit eating meat. On these issues, school children tended to be much more open-minded.

<sup>1</sup> The ten-cell unit is the lowest administrative and political level within the Tanzanian government system. Each village is divided into ten cell units, and each ten-cell unit consists of at least ten households.

Interviews based on a checklist were made with government officials at various levels, representatives of non-government organisations, and representatives of the commercial sector. The items on the checklist included national and local wildlife status, threats to sustainability of wildlife, amounts and use of incomes from hunting fees, traditional wildlife management systems and the extent of community participation in wildlife management. Excursions were made to remote parts of the village areas together with elderly villagers to explore local knowledge on wildlife feeding behaviour, animal tracks, and the use of wildlife and plant species for food, medicine and handicrafts. Direct observations in the field were informative on wildlife damage to crops, availability of bush meat, and human impacts on the wildlife habitat.

## Results

### *Advantages and disadvantages of living close to wildlife and their habitats*

Wildlife and forests provide important services to local people in the area. The most important benefit is the access to cheap meat. In addition, other animal products and plant products from the forest are important. But living close to wildlife also

involves disadvantages and conflicts. The household survey included impacts of wildlife in terms of damage to crops, livestock predation, injuries to human beings, and losses of human lives.

Majority of the sampled households would not admit that bush meat was easily available, but it was easy to observe that such meat was in good supply at the local markets. Importance of meat from wild animals can be seen from the school survey. Pupils were asked about the source of their latest meal of meat. A total of 96 pupils were able to respond to the question, and the answers are presented in Table 1. The pupils were also asked about the prices of meat from wildlife. The average of the answers corresponds to a price of TAS<sup>2</sup> 381 per kg, while the price of beef was about TAS 1000 per kg. Some food uses apart from meat were also reported. Of particular importance, fat from hippo was extracted and preserved. Such fat was eaten during February, which was reported to be the peak hunger period.

Apart from the use as food, parts of wild animals were also used for medicine, skin for making drums, and several other uses of practical, cultural and ritual value. These uses are summarised in Table 2.

Several plant products were harvested in the forest. Wild plants were used for food, particularly in the hunger period. Such plants include wild potatoes, wild sorghum, and wild fruits. Construction poles, ropes and thatching grasses were collected in the forest. Bamboo was particularly important, having uses like house construction, making baskets and traditional furniture, ornamental uses and food storage facilities. The leaves of palm tree (*Phoenix reclinata*) were used locally for making baskets, mats, hats and other items. The leaves were also important for the local economy because they were sold in the urban markets. Traditional healers were very important in the area. All medicine used by traditional healers was related to or harvested in the forest.

While the benefits from living close to wildlife are important, the disadvantages are also several. These include damages to crops, predation on livestock and injuries to human beings.

Damages to crops include trampling, fouling, uprooting, cutting and eating the crop. The respondents of the household interviews were asked to give estimates of harvest losses in terms of 100 kg bags of grain. The question was answered by 63.7% ( $n = 168$ ) of the households with rice farms and 35.9% ( $n = 131$ ) of the households with maize farms.

**Table 1.** Responses from pupils in Kilombero valley on species of their latest meal of meat

Species	Number of respondents ( $n = 96$ )	%
<b>Wild animals</b>		
Buffalo ( <i>Cyncerus caffer</i> )	38	39.6
Puku ( <i>Kobus vardoni</i> )	19	19.8
Elephant ( <i>Loxodonta africana</i> )	3	3.1
Bush pig ( <i>Potamochoerus porcus</i> )	5	5.2
Bush buck ( <i>Tragelaphus scriptus</i> )	1	1.0
Hippo ( <i>Hippopotamus amphibius</i> )	8	8.3
Warthog ( <i>Phacochoerus aethiopicus</i> )	1	1.0
Total	75	78.0
<b>Domestic animals</b>		
Cattle	16	16.7
Goat	1	1.0
Chicken	4	4.2
Total	21	21.9

<sup>2</sup> Tanzanian shillings. At the time of the field study, the exchange rate was about 600 TAS to 1 US\$.

**Table 2.** Traditional non-food uses of wildlife in Kilombero Valley according to household survey

Species	Part/product	Uses
Buffalo ( <i>Cyncerus caffer</i> )	Kidney, liver, breast	Sacrifices
Tortoise ( <i>Testudinidae</i> )	Shell	Spoon
Oryx ( <i>Oryx gazella</i> )	Horn and skin	Horn for trumpet and storage for medicine, skin for drum.
Cane rat ( <i>Thryonomus swinderianus</i> )	Hair	Mixed with coconut oil and charcoal as medicine to rib pain
Puku ( <i>Kobus vardonii</i> )	Skin	Drums, chairs and beds
Hippo ( <i>Hippopotamus amphibius</i> )	Meat, teeth	Meat for sacrifices and exchange for labour, teeth for ornamental uses.
White colobus monkey ( <i>Colobus</i> sp.)	Skin	Hat and drum for traditional dances
Spotted hyena ( <i>Crocuta crocuta</i> )	Skin	Hat for traditional dances
Baboon ( <i>Papio cynocephalus</i> )	Skin	Drum
Lizard ( <i>Sauria</i> )	Skin	Drum for Unyago (ritual ceremony for puberty), wedding and festival
Elephant ( <i>Loxodonta africana</i> )	Ear skin, tusk, faeces	Ear skin for drum, tusk for comb, faeces as medicine for children to cure malaria
Galago ( <i>Galago</i> sp.)	Hair	Medicine for treatment of fire wounds
Turtle ( <i>Chelonia</i> )	Shell	Mixed with seeds to improve harvest
Lion ( <i>Panthera leo</i> )	Fat	Eaten to boost courage. Smear along farm boundary to deter other animals from raiding crop.
Bush pig ( <i>Potamochoerus porcus</i> )	Fat	Smear around in the farm to deter bush pigs from raiding crops
Pangolin ( <i>Manis temminckii</i> )	Live animal	Prediction of society's future. (When a pangolin appeared, it was given water and fire to choose. If it chose water, there would be enough rainfall. If it chose fire, there would be drought or any other disaster.)

**Table 3.** Responses from household survey on animals causing crop damages. (Total percentage exceeds 100 because the respondents were allowed to give multiple answers.)

Animal	Number of respondents (n = 173)	%
Bush pig ( <i>Potamochoerus porcus</i> )	100	57.8
Warthog ( <i>Phacochoerus aethiopicus</i> )	11	6.4
Reed buck ( <i>Redunca arundinum</i> )	1	0.6
Rat ( <i>Rattus</i> spp.)	1	0.6
Baboon ( <i>Papio cynocephalus</i> )	44	25.4
Water buck ( <i>Kobus ellipsiprymnus</i> )	1	0.6
Oryx ( <i>Oryx gazella</i> )	1	0.6
Monkeys ( <i>Primates</i> )	25	14.4
Eland ( <i>Tragelaphus oryx</i> )	1	0.6
Green monkey ( <i>Cercopithecus aethiops</i> )	13	7.5
Birds ( <i>Aves</i> )	44	25.4
Bush buck ( <i>Tragelaphus scriptus</i> )	1	0.6
Blue monkey ( <i>Cercopithecus mitis</i> )	7	4.1
Elephant ( <i>Loxodonta africana</i> )	17	9.8
Puku ( <i>Kobus vardonii</i> )	23	13.3
Gazelle ( <i>Gazella</i> spp.)	12	6.9
Buffalo ( <i>Cyncerus caffer</i> )	27	15.6
Hippo ( <i>Hippopotamus amphibius</i> )	25	14.4
Cane rat ( <i>Thryonomys swinderianus</i> )	40	23.1

Among those who were able to answer, the average loss was as much as 5.1 bags among the rice farms and 4.6 bags among the maize farms. The loss represented 21.9% and 47.8% of the harvest of rice and maize, respectively, in the surveyed households. The respondents were also asked which animals were responsible for the crop damages. The results are presented in Table 3.

On top of the direct crop damages, farming families have to spend valuable time on protecting crops against animals. The household survey revealed that majority of farmers leave their houses to stay in the farmland and protect the crops day and night during the cropping season. The school survey showed that 88.4% of the pupils had participated in crop protection, and 60% of those had at least once missed classes in school because of crop protection activities.

In addition to losses of crops, villagers also reported predation on livestock. Within the surveyed villages, livestock means mostly chickens, which were kept by 81.9% of the surveyed households, and to some extent ducks, which were kept by 14.1% of the surveyed households. From the household interviews, only one respondent reported to have cattle and one respondent kept pigs. The main reasons for

**Table 4.** Responses from household survey on animals causing losses of livestock, mainly chickens

Predator	Number of respondents (n = 145)	%
Wild cat ( <i>Felidae</i> )	30	20.7
Striped polecat ( <i>Ictonyx striatus</i> )	31	21.4
Leopard ( <i>Panthera pardus</i> )	7	4.8
Owl ( <i>Strigiformes</i> )	1	0.7
Hawk ( <i>Accipitridae</i> )	23	15.9
Pied Crow ( <i>Corvus albus</i> )	1	0.7
Snakes ( <i>Squamata</i> )	18	12.4
Baboon ( <i>Papio cynocephalus</i> )	16	11.0
Jackal ( <i>Canis adustus</i> )	2	1.4
Lizard ( <i>Sauria</i> )	4	2.8
Unspecified predator	12	8.3

the limited extent of livestock keeping was reported to be predators and diseases affecting livestock. An average of 35% of the chicken stocks were killed by predators, according to the household interviews. The predators are listed in Table 4.

Wild animals in the area have been reported to cause injuries to human beings, sometimes with fatal outcomes. According to official records, eleven people had been killed by lion, hippo or crocodile within Ulanga district in 1995, and another four had been injured. The real number of injuries is substantially higher, since unlicensed fishermen and poachers are unlikely to report their cases, fearing legal implications. As much as 19.9% of the surveyed households reported that at least one of their members had been injured or killed by buffalo, hippo, lion, elephant, or crocodile.

### **Existing and potential management alternatives**

The household survey revealed that 10.7% of the households knew specific places that were traditionally used for sacrifices and pilgrimage, and where all other activities were forbidden. These restrictions had conservation value by preserving key habitat areas such as drinking water for wildlife.

In traditional hunting, fires were used to improve visibility. These fires may have been effective in improving pastureland for wildlife.

No specific season was traditionally restricted with regards to hunting. A man could however not hunt during the first four days after the death of a

**Table 5.** Villagers' preference of wildlife management alternative, according to household survey

Management alternative	Number of respondents (n = 177)	%
Communal	34	19.2
Co-management	30	16.9
Private	1	0.6
Don't know/No response	112	63.3

relative, when his wife was pregnant, or a relative was sick.

Taboos on eating specific species varied from one tribe to another. Wandamba were not allowed to eat zebra, eel fish and python. Wangindo tabooed eating Zebra, and Wapogoro were not allowed to eat bushbuck and civet. Marekano tribe could not eat warthog. In recent time, such taboos are not strictly observed any more.

At present, Kilombero Game Controlled Area is under government management. The main tool of management is allocation of hunting licenses based on quotas. As an example, a resident hunting quota of 15 buffaloes was allocated in 1995 in Kilombero district at a fee of TAS 6000 (about US\$ 10) per animal. At the same time tourist hunters killed 25 buffaloes at US\$ 840 per animal.

The household survey revealed that only 8.9% of the households were aware of the current wildlife policy discussion on community participation. Those who were aware, mentioned radio as the source of information. No respondent had experienced any wildlife extension services. None of the surveyed villages had a wildlife committee.

The respondents were asked which out of three wildlife management alternatives they would prefer, communal management by the local communities, co-management, or privatisation of the resource. Communal management was perceived as a transfer of all decision-making on hunting quotas and hunting fees as well as enforcement of the decisions to the local level. Co-management was explained as a transfer of some decisions to local level, while the state would still be responsible for general, overall decisions as well as enforcement towards trophy poachers and tourist hunters. Privatisation was explained as the transfer of ownership and management of the whole Kilombero Game Controlled Area from the state to a single private owner. The responses from those who were able to express an opinion on this matter are presented in Table 5.

**Table 6.** Confiscated products from poaching activities in Kilombero district, 1991–1996. Amounts are according to Kilombero District Game Office. All prices, irrespective of year, are based on court valuations in 1995 (1 US\$ = 600 TAS)

Year	Species	Product	Amount, kg	Price per unit, TAS	Value, TAS	Value per year, TAS
1991	Elephant ( <i>Loxodonta africana</i> )	Tusk	31.1	30 000	933 000	
	Puku ( <i>Kobus vardonii</i> )	Meat	20.0	200	4000	937 000
1992	Elephant ( <i>Loxodonta africana</i> )	Tusk	0.25	30 000	7500	7500
1993	Elephant ( <i>Loxodonta africana</i> )	Tusk	6.0	30 000	180 000	
	Hippo ( <i>Hippopotamus amphibius</i> )	Meat	120.0	200	24 000	204 000
1994	Elephant ( <i>Loxodonta africana</i> )	Tusk	43.0	30 000	1 290 000	
	Hippo ( <i>Hippopotamus amphibius</i> )	Meat	30.0	200	6000	1 296 000
1995	Elephant ( <i>Loxodonta africana</i> )	Tusk	73.0	30 000	2 190 000	
	Hippo ( <i>Hippopotamus amphibius</i> )	Meat	30.0	200	6000	
	Buffalo ( <i>Cyncerus caffer</i> )	Meat	2.5	300	750	
	Hartebeest ( <i>Alcelaphus buselaphus</i> )	Meat	5.0	200	1000	2 197 750
1996	Elephant ( <i>Loxodonta africana</i> )	Tusk	485.1	30 000	14 553 000	
	Hippo ( <i>Hippopotamus amphibius</i> )	Meat	30.0	200	6000	
	Buffalo ( <i>Cyncerus caffer</i> )	Meat	12.0	300	3600	
	Hartebeest ( <i>Alcelaphus buselaphus</i> )	Meat	3.0	200	600	14 563 200

### Constraints to sustainable wildlife management

Potential threats to the future of wildlife in Kilombero include agricultural expansion, unsustainable cutting of trees, and poaching.

Farm sizes varied from 0.5–11 hectare among the respondents in the household interview, with an average of 2.3 ha. About 32.0% of the respondents were not satisfied with their farm sizes. The most common reasons for wanting a larger farm were shortage of money, big family, and shortage of food. Out of the surveyed households, as much as 69% had acquired their farms by clearing virgin forest.

By Tanzanian standards, the farm sizes are large, the soil is fertile, and new farms can easily be acquired by clearing forest. As a result, farmers tend to migrate into the area. Immigrants also include pastoral tribes like Mang'ati and Masai as well as the agro-pastoralist tribe Wasakuma. When this immigration adds to a high birth rate, it is clear that agricultural expansion is very substantial and land use conflicts are frequent.

All the surveyed households depended on firewood as their source of energy. Collecting construction poles from the forest was also a quite significant activity. Such forest products were considered as free and easily accessible commodities with open access, evidenced by the fact that no single household had planted trees primarily for firewood.

The feeling among local government officials was that poaching had increased dramatically since 1994. The increase seems to be confirmed by reported cases of confiscated products from poaching activities (Table 6), indicating a sharp rise in the period from 1992 to 1996.

### Discussion

#### *Advantages and disadvantages of living close to wildlife and their habitats*

In the presentation of food from wildlife, we have chosen to present the responses from pupils in schools rather than the household interviews. While 29.4% of the pupils either denied to have eaten meat in their life or had forgotten when they ate meat for the last time, such poor memory was shown in as much as 63.8% of the household interviews. The differences between the responses from pupils and households on when they had their latest meal of meat, were highly significant in a chi-square test ( $\chi^2 = 121.51$ , d.f. = 5,  $P = 0.000$ ). This shows the sensitivity of the question. From general knowledge, it is unlikely that any single adult individual in these villages has not eaten meat in his whole life. People are, however, reluctant to admit it to outsiders, because it is well known that most of the available meat is from poaching. The sensitivity of the issue can also be seen from the fact that 68.9% of the household respondents claimed that it was difficult to get wild meat, while it could easily be observed that the meat was in good supply at affordable prices in the local market places. With this background, it seems fair to suggest that the responses from the pupils are much more reliable than the responses from adults in the households.

No attempts have been made in this study to quantify the amounts of meat from wildlife eaten by villagers. In a situation where people were not willing to admit that they eat meat from wildlife and that this meat is easily accessible, as indicated

by our observations, it would be meaningless to try to quantify amounts of meat in a questionnaire survey. It is still clear that wildlife meat plays an important role in the diet.

Based on the observations of advantages and disadvantages of living close to wildlife, it is easy to understand the social acceptance of poaching among villagers. The poachers make benefits available to the whole community by providing cheap meat and other animal products. At the same time, poaching controls and possibly reduces the population of wildlife close to the settlements. This reduces the disadvantages, such as damages to crops, predation on livestock, and risks of injuries and loss of human lives.

### ***Existing and potential management alternatives***

Natural resources can be held under one out of four property rights regimes: Open access, common property, private property and state property. In practice, however, natural resources are rarely managed solely within any one of these types (Murphree, 1991).

The traditional taboos and rules against hunting at certain times and places in Kilombero can be interpreted as elements of a common property management, but in the absence of strong rules and regulations the situation was close to open access to the common property resources. This may have been an efficient system in ancient times, when hunting hardly threatened any species or their environment, because of low human population and a hunting technology only based on traditional weapons.

The present system is a state property management, at least in theory. But again, the real property regime is close to open access because of government failure to enforce the management rules. With today's population pressure and hunting technology, strong elements of open access are bound to lead to resource depletion.

The main merit of traditional wildlife management is high social acceptance among local population. Unfortunately, the traditional management does not provide any guarantee against over-exploitation and even extinction of resources. In the present situation, traditional local taboos do not provide an answer to the pressing threats against the wildlife populations.

Government management, based on licenses, has the merit of securing sustainable wildlife management if the rules are followed. Unfortunately, they

are not. Considering the good availability of wildlife meat in the villages and the limited number of licenses issued, it is clear that only a fraction of meat comes from animals that are killed by legal hunting.

Tanzania Forestry Action Plan suggests a change in wildlife management, involving, among other things, communal participation in utilisation schemes and wildlife extension services (Ministry of Land, Natural Resources and Forestry, 1989). It became clear from the household survey that no respondent had seen any such extension service, and that people had not even heard of the proposed changes in wildlife management, apart from a few respondents who had heard of it from radio. It seems clear that new ways of thinking about government wildlife management, as proposed by the Tanzania Forestry Action Plan, has not yet reached as far out as to Kilombero Game Controlled Area.

It is noteworthy that ownership in private hands seems to have no support among the population in Kilombero. Private property may be associated with ownership by outsiders who will harvest the benefits of wildlife, leaving little or nothing to the local communities. Communal management or co-management was preferred, because those systems appear to secure benefits for local people. Those who preferred co-management to communal management, pointed at the lack of technical capacity, lack of facilities such as weapons, and lack of local law enforcement institutions as reasons to involve government management to some extent rather than going for pure communal management.

### ***Constraints to sustainable wildlife management***

According to O'Riordan (1990) sustainable utilisation of wildlife means avoiding to exceed the productive capacity of exploited species, reducing yields to sustainable levels, reducing incidental take, maintaining the habitats of exploited species, carefully allowing timber concessions and limited firewood consumption, and regulating the stocking of grazing lands.

Both poaching and agricultural encroachment into wildlife habitats seem to pose real threats to the long-term sustainability of the wildlife populations of Kilombero Game Controlled Area. Such threats raise the very delicate question of how to balance wildlife conservation against the satisfaction of immediate and basic human needs, primarily the need for food. This question does not have any clear-cut answer. On the other hand, it is possible to

discuss moves that could both preserve the wildlife and improve the livelihood of the local population in wildlife areas.

## Conclusive remarks

Central government system of wildlife management is based on regulating the harvest by hunting quotas, set by government. The regulations are enforced by government employees who patrol the protected areas. This approach still has a strong standing in Tanzania, and some scholars argue that sustainability can be achieved that way. Caro *et al.* (1998a) studied the effect of human activities on 21 mammal species in Tanzania based on an aerial census. They found relatively high densities of animals in areas that were patrolled by guards. Based on that, they suggest that wildlife can be protected by 'prohibition of human activities backed up by on-site enforcement'. In another paper (Caro *et al.*, 1998b) they suggest that 'sustained exploitation' can be achieved by adjusting hunting quotas.

For several reasons we do not believe in such an approach for areas like the Kilombero Game Controlled Area. First, it is clear from this paper that wildlife is so important for the livelihood in Kilombero Valley that strict enforcement of laws designed to keep people away from wildlife would be intolerable to the local people and thereby result in severe conflicts. Second, regulating hunting quotas has limited effect with the extent of unlicensed hunting that takes place in Kilombero, as evidenced in this paper by the availability of wildlife meat. Third, efficient patrolling by government employees in a huge area like Kilombero Game Controlled Area seems to be beyond the financial capacity of a poor country like Tanzania.

Instead, we think there is a lot to learn from successful community based programs like CAMPFIRE (Child, 1996). By making sure that both responsibility and benefits deriving from wildlife conservation are distributed to the villages, one can raise people's motivation for conservation. Tourist hunting licenses involve large amounts of money, compared to the amounts earned by average Tanzanian villagers. Allocating a certain percentage of the hunting licence fees to the villages would be a first step to raise people's motivation for wildlife conservation and to build mutual confidence between the government wildlife managers and the local people.

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