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CONSTRAINTS TO SUSTAINABILITY OF BENEFITS FROM WILDLIFE RESOURCES: AN ANALYSIS OF SOCIOECONOMICS OF BUSHMEAT HUNTING IN AND AROUND MAJOR HUNTING SITES IN UGANDA

Overharvesting is a major threat to conservation and a potential hindrance to achievement of full benefit from wildlife resources. Wildlife is a potentially renewable resource, which, if managed carefully, can sustain indefinitely. We believe that a lasting solution to any problem must begin with a thorough analysis. This report analyses illegal hunting and underlying influences in Uganda's premier parks and in an expanse of wildlife-rich but privately owned land. The report is intended to provide an understanding of the extent of illegal hunting, some of the factors driving it, and to suggest potential corrective actions. The analysis is performed within the scope of data from four field- and some urban sites.

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Acronyms

ABCG – African Biodiversity Collaborative Group
CARE – Cooperative for Assistance and Relief Everywhere, Inc
CBFP – Congo Basin Forest Partnership
CCR – Community Conservation Ranger
GIS – Geographic Information System
GPS – Global Positioning System
ITFC – Institute of Tropical Forest Conservation
IUCN – International Union for the Conservation of Nature
MFCA – Murchison Falls Conservation Area
PRIME/West – The Productive Resources Investment for Managing the Environment in Western Uganda
NRC – National Research Council
ODI – Overseas Development Institute
QECA – Queen Elizabeth Conservation Area
QENP – Queen Elizabeth National Park
RMNP – Rwenzori Mountains National Park
USAID – United States Agency for International Development
UWA – Uganda Wildlife Authority
WWF – World Wide Fund for Nature

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Summary

Wildlife offers numerous environmental, economic, spiritual and cultural benefits important for the well being of human society. The potential of these resources to serve society in the long term is however threatened primarily by overharvesting and land use change. Uganda for example underwent a period of breakdown of law and order during the mid 1970s to early 1980s and this led to massive hunting followed by drastic wildlife population declines and extinctions of some species. Prior to this, Uganda had been a prime tourist destination with Murchison Falls National Park as one of the top tourism destinations in Africa. As a result of population declines, Uganda was no longer as interesting and is yet to recover its former glory as a tourism destination.

We studied patterns of illegal bushmeat offtake and drivers of illegal hunting in and around Murchison Falls Conservation Area (MFCA), Queen Elizabeth Conservation Area (QECA)-the part comprising Queen Elizabeth National Park, Kyambura Wildlife Reserve, and Kigezi Wildlife Reserve only - , Rwenzori Mountains National Park (RMNP), and the Kafu River Basin in Central and Midwestern Uganda. All of these sites are savanna or mixtures of woodland and savanna, except for RMNP which is forest. The study was performed through household survey, observation, and interviews with surrendered poachers.

In general, we found that except for households headed by hunters, bushmeat was a less important source of protein to the households in these sites compared to livestock meat and fish. Hunters also heavily depended on bushmeat as a source of income. Poverty and cultural attachment were the main reasons for bushmeat use. Bushmeat eating households regard bushmeat as more tasty and medicinal than livestock meat and fish. Animal parts are also valued for curative, spiritual and supernatural uses and this is in part what drives hunting of some species. Crop raiding and other forms of human-wildlife conflict also drive illegal hunting but on a smaller scale than hunting for bushmeat.

Potential solutions to the problem of unsustainable wildlife hunting lie in strengthening law enforcement, increasing conservation education, reducing human-wildlife conflict, and empowering rural households with better formal education, alternative income, and meat sources. Land use planning including components of wildlife management should be instituted in wildlife rich privately owned lands.

1. Introduction

1.1. Biodiversity values, population impact and significance of bushmeat

Natural biodiversity, despite progress in agricultural productivity and plantation forestry, is important to humans in providing food security, micronutrients, medicines, fuel, construction materials, raw materials, farming inputs (ABCG, 2004). Biodiversity also provides important ecosystem services such as soil, watershed, pollinator and wildlife habitat and ecological functions (Ape Alliance, 2006). From an ecological view point, wild plants are for example reliant on animals for pollination, seed dispersal and germination (Williamson, 2002; Serio-Silva and Rico-Gray, 2002; Riley, 2002). Large mammals such as apes and elephants, play such an important ecological role – dispersing seeds in their dung, pruning trees as they pluck leaves and creating light gaps in the canopy as they break branches – that they are sometimes referred to as the gardeners of the forest (Ape Alliance, 2006).

Prevailing scientific opinion is however that current species extinctions and biodiversity declines are higher now than at any other point in human history, and that the major cause is the human species. Geographic nuclei of species extinctions are areas where human populations and pressure from hunting and agriculture are most intense (Ceballos and Ehrlich, 2002; Ape Alliance, 2006). Popular contemporary belief is however that hunting for food rather than habitat loss is the leading driver of these losses (Robinson et al., 1999; Wilkie and Carpenter, 1999; Ape Alliance, 2006). Human use of biodiversity is natural, but the scale of that use has risen exponentially in the past century with bushmeat as a major contributor of faunal loss (Ape Alliance, 2006).

Bushmeat is thought to be an important resource for the many poor rural peoples in Africa, Asia, and South America (Robinson & Bennett, 2004. In the Malaysian state of Sarawak, 67% of the meals of the Kelabis contain wild meat (Bennett *et al*., 2000). In Liberia, 75% of the country's meat derives from wild animals (Anstey, 1991). A high economic value is attached to the subsistence use of, and the commercial trade in wild meat, making it an important source of livelihood for both rural and urban communities. For instance the value of meat harvested in the Amazon Basin exceeds US$ 175 million per year and in the Ivory Coast the value of meat eaten each year is estimated to be US$200 million (Lamarque, 1995). In parts of eastern and southern Africa where commercial hunting is established, the combined output from the formal game meat industry and the non-directed game meat production systems, in seven countries was estimated at an economic value of US$ 7,698,224 per annum (Barnett, 2000). Although commercial trade in bushmeat occurs across almost all of tropical Africa, Asia and the

Neotropics (Robinson and Bennett, 2000), it is as far as it is known, most critical in the densely forested regions of Central and West Africa where the magnitude of hunting is six times the sustainable rate (Bennett, 2002).

Bushmeat hunting is a major cause of decline of wildlife populations in Africa (Barnett, 2000; Barnes, 2002; Loibooki *et al.*, 2002; Naughton-Treves *et al.*, 2003; Brashares *et al.*, 2004; deMerode *et al.*, 2004; Cowlishaw *et al.*, 2005; Fa *et al.*, 2005). Studies conducted so far deal mainly with the bushmeat trade in West Africa and Congo Basin where the trade is more explicit and there are open markets for bushmeat, despite its illegality in many countries (Wilkie, 2001; Fa *et al.*, 2003). These studies suggest that the impact of the trade surpasses that of habitat modification, particularly for large mammals (Bulte and van Kooten, 2001; Wilkie *et al.*, 2001). Less is known about the trade in East and Southern Africa (Barnett, 2000) although the number of studies has been increasing recently (Kenya- Muriithi and Kenyon, 2002; Born Free, 2004; de Merode and Cowlishaw, 2006; Wato *et al.,* 2006; Lutz and Newiadomsky, 2007; Tanzania- Carpaneto and Fusari, 2000; Loibooki *et al.,* 2002; Holmern *et al.,* 2006; Nielsen, 2006; Holmern *et al.,* 2007; Jambiya *et al.,* 2007; Uganda – CARE, 1999; Okello, 2004).

Studies suggest that in many areas in West and Central Africa, bushmeat is an economically important food and trade item for thousands of rural and urban families and animal parts are also important for their role in ritual (Wilkie and Carpenter, 2001). In West Africa, there are for a large part no legal restrictions on bushmeat hunting and bushmeat is sold openly in the markets. Wildlife populations have been so depleted by years of unsustainable hunting for meat, that bushmeat is no longer the most important source of protein in families' diets (Cowlishaw *et al.*, 2005). In many markets, rodents now form the bulk of the bushmeat as the antelopes and other larger mammals have been extirpated from the forests (Cowlishaw *et al.*, 2005; Fa *et al.*, 2005). In eastern and southern Africa, the importance of bushmeat to community development and national revenues is less well understood. Illegal bushmeat hunting, has until recently, been thought of as a subsistence-motivated activity, carried out exclusively by rural families with a history of traditional use, but commercial trade across the region is now of serious conservation concern (Barnett, 2000; Born Free, 2004). At least 25% of meat in Nairobi butcheries is bushmeat, sold under the auspices of domestic meat, and a further 19% is a domestic-bushmeat mix (Born Free, 2004).

1.2. Root causes and drivers of bushmeat utilization

Drivers of bushmeat use vary between communities. Some people may eat it because it is affordable, familiar, culturally traditional or prestigious. Others may do so because it tastes good to them and adds variety to household diet (Wilkie *et al.,* 2005). Obtaining bushmeat is

however not the only reason for hunting. Acquisition of animal trophies as cultural artifacts or for personal adornment (e.g., feathers, skins, teeth) is a widespread practice throughout tropical forest regions. Many artifacts are got from animals which would not be farmed for their meat (e.g., hornbills, birds of paradise, large carnivores). Animals hunted in the wild are frequently regarded as having medicinal properties, or have particular symbolic or social importance (Mockrin *et al.,* 2005). For some cultures, hunting is compounded by lack of concept of or belief in natural resource scarcity (Croll and Parkin, 1992). In other cultures, to be a hunter is essential in gaining respect, achieving manhood, or winning a bride (Bennett and Robinson, 2000).

Bushmeat use is compounded by numerous factors, summarized by Ape Alliance (2006) as: increasing human population and rising demand; uncontrolled access to forest wildlife facilitated by logging; mining and hydroelectric or fossil fuel transport companies; war and civil strife; weak governance; institutional deficiency and civil disobedience; sophistication of hunting techniques; lack of capital or infrastructure for meat production; changes in the cultural environment and discarding of social taboos and traditional hunting embargoes; structural adjustment plans imposed by international financial institutions resulting in civil service job losses; unemployment; poverty and dysfunctional economies, with lack of alternative monetary opportunities; and local factors, including topography, available infrastructures, market access, taboos, religions, weapon availability and hunting seasons.

In the Congo Basin where the problem is believed to be most severe, logging and petroleum production and mining are leading industries in the Congo Basin (Minnemeyer, 2002; CBFP, 2005). These activities have had major impacts through road development, establishment of education and health care infrastructure, and through job creation (Noss, 1997; Eves and Ruggiero, 2000). Whole villages of unemployed households have sprung up adjacent to official logging company housing to support logging employee needs for agriculture and hunting activities (Eves, 1996).

Bushmeat hunting is rarely linked to human-wildlife conflict, but some legal hunting does occur in response to this in parts of east and southern Africa (Barnett, 2000). In Uganda, there has been mounting pressure to legalize hunting of problem animals. For example, Naughton-Treves *et al.* (1998) reported that in Kibale, up to 17 wildlife species damage crops around the park and primates account for as much as 71% of damage events. Because resulting risk perception among farmers has been amplified by legal prohibitions on killing wild animals (Naughton-Treves, 1997), Uganda Wildlife Authority declared three species – bush pigs, baboons, and vervet monkeys – vermin and these are occasionally hunted by farmers with supervision of the Wildlife Authority personnel.

1.3. Impacts of bushmeat hunting on species and natural systems

Over-exploitation of wildlife is expected to alter forest composition, architecture and biomass, as well as altering ecosystem dynamics, such as re-growth and succession patterns, deposition of soil nutrients and carbon sequestration (Apaza *et al.,* 2002). The 'empty forest syndrome' (Redford, 1992) or 'empty savanna syndrome' (Ape Alliance, 2006) therefore threatens the future not only of species but entire ecosystems. Research suggests that bushmeat use is positively correlated with availability, the most commonly hunted species being those that are abundant, proximal to human habitation and commonly regarded as pests (Bowen-Jones and Pendry, 1999).

Habitat type and location are also crucial factors. Savanna and woodland ecosystems are thought to be more productive than forests and xeric landscapes and moderately disturbed habitat more than undisturbed (Robinson and Bennett, 2004). Bushmeat consumption is more prevalent in forest communities than in any other type of habitat (Kümpel, 2005). In agricultural park-boundary areas, the main productivity is small game, and the loss from crop raiding can exceed the gain from bushmeat hunting (Naughton-Treves *et al.,* 2003). The most profitable species to hunt in forest situations are believed to be large-bodied animals, weighing more than 1kg (for example, apes and duikers), which provide more meat per gun cartridge than smaller species (Kaul *et al.,* 1994; Robinson, 1995). Large-bodied animals are however the most vulnerable to hunting due to their low reproductive rates (Barnes, 2002).

The opportunistic nature of hunting keeps pressure on animals high and accelerates extinction of mainly large mammals (Barnes, 2002; Wilkie and Carpenter, 1999). The vulnerability of a species to hunting is a product of biological characteristics, including body size, growth rate and reproductive biology, as well as demographic factors, including population density, distribution and habitat specificity. So, although large-bodied species are initially the target of hunters, hunters turn increasingly to smaller and smaller species as populations decline, and the effect spreads throughout the biological community (Fa *et al.,* 2001; Milner-Gulland *et al.,* 2003). In Uganda, there are indications that without controls, hunting is not sustainable. In a review of management options for Uganda's Wildlife Reserves and Controlled Hunting Areas, Lamprey and colleagues (Lamprey *et al.,* 2003) noted that rampant killing of wildlife as a result of breakdown of law and order in the country during the mid 1970s-early 1980s reduced large mammal populations by over 90%.

1.4 Goal and Objectives

This study was undertaken to increase knowledge of bushmeat hunting in East Africa by documenting trade, extent of the market, dependence on bushmeat, and factors driving bushmeat use in and around main hunting sites in Uganda.

Specific Goal: To understand the bushmeat trade in Uganda in order to provide recommendations about how to best to mitigate the threat caused to the long term survival of wildlife populations.

Specific objectives:

1) Understand the extent of the problem of bushmeat utilization for both subsistence needs and also for commercial purposes around the remaining centres of wildlife in Uganda;
2) Assess the socioeconomic factors that drive the bush meat market including cultural values and alternative sources of protein;
3) Assess the market chain from the main wildlife areas in Uganda to Kampala, and the role that the bushmeat trade plays in household livelihoods; and
4) Obtain a data set to understand the linkages between crop-raiding and bushmeat harvesting.

2. Methods

2.1. General

The focus of this study was four field sites and one major urban area; Kampala. The field sites were Murchison Falls Conservation Area (MFCA); Kafu River Basin (Kafu Basin); Queen Elizabeth Conservation Area (QECA) – the part comprising Queen Elizabeth National Park, Kyambura Wildlife Reserve, and Kigezi Wildlife Reserve only; and Rwenzori Mountains National Park (RMNP) (Fig. 1). These sites were chosen on the basis of prior knowledge that they are the main bushmeat hunting sites in Uganda and in the case of Kampala, it was considered a potentially large market for urban trade.

We collected data through household interviews, observation, and interviews with surrendered hunters during April 2007-January 2008. For the household survey, the area of interest was the villages up to 5km from protected area boundaries. In the case of the Kafu Basin, we were interested in the band 45km long and 25km wide on either side of the river in the lower basin abutting Lake Kyoga and the Victoria Nile. The project was accomplished with help of research assistants and field assistants (including key informers). Field assistants were supervised by research assistants, who held first or second university degrees, and based near the sites. They had substantial prior experience in independent research. In each site, one staff member volunteered by the Uganda Wildlife Authority participated in the survey. All field staff were directly supervised by W. Olupot and information from all key informers was regularly cross validated for error.

Reducing the problem of illegal bushmeat utilization requires understanding of the role that bushmeat plays as a source of protein among the rural households and underlying factors. We conducted household surveys to determine frequencies with which households ate bushmeat as opposed to livestock meat and fish and to relate that to income, wealth, and other characteristics often used in household surveys (Grosh and Glewwe, 2000). We were also interested in the extent to which crop raiding and other forms of human-wildlife conflict were a problem and how these translated to killing of animals. We reckoned that a sample size of at least 300 households was sufficient to reveal the true patterns of the information we sought in each site.

Among the set of questions asked during the household survey (Appendix 3), we did not ask people how many times they ate bushmeat each day over a given set of days (up to 3 days is usually recommended for best recall – e.g. review by Eves, 2006). This was because our

experience in Uganda is that bushmeat consumption is illegal except as linked to rare cases of vermin control, sport hunting, and legal import from ranchlands abroad. People in and around the study sites were thus likely to be averse to being asked about whether or not, and how many times they ate bushmeat in the last few days. We thus opted for a 'friendlier' approach of asking how many days on average, according to their experience, they ate bushmeat over a given number of days (examples of answers were every day, once a week, two times a month, two times a year, and so on). Although this approach does not give as good an indication of how much bushmeat they ate as asking them how many times they ate it during the last three days (for which we were likely to jeopardize the interview or get no answers), it gave a consistent basis for understanding the relative importance of bushmeat in their diets, compared to for example livestock meat, and for determining socio-economic drivers of bushmeat use in each site.

Roads have been shown by several studies to drastically increase the probability of bushmeat offtake particularly in the Congo Basin (e.g. Bennet and Deutsche 2003, Eves 2006). This impact usually arises where new roads are cut into intact forest for logging or mining, easing movement of hunters and bushmeat and yet movement of both hunters and bushmeat are relatively open in these situations. Impact of roads was not investigated in this study in part because the roads associated with the study sites are long established but also because bushmeat movement is typically clandestine. As such, we reckoned that a directed study may be needed to investigate effect of roads.

To locate households for interview, we used LC1s as base reference points. LC1s are the smallest government administrative units. We aimed at visiting at least 30 LC1s and to talk to 10 households in each to raise our intended sample of households. To identify the LC1s to visit, we used ArcView GIS to overlay a grid of 1km squares over the areas of interest in each site (Fig. 2) and generated mid point UTM coordinates for each square. These coordinates then represented points in LC1s we would visit. Because there were many points generated as a result (hundreds to over a thousand depending on the site) we had to select a few that would represent our LC1s of interest. Based on our required upper limit of 600-650 households in each site, we used Microsoft excel to randomly select 60 and for the case of QECA, 65 geographical locations. These coordinates were imported into hand held GPS units to guide assistants to the LC1s to sample. On reaching a selected LC1, researchers introduced themselves to the local officials to obtain permission and then proceeded to talk to household heads.

Since it would not have been possible to obtain information on hunting incidences through household surveys, we used assistants (key informers) residing in the villages and trading centres adjacent or inside study sites. Assistants provided monthly information on animals

killed, hunting locations, weapons used, and how the meat was used by hunters. Assistants also recorded how much the hunters ate and sold, areas where meat was sold, or taken and how much it cost. We wanted to obtain at least five monthly observational records from each site and as such we aimed at employing five assistants in each site, spaced far enough from each other to prevent duplication of records.

Surrendered hunters were interviewed to obtain supplementary information on factors that drive illegal hunting. Among questions asked were what motivated them to hunt, and how body parts from the dead animals are used and what could be done to stop or reduce illegal hunting. We aimed at talking to at least 10 poacher groups.

2.2. Study Site Description

Three out of the four field sites are National Parks, and one, the Kafu Basin, is a woodland predominated by a series of privately owned ranches and pastoral lands. The national parks are Uganda's premier tourism sites, attracting some of the highest numbers of tourists annually of any other sites in the country. Wildlife hunting in these sites and throughout Uganda is illegal but for occasional incidences where UWA supervises removal of bush pigs, baboons, and vervet monkeys which are regarded as vermin. There is substantial effort going into the enforcement of the law on hunting. The only other case of legal hunting is around Lake Mburo National Park, where UWA issues permits to sport hunters.

The study sites represent a broad range of habitats, from savanna through woodland to forest, allowing for exploration of the bushmeat use across a broad range of species, density situations, and management regimes. Primate species richness for example is highest in forested RMNP, while the savanna and woodland sites are richer in ungulate populations. The sites also vary in potential productivity. Savanna and mixed woodland systems of Africa have been shown to be an order of magnitude higher than forests for mammals (Robinson and Bennett, 2004) and as such bushmeat productivity can be expected to be lower for RMNP than other sites.

Murchison Falls Conservation Area (MFCA) lies at the northern end of the Albertine Rift and includes part of the valley floor and escarpment. It is comprised of Murchison Falls National Park (3,893km^2), Karuma Wildlife Reserve (678km^2) in the east and south east, and Bugungu Wildlife Reserve (474 km^2) in the southwest (UWA 2001). The conservation area is a savanna, heavily wooded in the south, grading gradually into a grassland-dominated landscape to the north. In the south, this site abuts Budongo Central Forest Reserve. River Nile cuts right through in an approximately east-west direction two thirds of the distance from the southern edge. Large mammals occurring here include elephants, hippos, buffalos, Jackson's hartebeest, and

waterbuck. The only viable populations of Rothchild's giraffe and the Nile Crocodile in Uganda are found here as giraffe numbers in Kidepo Valley National park and crocodiles in QENP are not sufficient to sustain the populations (Olupot et al., in prep). Other large bodied animals occurring here are Uganda kob, sitatunga, and bushbuck. The focus was the area south of the Nile, in villages within 5km of the protected area boundary. Agriculture is the main stay of the economy of the villages to the east and south of the site, with at least 44 crop types grown. Most of the western part overlooking Lake Albert is pastoral except for the northerly areas adjacent the Nile banks. Main crops grown by households living around this site are cassava (grown by 77% of all the households interviewed), maize (62% of households), sweet potatoes (22%), groundnuts (14%), and cotton (13%). Other main crops include sunflower (9%), bananas (9%), mangoes (7%), and rice (6%). Cattle, goats, chicken, pigs, guinea fowls, pigeons, rabbits, sheep, and turkey are the animals kept by people in this area, but the main ones are chicken (kept by 77% of the households, goats (51% of the households), cattle (21%), and duck (13%). In agricultural areas, land is farmed right up to the edge of the protected area whereas in the mostly pastoral western areas, vegetation transition from the protected area to the lake flats below inhabited by communities is not abrupt.

Figure 1: Map of Uganda Showing study sites. Kampala, Masindi, Fort Portal and Kasese were the only represented urban sites covered.

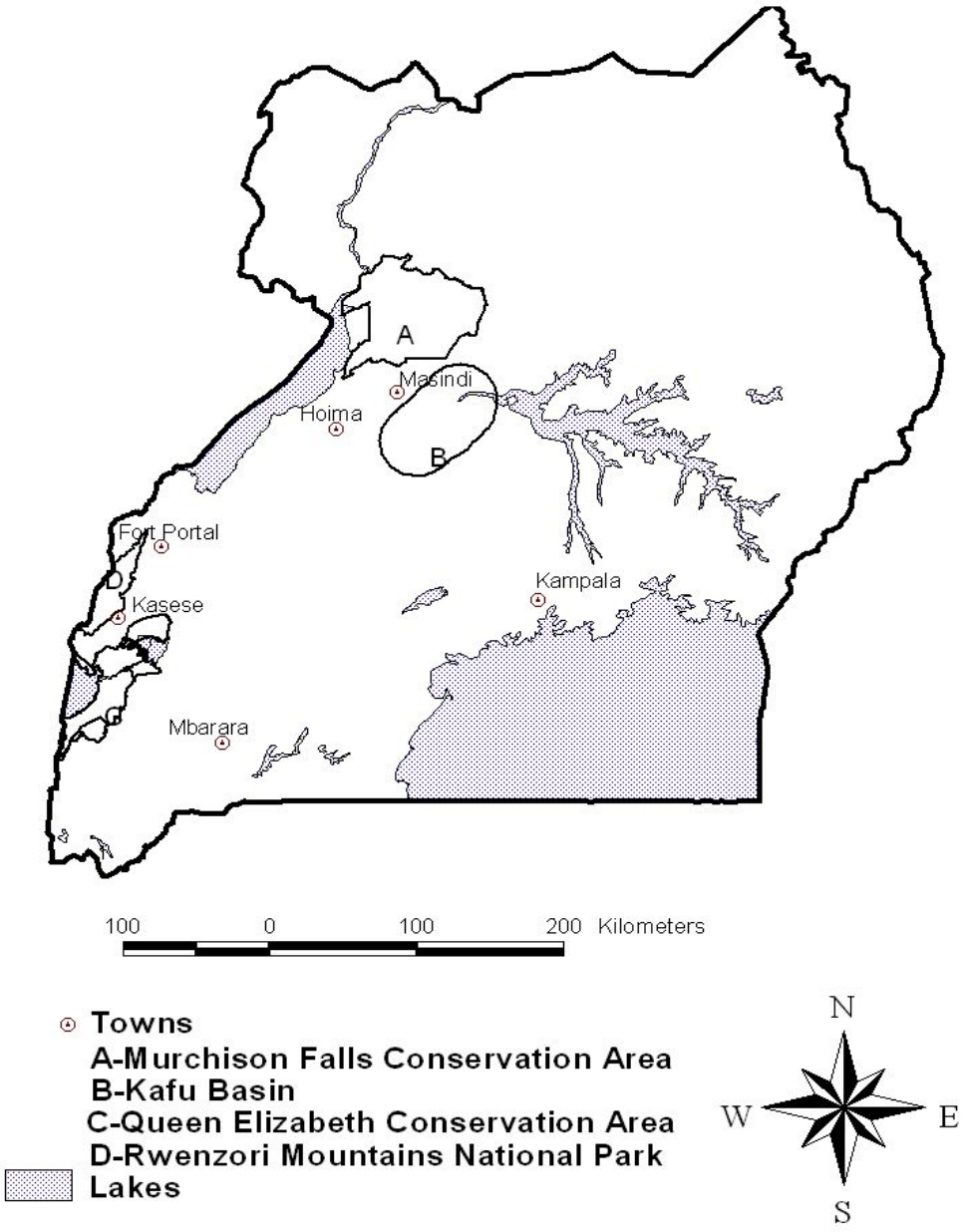
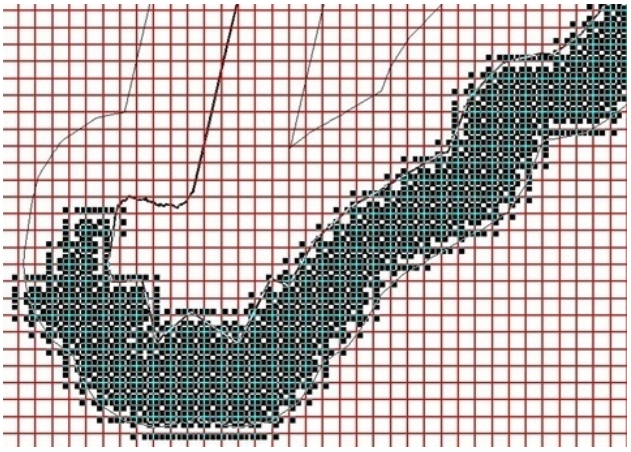


Figure 2: An example of the way in which we generated our sample of LC1s visited : Map of the southernmost tip of RMNP showing a 5km buffer (dark strip) along the outer edge of the park boundary. 1x1 km squares in this band were used to generate a pool of coordinates from which we drew a random sample to guide us to LC1s for the household survey



The Kafu River Basin (Kafu Basin) is a catchment for River Kafu which drains from the west near Lake Albert to the point where the Nile exits Lake Kyoga to the east. The area is typically a wooded savanna Predominated by ranches and pastoral lands and dotted with small-sized crop fields. River Kafu runs through the middle of this area, with the district of Masindi on the northern bank, and Kiboga, Nakaseke and Nakasongola on the southern bank (Rwetsiba *et al.,* 2007). This study focused on a 45km long and 25km wide strip on either side of River Kafu between the point where R. Mayanja pours into the Kafu and River Kafu's mouth in the east. While preparing for this study during early 2007, W. Olupot and his team sighted more than twice as many animals here per unit distance (typically Bushbuck, Oribi, and Kob) when driving through this area than they saw during the same week while travelling between Kichumbanyobo gate and Paraa Safari Lodge in Murchison Falls National Park. A recent census by UWA counted populations of kob, bushbuck, oribi, waterbuck, reedbuck, sitatunga, and duiker in this area (Rwetsiba et al. 2007). The importance of this site for the conservation of Oribi needs further consideration, in the meantime judging from available records of population counts, the site appears to be one of the most important, if not, the most important for conservation of Oribi in Uganda. Indications by hunting records filed by key informers are that hippo, hartebeest, and warthog are extant, though the recent census by UWA (Rwetsiba *et. al.,* 2007) suggests otherwise. Domestic animals kept by the residents here are chicken (kept by 73% of the households), cattle (63% of the households), goats (61%), pigs (25%), sheep (8%), and duck (0.4%). Main crops grown are cassava (grown by 30% of the households), sweet potatoes (27%), maize (24%), beans (18%), and groundnuts (14%). Other crops include millet, bananas, peas, cotton, and fruit crops.

Queen Elizabeth Conservation Area (QECA) lies in the western rift valley at the southernmost tip of the Rwenzori mountains. Predominant features of this site are Lake George in the North and L. Edward to the south. The southernmost tip borders the DRC along River Ishasha. The conservation area is comprised of Queen Elizabeth National Park (1,978 km^2), Kyambura Wildife Reserve (154 km^2), and Kigezi Wildlife Reserve (269 km^2) and is 2,401 km^2 in size (Rwetsiba et al. 2002). It is a mosaic of woodland savanna vegetation, densely wooded in the southeast in the area of the Maramagambo forest, but more open in the rest of the park. The most common large bodied animals in the park are elephant, hippo, buffalo, waterbuck, topi, kob, warthog, bushbuck, giant forest hog, lion, hyena, and leopard. The main focus of this study was the villages within 5 km of the park boundary. Agriculture and livestock keeping are two main activities of the residents and several fishing enclaves occur on shores of both lakes. To the west, the areas adjoining the park boundary in the district of Kasese are predominantly pastoral, while those in the east, in the districts of Kanungu, Rukungiri, Bushenyi, and Kamwenge are predominantly agricultural. The distinction between the conservation area and surrounding lands is more abrupt on the eastern side, with land cultivated right up to the boundary. At least 50 crop types are grown here. Main crops are cassava (grown by 76% of the households), maize (grown by 75% of the households), beans (74%), bananas (53%), coffee (48%), millet (44%), groundnuts (40%), mangoes (38%), and avocadoes (31%). Others are cotton, egg plants, papaya, jack fruit, and eucalyptus. Animals kept include chicken (kept by 77% of the households), goats (64% of the households), cows (13%), pigs (12%), sheep (11%), and duck (11%). Others less commonly kept are pigeons, rabbits, donkeys, turkeys, and guinea pigs.

Rwenzori Mountains National Park (RMNP) is a montane forest on the Rwenzori mountain ranges from Kasese district in the south to Bundibugyo in the north. The Park ($0^o06'$:$0^o46'$N, $29^o47'$:$30^o11'$E) is located along the Ugandan border with the DR Congo and covers much of the Rwenzori Massif above 1,600 m and an area of 998 km^2 in the districts of Kasese, Kabarole, and Bundibugyo. The mountain range runs over 100 km in a northeast-southwest direction and is 50 km wide at the widest part. Most of the western edge lies along the Uganda-DRC border. One hundred and two mammal species occur in the park including elephant, giant forest hog, the Rwenzori duiker, sitatunga, buffaloes, hyrax and leopards, and four species of diurnal primate (Plumptre et al. 2003). The focus of this study was the villages on the Ugandan side within 5km of the park boundary from the southwestern edge adjacent the DRC border to the northernmost tip. This strip falls mostly within the rugged slopes of the mountain base, and receive heavy rainfall. The main economic activity in this area is agriculture. At least 40 crop types are cultivated. Commonly grown are beans (99% of the households interviewed), cassava (97% of the households), coffee (78%), Irish potatoes (63%), matooke (63%), yams (61%),

ground nuts (57%), passion fruits (41%), and maize (31%). Other crops include garlic, mangoes, onions, millet, and jack fruit. Animals reared are chicken (kept by 88% of the households interviewed), goats (74%), pigs (17%), and sheep (15%), cattle (14%), and ducks (2.7%). Less common are donkeys, rabbits, and turkeys.

2.3. Data Analysis

All data were stored in Microsoft Access. Processing and analysis were performed using Systat Version 10.2 and Microsoft Excel (2007edn). Spatial representation was achieved using ArcView Version 3.2a.

The majority of statistical tests were employed to assess socioeconomic characteristics that distinguished bushmeat eating from non-bushmeat eating households, and to explore the relationships between potential drivers of meat use and the frequency of meat consumption. In the case of the former, we used unmatched sample t-tests to compare means while for the latter, we employed simple linear and multiple Pearson regressions. Meat eating frequencies used were rates calculated from original records (of number of times per week, or per month and so on). Because we asked respondents how many days their families ate bushmeat for a given period rather than many times ate bushmeat each day, our daily rates are somewhat different from what is typically reported from the Congo Basin or other areas where bushmeat is transported and usually eaten openly. All data used for these tests were converted to logarithms to meet assumptions of parametric analyses. We used the “log10(value+1)” conversion for all cases requiring data transformation. We also used Pearson correlations and Z-test for proportions where appropriate.

Village (LC1) characteristics (distance from PA edge and social infrastructure, and population size) though assessed, were considered uninformative and therefore not analyzed as predictors of household bushmeat consumption because of the low sample size of respondents answering in the affirmative to eating bushmeat.

3. Results and Discussion

3.1. Sample sizes

For the household survey, we aimed at talking to at least 300 household heads in each site, 10 from each randomly selected LC1. Altogether, 440-524 households in 40-52 LC1 were covered in each site (Table 1). There were 1-14 informers reporting from anyone site each month (Table 2) and up to 20 surrendered poacher groups and subgroups were interviewed (Table 3).

Table 1: Number of LC1s covered and respondents interviewed in each site.

Site	**Number of LC1s**	**Number of Respondents**
MFCA	40	440
Kafu Basin	50	501
QECA	57	564
RMNP	52	524
Total	211	2115

Table 2: Number of assistants returning monthly records of hunting, bushmeat use, movement, and trade in each site during the study period

Month	MFCA	Kafu Basin	QECA	RMNP
Apr-07	2	2	4	0
May-07	3	3	5	1
Jun-07	3	4	5	1
Jul-07	5	3	8	3
Aug-07	5	4	9	1
Sep-07	5	5	10	4
Oct-07	5	4	14	4
Nov-07	7	5	11	4
Dec-07	5	6	11	4
Jan-08	5	5	11	4

Table 3: Surrendered poacher groups interviewed who were associated with study sites.

Name of surrendered poacher group	**Associated Focal Site**
Awanyandato expoachers association subgroup A	MFCA
Awanyandato expoachers association Subgroup B	MFCA
Candek hunter's group	MFCA
Karuma expoachers	MFCA
Kibamba expoachers group	MFCA
Kimina expoachers Association - subgroup A	MFCA
Kimina expoachers Association - subgroup B	MFCA
Mboira Kyahuterare group	MFCA
Bahigi-Kweiteisa subgroup A	QECA
Bahigi-Kweiteisa subgroup B	QECA
Bwanika antipoaching group	QECA
Ihandiro antipoaching	QECA
Kamuruli antipoaching group	QECA
Kisinga antipoaching association	QECA
Kiyanga expoachers	QECA
Kyambogho antipoaching group	QECA
Munkunyu veteran expoachers association	QECA
Kyempara antipoaching group	QENP
Kitolhu antipoaching group	RMNP
Rwenzori antipoaching community	RMNP

3.2. Frequency of meat intake among rural households

Meat consumption was explored to understand how often families eat bushmeat and how frequency of bushmeat intake compares to that of eating livestock meat and fish. Household heads were asked whether their families ate meat and if so, how often they ate it, specifying by meat type including bushmeat as much as possible. Examples of answers were everyday, number of times per week, number of times per month, number of times per year or never. A small proportion (5-32%) of respondents interviewed admitted to eating bushmeat but the majority of families (94-100%) ate livestock meat and/or fish (Table 4 a&b).

Table 4: Percentage of respondents that reported eating bushmeat and/or livestock meat and fish.

a) Bushmeat

Field site	Number of respondents	%
MFCA	140	32
Kafu Basin	58	12
QECA	110	20
RMNP	24	5

b) Livestock meat and fish

Field site	Number of respondents	%
MFCA	412	94
Kafu Basin	495	99
QECA	561	99
RMNP	522	100

The most commonly mentioned livestock meat types were beef, chicken, goat, mutton, and pork. Fish (and fish bones from filleting industries) are by far by the most frequently reported eaten by households around MFCA, QECA, and RMNP, eaten on average in 20-40 days in every 100 days (Table 5). Beef is the most commonly eaten meat type in the Kafu Basin, eaten on average in 8 out of every 100 days. Livestock meat and fish were reported as eaten in 5-14 of every 100 days overall.

Table 5: Mean daily consumption of livestock and fish by people living in and around the study sites. Fish was cited as the most frequently eaten in three out of the four sites and beef in one site. Mutton was consistently cited as the least frequently eaten in all sites. n=number of affirmative responses.

	MFCA		Kafu Basin		QECA		RMNP	
Livestock meat	Mean daily consumption	n	Mean daily consumption	n	Mean daily consumption	n	Mean daily consumption	n
Beef	0.093	396	0.083	495	0.094	562	0.109	516
Chicken	0.085	405	0.035	494	0.025	541	0.012	513
Duck	0.011	1			0.033	1		
Fish	0.379	386	0.060	490	0.218	488	0.224	382
Fish bones				495	0.653	34	0.741	76
Goat	0.071	375	0.035	470	0.071	532	0.084	521
Mutton	0.030	265	0.002	491	0.013	223	0.083	109
Pork	0.153	333	0.064		0.068	349	0.103	261
Overall (calculated from all records)	0.140		0.047		0.095		0.119	

Bushmeat, on the other hand was reported as eaten by a comparatively small number of respondents. Even among the respondents that reported eating it, it was far less frequently eaten than livestock meat and fish. On average, households that reported eating bushmeat consumed it in 1-12 out of every 100 days (Table 6). Bush pigs, cane rats, guinea fowls and kob were the main sources of bushmeat around MFCA; bushbucks, duikers, oribi and bush pigs within the Kafu Basin; hippos, buffalos, bush pigs, and kob around QECA; and redtail monkeys, black-and-white colobus monkeys, and bush pigs around RMNP.

Table 6: Mean daily bushmeat intake by households in and around major hunting sites. n=number of affirmative responses. The category 'any species' does not have records for Kafu Basin and RMNP as this answer was not given by any of the households there.

	MFCA		Kafu Basin		QECA		RMNP	
Bushmeat type	Mean daily consumption	n	Mean daily consumption	n	Mean daily consumption	n	Mean daily consumption	n
Any species	0.161	9			0.066	3		
Birds							0.104	2
B & W Colobus							0.013	10
Blue monkey							0.001	1
Buffalo	0.023	28			0.010	54	0.005	2
Bushbuck	0.089	16	0.023	48				
Bush pig	0.114	78	0.006	31	0.053	40	0.004	10
Cane rat	0.315	29	0.008	7			0.007	3
Dikdik	0.033	1						
Duiker	0.068	6	0.039	45	0.002	2		
Elephant	0.008	17						
Francolin	0.074	2					0.004	2
G. forest hog					0.009	20		
Guinea fowl	0.100	25			0.011	1		
Hartebeest	0.003	1						
Hippo					0.012	78	0.008	5
Hyrax							0.012	2
Uganda kob	0.092	20			0.014	64		
Oribi	0.011	1	0.027	22				
Porcupine	0.033	1	0.010	15			0.025	2
Rabbit	0.643	4						
Redtail monk.							0.011	11
Reedbuck	0.122	11	0.012	9			0.002	3
Rwe. colobus							0.010	3
Sitatunga	0.066	1	0.008	1				
Squirrel	0.177	5	0.016	1				
Topi	0.005	1						
Warthog	0.044	15			0.010	18		
Waterbuck	0.066	2	0.004	2				
Grand Mean	0.120		0.022		0.018		0.012	

Households that ate bushmeat also ate livestock meat as often as households that did not, except for those around MFCA for which livestock meat and fish intake was significantly lower for bushmeat eating households (Table 7). In all sites, there was no relationship between mean daily bushmeat and livestock meat and fish intake, suggesting that increasing livestock meat and fish intake of bushmeat eating households would not necessarily decrease their bushmeat intake (Table 8). A significantly higher mean livestock meat intake among non-bushmeat eating households around MFCA was a result of an unusually high livestock meat intake among a few households. Eating bushmeat significantly increased total frequency of meat intake for households that ate it, except those around QECA (Table 9).

Table 7: Comparisons of livestock meat and fish intake of respondents that reported eating bushmeat and those that did not, to determine whether bushmeat eating households had a lower livestock meat intake. All tests are two-tailed. BM=Bushmeat

Site	Category of respondent	Mean daily intake	SD	t(stat)	p
MFCA	BM eating	0.086	0.063	-2.021	0.044
	None BM eating	0.103	0.078		
Kafu Basin	BM eating	0.047	0.043	0.087	0.930
	None BM eating	0.047	0.059		
QECA	BM eating	0.129	0.101	-1.700	0.090
	None BM eating	0.153	0.161		
RMNP	BM eating	0.127	0.059	0.798	0.425
	None BM eating	0.116	0.061		

Table 8: Results of Pearson regressions of daily bushmeat consumption frequencies on daily livestock meat consumption rates for bushmeat eating households. This was to test whether increasing livestock meat intake of bushmeat eating households would reduce their bushmeat intake.

Site	R^2(adjusted)	p	+/-	n
MFCA	0.0009	0.353	-	140
Kafu Basin	0.009	0.485	-	57
QECA	0.0009	0.333	-	109
RMNP	0.024	0.506	-	23

Table 9: Comparisons of total meat (livestock, fish, and bushmeat) intake of households that reported eating bushmeat and those that did not to determine whether bushmeat use increased meat intake of bushmeat eating households. It was the case in all sites except QECA. All tests are two-tailed.

Site	Category of respondent	Mean daily intake	SD	t(stat)	p
MFCA	BM eating	0.228	0.178	4.317	<0.0001
	None BM eating	0.154	0.161		
Kafu Basin	BM eating	0.070	0.067	2.817	0.005
	None BM eating	0.047	0.059		
QECA	BM eating	0.104	0.071	0.200	0.841
	None BM eating	0.103	0.078		
RMNP	BM eating	0.141	0.062	1.941	0.052
	None BM eating	0.116	0.061		

3.3. Bushmeat off take

The pattern in bushmeat utilization reported by households paints a picture of very low bushmeat usage per each household and therefore low levels of wildlife hunting, but just how small is the off take?

3.3.1. Species hunted, hunting tools, and sites

3.3.1.1. Species hunted and numbers of individuals

Based on monthly returns of hunting incidences by key informers, thousands of individuals of at least 60 species were killed in the study sites for various reasons during the course of this study (Table 10). Numbers varied according to the site but this should not be interpreted as total numbers animals killed as our informers did not cover every village. The actual estimates of numbers killed may vary from at least one and a half times as much in the case of QECA which we covered fairly well to over twice as many in the Kafu Basin and RMNP. These off take rates do not appear to be consistent with the daily bushmeat intake rates reported by resident households.

Main animals targeted in the savanna sites were large- to medium-sized mammals. Uganda kobs, bush pigs, bushbucks, hippos, waterbuck, buffalo, warthogs, and duikers were the most commonly hunted, while the smaller bodied ones particularly porcupines and cane rats were also frequently hunted for the taste of their meat. Arboreal monkeys, bush pigs, duikers, baboons, and giant forest hogs were the most commonly killed in forested RMNP. Based on monthly averages for informers in each site, there was a higher off take in the Kafu Basin than in the protected sites. Among the protected areas, it was higher in QECA and MFCA than in RMNP (Table 11). Although numbers killed may reflect local population sizes, they in part reflect degree of protection. These results demonstrate the importance of law enforcement in controlling illegal hunting.

Table 10: Species hunted in each site and total numbers per site as reported by assistants based in and around these sites during the months April 2007-January 2008.

Species	**Kafu Basin**	**MFCA**	**QECA**	**RMNP**	**Total no. of Individual animals killed**
Abdim Stork		2			2
Aardvark	5				5
Baboon	36	11	51	17	115
Black-and-White Colobus			24	34	58
Blue monkey				13	13
Buffalo	17	84	93		195
Bushbuck	155	111	36	6	308
Bush pig	134	119	112	28	402
Cane rat	61	58	67	2	196
Caracal		3			3
Chimpanzee			1	7	8
Civet			1		1
Colobus				1	1
Crocodile	1	1			2
Crown-hawk eagle				1	1
Dikdik		5			5
Duck				1	1
Duiker	54	60	11	21	146
Elephant		1	13	2	16
Francolin			1		1

Table 10 continued

Species	Kafu Basin	MFCA	QECA	RMNP	Total no. of Individual animals killed
Fox			3	4	7
Giant forest hog		1	27	12	40
Giraffe		4			4
Golden cat				4	4
Goose	3				3
Goshawk		2			2
Guinea fowl	13	13	204	6	236
Hadada ibis		1			1
Hartebeest	12	4			16
Heron		1			1
Hippopotamus	21	62	194		280
Hyaena	1		7		8
Hyrax			4	15	19
Jackal		4		1	5
Kite		1			1
Leopard	1	3	5	1	10
Lion			6		6
Marabou Stork		1			1
Mole	3				3
Mongoose			8	8	16
Monkey (unspecified)	41	2	15	42	100
Oribi	97	21			111
Pangolin	2	1			3
Porcupine	114	62		5	181
Potto		2			2
Python	4		2		6
Rabbit	36	6	12		54
Redtail monkey		3	2	7	5
Reedbuck	12	11		5	28
Serval cat		1			1
Shoebill		1			1
Sitatunga	29	20	17		66
Squirrel	33	31			64
Topi			3		3
Uganda kob	122	74	327		527

Table 10 continued

Species	Kafu Basin	MFCA	QECA	RMNP	Total no. of Individual animals killed
Vervet monkey	26	5	16	15	62
Warthog	32	21	114		167
Waterbuck	93	31	84		209
White-tailed mongoose			5		5
Wild cat			2		2
Total no. of species	**28**	**40**	**32**	**25**	**61**

Table 11: Gross numbers of individuals per species hunted in each site per month and as reported by assistants based in and around these sites during the months April 2007-January 2008. This provides a crude idea about how hunting intensity compares among sites.

Focal Area	Kafu Basin	MFCA	QECA	RMNP
Total no. of individual animals killed	1158	848	1467	258
Total Number of reports	44	45	88	26
Average no. of individual animals killed per report per month	**26.32**	**18.84**	**16.67**	**9.92**

3.3.1.2. Hunting tools

Hunting tools recorded were spears (the killing weapon once restraint is achieved) and snares, traps, and dogs (used for restraint). According to monthly reports by key informers, bows and arrows were commonly used in the Kafu Basin and in and around MFCA (Table 12). Off take rate appeared to be on the rise as can be seen from the trend of gun-related hunting incidences (Table 13; Fig.3). The key to reducing the problem of illegal off take in the short run seems to lie in reducing gun use.

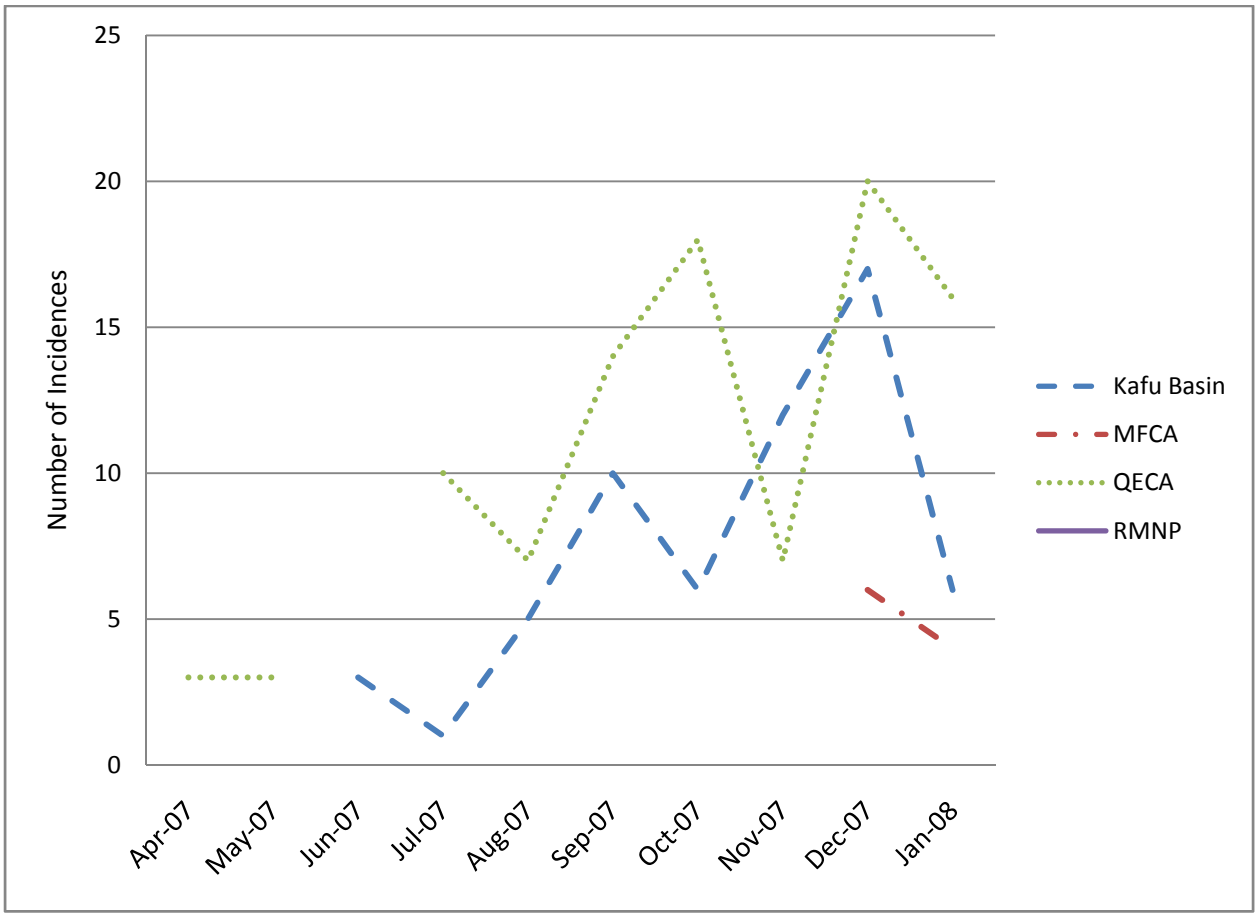
Table 12: Hunting tools and number of associated hunting incidences as reported by assistants based near the study sites

Hunting Tool	Kafu Basin	MFCA	QECA	RMNP	Total	%
Gun	64	11	101	1	177	9.7
Snare	105	195	55	3	358	19.7
Trap[1]	102	118	64	45	329	18.1
Net	45	25	33	1	104	5.7
Bow and arrow	41	34		1	76	4.2
Poison[2]	4		13		17	0.9
Dogs	8	16	59	68	151	8.3
Spear	117	80	308	74	579	31.8
Machete		3			3	0.2
Sticks	2	2	3	1	8	0.4
Catapult	1				1	0.1
Fire		2			2	0.1
Stones		10	4		14	0.8
[1]Trap = Pit trap, Nail Trap, Wheel Trap, Box trap – whether baited or not						
[2]Poison = Rat poison, Pesticides, Insecticides						

Table 13: Changes in reported gun-related hunting incidences in all sites

	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Jan-08
Kafu Basin	5		3	1	5	10	6	12	17	6
MFCA		1							6	4
QECA	3	3		10	7	14	18	7	20	16
RMNP										1

Figure 3: Monthly changes in gun related hunting incidences. Gun use poaching incidences rose during the study, particularly in the Kafu Basin and around QECA



3.3.2. Hunting locations and seasons

Hunting in protected areas occurred both inside and outside boundary lines. Of the 654 hunting locations specified by key informers, 40% were outside protected areas (Table 14). Hunting occurs throughout the year with peaks (according to surrendered poachers) occurring in the dry season (around MFCA and probably for the Kafu Basin as well), and during the rainy season (for QECA and RMNP) (Table 15). Peaks also occur around end of year celebrations. With exception of the Kafu Basin where most hunters are probably non-residents, the hunters were usually residents in the villages in and around the study sites.

Table 14: Number of hunting incidences specified as inside or outside protected areas. A high number of incidences occurred outside boundary lines.

Protected Area	Inside PA	Outside PA	Total
MFCA	198	103	301
QECA	135	136	271
RMNP	56	26	82
Total	389	265	654
%	**59.5**	**40.5**	

Table 15: Number of times in which ex-poacher groups cited hunting in different seasons

Study Site	Dry	Wet
MFCA	9	1
QENP	2	8
RMNP		2
Total	**11**	**11**

3.4. Drivers of bushmeat off take

3.4.1. Wealth and income

Analyses of wealth and incomes focus on comparisons of means between bushmeat and non-bushmeating households and the relationships between some of these variables and daily meat intake. We expected bushmeat eating households to be less wealthy and earning low income, and as such negative relationships between rates of bushmeat intake and wealth and income indicators if improving household wealth and incomes are going to be solutions to the bushmeat problem. We also distinguish wealth types and livelihood sources to determine what occupational groups are involved in bushmeat use, and therefore which may need to be engaged separately to address the bushmeat problem.

3.4.1.1. Income

People who reported eating bushmeat realized their incomes mainly through crop farming. Bushmeat eating households had significantly higher incomes from crop farming around MFCA; crop and other income within the Kafu Basin; other income around QECA; and crops and total

income around RMNP (Table 16). This means that around MFCA, in the Kafu Basin, and RMNP, it was the farmers that tended to eat bushmeat. In the Kafu basin and QECA, also people in business and/or employed, and around RMNP, also high income earners. Thus, it would look like bushmeat solutions should focus on farmers in most of these areas, business people or the employed in the Kafu Basin and around QECA, and high income earners around RMNP. An income solution however appears questionable, as in all sites, bushmeat eaters tended to earn just as much, and in most cases a little more than the non-bushmeat eaters, overall. Whether bushmeat eating was higher among farmers and other high income earners because they were more frank about their eating habits is a possibility that could be investigated but was not established.

Assuming however that these results reflected the truth of the situation, we ran regressions of total income on bushmeat consumption in all sites to assess how frequency of bushmeat eating would change as incomes increased or decreased (Table 17). In general, total income looks like a poor predictor of bushmeat use. Except around RMNP where it accounted for a significant (22%) proportion of the variance in bushmeat consumption thus looking like increasing incomes would significantly reduce bushmeat consumption and vice versa, it appears that bushmeat consumption would remain constant in the other sites even if incomes increased, at least in the short term.

Table 16: Results of two-sample t-tests comparing incomes of bushmeat and non-bushmeat eating households. Analyses are based on log-transformed values and are two-tailed and significant at p=0.05. “other income”=income from business + income from employment. “total income”=crop income + livestock income + other income. The abbreviation “BM” is for “bushmeat”.

Table 16a: Murchison Falls Conservation Area

Income type (MFCA)	**Respondent category (n= respondents)**	**Mean Log10 (Income+1)**	**SD**	**t(stat)**	**p**
Crop	BM eating	4.323	2.413	2.214	0.027
	Non-BM eating	3.753	2.551		
Livestock	BM eating	1.453	2.281	1.332	0.183
	Non-BM eating	1.158	2.101		
Other Income	BM eating	1.717	2.659	-0.181	0.856
	Non-BM eating	1.768	2.792		
Total Income	BM eating	5.212	1.719	1.718	0.086
	Non-BM eating	4.862	2.099		

Table 16b: Kafu Basin

Income type (Kafu Basin)	**Respondent category (n= respondents)**	**Mean Log10 (Income+1)**	**SD**	**t(stat)**	**p**
Crop	BM eating	2.926	2.958	5.518	<0.0001
	Non-BM eating	1.104	2.277		
Livestock	BM eating	4.160	2.604	0.378	0.705
	Non-BM eating	4.010	2.892		
Other Income	BM eating	0.102	0.775	-1.949	0.051
	Non-BM eating	0.553	1.738		
Total Income	BM eating	4.917	2.364	0.238	0.811
	Non-BM eating	4.833	2.524		

Table 16c: Queen Elizabeth Conservation Area

Income type (QECA)	**Respondent category (n= respondents)**	**Mean Log10 (Income+1)**	**SD**	**t(stat)**	**p**
Crop	BM eating	5.788	1.300	-0.417	0.676
	Non-BM eating	5.834	1.000		
Livestock	BM eating	3.044	2.379	1.264	0.206
	Non-BM eating	2.727	2.355		
Other Income	BM eating	3.250	2.895	2.622	0.010
	Non-BM eating	2.448	2.875		
Total Income	BM eating	6.096	0.926	-0.376	0.706
	Non-BM eating	6.120	0.512		

Table 16d: Rwenzori Mountains National Park.

Income type (RMNP)	Respondent category (n= respondents)	Mean Log10 (Income+1)	SD	t(stat)	p
Crop	BM eating	6.002	0.227	3.024	0.003
	Non-BM eating	5.520	0.779		
Livestock	BM eating	3.761	1.750	1.661	0.097
	Non-BM eating	3.027	2.130		
Other Income	BM eating	3.227	2.296	-0.765	0.444
	Non-BM eating	3.528	1.860		
Total Income	BM eating	6.112	0.229	3.717	0.0002
	Non-BM eating	5.769	0.449		

Table 17: Results of Pearson regressions of total income on bushmeat eating frequency among bushmeat eating households. Variation in bushmeat eating frequency can be little explained by total income in most of the sites except for RMNP where it accounted for a significant 22%.

Study site	R^2(adjusted)	p	Slope (+/-)
MFCA	0.004	0.503	-
Kafu Basin	0.016	0.173	+
QECA	0.009	0.844	-
RMNP	0.223	0.011	-

3.4.1.2. Livestock wealth

To understand how livestock wealth influenced bushmeat use, we analyzed the relationships among livestock types. Around MFCA, people who reported eating bushmeat kept more pigs, and had slightly more cows, and goats, but fewer sheep (Table 18). People in this area were mostly farmers. In the Kafu Basin, people who reported eating bushmeat had fewer cows and tended to have fewer goats and sheep than those who reported not eating it. However, they kept more pigs, and slightly more chicken. Around QECA, people who reported eating bushmeat had more goats, and tended to have more pigs and sheep. People who did not report eating bushmeat had more chicken and slightly more cattle. Around RMNP, people who reported eating bushmeat had more pigs, sheep and chicken but fewer cattle. Thus, in general, the people who ate bushmeat were those that reared pigs and chicken a pattern consistent with small holder farmers, while those who did not report eating it had cattle, goats and sheep,

a pattern consistent with pastoralism and ranching. By these results, it would look like a potential solution to the bushmeat problem is for everyone to keep cattle, goats and sheep but this is not practical due to space and other constraints. It also leads to the assumption that livestock ownership directly translates into increased meat intake, but is it really the case?

To answer this question, we explored the relationship between numbers of a given livestock species in the household and the household's daily intake of meat from that species for households that reported eating livestock meat (Table 19). This appeared to be indeed the case for cattle, goats, and pigs in most sites. To assess whether livestock numbers meat types reduces bushmeat intake, we ran, first regressions of daily bushmeat intake on livestock numbers and daily bushmeat intake on daily livestock meat intake for the households that reported eating bushmeat.

Table 18: Results of two-sample t-tests comparing numbers of livestock between of bushmeat eating and non-bushmeat eating households. Analyses are based on log-transformed values, and are two-tailed and significant at p=0.05. The abbreviation "BM" is for "bushmeat".

Table 18a: Murchison Falls Conservation area

Livestock species (MFCA)	**Respondent category (n=440 respondents)**	**Mean Log10 (livestock no. +1)**	**SD**	**t(stat)**	**p**
Cows	BM eating	0.267	0.474	1.626	0.105
	Non-BM eating	0.189	0.459		
Goats	BM eating	0.457	0.476	1.305	0.192
	Non-BM eating	0.394	0.471		
Pigs	BM eating	0.073	0.228	2.079	0.038
	Non-BM eating	0.034	0.153		
Sheep	BM eating	0.010	0.083	-1.735	0.083
	Non-BM eating	0.037	0.173		
Chicken	BM eating	0.885	0.595	1.650	0.193
	Non-BM eating	0.808	0.561		

Table 18b: Kafu Basin

Livestock species (Kafu Basin)	**Respondent category (n= respondents)**	**Mean Log10 (livestock no. +1)**	**SD**	**t(stat)**	**p**
Cows	BM eating	0.538	0.622	-3.272	0.001
	Non-BM eating	0.912	0.840		
Goats	BM eating	0.502	0.584	-1.613	0.107
	Non-BM eating	0.631	0.571		
Pigs	BM eating	0.212	0.305	2.617	0.009
	Non-BM eating	0.118	0.249		
Sheep	BM eating	0.033	0.154	-1.226	0.221
	Non-BM eating	0.076	0.261		
Chicken	BM eating	1.006	0.499	2.128	0.034
	Non-BM eating	0.836	0.580		

Table 18c: Queen Elizabeth Conservation Area

Livestock species (QECA)	**Respondent category (n= respondents)**	**Mean Log10 (livestock no. +1)**	**SD**	**t(stat)**	**p**
Cows	BM eating	0.147	0.381	-0.615	0.539
	Non-BM eating	0.122	0.384		
Goats	BM eating	0.509	0.422	2.077	0.038
	Non-BM eating	0.418	0.406		
Pigs	BM eating	0.095	0.233	1.551	1.647
	Non-BM eating	0.061	0.201		
Sheep	BM eating	0.072	0.226	0.748	0.455
	Non-BM eating	0.056	0.185		
Chicken	BM eating	0.718	0.359	-2.756	0.006
	Non-BM eating	0.594	0.438		

Table 18d: Rwenzori Mountains National Park

Livestock species (RMNP)	**Respondent category (n= respondents)**	**Mean Log10 (livestock no. +1)**	**SD**	**t(stat)**	**p**
Cows	BM eating	0.000	0.000	-1.889	0.060
	Non-BM eating	0.078	0.202		
Goats	BM eating	0.458	0.357	0.058	0.953
	Non-BM eating	0.454	0.299		
Pigs	BM eating	0.115	0.247	1.892	0.060
	Non-BM eating	0.057	0.140		
Sheep	BM eating	0.199	0.298	2.711	0.007
	Non-BM eating	0.079	0.207		
Chicken	BM eating	0.859	0.249	3.580	0.0004
	Non-BM eating	0.617	0.326		

Table 19: Results of Pearson regressions of the relationship between frequency of livestock meat eating and livestock ownership among people who reported eating meat.

	MFCA, n=412			**Kafu Basin, n=491**		
Meat type	R^2(adjusted)	p	Slope (+/-)	R^2(adjusted)	p	Slope (+/-)
Beef	0.0023	0.804		0.048	<0.0001	+
Goat	0.016	0.006	+	0.020	0.0009	-
Pork	0.009	0.029	+	0.066	<0.0001	+
Mutton	0.020	0.002	-	0.001	0.747	
Chicken	0.002	0.996		0.007	0.028	+

	QECA, n=560			**RMNP, n=420**		
Meat type	R^2(adjusted)	p	Slope (+/-)	R^2(adjusted)	p	Slope (+/-)
Beef	0.018	0.0007	+	0.042	<0.0001	+
Goat	0.002	0.905		0.001	0.645	
Pork	0.009	0.012	+	0.015	0.003	+
Mutton	0.002	0.773		0.017	<0.0001	+
Chicken	0.002	0.143		0.002	0.115	

Among people who ate bushmeat, relationships between daily bushmeat intake and numbers of livestock owned were not always consistent with the expected based on the patterns of the relationships between daily livestock meat intake and livestock numbers.

Stepwise linear regressions (with all predictor variables put together and removed in steps to isolate the explanatory variables) of daily bushmeat intake on livestock numbers for each site showed hardly any significant relationships. Around MFCA, the relationship was strong only for goats (R^2=0.044, p=0.014) and in the Kafu Basin fairly strong for the number of cows owned (R^2=0.075, p=0.021). No other significant relationships were apparent within the Kafu Basin itself and other sites.

Regressions of daily bushmeat intake on daily intake of livestock meat types and fish similarly showed a few strong relationships. For MFCA , the relationship was strong and positive for chicken and for the Kafu Basin, strong for goat meat (Stepwise linear regressions: R^2=0.027, p=0.030 for chicken; and R^2=0.061, p=0.034 for goat meat). The only other significant relationships were for fish (and fish bone) and mutton around RMNP. Here, daily bushmeat intake decreased significantly with fish and fish bone intake, accounting for 70.4% of the variance in bushmeat intake. The same was true of mutton in the same site (Stepwise linear regressions; Fish: R^2=0.704, p<0.0001; Mutton: R^2=0.017; p<0.008). This means that around MFCA and Kafu Basin, people who had access to, or showed preference for chicken and goat meat also ate/liked/preferred bushmeat. Around RMNP, people who had no access to or did not prefer bushmeat depended on fish as an animal protein source.

Based on these analyses, it looks like fish alternatives and mutton could serve as meat protein alternatives for bushmeat eaters around the Rwenzoris. In MFCA and Kafu Basin, the role of chicken and goat in the diet of bushmeat eaters needs further assessment in the light of alternatives. Around QECA, the results are uninformative and further analysis of interviews with surrendered poachers helped shed some light into this. We however also know that among livestock meat eaters which includes all bushmeat users that many livestock meat types, principally pork are all positively correlated with corresponding livestock numbers in the households (Table 19). The pig solution in this case appears to be particularly appealing as a solution to bushmeat as it features consistently across all sites.

3.4.1.3. Land ownership, use and domestic assets

As with analyses of income sources, analysis of land use and ownership showed that people who ate bushmeat tended to be the large cropland owners, while those who didn't tended to have large lands under pasture (Table 20). On the other hand, exploration of the distinction of

asset ownership among households that reported eating bushmeat and those that did not was uninformative (Table 20).

Table 20: Results of two-sample t-tests comparing land assets and value of domestic assets. Analyses are based on log-transformed values and are two-tailed and significant at p=0.05. The abbreviation "BM" is for "bushmeat".

Study site	**Assets & Value**	**Respondent category**	**Mean Log10 (value +1)**	**SD**	**t(stat)**	**p**
MFCA	Total land size	BM eating	0.904	0.336	3.924	0.0001
		Non-BM eating	0.749	0.404		
	Land under crop	BM eating	0.686	0.259	4.51	<0.0001
		Non-BM eating	0.555	0.293		
	Land under pasture	BM eating	0.254	0.408	2.254	0.024
		Non-BM eating	0.164	0.381		
	Household Asset value	BM eating	4.488	1.593	0.482	0.630
		Non-BM eating	4.409	1.587		
Kafu Basin	Total land size	BM eating	0.950	0.647	-3.270	0.001
		Non-BM eating	1.357	0.917		
	Land under crop	BM eating	0.568	0.234	4.485	0.0001
		Non-BM eating	0.349	0.363		
	Land under pasture	BM eating	0.408	0.814	-4.189	<0.0001
		Non-BM eating	1.046	1.121		
	Household asset value	BM eating	5.119	0.901	0.512	0.609
		Non-BM eating	5.028	1.303		
QECA	Total land size	BM eating	0.818	0.347	1.432	0.153
		Non-BM eating	0.761	0.387		
	Land under crop	BM eating	0.664	0.257	2.231	0.026
		Non-BM eating	0.604	0.240		
	Land under pasture	BM eating	0.119	0.368	0.274	0.784
		Non-BM eating	0.107	0.672		
	Household Asset value	BM eating	4.303	1.434	1.184	0.237
		Non-BM eating	4.100	1.651		

Table 20 continued

Study site	Assets & Value	Respondent category	Mean Log10 (value +1)	SD	t(stat)	p
RMNP	Total land size	BM eating	0.704	0.255	-0.498	0.619
		Non-BM eating	0.725	0.202		
	Land under crop	BM eating	0.559	0.156	-0.158	0.874
		Non-BM eating	0.563	0.147		
	Land under pasture	BM eating	0.095	0.200	-2.793	0.005
		Non-BM eating	0.222	0.218		
	Household Asset value	BM eating	4.417	0.457	1.789	0.074
		Non-BM eating	4.030	1.053		

3.4.5. Social and demographic situations of a family as drivers of bushmeat use

3.4.5.1. Family size

Analysis of the relationship between family size and bushmeat showed a distinction between MFCA and the other three sites. In the villages surrounding MFCA, bushmeat eating households had larger family sizes than those that did not report eating bushmeat (Table 21). Among those that reported eating bushmeat, daily bushmeat intake increased with total family size (Pearson regressions: number of adults, p=0.380; number of children, p=0.196; total family size, p=0.038; df=139). In the Kafu Basin, there were no pronounced differences in mean household composition (Table 20) and no significant relationships between household numbers and daily bushmeat intake (Pearson regressions: number of adults, p=0.648; number of children, p=0.842; total family size, p=0.954; df=58). The same was true of villages surrounding QECA (Pearson regressions: number of adults, p=0.0.492; number of children, p=0.760; total family size, p=0.931; df=109); and RMNP although there was a slight tendency for daily bushmeat intake to decrease with the number of children in the household (Pearson regressions: number of adults, p=0.643; number of children, p=0.073; total family size, p=0.086; df=58). Household size and composition appears to be a driver of bushmeat use in the villages around MFCA but not in the other study sites.

Table 21: comparisons of mean household size between bushmeat eating and non-bushmeat eating households.

Table 21a: Murchison Falls Conservation Area

Family size (MFCA)	**Category**	**Mean**	**SD**	**t(stat)**	**p**
Number of adults	BM eating	2.80	2.4	2.81	0.005
	Non-BM eating	2.18	2.0		
Number of children	BM eating	4.12	3.5	2.98	0.003
	Non-BM eating	3.18	2.9		
Total family size	BM eating	6.9	4.77	3.66	0.0003
	Non-BM eating	5.6	3.81		

21b: Kafu Basin

Family size (MFCA)	**Category**	**Mean**	**SD**	**t(stat)**	**p**
Number of adults	BM eating	3.6	1.78	-0.538	0.591
	Non-BM eating	3.7	2.29		
Number of children	BM eating	4.79	2.82	-1.072	0.284
	Non-BM eating	5.27	3.11		
Total family size	BM eating	7.77	4.20	-1.432	0.152
	Non-BM eating	8.72	4.79		

Table 21 continued

21c: Queen Elizabeth Conservation Area

Family size (MFCA)	Category	Mean	SD	t(stat)	p
Number of adults	BM eating	3.28	2.15	0.44	0.66
	Non-BM eating	3.19	1.85		
Number of children	BM eating	4.072	3.439	0.455	0.649
	Non-BM eating	3.940	2.537		
Total family size	BM eating	7.354	4.915	0.561	0.574
	Non-BM eating	7.132	3.382		

21d: Rwenzori Mountains National Park

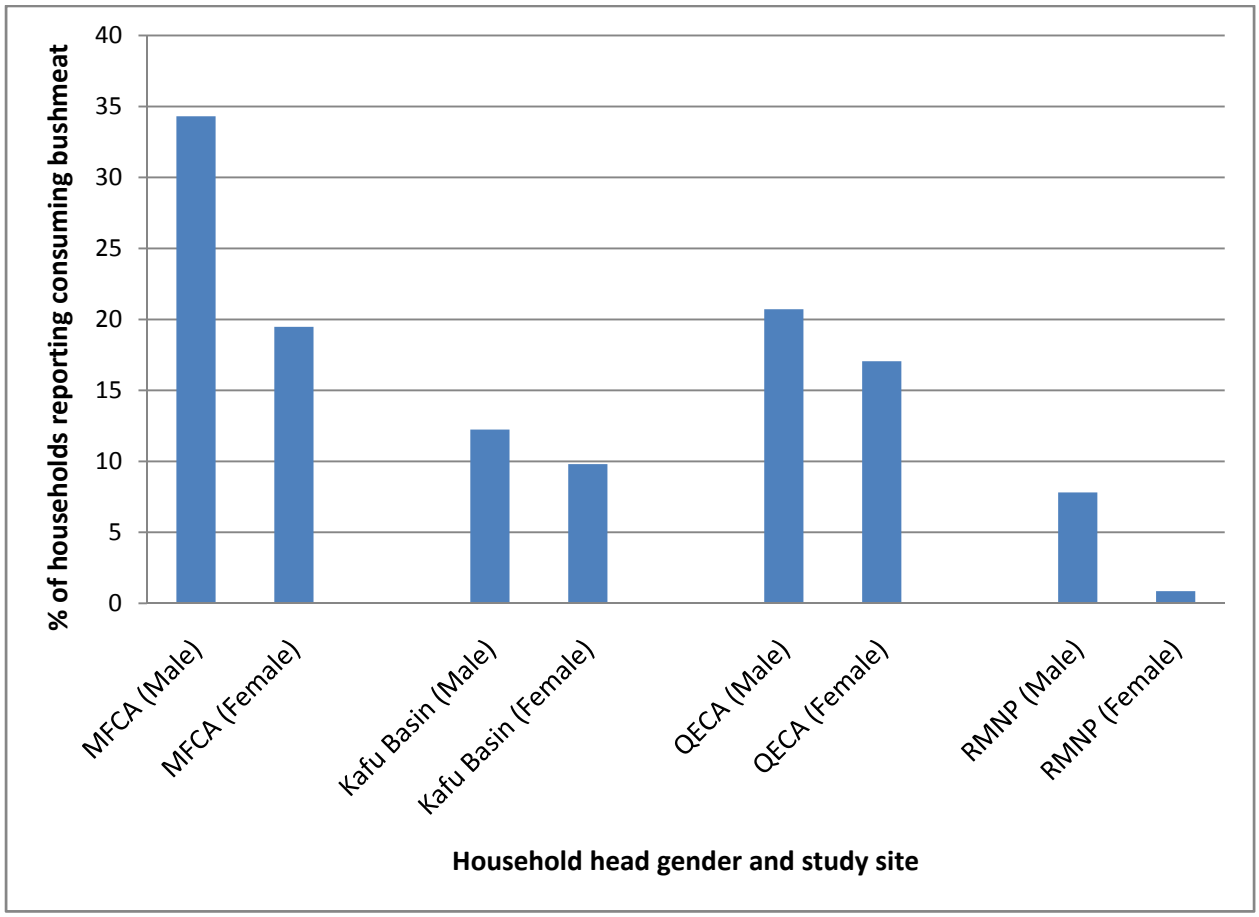
Family size (MFCA)	Category	Mean	SD	t(stat)	p
Number of adults	BM eating	2.583	1.212	1.373	0.170
	Non-BM eating	2.302	0.967		
Number of children	BM eating	4.708	2.053	0.695	0.487
	Non-BM eating	4.414	2.023		
Total family size	BM eating	7.291	2.475	1.145	0.252
	Non-BM eating	6.716	2.400		

3.4.5.2. Gender (of household head)

Of the total number of households interviewed in each site and gender category, female-headed households reported less daily meat intake (Figure 4). Interviews with individual surrendered poachers help shed light into the role of women in bushmeat hunting and trade. While men hunted, women helped to carry the meat where such help was needed. It was usually the spouses of the poachers that help with this, so unless the female household head was enlisted as a carrier, she was less likely to obtain bushmeat for household use. There are other avenues that she could use to obtain bushmeat, for example if she was a friend trusted

by the spouse of the hunter. In the villages near hunting sites, female spouses of the hunters help to market it at home by contacting trusted individuals within their villages. This again however restricts female household head from accessing bushmeat.

Figure 4: Percentage of households in each gender group that reported eating bushmeat. The proportion of female-headed households that eat bushmeat is consistently smaller than proportion of male households.

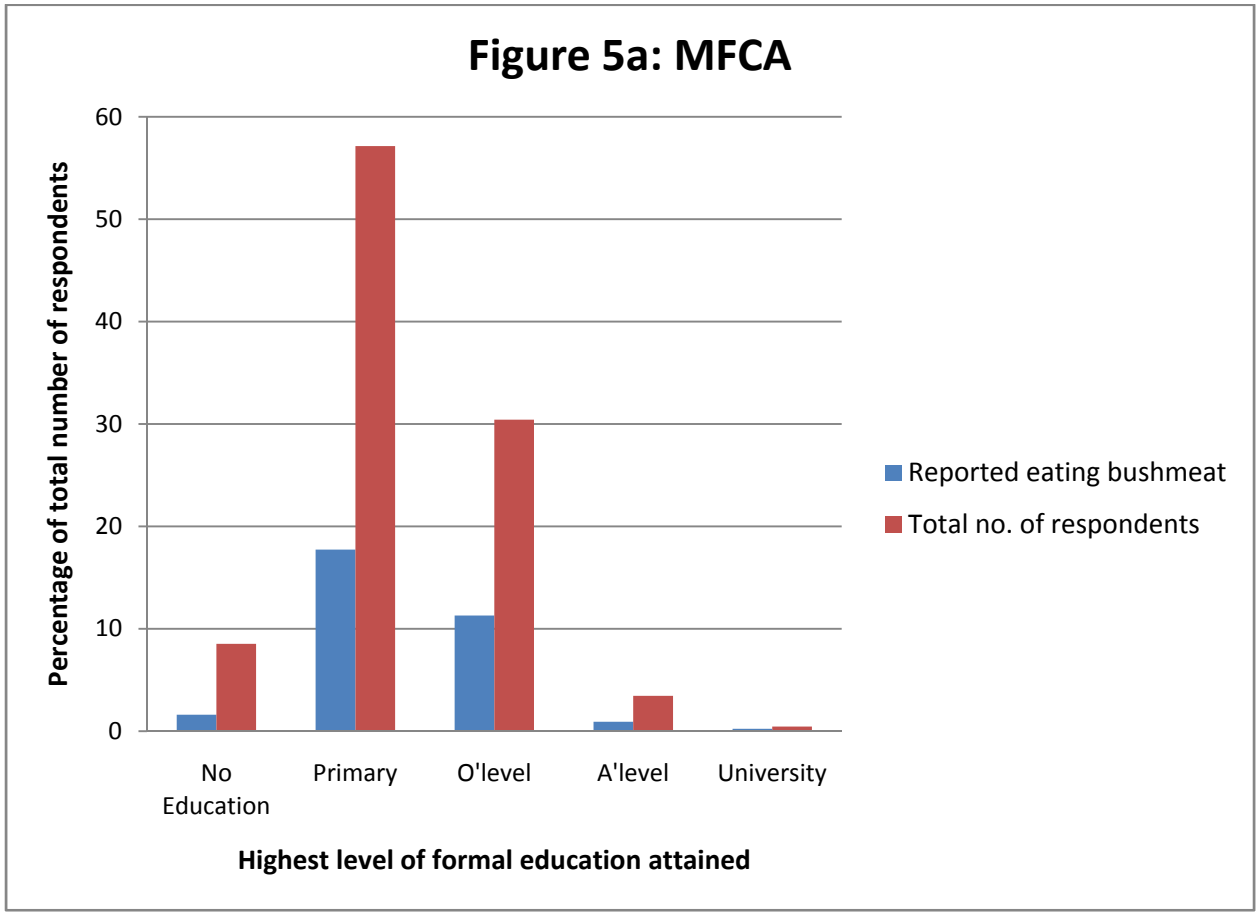


3.4.5.3. Literacy/enlightenment (of household head)

Education levels of household heads were analyzed from categories coded as follows: Code 0=No formal education, Code 1=Primary, Code 2=O'level, Code 3=A'level, and Code 4=University. On average, the highest education level attained by household heads in these sites was primary school. There were no differences in average education between bushmeat and non-bushmeat eating households (MFCA: mean bushmeat = 1.380, sd=0.665, mean non-bushmeat =1.266, sd= 0.702, t(stat)= 1.628, P=0.100; Kafu Basin: mean bushmeat eating = 1.053, sd=0.553, mean non-bushmeat eating=1.143, sd=0.648, t(stat)=0.992, p=0.321; QECA:

mean bushmeat eating = 1.278, sd=0.694, mean non-bushmeat eating=1.156, sd=0.0692, t(stat)=1.618, p=0.106; RMNP: mean bushmeat eating =1.167, sd=0.564, mean non-bushmeat eating=1.032, sd=0.533, t(stat)=1.205, p=0.229). Formal education of the respondents in general therefore has no clear influence on bushmeat use, and thus mirrors the educational structure of the village residents which typically has a strong showing in early stages of education (Fig. 5).

Figure 5: Highest levels of formal education attained by bushmeat eating households as related to the distribution of total number of respondents interviewed in each site



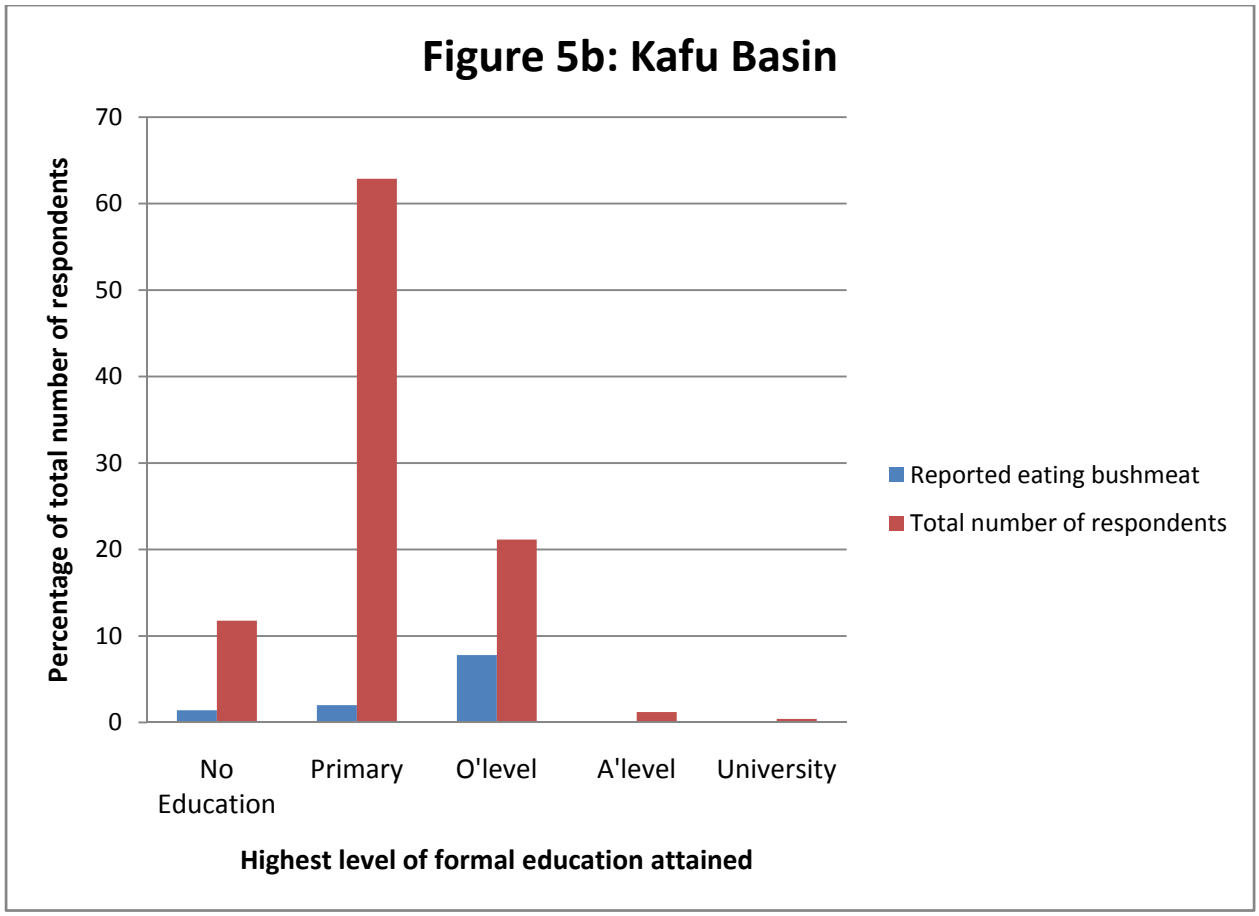


Figure 5b: Kafu Basin
Percentage of total number of respondents
70
60
50
40
30
20
10
0
No Education
Primary
O'level
A'level
University
Highest level of formal education attained
Reported eating bushmeat
Total number of respondents

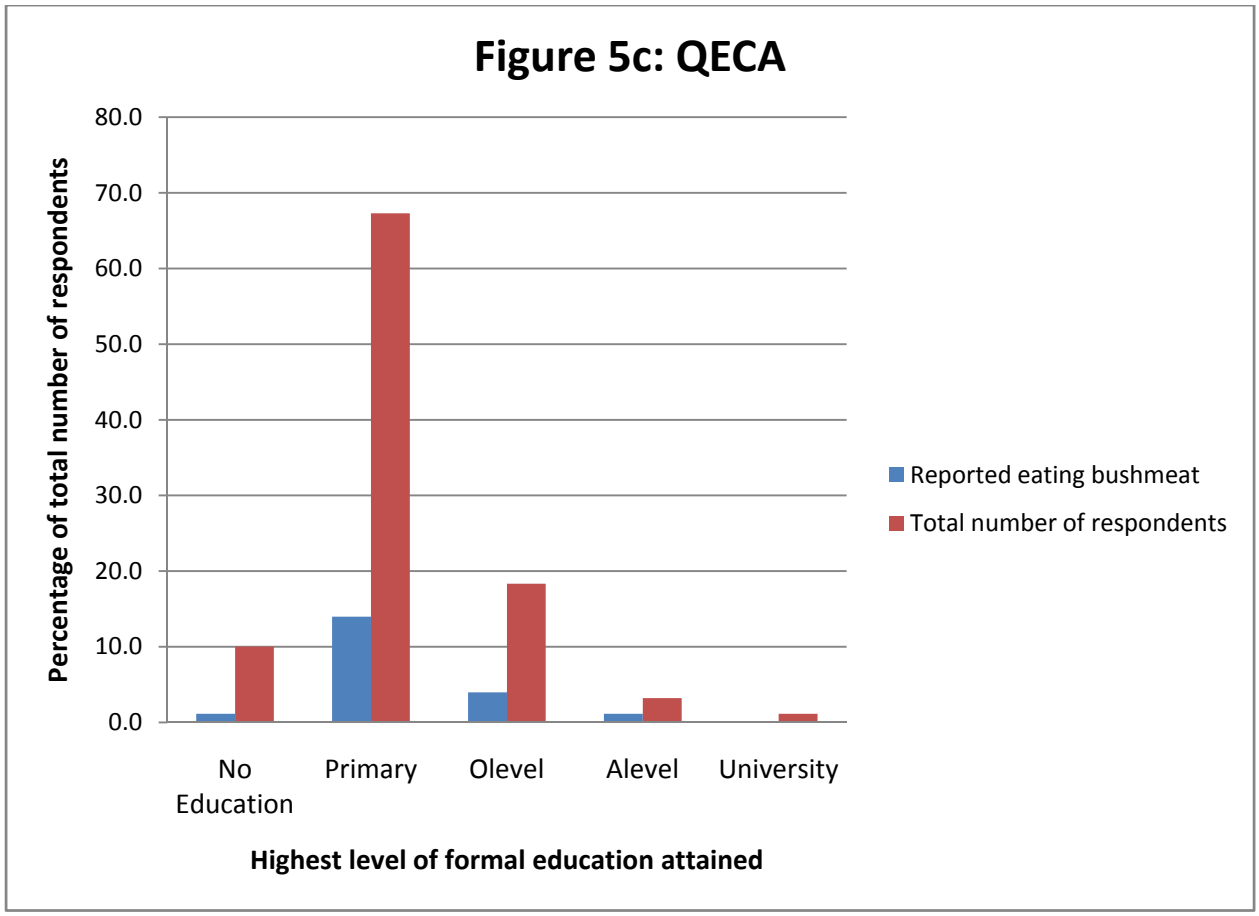
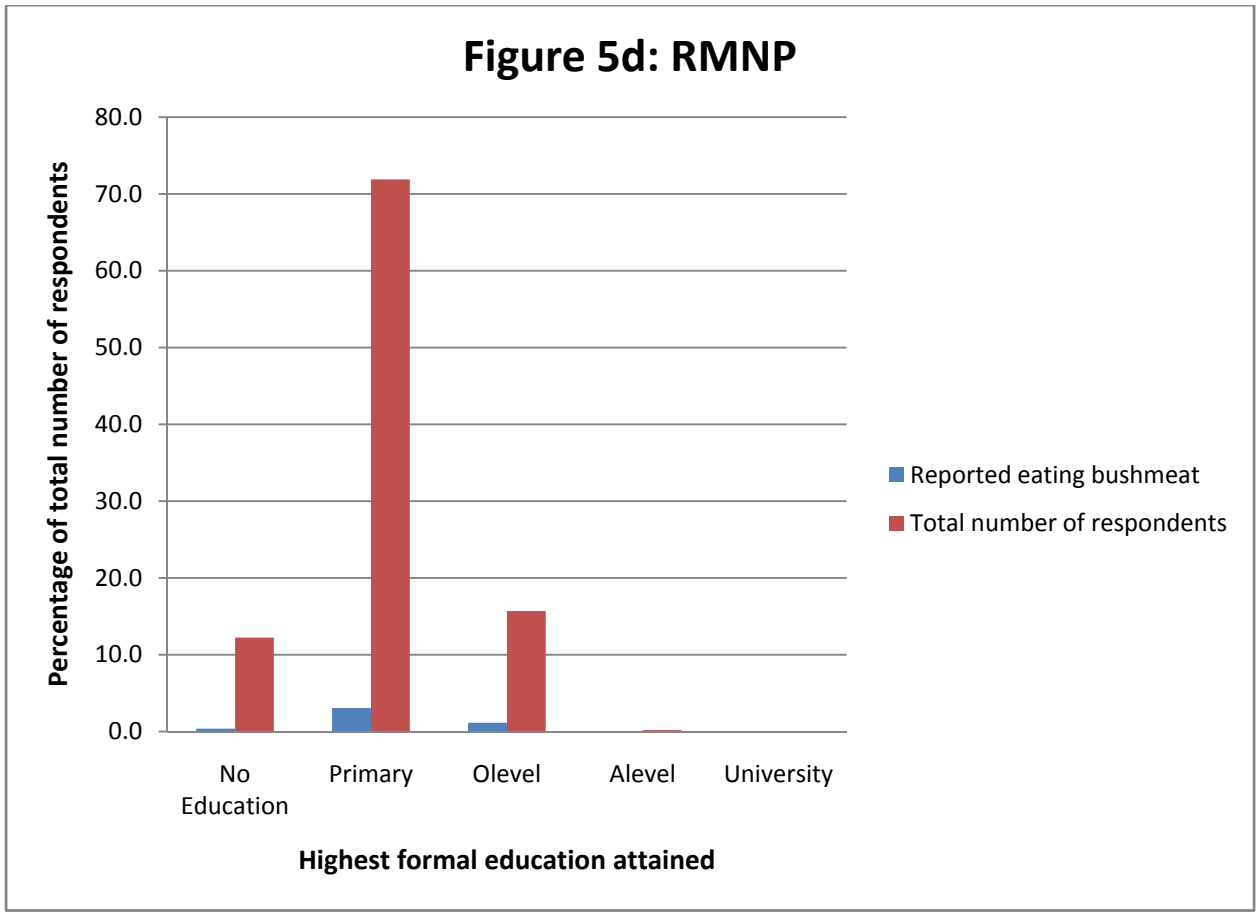


Figure 5c: QECA
Percentage of total number of respondents
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
No Education
Primary
Olevel
Alevel
University
Highest level of formal education attained
Reported eating bushmeat
Total number of respondents



3.4.5.4. Tenure in the village

Mean durations of residence by households in the villages studied varied significantly among sites (ANOVA; F_{2014}=51.66, p<0.0001) and was highest around RMNP followed by QECA, and then Kafu Basin. Lowest duration of stay was around MFCA. Pairwise comparisons showed significant differences among these sites except between QECA and RMNP (Sheffe Test; P<0.005 and p=0.417 respectively). This does not however necessarily mean that differences in reported bushmeat eating can be explained by duration of stay, as within sites, bushmeat eating households did not differ from non-bushmeat eating households in the duration of the time they had stayed in the villages surveyed (Table 22). Differences in bushmeat eating tendencies cannot therefore be readily explained by migration patterns.

Table 22: Results of t-tests comparing mean duration of stay in the villages of bushmeat and non-bushmeat eating households. Both bushmeat eating and non-bushmeat eating households have stayed in these villages for a similar duration of time.

Study site	Category	Mean length of stay (years)	SD	t(stat)	p-value
MFCA	BM eating	18.911	13.002		
	Non-BM eating	16.885	12.500	1.546	0.123
Kafu Basin	BM eating	22.879	19.601		
	Non-BM eating	20.706	15.643	0.963	0.336
QECA	BM eating	27.682	12.775		
	Non-BM eating	25.681	14.369	1.337	0.181
RMNP	BM eating	31.708	8.645		
	Non-BM eating	27.317	13.283	1.602	0.110

3.4.5.5. Ethnicity

Ethnicity was not a clear indicator of bushmeat eating as only a small proportion of individuals sampled reported eating bushmeat (Table 23). We however know that most ethnic groups eat bushmeat.

Table 23: Ethnic groups of respondents interviewed in the study sites, total numbers interviewed, and number that reported eating bushmeat. BM=respondents that reported eating bushmeat.

Ethnic group	MFCA Total	MFCA BM	Kafu Total	Kafu BM	QECA Total	QECA BM	RMNP Total	RMNP BM
Acholi	33	5	5	0	1	1	0	0
Alur	124	38	8	1	0	0	0	0
Kakwa	10	2	18	0	0	0	0	0
Kuku-Sudan	5	1	0	0	0	0	0	0
Karamojong	0	10	0	0	0	0	0	0
Langi	15	5	3	0	0	0	0	0
Lendu	3	0	0	0	0	0	0	0
Lugbara	23	6	3	1	0	0	0	0
Luo	4	1	1	0	2	0	0	0

Table 23 continued

Ethnic group	MFCA Total	MFCA BM	Kafu Total	Kafu BM	QECA Total	QECA BM	RMNP Total	RMNP BM
Maragoli	5	1	0	0	0	0	0	0
Muchope	25	15	0	0	0	0	0	0
Mufumbira	1	0	0	0	18	7	0	0
Muganda	5	3	35	21	0	0	1	0
Mugishu	22	7	12	2	0	0	0	0
Mugungu	70	19	2	0	0	0	0	0
Mukiga	3	1	1	0	176	48	0	0
Mukonjo	0	0	0	0	171	37	459	24
Munyabindi	0	0	0	0	6	2	0	0
Munyabutumbi	0	0	0	0	4	3	0	0
Munyankole	2	0	132	1	155	11	0	0
Munyarwanda	1	0	30	1	2	0	0	0
Munyaruguru	0	0	0	0	1	0	0	0
Munyisale	0	0	0	0	1	0	0	0
Munyoro	53	20	88	16	1	1	0	0
Muruuli	4	1	149	15	0	0	0	0
Musamya	0	2	0	0	0	0	0	0
Musoga	0	1	0	0	0	0	0	0
Musongora	0	1	0	0	17	0	0	0
Mutagwenda	0	1	0	0	0	0	0	0
Mutoro	0	0	0	0	4	0	62	0
Iteso	20	8	11	0	0	0	0	0
Nandi	0	1	0	0	0	0	0	0
Nubian	0	1	0	0	0	0	0	0
Okebu	9	4	1	0	0	0	0	0
Omuhororo	0	0	0	0	1	0	0	0
Sebei	2	1	2	0	0	0	0	0
Total	439	139	501	58	560	110	522	24

3.4.6. Human-wildlife conflict and bushmeat use

To examine how bushmeat use was linked to crop raiding and other forms of human-wildlife conflict, we assessed: a) the role of crop raiding as a cause of crop loss, b) whether or not animals are killed when crop raiding and why, c) and the proportion of households that ate bushmeat of the households that experienced major crop losses to crop raiding animals in the last six months. We supplemented this information with that provided by surrendered poacher groups.

3.4.6.1. Household survey results

Overall, crop raiding ranked as the number two cause of crop loss in each site after drought, but too much rain was ranked as number one by residents around RMNP. Loss of soil fertility was introduced and ranked high by residents around RMNP (Table 24). The most commonly cited crop raiding species were baboons, bush pigs, bushbucks, vervet monkeys, guinea fowls. Others were squirrels, cane rats, porcupines, blue monkeys, buffalos, kob, and francolins (Appendix 1). These results suggest that crop loss to wildlife can be a sound basis for hunting, and a possible reason for bushmeat hunting.

Table 24: Importance of crop raiding as a cause of crop loss. Values are average ranks

	MFCA	**Kafu Basin**	**QECA**	**RMNP**
Crop raiding	3.2	2.0	3.0	3.7
Disease	3.3	4.0	3.4	4.0
Drought	1.6	1.3	1.5	2.4
Insect damage	3.5	3.0	3.0	3.7
Too much rain	3.0	3.5	4.5	1.7
Declining soil fertility				2.1

Respondents in all sites admitted that animals were actually killed while crop raiding (Table 25). Among all possible reasons why wild animals were hunted, hunting in response to crop raiding was second to bushmeat (Table 26). Of the households that had experienced major crop losses during six months prior to the interview, the proportion that ate bushmeat was not higher than those that did not, as was expected. It was only in one site-MFCA where this was the case (z-test for proportions: MFCA- 67/139 eating, 103/301 non- eating, p=0.007; Kafu Basin-5/58 eating, 64/443 non- eating, p=0.358; QECA- 61/110 eating, 278/454 non- eating, p=0.296; RMNP- 23/24 eating, 430/504 non- eating, p=0.277) suggesting again that although animals may be killed while crop raiding, crop raiding is not necessarily a major driver of bushmeat utilization. The overall pattern thus revealed by the foregoing analyses is that hunters go after animals for crop raiding but that more hunting does occur when people are seeking out bushmeat.

Table 25: Percentage of respondents stating whether or not wild animals were hunted while raiding crops.

	MFCA	Kafu Basin	QECA	RMNP
Yes	26.1	10.4	36	65.8
No	45.0	87.2	48.2	24.8
Don't know	27.0	1.0	9.0	4.0
Undecided	1.8	1.4	6.7	5.3

Table 26: Percentage of times respondents cited various reasons as motives for hunting. Hunting for bushmeat was cited as the most important factor followed by crop raiding

Hunting reason	MFCA	Kafu Basin	QECA	RMNP	Overall
Crop raiding	52.8	20.8	28.2	32.5	33.3
Livestock raiding	16.2	5.1	18.3	17.7	16.2
Attacking people	4.4	0.0	4.5	0.2	1.4
Meat	25.9	74.1	49.0	45.2	46.3
Dog meat	0.0	0.0	0.0	4.3	2.6
Other reasons	0.6	0.0	0.0	0.1	0.2

3.4.6.2. Hunter group data

Data collected through interviews with surrendered hunters corroborated patterns revealed by household respondents on links between crop raiding, hunting, and bushmeat. Hunter groups were asked to name species they hunted, and to rank them according to hunting motives. Sixty eight species were in total listed (50 from MFCA, 55 from QECA, and 25 from RMNP; Table 27).

Hunters assigned product use ranks (use of meat and/or other body parts) to 94% of the species, crop raiding ranks to 34%, livestock raiding ranks to 29%, and attacks on humans to 7% (Table 27). When points were assigned to ranks (as follows: rank no. 1 = 3 points, rank no. 2 = 2 points, and rank 3 = 1 point) it became clear that hunting for wildlife products was at least 3 times as important as hunting for crop or livestock raiding, and 17 times more important than hunting as a result of attacks on humans (Table 28). The ex-hunter's list of species most commonly hunted for crop raiding included baboons, vervet monkeys, porcupines, squirrels, and black-and-white colobus monkeys; for livestock raiding were jackals, hyenas, serval cats, pythons, common civets, and leopards; and attacks on humans as pythons, leopards, elephants, and baboons (Table 27).

Table 27: Frequency of ranking of species by hunting motive. Values represent the number of poacher groups that assigned a species a given rank for a given motive.

	Rank and Rank Frequency										
	Product use			Crop raiding		Livestock raiding			Attacks on humans		
Species	**1**	**2**	**3**	**1**	**2**	**1**	**2**	**3**	**1**	**2**	**3**
Aardvark	12										
African civet	2	1			1	1					
Baboon	5	4	1	10	2		1	1			1
Banded mongoose	2					1					
Blue monkey	2										
Buffalo	17										
Bushbuck	14				2						
Bush pig	13	3		5	4						
Black-and-White colobus	8	1		3							
Cane rat	14				4						
Chimpanzee	6			1	1						
Civet	1	1				1					
Common civet	4	2			1	4	1				
Crowned Crane	1	1		1							
Crocodile	3										
Dikdik	4										
Duck	2										
Duiker	11				1						
Eagle	2					1					
Elephant	18			1	2			1			1
Francolin	4				2						
Genet		1				2					
Giant forest hog	9										
Giraffe	1										
Goshawk	2	1				1					
Green pigeons	1										
Guinea fowl	11				4						
Hadada ibis				1							
Hartebeest	7										
Hawk	1										
Heron	1										

Table 27 continued

	Product use			Crop raiding		Livestock raiding			Attacks on humans		
Species	**1**	**2**	**3**	**1**	**2**	**1**	**2**	**3**	**1**	**2**	**3**
Hippopotamus	16										
Hyena	2	1		2		8		2		1	
Hyrax	4				1						
Jackal	2	1				9					
Kite	2					2					
Uganda kob	14										
Leopard	13	1	2			3	2	1		3	1
L'Hoesti monkey	2										
Lion	13	1				1					
Mole rat	1										
Mongoose	1										
Monkey (unspecified)					1						
Oribi	3										
Otter	1										
Owl	1										
Pangolin	5			2							
Pelican	1										
Porcupine	9	5		4	4	1					
Potto	1										
Python	7	1	2			5	2		2	4	1
Rabbit	10										
Rats				1							
Red colobus	1										
Redtail monkey	1										
Reedbuck	4										
Serval cat	7	1				7	2				
Sitatunga	4										
Squirrel	8	3	1	4	1	1	1				
Topi	2										
Tortoise	3										
Vervet monkey	7	2		8	2						
Vulture		1				1					
Warthog	15										
Waterbuck	15										
W-tailed mongoose	5					1					
Wild cat	1	1		1							
Grand Total	**359**	**33**	**6**	**44**	**33**	**50**	**9**	**5**	**2**	**8**	**4**

Table 28: Number of times hunters ranked motives for hunting each species. Product use came first, followed by crop and livestock raiding. Attacks on humans were least frequently cited as a reason for hunting. Overall weight = sum (rank points x rank frequency).

	Rank				
Hunting motive	1	2	3	Overall weight (points)	Relative % weight
Product use	62	20	4	230	60
Crop raiding	14	16	0	74	19
Livestock raiding	18	6	4	70	18
Attacks on humans	1	3	4	13	3

3.4.6.3. Key informer data

The final assessment of possible linkage between hunting, crop raiding, and bushmeat was performed through analysis of data provided by key informers. Based on specific hunting incidences in which informers around MFCA, QECA, and RMNP specified hunting locations as inside or outside park boundaries, it is clear that while most of the hunting in these sites takes place within PA boundaries, a substantial number of incidences (40%) occur in the public lands adjacent these sites (Table 29), which land may be fallow or under pasture, but in some cases possibly under crop. Thus whichever way it was assessed, crop raiding clearly showed as one of the factors driving illegal hunting. Solutions to bushmeat use should integrate strategies to reduce crop raiding, and minimize the possibility of animals exiting protected areas in general.

Table 29: Number of hunting incidences specified by assistants as occurring inside or outside protected areas.

Protected Area	**Inside PA**	**Outside PA**	**Total**
MFCA	198	103	301
QECA	135	136	271
RMNP	56	26	82
Total	389	265	654
%	59.5	40.5	

3.4.7. Subsistence need and trade as factors driving bushmeat use

In this section, we use data generated by key informers and from hunter groups and individuals to understand forms of bushmeat use, and drivers, price spectrums and movement networks of the bushmeat market.

To quantify forms of bushmeat use and market characteristics, key informers were asked to record and make monthly returns of how much of the meat secured by hunters was eaten by hunters and their families, how much they sold within their villages and to distant areas. They also recorded unit prices at each point of sale, types of transport used and packaging of meat and identity of destinations and locations of origin. Other related data gathered were livestock meat and fish prices in areas where bushmeat was sold.

To determine what factors drive bushmeat use from a hunter's perspective, surrendered poacher individuals were asked to state their incomes including income from bushmeat. Poacher groups were asked to state the role of income, subsistence, and other factors as motives for hunting. They were also asked to list species that they hunted for bushmeat and to rank them according to profitability, and the meat according to cost, taste, perceived health benefit, availability and preference. Surrendered poachers were also asked to match livestock meat types against ranks assigned to bushmeat for taste and preference.

3.4.7.1. Consumption and marketing

Except for hunters around RMNP that ate all the meat they hunted, hunters in all sites consumed on average a third of the meat in their households and sold the other two thirds (Table 30). Of the amount sold, approximately one third was sold to neighboring households and the remainder to distant villages usually within the same subcounty or to distant urban centres (Fig. 6, Table 31).

These proportions are in close agreement with those provided by expoachers who on average recorded 30% for home consumption and 70% for sale. They cited the need for meat and to make money 100% of the time they were asked to mention what motivated their hunting decisions and ranked both equally. Other motives, like crop raiding, need for animal parts, leisure and employment were also mentioned but less than 50% of the time and were ranked last. Ex-poachers said that their households ate meat every day and a lot of it at each meal while they were still active as opposed to once in two weeks or less now, and much less of it for each meal. This means that although bushmeat does not on average appear important in the diets of households living in and around hunting sites, it is important in the diet of active hunters.

Individual interviews with ex-hunters around MFCA (n=83) and in the Bushenyi part of QECA (n=12) showed that income from bushmeat formed on average 48% (range = 11-71%) of annual household incomes averaging shs 376,083 and 21% (range=0-45%) of annual household income averaging shs 2,109, 590 for MFCA. Income levels for hunters around QECA are far below average per capita earnings of shs 2,482,023 for households interviewed around QECA (n=524). On the other hand, average per capita income for poachers around MFCA was far higher than similar income (of shs 1,510,174; n=440) for households interviewed around MFCA. Bushmeat hunting and use therefore raised incomes of hunters around MFCA far above the village average incomes, but was of little help in improving the financial status of hunters around QECA. While hunters around QECA appear to be the very needy ones, those around MFCA are not as desperate. This means that the same solutions need not necessarily be applied to all areas; they should be area-specific and selected on case by case basis.

Bushmeat was transported secretly and usually delivered at the hunter's homes at night. Sales are also secretive- hunters and dealers sold to only the people they trusted and each trusted person was alerted secretly about the meat using a password, for example "mushrooms" in conversation. Informers obtained information through people known to the hunters or by talking to the hunters who trust them.

Our knowledge of bushmeat trade in urban centres is limited to what friends and acquaintances of our informers based in these sites tell them. Informers did not usually make direct observations of bushmeat as one was normally required to buy the meat before they were even allowed to see it. Attempts to study bushmeat trade in Kampala were the least informative. Our approach here was focused on surveying restaurants and markets. All the major markets in Kampala were explored and upscale restaurants and market eateries were randomly selected in the city and suburbs and surveyed. We established small scale sale in only one of the main markets and this was limited to one vender who sold dried haplochromine fish. In two other potential sites within the city, we were only able to establish pricing, but the meat was not there as it was to be made available to buyers only on order which was said to last several weeks before delivery. These results suggest that bushmeat trade in urban centres is highly clandestine and at this point we cannot establish the volume of bushmeat trade in urban centres using this strategy. We however know that some meat from QECA is taken to Kasese and Bwera and that from MFCA and Kafu Basin is taken to Masindi, Kampala, Gulu, and Apac among other places. Results from Kampala seem to point to the possibility that bushmeat trade here is low, but it could also mean that different approaches are needed to establish the volume of trade and bushmeat hotspots in the city.

Table 30: Mean percentage of bushmeat hunted that was consumed or sold by hunters.

Field Site	% Eaten by hunters	% Sold to local area	% Sold to distant areas
Kafu Basin	37.1	26.1	35.3
MFCA	30.8	33.6	34.4
QECA	33.1	26.3	39.3
RMNP	98.1	0.9	0.3

Figure 6: The bushmeat chain showing bushmeat sites originating or receiving bushmeat.

Fig 6a: MFCA and Kafu Basin.

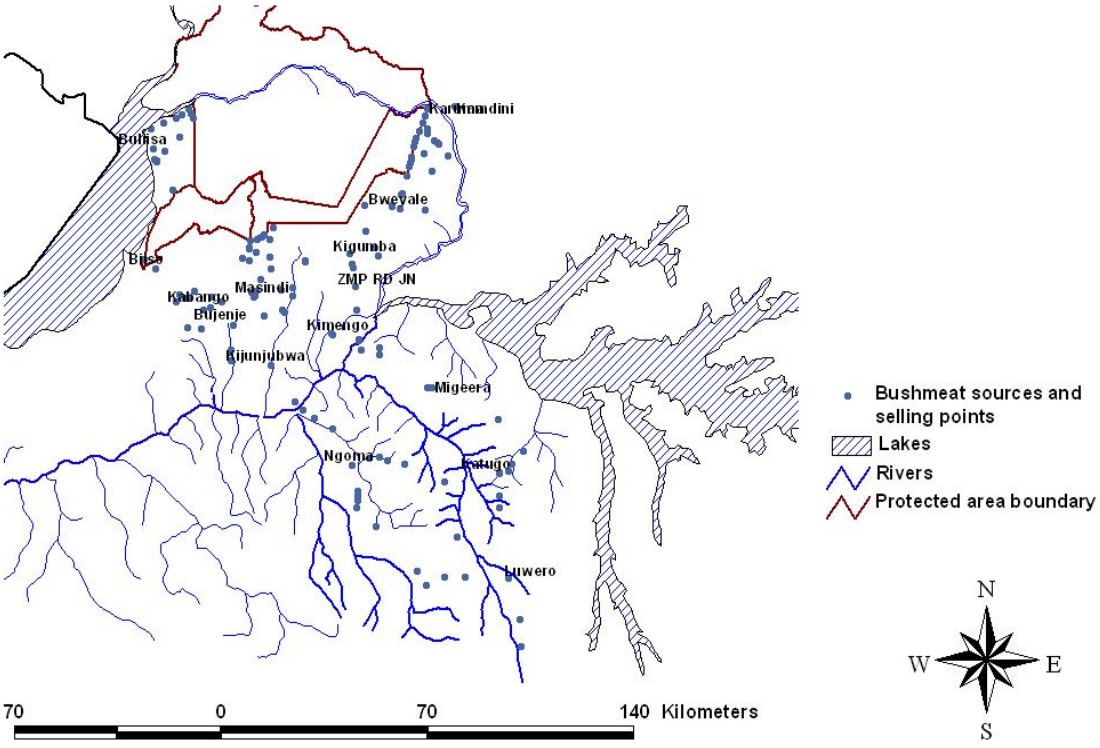


Figure 6b: QECA and RMNP. All of the points represented are either bushmeat sources or selling points, except for Rukungiri and Kanungu towns which are included here as spatial markers.

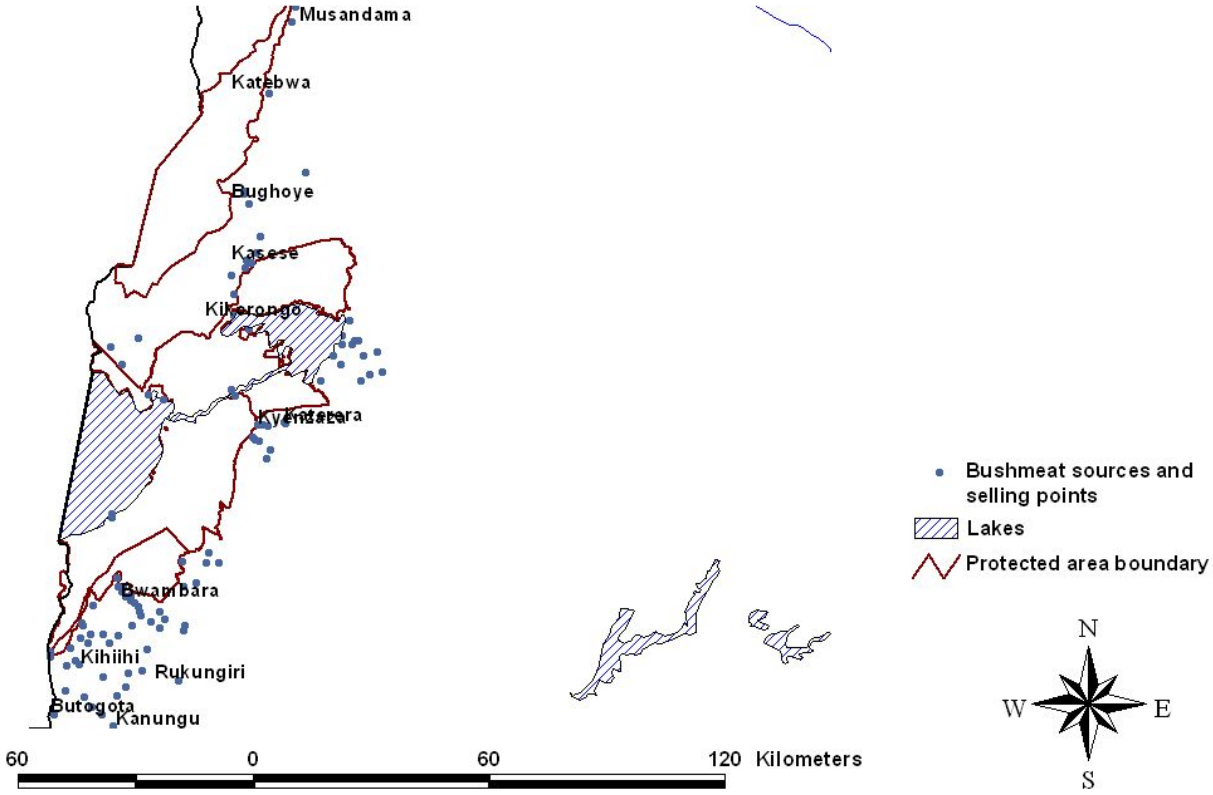


Table 31: Distant bushmeat markets and corresponding sites of origin

Hunting site	**Distant areas supplied**
MFCA	Masindi Town, Kampala, Gulu, Lira, Apac, Kitgum
Kafu Basin	Masindi Town, Kampala, Kakooge, Gulu, Lira, Apac, Kitgum
QECA	DRC, Kasese town, Bwera town, Kabarole
RMNP	None

3.4.7.2. Pricing and profitability

Bushmeat prices were not uniform across sites (Table 32). On average, bushmeat cost Uganda shs 2,000 per kg or its approximation near hunting sites and just under shs 3,000 in distant areas. Between villages near hunting sites and distant areas, bushmeat prices appreciated by approximately 40%, fetching more money for hunters if they moved it themselves or attractive profits for the middlemen.

Considering unit costs of individual meat types, hippo meat was on average the most highly priced (Table 33). Although some species appeared to fetch more, average prices are uncertain as the sample sizes are low. Bushbuck, duiker, and Uganda kob were the cheapest meat types near hunting sites, probably because of their high availability.

Table 32: Average bushmeat prices (in UGX) per kg and profits associated with each of the four field sites

Site	Cost near hunting site	Cost in distant area	Profit	%profit	N
Kafu Basin	2061	3011	950	46	300
MFCA	2343	3283	939	40	350
QECA	1665	2126	461	28	364
RMNP	1500	2400	900	60	2
Overall Average	2015	2786	770	38	1017

Table 33: Average bushmeat prices near hunting sites by site and species. [1]Unit measures are pieces or Kgs, and whole=whole animal is sold.

Species	Kafu Basin	MFCA	QECA	RMNP	Overall Average	n	Measure[1]
Leopard		4000			4000	2	Unit
Giraffe		3400			3400	1	Unit
Crocodile	4000	2000			3000	2	Unit
Goose	3000				3000	1	Unit
Potto		3000			3000	1	Unit
Hartebeest	2500	3050			2867	3	Unit
Porcupine	2714	2950			2826	42	Whole
ZEBRA??		2750			2750	2	Unit

Table 33 continued

Species	Kafu Basin	MFCA	QECA	RMNP	Grand Average	n	Measure[1]
Cane rat	1792	2500	4500		2250	21	Whole
Guinea fowl	500	3000	1000		2250	6	Unit
Rabbit	2350	2125	2000		2250	16	Whole
Hippopotamus	3485	2942	1823		2202	184	Unit
Waterbuck	2383	2389	1707		2165	88	Unit
Buffalo	2500	2557	1581		2103	117	Unit
Sitatunga	2010	2800	1750		2090	20	Unit
Bush pig	2474	2135	1371		2076	130	Unit
Bushbuck	1815	2193	1415		1943	133	Unit
Duiker	1727	2121	1833		1905	44	Unit
Uganda kob	2127	2427	1648		1883	171	Unit
Squirrel	1650	2050			1850	20	Whole
Oribi	1720	1926			1809	44	Unit
Reedbuck	1611	1988			1788	17	Unit
Warthog	1821	2208	1283		1626	57	Unit
Giant forest hog		1000	1630		1573	11	Unit
Baboon		1500			1500	2	Unit
Francolin			1500		1500	1	Whole
Goshawk		1500			1500	2	Whole
Lion			1500		1500	1	Unit
Topi			1500		1500	1	Unit
Dikdik		1433			1433	3	Unit
Elephant		3000	958	1500	1306	9	Unit
Mole	1267				1267	3	Unit
Kite		1200			1200	1	Whole
Aardvark	1100				1100	5	Unit
Hadada ibis		1000			1000	1	Whole
Heron		1000			1000	1	Whole
Vervet monkey		1000			1000	1	Unit
Pangolin	1000	800			933	3	Unit
Black-and-White Colobus			500	500	500	2	Unit
Grand Total	**2120**	**2376**	**1645**	**1167**	**2029**	**1169**	

Bushmeat is sold either fresh or smoked, but usually fresh (Table 34). Occasionally, animals are sold alive. Based on livestock meat prices gathered from bushmeat selling areas, bushmeat was evidently cheaper than livestock meat (Paired t test, t=3.091; $p_{two\ tail}$=0.004; df=32) (Table 35). Bushmeat was rarely sold in restaurants and market eateries.

Table 34: Condition of bushmeat sold: values represent total number of records key informers logged against each type of meat sold

Field Site	Fresh or Smoked	Fresh	Smoked	Sold alive	Sun-dried
Kafu Basin	138	107	96		1
MFCA	157	134	129	2	
QECA	137	412	98		
RMNP	1	2	3		

Table 35: Average bushmeat and livestock meat (Beef, Goat meat, Mutton, and Pork) retail prices based on monthly data provided by informers in various districts

Informer Code	Base District	BM Retail	n	BM Meal	n	LS Retail	n	LS Meal	n
ACK	Nakasongola	5100	5			3000	4	2000	2
AMM	Masindi	2923	26	1674	27	2269	16	2025	8
ASQ	Kanungu	1383	29	820	5	2933	30	2286	14
ATM	Masindi	2336	39	1400	28	2767	36	1534	16
AVQ	Kamwenge	1747	19			2612	17	1200	10
AVRQ	Kabarole	2250	2			2900	12	1100	6
BAM	Masindi	3552	89	2042	93	3013	60	1693	30
BAR	Bundibugyo	1338	8			2861	18	1571	7
BBQ	Kasese	1942	43			3194	44	1491	17
DQ	Bushenyi	2250	2						
KEQ	Kanungu	1775	8	580	5	2863	8	1575	4
KGK	Masindi	2417	18			2809	11	1125	8
KGK	Masindi	2714	7			2800	6	1000	4
KGQ	Kanungu	1596	26			3079	24	1850	10
KIQ	Bushenyi	2072	38			2915	26	1764	14
KSR	Kasese					3160	20	1840	10
KWM	Bulisa	2344	32	1370	23	2843	28	1464	14
MAQ	Kasese	2227	11			2879	28	843	14
MDiQ	Rukungiri	5200	9			2766	35	1250	4
MDQ	Kanungu	1733	27	1382	17	1900	8	1500	16
MMcK	Kampala								
MMK	Kampala	3333	3						
MNQ	Kasese	1992	13			3525	16	2250	8
NFK	Nakasongola	1500	2			2700	4	2500	2

Table 35 continued

Informer Code	Base District	BM Retail	n	BM Meal	n	LS Retail	n	LS Meal	n
OCK	Masindi	5500	8	2088	8			3250	4
OCM	Masindi	2519	36			2908	36	1078	18
ORK	Masindi	3425	60	2117	70	3060	53	1830	27
OVK	Kampala	5800	5						
OYM	Masindi	3249	45	1054	41	3100	31	1387	15
RAQ	Bushenyi	1917	12			3353	17	1367	9
RFK	Nakaseke	2038	13			3300	5	1300	5
RJR	Kabarole					2568	19	1222	9
SRK	Nakasongola	1839	31			3129	14	1350	10
TJK	Nakaseke	2375	32	1000	1	3331	16	1564	11
TJQ	Rukungiri	2229	12			2784	19	1350	12
TLQ	Kamwenge	1700	7			2371	7	1050	4
TRQ	Bushenyi	1813	8	1750	5	2557	35	1611	18
TSQ	Kasese	1750	4			2672	32	1303	16
Mean/Total		**2568**	**262**	**1705**	**323**	**2909**	**735**	**1545**	**376**

Bushmeat was consistently cheaper than livestock meat throughout the duration of this study (Tables 36 & 37; Fig. 8). Prices of livestock meat increased gradually throughout the study whereas bushmeat prices remained fairly constant with slight fluctuations during the study period. Prices of both bushmeat and livestock meat peaked in December.

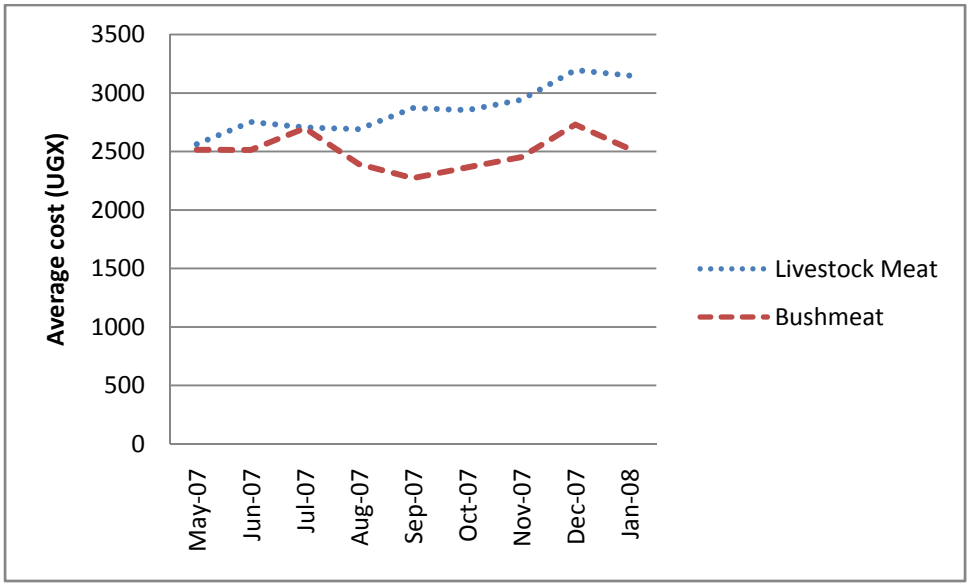
Table 36: Monthly trends in bushmeat and livestock meat retail prices in UGX. Prices of livestock meat were on an upward trend during the study period.

	Gulu	Kafu Basin	Kampala	MFCA	QECA	RMNP	BM Average Retail
May-07		2750		2635	1833		2514
Jun-07		2875		3009	1443	1350	2513
Jul-07		2875		3189	1897		2699
Aug-07		2135	3333	3100	1829		2424
Sep-07		2210		2867	1843		2272
Oct-07		2150		2758	2344	1167	2364
Nov-07		2485	5800	2715	2269	1250	2619
Dec-07	5400	3003		3444	1967	2000	2855
Jan-08	5667	2685		2984	1959		2621
Average	**5500**	**2564**	**4875**	**2978**	**1989**	**1338**	**2568**

Table 37: Monthly trends in livestock meat (Beef, Goat, Mutton, Pork) retail prices in field sites

Month	Kafu Basin	MFCA	QECA	RMNP	Average	n
May-07	3075	2552	2408		2562	37
Jun-07	3075	2900	2433	2786	2752	48
Jul-07	2575	2748	2690		2707	53
Aug-07	2848	2604	2666	2600	2690	84
Sep-07	2965	2956	2808	2871	2872	90
Oct-07	3074	2974	2754	2625	2855	99
Nov-07	3218	3054	2781	2836	2941	105
Dec-07	3300	3167	3219	3067	3196	109
Jan-08	3148	3013	3221	3425	3150	96
Average	**3067**	**2885**	**2864**	**2868**	**2909**	**732**

Figure 7: Monthly changes in bushmeat and livestock meat costs near bushmeat hunting sites



3.4.7.3. Transportation

There was no clear pattern to modes of transportation for bushmeat (Table 38). Transport used depended on where the meat happened to be, how much it was, and how far it was being moved. From the hunting sites, meat was moved on foot, by bicycle, boat, raft, canoe, or motorcycle. Movement over longer distances was achieved using whatever transport hunters or dealers found most convenient.

Table 38: Forms of transport used and number of times in which they were cited as used to move bushmeat from hunting sites to points of consumption.

Transport type	Kafu Basin	Kampala	MFCA	QECA	RMNP	Total
Foot	40		93	250	56	439
Bicycle	147		193	97		437
Motorcycle	66		53	91		210
Car	29		42	30		101
Pickup	9			24	5	38
Taxi	15	8	3	2		28
Truck	20		7	1		28
Bus		8	7	2		17
Charcoal truck	9		1			10
Rafts			10			10
Private car	2			5		7
Boat/Canoe			1	4		5
Aeroplane		1				1

3.4.7.4. Packaging and concealment

As with transportation, there was no clear pattern as to how bushmeat was disguised or concealed. It was packaged and moved like anything else people usually move around. For example, it could be hidden among produce in a truck carrying charcoal, cassava or maize or fish or tomatoes. In a passenger vehicle, it could be carried as luggage. In construction trucks moving through hunting sites, it could be hidden under sand, timber or stones. Bushmeat was most frequently packed in sacks or gunny bags, and boxes and usually disguised as charcoal, fish, firewood or agricultural produce (Tables 39 & 40). It was usually moved out of hunting areas at night.

Table 39: Modes of packaging bushmeat during transportation as reported by key informers. Values are totals of the number of times logged.

Mode of packaging (containers/Wrappers)	**Kafu Basin**	**Kampala**	**MFCA**	**QECA**	**RMNP**	**Total**
Bags	33	6	41	52	8	140
Basket			1	22		23
Boxes	73		65	5		143
Jerrycans	3					3
Polythene bags	14			113		127
Sacks	121		124	73	1	319
Suitcases	2	6				8
Water jars				6		6
Banana leaf wrapper	1			17		18
Grass				10		10
Truck/pickup carriage				2		2
Plates				1		1
Paper bags				2		2
Spear grass				4		4

3.4.7.5. Species level analysis of drivers of bushmeat use

Using data obtained through interviews with surrendered poacher groups, we examined the roles of income returns, taste, health benefits, and availability at the level of individual species to assess how these factors influenced bushmeat use, and preference of certain species over others.

Hippos ranked topmost in every respect. Surrendered poachers ranked it as their biggest source of income, the tastiest, most expensive meat, meat that provided the highest health benefits, and the most commonly available bushmeat in their villages (Table 41).

Other species did not rank as consistently across ranking variables (Table 42). For example, buffalo ranked overall as number two for income, cost, taste, and availability but not for health benefit; while Kob ranked similarly for taste, health benefit, and availability but not for income. Elephants ranked high as a source of income but low for meat taste and were one of the cheapest bushmeat types. Among the species most frequently cited as hunted, hippo was the most preferred, followed by buffalo and warthog. Other highly ranked species were the giant forest hog, and Uganda kob. Elephant meat was the least preferred (Table 41). Whereas these are ranks averaged across sites, area-specific choices exist. For example, hunters from RMNP ranked chimpanzee meat highest for health benefit and blue monkeys, l'Hoesti, and red

colobus monkeys high for taste. Highly ranked species under each driver are likely the ones most threatened by hunting for given motives. Thus, both commercial and subsistence bushmeat users may go for the species whose meat is most preferred. These would be hippo first, and then buffalo, kob, giant forest hog, so on and so forth. Key then to understanding what drives bushmeat offtake is to understand what drives preference.

We examined cost, taste, perceived health benefits and availability as factors determining preference of certain bushmeat types over others (Table 42).

Table 40: Ways in which bushmeat is disguised during transportation. Values are total number of times logged by key informers

Mode of concealment	Kafu Basin	Kampala	MFCA	QECA	RMNP	Total
Bushmeat disguised as:						
Charcoal	17		20	26		63
Fish	1			31		32
Livestock meat	14		8	4		26
Maize				4	16	20
Not disguised	6			9		15
Firewood			1	13		14
Potatoes				12		12
Sugar				7		7
Tomatoes			1	4		5
Cassava	1			2		3
Groundnuts				3		3
Cabbages	1			1		2
Grass thatch	1			1		2
Shopping basket				2		2
Tobacco				2		2
Women clothes				2		2
Beans				1		1
Fish nets				1		1
Flour				1		1
Grass fodder	1					1
Logs				1		1
Sand load				1		1
Moved during:						
Night	29		77	99		205
Day			1			1

Table 41: Average ranks of bushmeat species ranked for income, taste, health, availability, and preference. Ranks are based on averages of four or more records per species per category.

Species	Income	Cost	Taste	Health	Availability	Preference
Buffalo	2	2	2	4	2	2
Bushbuck	6	5	5	4	4	5
Bush pig	5	5	3	4	3	4
Cane rat	7	7	4	3	3	4
Duiker			2	4	6	4
Elephant	3	6	6			7
G. forest hog	4	4	2	3	3	3
Guinea fowl					5	6
Hartebeest	3		5			
Hippo	1	1	1	1	1	1
Uganda kob	4	4	2	2	2	3
Porcupine			4			5
Rabbit					5	
Squirrel					3	
Warthog	5	3	2	2	4	2
Waterbuck	4	4	5		4	5

Preference was correlated strongly with taste, but weakly with other variables (Table 42) and taste was the only strong determinant of preference (Stepwise linear regression, p=0.001, Table 43, Fig. 8).

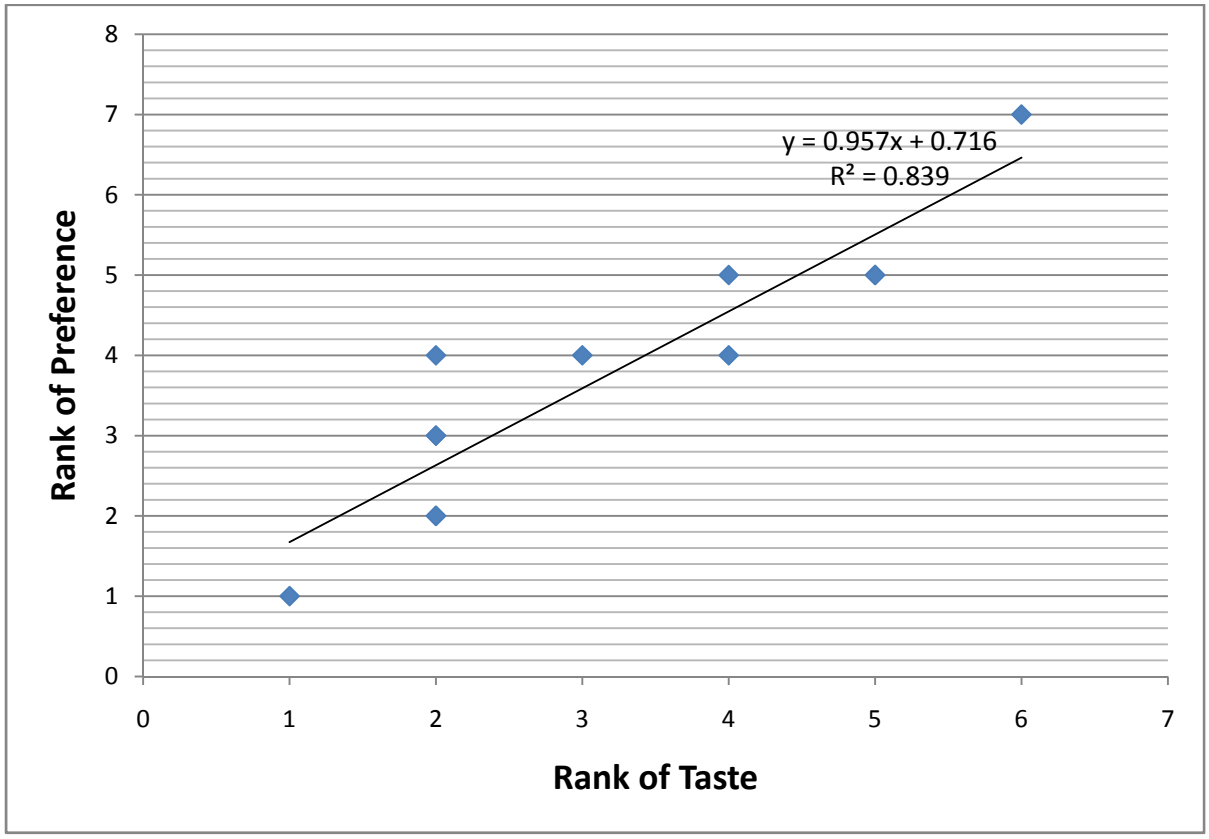
Table 42: Matrix of Pearson correlation coefficients and Bonferonni probabilities (in brackets) showing pairwise correlations of potential drivers of bushmeat consumption. Preference was most strongly correlated with taste.

	Cost	Taste	Health	Availability
Taste	0.793 (0.284)			
Health	0.463 (1.000)	0.645 (1.000)		
Availability	0.567 (1.000)	0.662 (1.000)	0.460 (1.000)	
Preference	0.868 (0.078)	0.921 (0.017)	0.678 (0.967)	0.632 (1.000)

Table 43: Results of a stepwise linear regression of preference on potential factors determining preference. Taste was the only significant determinant of preference of certain bushmeat types over others.

Effect	F	'p'
Taste	33.767	0.001
Cost	2.555	0.171
Health benefits	0.432	0.540
Availability	0.029	0.871

Figure 8: Relationship between taste and preference



Given that taste and preference were the main factors determining choice of certain bushmeat types over others, we assessed whether or not these factors had any bearing on possible choice of bushmeat over livestock meat and vice versa, and the extent to which they did so.

Surrendered hunters ranked livestock meat and fish below all bushmeat types; 71% of the time in taste, and 78% of the time in preference. On the few occasions domestic meats were ranked at the same levels with bushmeat types, they did not rank top, but at the moderate to low levels of bush pigs, cane rat/porcupine, bushbuck/hartebeest/waterbuck. Goat meat was the highest ranked in taste among domestic meat types, followed by chicken, pork, and beef in decreasing order. Ranking for preference was more or less similar to taste, except that sample sizes for chicken and pork are a little too low. Fish and mutton ranked lowest in both taste and preference. Livestock meat types and fish were in general regarded as less tasty and therefore less preferred than all types of domestic meat (Table 44).

Table 44: Relative ranks of taste and preference of livestock meat types and fish when compared against bushmeat types. In general, 'livestock' meats ranked low and usually below all bushmeat types in both taste and preference.

Meat type	**Taste Rank**	**No. times matched**	**Preference Rank**	**No. times matched**
Beef	6	5	4	5
Chicken	4	5	2	2
Fish	12	1	5	2
Goat	3	6	2	4
Pork	5	5	4	3
Mutton	9	3	7	3
No of times matched		25		19
Total no. times ranked		62		66
% no. of times matched		29		22
% no. of times ranked below bushmeat		71		78

Perception of domestic meat types as less tasty and preference of bushmeat to livestock meat is potentially a constraint to implementation of a protein substitute approach as a solution to the issue of illegal hunting for bushmeat.

3.4.8. Cultural drivers: the role of beliefs and practices

Use of body parts for purposes other than food was presumed to be another factor driving illegal hunting. To understand the extent to which use of body parts played in illegal killing of wild animals, surrendered poacher groups were asked to name the species they hunted and the uses to which they put body parts.

Up to 62 species altogether were listed by the 11 expoacher groups (Table 45). Most frequently cited as hunted in most sites were ungulates such as hippos, buffalos, bushbuck, kob,

waterbuck and duikers. Elephants were also cited as hunted by most poacher groups. Of the small-bodied species, the most frequently hunted were cane rats, porcupines, guinea fowls, rabbits and squirrels. In general, these are also the species most likely to be hunted for bushmeat. However, there are location-specific habits that may put other species in peril in specific hunting locations. Primates for example were usually cited as hunted for bushmeat by hunters associated with RMNP. Hunting of birds, rodents and reptiles was restricted to a few species while amphibians were never mentioned.

Diversity of body parts used for other purposes was high. Elephants, leopards, lions, pythons, hippos, chimpanzees, hyenas, baboons, and crocodiles in decreasing order had the highest diversity of body parts put to other uses, and were therefore the most likely to be hunted for uses additional to bushmeat.

Table 45: Species most likely to be hunted in each protected area for meat and/or other body parts as indicated by the number of hunter groups and number of different body parts respectively as given by surrendered poachers from three hunting sites. Overall, most of the species hunted are eaten and body parts from many are also put to several different uses.

	MFCA		**QECA**		**RMNP**		Total No. hunter gps (Meat Eaten)	Total No. of other parts used
Species	No. hunter gps (Meat Eaten)	No. of other parts used	No. hunter gps (Meat Eaten)	No. of other parts used	No. hunter gps (Meat Eaten)	No. of other parts used		
Aardvark	6	5	4	2	1	1	11	5
African civet		1	1				1	1
Baboon	3	5	3	5	2		8	8
Banded mongoose			2	2			2	2
Black kite			1		1		2	
Black-and-White colobus	1	1	4	2	2	1	7	2
Blue monkey					2	1	2	1
Buffalo	10	4	7	4			17	4
Bushbuck	9	2	6	3			15	3
Bush pig	7	1	7	4	2		16	5
Cane rat	9	1	6	1	1		16	2

Table 45 continued

	MFCA		QECA		RMNP		Total No. hunter gps (Meat Eaten)	Total No. of other parts used
Species	No. hunter gps (Meat Eaten)	No. of other parts used	No. hunter gps (Meat Eaten)	No. of other parts used	No. hunter gps (Meat Eaten)	No. of other parts used		
Chimpanzee		3	2	4	2	5	4	8
Civet			1	1			1	1
Common civet		1	2	1			2	1
Crocodile	2	4	1	3			3	6
Dikdik	4	2	1				5	2
Duck	2						2	
Duiker	7	2	3	2	2		12	2
Eagle			2	1			2	1
Elephant	8	7	7	14	2	1	17	18
Francolin	1		3				4	
G. forest hog			7	3	1		8	3
Giraffe	1	2					1	2
Goshawk	1		1		1		3	
Green pigeon	1	1					1	1
Grey-crowned crane		1	1				1	1
Guinea fowl	5	1	6		1		12	1
Hartebeest	8	2					8	2
Hawk				1				1
Heron			1	1			1	1
Hippopotamus	10	3	8	8			18	9
Hyena	1	6	3	4			4	8
Hyrax	1		1		2	1	4	1
Jackal	1	3	1				2	3
Leopard	5	7	5	8	1	1	11	14
L'hoest's monkey			1	1	1	1	2	1
Lion	6	8	6	6			12	12
Mole rat	1						1	
Mongoose (unspecified)					1		1	
Oribi	4	2					4	2

Table 45 continued

	MFCA		QECA		RMNP		Total No. hunter gps (Meat Eaten)	Total No. of other parts used
Species	No. hunter gps (Meat Eaten)	No. of other parts used	No. hunter gps (Meat Eaten)	No. of other parts used	No. hunter gps (Meat Eaten)	No. of other parts used		
Otter	1	1					1	1
Owl				1				1
Pangolin	5	2	1				6	2
Parrot				1				1
Porcupine	8	1	5	1	2	1	15	1
Potto					1	1	1	1
Python	4	9	3	5			7	10
Rabbit	6	2	5	2			11	3
Redtail monkey					1	1	1	1
Reedbuck			3	2			3	2
Rwenzori colobus					1		1	
Serval cat	3	1	5	1	1	1	9	1
Sitatunga	3	1	1	1			4	1
Squirrel	7	5	4	1	1		12	5
Topi			1	1			1	1
Tortoise	1	1	1	1			2	1
Uganda kob	7	2	7	5			14	5
Vervet	1	1	6	4	1	1	8	4
Vulture			1				1	
Warthog	6	3	6	5			12	5
Waterbuck	8	2	7	3			15	3
White-tailed mongoose	2	1	2	2	1		5	2
Wild cat	1						1	
Total number of species	41	39	47	39	25	13	60	54

In addition to bushmeat use, bodies of animals killed were put to several different uses (Table 46). Parts other than meat (Table 47) were most commonly cited as used for medicinal purposes, sale to make money and for craft (making musical instruments, mats, bags).

Table 46: A summary of ways in which animal parts are used in addition to food-according to surrendered poachers. Values represent number of times in which poacher groups in the different areas mentioned use of specific parts for the given uses.

Use type	MFCA	QECA	RMNP	Total	%
Barter trade		2		2	0.2
Alcohol brewing		1		1	0.1
Controlling bedbugs	1	1		2	0.2
Cash trade	94	35	6	135	13.8
Costume making	4	7	4	15	1.5
Craft making	63	46	3	112	11.5
Crop yield improvement	1			1	0.1
Decorative	13	3		16	1.6
Garment making		2		2	0.2
Medicinal uses	58	92	6	156	16.0
Food	178	166	35	379	38.8
Poison	5	5		10	1.0
Prevention of livestock diseases		1		1	0.1
Rope and string making	3	1		4	0.4
Sexual healing	4	1	1	6	0.6
Spiritual/Supernatural uses	59	50	3	112	11.4
Status definition	4	3		7	0.7
Tool making	3	4		7	0.7
Vermin control	3	6		9	0.9
Total	493	426	58	977	

Table 47: A summary of body parts used and the number of times mentioned by hunter groups

Body part	Number of times cited
Bile	4
Bone	23
Brain	3
Claws	16
Dung	10
Ear	13
Eyebrow	2

Table 47 continued

Body part	**Number of times cited**
Fat	43
Feathers	5
Cloaca	3
Fingers	4
Forehead skin and nose	1
Foreskull	1
Gullet	2
Gut stone (thought to be in leopard)	1
Hair	34
Head	3
Heart	6
Hooks (on a python)	1
Hooves	7
Horns	49
Intestines	1
Ivory	2
Lips	1
Leg	1
Liver	5
Mane	1
Meat	383
Menses blood	1
Nails	10
Nose	5
Male genitalia	14
Placenta	4
Quills	16
Ring on tail base (thought to be on leopard)	1
Saliva	1
Scales	6
Shell	4
Skin	174
Skull	4
Tail	11

Table 47 continued

Body part	Number of times cited
Tail Hair	15
Tail skin	1
Teats	2
Teeth	31
Thumb	5
Toes	2
Tongue	1
Trunk (elephant only)	1
Tusks	22
Udder	4
Whiskers	1
Grand Total	968

3.5. Wider issues of bushmeat use

Wider issues of bushmeat use related to this study included land use change and management, engagement of surrendered poachers, and role of local administrations in conservation. These were issues that could have compounded the problem of hunting beyond the immediate pressure to hunt for bushmeat, other wildlife products and to eliminate problem animals.

In relation to engagement of surrendered poachers- the UWA signature campaign to make poachers surrender voluntarily is commendable, appears to have been well received and is probably realizing some success in controlling illegal hunting. The only problem seems to be continued engagement of the surrendered poachers. Follow-up action seems to going well around MFCA but not QECA. Many groups have surrendered around QECA, but there is not sufficient follow up to mobilize them to engage in alternative activities and to support these activities. Accordingly, some groups are disgruntled and re-thinking their decisions to surrender. There is need to facilitate community conservation rangers to make this follow-up, support poachers with planning of appropriate projects, and financing of those projects.

Local governments have a big sway over the way the people they serve behave, but this influence does not appear to have been sufficiently tapped for the benefit of conservation. During this study, we heard of cases where local council heads discouraged the community from reporting people who poach or actually encouraged them to hunt. Unless local government authorities are sufficiently engaged and obligated to mobilize communities against

illegal hunting, we are likely to continue seeing unsustainable pressure on wildlife both inside and outside protected areas. Part of the accounting for financial support from the park to the people living around protected areas (in form of revenue sharing) should be commitment of local authorities to reduce and stop illegal activities in parks. There is also need for legal provisions obligating local leaders to participate in monitoring and punishing environmental crimes.

Land use change and management regime has a serious implication on wildlife management around protected areas but the case of the Kafu Basin needs highlighting. Privately owned land is subject to the discretion of the individual owner. The Kafu Basin is a special case because whereas wildlife populations are abundant here, they have no safe rear 'bases' to retreat in event of increased pressure unlike those in protected areas. The animals here have hitherto been protected more out of the good will of the people than government policy or community mobilization activities. But there are indications that the situation is changing. Land use intensification and conversion is on the rise as are conflicts. Everywhere in the basin, there is a rising trend of fencing and thinning bushes. Indigenous vegetation is being slashed for charcoal and to give way to pine. North of the river, there is also increased conversion to sugar cane plantations. This area has maintained relatively large wildlife populations of any area outside protected areas because of its low population density; it is largely inhabited by pastoralists whose culture does not allow eating wild animals, and its remoteness. Trends in hunting and habitat conversion are likely to worsen as the road network expands and it becomes more accessible. Unless strong measures are put in place, it will only take a matter of years for vegetation cover in this area to change drastically, and for the biodiversity, in this area to reduce to insignificant levels beginning with rich populations of antelopes and birds found here.

Recently, there has been a push to start collaborative management particularly putting in measures for sustainable extractive use and tourism—but this needs to go further—there is the whole issue of how to manage the habitat in a way that does not reduce food resources, protects breeding grounds and nesting/nursing sites, and that maintains movement of animals in search of mates or food resources. These needs can only be met if animals if home ranges which maintain traditional movement routes are retained. There is need to i) uphold practices that have maintained wildlife here for ages and to help people to realize value from this inheritance, ii) deal with biases about potential competition for resources with livestock, spread of diseases, and ways to control illegal hunting), and iii) to come up with a strategy to protect viable populations of wildlife in this area. Planning expansion of plantations is needed, and integrating wildlife management into plantation management is also needed if the biodiversity of this area is going to be maintained. Needless to say, this should go hand in hand with putting into place mechanisms of vermin control. The Kafu Basin has potential to serve as a brilliant

model for coexistence of people and wildlife outside protected areas when land use is planned with wildlife management integrated into that planning. It will be useful to work with owners of rangelands and plantations to include good practices into their management plans.

3.6. Current trends in bushmeat off take, demand, and supply

Analyses of trends are based on key informers' prior experience, and actual figures from monthly hunting records for each site. Before they started filing monthly records of hunting incidences where they were based, key informers were asked to state what they thought, based on their experience the trends in bushmeat supply and demand had been during the previous five years; specifically whether increasing, decreasing, or constant and reasons for the trends.

3.6.1. Trends in demand and supply over the last five years

Bushmeat supply was logged as decreasing 55% of the time and increasing 24% of the time, and the rest of the time as constant, averaging a trend that was constant with a slight tendency towards decreasing (Fig. 9). As expected, there was variability of perceptions between sites. For example informers based in Bulisa and Bushenyi districts were strongly but independently affirmative that bushmeat supply had been decreasing in their areas over the years, while those based in Rukungiri (Rwenshama fishing village and Bikurungu) were affirmative that supply has in general been constant in their reporting areas. Informers in the rest of the locations generally had the impression that supply is somewhere between constant and decreasing.

For individual species, similar heterogeneity exists. Supply of hippo meat was for example cited as definitely decreasing in most of the locations except for Rukungiri where there appeared to be a tendency towards increasing. On the other hand supply of meat from medium sized antelopes and bush pigs was thought to be constant in many areas with a strong tendency towards increasing. The most common explanations given for increase in bushmeat supply was lax law enforcement and occurrence of many hunters (mentioned by informers at Rwenshama landing site and Bikurungu in Rukungiri district), perceived (but not necessarily true) high abundance and increasing wildlife populations in the Kafu Basin (particularly of bushbuck, duikers and oribi as reported by informers at Ngoma and Kinyogoga in Nakaseke district) and high frequency of animals exiting protected areas (Table 48). Of the reasons given for reduced supply of meat from certain species, population decline was topmost, followed by increased legal restrictions (Table 49). Availability of livestock alternatives was another common reason given. Conservation awareness was not a frequent explanation.

Figure 9: Trends in bushmeat supply in rural sites as given by Key Informers. Percentages represent proportion of times logged for each category.

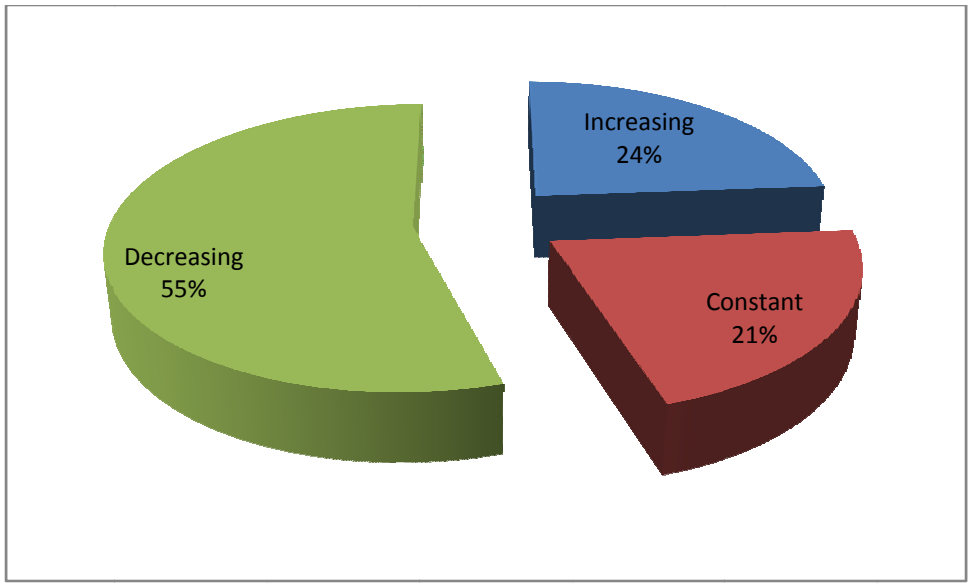


Table 48: Reasons for increasing bushmeat supply as given by Key Informers

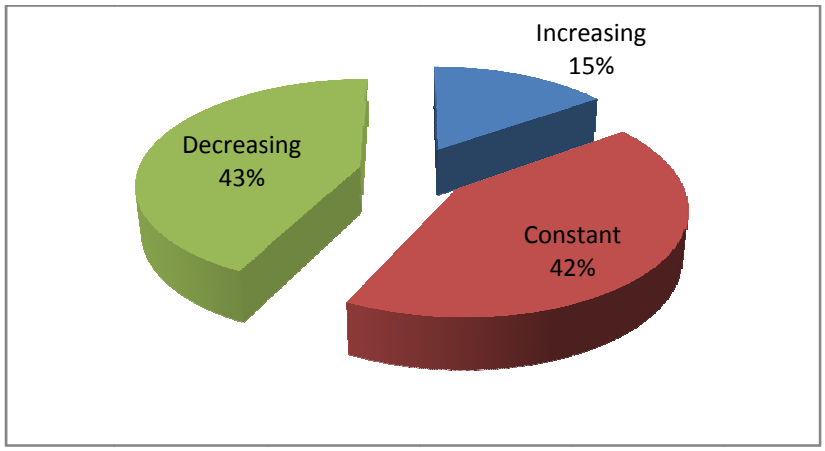
Reasons for increasing supply		
Reason	Number of times cited	%
Lax security	5	23.8
Animals are abundant	3	14.3
Animal numbers increasing	2	9.5
Many hunters	2	9.5
High demand	1	4.8
Tasty	1	4.8
Crop raid	1	4.8
Increasing incidences of dead animals	1	4.8
Legal to hunt	1	4.8
Legal restrictions	1	4.8
Ranger-Poacher collaboration	1	4.8
Home consumption	1	4.8

Table 49: Reasons for decreasing bushmeat supply as given by Key Informers

Reasons for decreasing supply		
Reason	Number of times cited	%
Legal restrictions	33	43.4
Rare or population has declined	30	39.5
Increased livestock alternatives	4	5.3
Conservation awareness	3	3.9
Lax security	1	1.3
Common	1	1.3
Few people eat	1	1.3
Hard to kill	1	1.3
No legal restrictions	1	1.3
Not preferred	1	1.3

Trends in demand were similar to supply. Key informers were generally of the view that demand for bushmeat is generally constant with a possibility of a decreasing trend overall (Fig. 10, Table 50). No particular species were particularly associated with any individual trend.

Figure 10: Trends in bushmeat demand as given by Key Informers. Percentages represent proportions of times logged for each category.



Where increased demand was cited, scarcity, low cost and preference were the most frequently given explanations. On the other hand, where demand was cited as decreasing, scarcity and legal restrictions were most commonly cited causes (Table 51). Voluntary factors like increased conservation awareness, people refusing to buy it for whatever reason, change in preferences were also frequently cited as explanatory factors for reduced demand.

Table 50: Reasons for increasing demand as given by Key Informers

Reasons for increasing demand	
Reason	Number of times cited
Not Available	3
Cheap	2
Preferred	2
People still hunt in PA during Christmas season	1
Animal numbers are constant	1
Crop destruction	1
Constant supply	1
Problem animal	1
Legal restrictions	1
Tasty	1
Common	1
Main source of meat	1
People have time to hunt	1

Table 51: Reasons for decreasing demand as mentioned by Key Informers

Reasons for decreasing demand	
Reason	Number of times cited
Scarce	12
Legal restrictions	12
Conservation awareness	9
People don't buy it	4
Population decline	2
Cultural change (no longer preferred)	2
Many hunters	1
Irregular supply	1
Not preferred	1
Park benefits	1

3.6.2. Trends in off take over the duration of the study

Hunting data collected by key informers from April 2007-January 2008 showed a tendency of bushmeat off take increasing towards in MFCA but fairly constant in other sites. In sites where it was constant overall, it was not necessarily the case for all species. Removal of porcupines for example showed a distinct declining trend in the Kafu Basin and hunting of guinea fowls a distinctly rising trend in QECA (Fig. 11). These trends may be driven by a multiplicity of factors including human pressure, seasonality, and variation in degree of law enforcement. They suggest that although there may be reduction in hunting intensity over the years, it is small and cannot be readily verified by data collected within a short time frame.

Figure 11: Trends in monthly off take of top five hunted species in each site. Plots are of moving averages per study site during the months May-December 2007. Hunting intensity increased around MFCA during this period, remained constant around the Kafu Basin and QECA, and decreased around RMNP.

Figure 11a: Murchison Falls Conservation Area

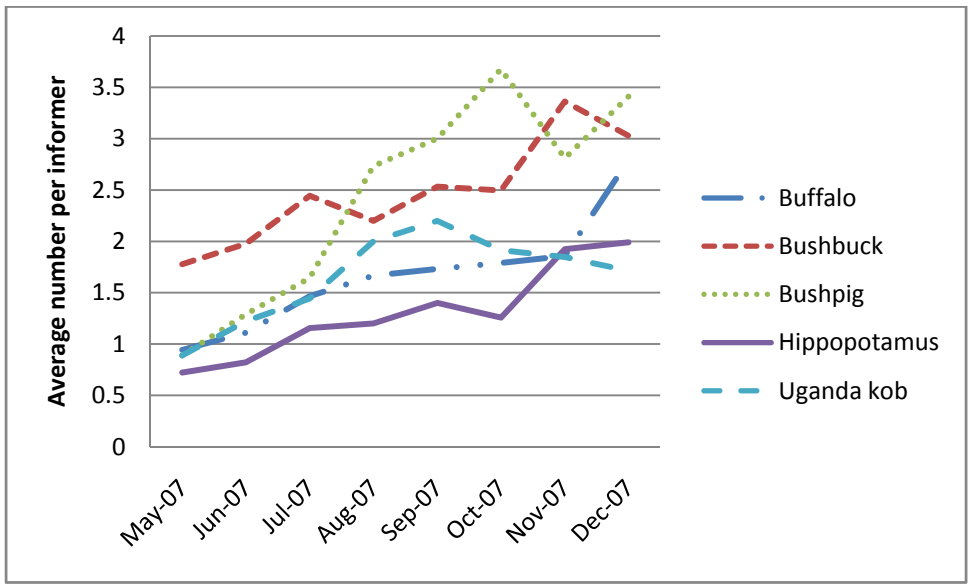


Figure 11b: Kafu Basin

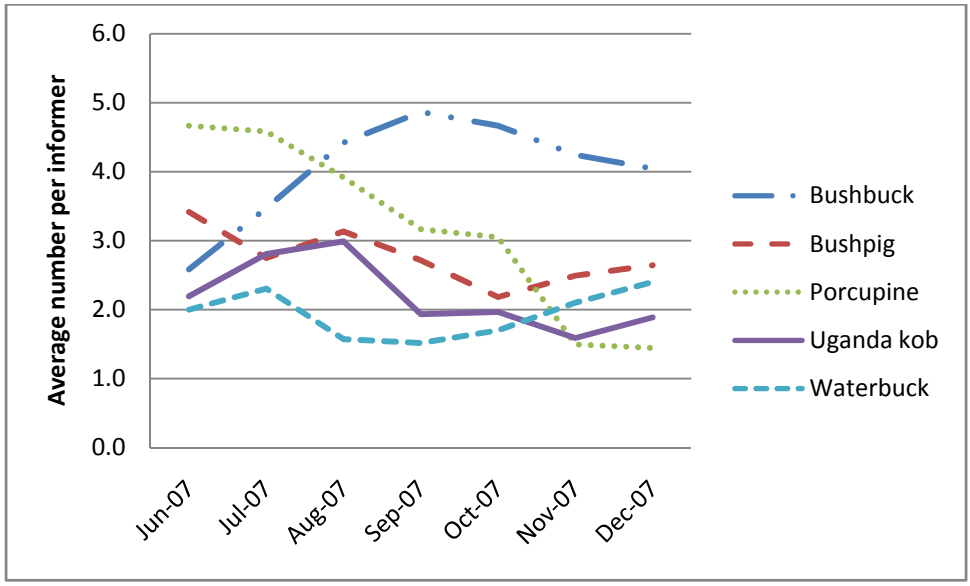


Figure 11c: Queen Elizabeth Conservation Area

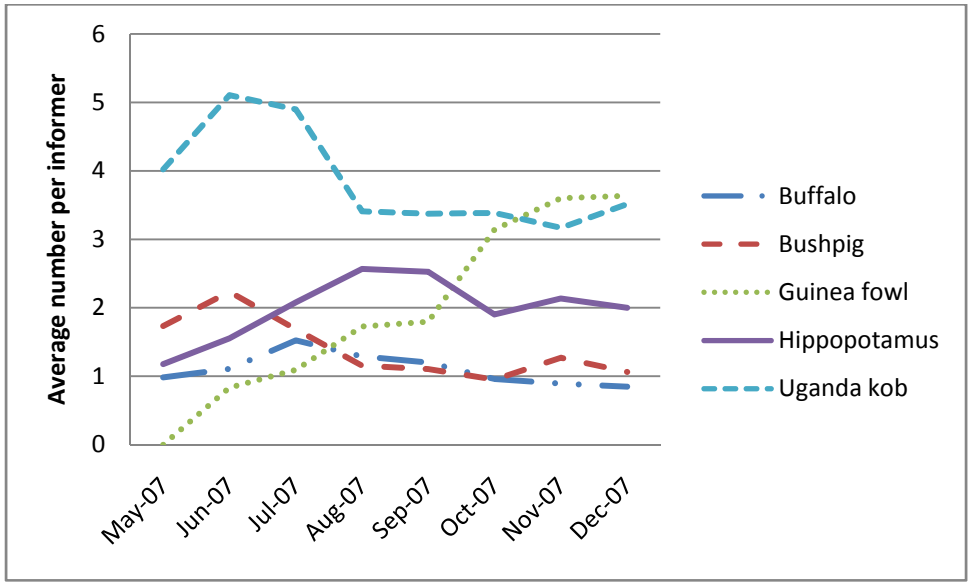
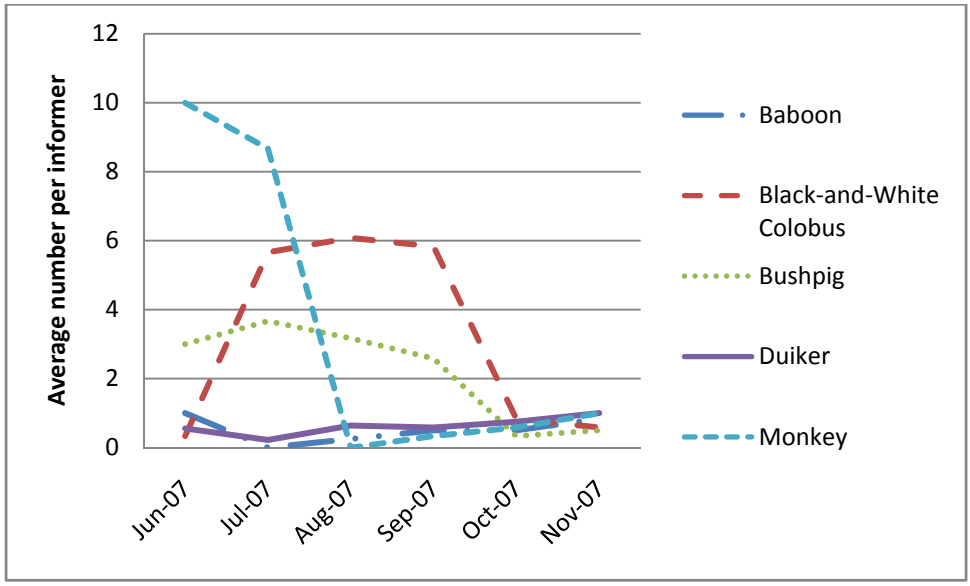


Figure 11d: Rwenzori Mountains National Park



4. Review of results/general discussion

Previous knowledge of bushmeat use in Uganda has hitherto been limited to CARE's (CARE, 1999) evaluation of trade in QENP products by local communities and Okello's (Okello, 2004) study of bushmeat trade and consumption in Kampala. Results from this study have substantially expanded our knowledge of bushmeat trade and consumption in Uganda. The main findings were that:

i) bushmeat was not the main source of meat for an average household living in and around major hunting sites. It was eaten by 5-32% of the households, and rarely so (in 1-12 days in 100 days). High income earners were more likely to eat bushmeat than low income households, and farming households more than ranchers and pastoralists, ii) bushmeat was the main meat source for hunters. It contributed significantly to the hunter's income, and the trade was profitable to the dealers, iii) bushmeat was on average cheaper than livestock meat in rural sites, but higher in Kampala iv) most of the meat hunted in QECA was consumed in the neighboring villages usually within 20km of the PA boundary, while there was virtually no bushmeat trade associated with RMNP. Meat hunted from the Kafu Basin and south of MFCA supplied a much wider market, including Kampala to the south, and Gulu and Kitgum in the north, v) in both rural and urban sites, bushmeat trade was underground – bushmeat was never sold in market stalls and very rarely in restaurants, vi) during transportation, it was disguised as agricultural produce or other legal merchandise and usually moved at night, vii) there were indications that bushmeat trade and consumption was reducing, but offtake was still high and likely not sustainable, viii) ungulates were the main animals hunted for bushmeat, and primates rarely, except in RMNP, ix) spears, snares, and traps were the main hunting implements, and gun use was frequent, x) hunting incidences inside protected areas and their environs were comparable, xi) crop raiding and other forms of human-wildlife conflict drove hunting but to a lesser degree than the need for bushmeat, xii) uses placed on parts such as skins, tusks, hair, canine teeth, fats, oils and a variety of other body parts also drive hunting, particularly of the big predators, elephants, and pythons, xiii) hunters were mainly driven to hunt by the need to make money and both need and preference for bushmeat for subsistence, xiv) certain bushmeat species were considered more tasty than others, and were thus preferred for that reason. In general, all forms of bushmeat were regarded tastier and than livestock meats and fish. Bushmeats were preferred to livestock meats mainly for that reason.

The QENP study and the Kampala study both revealed some findings similar to what was found here. The study by CARE (CARE, 1999) found that income from bushmeat contributed 10% of

the total annual protected area income to the local communities around QENP. It was second to firewood which contributed 68% of the total income valued at shs 739 million per annum near protected area edges. Hippo was the main animal sought, contributing 83% of income from bushmeat. The Kampala study (Okello, 2004) established that bushmeat trade was existent in Kampala but was underground and limited to certain communities, mainly in Naguru, Kamwokya, Kyebando, Kinawattaka, Nakawa, and Nsambya. Sales were not open and when bushmeat was supplied in large quantity, it was offloaded from buses at the city suburbs, into hired pickups. Dealers sold the meat door to door and in local brew pubs, but only to the people they knew. People ate the meat for its taste, and out of tradition and habit. Bushmeat prices were higher than those of equivalent quantities of livestock meat. Most of the meat was brought into Kampala from the Kafu Basin, MFCA, and QECA.

Results from this study also bear similarities and differences with what has been found elsewhere in Africa and particularly in East African sites. For example, it was established that bushmeat intake was lower than expected in the villages surveyed. This has also been determined in other locations, for example the villages around the Udzungwa Mountains, Tanzania. Bushmeat was low in importance and contribution to protein intake Nielsen (2006). The most common pattern of bushmeat consumption near village hunting sites is however a heavy dependence on bushmeat by rural households (e.g. Botswana- ODI, 2006; Kenya- Fitzgibbon, *et al.,* 1995; in the Congo Basin- Wilkie and Carpenter, 1999; Eves and Rugierro, 2000; Eves, 2006; in West Africa- Bennett and Deutsch, 2003; Owusu *et al.,* 2006). Where there is heavy dependence on bushmeat, it is thought to compensate for low protein intake (e.g. Eves, 2006). In the sites studied as in the rest of Uganda, alternative protein sources are readily available for household (e.g. as evidenced from crops cultivated by households in these sites). Protein from plant sources - beans, for example- are extensively planted by most (beans are planted by up to 99%) of the households in the study sites and available even to the poorest of the households in Uganda. It is thus difficult to explain bushmeat eating in terms of protein, and some other nutritional explanation may apply, for example, essential vitamins and minerals. On the other hand, it may simply be a manifestation of a “meat culture”. Non-meat protein sources are unlikely to serve effectively as protein substitutes for bushmeat for people living in and around these sites.

Loibooki *et al.* (2002) found in the Serengeti area of Tanzania that most individual and group respondents were subsistence farmers who considered bushmeat as a source of protein. The same situation may apply here, except that bushmeat is regarded as a delicacy. Hunters around the Serengeti also see bushmeat as a source of income, and the same situation applies here except that dealing in bushmeat trade supported people in the savanna and woodland sites but not the forest site (RMNP). Around RMNP, communities in general do not realize high income

from the PA and it has been established that PA products reduce poverty of the residents by only 2.8-4.7% (Tumusiime, 2006) although residents around RMNP may be benefitting more than the others living around forests in the northern end of the Ugandan portion of the Albertine Rift (Bush *et al.,* 2004). According to these authors, residents living around RMNP realize as much as 35.6% of their total annual incomes from forest resources.

In all sites, resolution of the bushmeat problem in part appears to lie in livestock ownership. Participation in illegal hunting among the Serengeti communities decreased as wealth in terms of the number of sheep and goats owned increased (Loibooki *et al.,* 2002). Although hunting has been linked to poverty and low protein intake by some studies, for example Nielsen (2006) in the Udzungwas, this linkage appears to be true mostly of livestock wealth. In this study, crop farmers were more likely to eat bushmeat than livestock keepers but, wealth and income were less likely to explain why people hunted or ate bushmeat. It was also not likely to be because farmers had easier access to wildlife than livestock keepers. Comparisons of hunters and average households in the same sites showed a poverty linkage for hunters in QECA and possibly RMNP, but not MFCA. This suggests that for this area, cultural attachment was more likely to explain bushmeat hunting and consumption than differences in wealth or income levels.

Solutions to bushmeat hunting in these situations include increasing the number of domestic animals, such as pigs and goats to poor farming households and conservation awareness and education to address habits and attitudes. Small-livestock production such as rabbit raising (NRC, 1991; Hardouin, 1995; Wilkie, 2003) have been adopted by households in Cameroon in areas where wildlife is already scarce (HPI 1996). Small animal raising has been shown to be viable in peri-urban areas close to sources of demand and where proximal wildlife species populations have already been depleted (Lamarque, 1995). That said, livestock rearing as an alternative to wildlife hunting is only likely to be successful, however, when the labor and capital costs of production are less than the costs of wildlife hunting and marketing (law enforcement keeps the cost of wildlife hunting and marketing high). If domestic production of meat only becomes economically viable after wild animals have become so scarce as to be unprofitable to hunt, the strategy is clearly ineffective as a conservation measure (Wilkie, 2003). This may be part of the reason why hunters are giving up in certain areas, for example around RMNP.

Wildlife farming has been suggested as one of the solutions to illegal hunting (Ape Alliance, 2006). This is thought to allow people to eat wild meat, while taking pressure off wildlife populations. The solution of wildlife farming is however controversial, with concerns about the viability of such farming, its cost effectiveness, and its impact on wildlife populations (review by

Mockrin *et al.,* 2005) and is unlikely to work if introduced widely. Because of this, it should, be limited to a few species and to a few interested people and capable of rearing them to realize cultural attachment. For others, access to bushmeat through restricted hunting should also address the problem of cultural attachment, but not necessarily as a protein solution as stocks are unlikely to be large enough to support this objective.

Licensing hunting for "big" days such as Christmas has also been suggested by surrendered hunters from MFCA as a solution to illegal hunting. This could address the issue of cultural attachment, but not meat protein source as cost effectiveness of raising animals to slaughter has been shown to be higher for all livestock than all bushmeat species (Feer 1993 cited by D. Wilkie in Bennett and Deutsch 2003). Such species could be the fast reproducing/high productivity ones like bush pigs, bushbucks, and duikers frequently, and slow reproducing ones (as determined by analysis taking into account gestation period, number of offspring per birth, interbirth intervals, time to first reproduction, and longevity) less frequently.

One of the key factors driving bushmeat consumption in the study areas is its perceived superior taste, and healing abilities. Taste is sometimes the explanation for bushmeat eating. For example in Ghana, Cowlishaw *et al.* (2005) found that variation in the price of bushmeat was largely explained by transport costs and taste preferences. The logic among the local communities may lie in both observation and imagination. According to one group of poachers in Bushenyi district, one leg of a hippo can heal a child with Kwosiorkor. The meat is cooked in bits and fed to the child and malnourishment disappears when all the meat has been fed to the child. On the other hand, belief in nutritional qualities lies in the logic that wild animals are exposed to a wider nutritional base as they feed on a wider range of plants compared to domestic animals. This belief was widespread among surrendered poacher groups and appears to bear some scientific truth. For example, Eltringham (1984) suggested that game meat is nutritionally superior and contains far less fat compared to livestock meat, and ungulates yield greater amounts of edible protein per unit of live weight than domestic animals and it has been that the fat content of the carcass is 7.7 times greater in domestic than wild animals so that humans would be healthier eating wild meat over livestock meat (Barnett, 2000). It would be useful to conduct a study to show whether or not this is indeed the case among the species most preferred in this study.

Gun use in hunting is a serious threat that has also been documented elsewhere. In the DRC for example, guns have become more readily available (Barnes, 2002) and are virtually universally adopted by anyone who can afford to buy one (or hire one from an entrepreneur) to increase hunting success. For a small investment, the economic pay-off is substantial, and uncontrolled hunting becomes widespread. In the Tabora district of Tanzania, Carpaneto and Fusari (2000)

found that gun use was prevalent. Guns were used during 53.81% of the hunting incidences. In Makao site in Nouabalé-Ndoki National Park in the Republic of Congo, human population had been stable until 2001 when a logging company arrived, adding 1000 people to the local population (Bennett and Deutsch, 2003). This resulted in rises in bushmeat prices, increased gun use, and a change in number and proportions of animals hunted, and a crash in off take in the fifth year. By the end of 3 years, no large mammals were found within 6 km of the village and the number of guns rose by 30% in a period of three years. In this study, gun use was related to the calendar, but not season and increased towards the end of the year.

Seasonality in hunting patterns is a known occurrence in hunting sites. In QECA and RMNP, hunting was commonest during the wet season. This was presumably the time when animals become less concentrated around water sources but more likely to stray out into the neighboring villages. In MFCA, and perhaps Kafu Basin as well, hunting may be common during the dry season because the hunters are less pre-occupied in their gardens and there is a greater scarcity of stew. In all sites and mostly MFCA, off take increases at the end of the year coincident with the end-of-year festivities, testimony to surrendered poachers' submission that bushmeat demand is high at this time and hence their request for legalization of hunting then. Climatic and holiday peaking has been reported in sites across Africa where commercial bushmeat trade is not intensive. In the Mbam Djerem National Park in Cameroon, Bennett and Deutsch (2003), reported peaking during the rainy season and around the end-of-year celebrations, and Owusu *et al.* (2006) reported climatic peaks in the Afadjato and Agumatsa Conservation Area in Ghana. Park managers can use an understanding of seasonality to plan law enforcement activities or to design collaborative management options based on licensing hunting.

Occurrence of a link between human-wildlife conflicts observed in this study is not surprising. In eastern and southern Africa, it has been shown that increases of associated demand for land to undertake agricultural and livestock production have raised such antagonism to the level of illegal hunting of problem animals (Barnett, 2000). It is possible that such antagonism may be rising in the Kafu Basin where land use conversion and habitat modification appear to be increasing. One way to reduce such antagonism, shown to be effective, is supply of game meat to affected communities (Barnett, 2000). Game meat derived from problem animal culling in many cases represents the only form of direct and tangible compensation that communities receive for wildlife damage caused to property, crops and human lives (Barnett, 2000).

The need for bushmeat, the need to make money, and hunting in response to human-wildlife conflict as factors driving illegal hunting are complicated by the attitude that wildlife is free and limitless. Many hunter groups interviewed believed that this was the case, except for RMNP

where hunters suggested that animals are getting scarcer. Depletion combined with the low inherent productivity of forested habitats may indeed be the explanation for the relatively low off take observed in RMNP; whereas because QECA, Kafu Basin and MFCA are potentially more productive habitats, off take was found to be higher. The Kafu Basin in particular seems to fit into Robinson and Bennett's (2004) model where productivity can be expected to be highest as it is a mix of fairly intact but grazed patches of moist savanna and cultivation.

The attitude limitlessness of wildlife appears widespread. In a survey in the Congo Basin, Eves (1996) found that 58.9% of respondents agreed with the statement that wildlife could not 'get finished' even if it is not protected by wildlife laws. In villages far from roads or development where wildlife was still relatively abundant as it was in cities far from the wildlife resource, she found that this was often the sentiment. That however was not the case in villages that had been hunted out. That lack of understanding may be shared by many non-biologists in general (Eves, 2006) and needs to be emphasized by community mobilization programs.

In part because of the attitude of limitlessness, inherent productivity and cultural norms are in themselves not sufficient to protect wildlife and hunting restrictions and effective enforcement of those restrictions are needed to ensure sustainability. This study has shown that in general, poverty and cultural beliefs and attachment are the root causes of bushmeat use in Uganda. It has also shown that hunting is also driven by non-food uses of animal parts, human-wildlife conflict, ranging of animals outside PA boundaries which make them easy targets. Limitations of law enforcement, habitat modification and conversion, and availability of the bushmeat market also fuel illegal hunting. Bushmeat solutions should aim at addressing these issues.

5. Lessons and conclusions

Meat consumption frequency

- Household survey results showed that most households (>90%) eat livestock meat and fish but daily consumption is low (eaten in only 5-14 days in 100 days on average). Fewer households (5-32%) reported eating bushmeat. Among these households, bushmeat intake was low, eaten only in 1-12 days on average in 100 days. Among active hunters however, bushmeat intake seems very high, as it may be eaten daily. Bushmeat is therefore an important source of protein for households of hunters, but not for an average person in villages near hunting sites.
- On average, households that ate bushmeat tended to eat less domestic meat, however their overall meat intake was equal to, and in some cases higher than that of households that did not report eating bushmeat.

Trends in bushmeat demand, supply, and offtake

- Level of off take in protected areas is still high despite elevated conservation effort and the fact that hunting intensity may have reduced over the last few years. Traditional weapons still dominate the hunter's arsenal but use of guns occurs and is non-trivial.
- Bushmeat supply and demand have been more or less constant in the villages in or near the study sites over the last five years but there is an indication that these are both decreasing.
- Off take was highest in the unprotected Kafu Basin and lowest in forested RMNP. This suggests that important factors influencing off take are level of law enforcement and abundance of animal populations. Among the four field sites, wild animal population density is probably lowest in RMNP but high in the savanna sites.
- Other factors that can influence off take may wait to occur under the right conditions. Such conditions include i) lapses in law enforcement, ii) when human-wildlife conflicts increase as a result of increased movement of wildlife out of protected areas or when people encroach protected areas, iii) when there is a breakdown in law and order, and iv) if political will for conservation wavers. Protected area planners need to take these conditions into account.

Socioeconomic status and cultural backgrounds of rural households that eat bushmeat

- Rural people who ate bushmeat realized most of their incomes from farming, but their incomes were not on average lower than those of the people who did not report eating bushmeat; in fact they at times had higher incomes. People who realized most of their incomes from cattle and goats tended not to eat bushmeat. So, farmers tend to eat bushmeat while ranchers and pastoralists tended not to eat bushmeat.
- Among hunters, poverty is not a good predictor of who hunts. Around MFCA, hunters are richer than the average person in their villages, while among the farming community east of QECA, hunters are the poorest people in the community.
- The fact that farmers tend to eat bushmeat while cattle keepers do not suggests that use of bushmeat is in part determined by cultural attachment. This is reinforced by the fact that in some places, hunters are not necessarily always the poorest people in the community.
- Because of the effect of culture:- size of land owned, wealth and assets owned, demographic situation of the family, duration of stay in a village, education level, household income are not necessarily good predictors of bushmeat use if cultural totems and practices have not been established prior to assessments and factored into sampling procedure and data analysis.

The relationship between human-wildlife conflict and bushmeat off take

- Human-wildlife conflict is an endemic problem in and around major wildlife hunting sites
- Crop raiding and livestock raiding by wildlife are the main causes of this conflict. Wildlife attacks on humans are also another form of conflict but are rare.
- Human-wildlife conflict is three or more times a less important motive for hunting than the need for bushmeat and animal products. More than 30% of all hunting incidences may in part be related to crop raiding and thus one of the factors driving bushmeat use and availability
- Crop raiding ranks as the number two source of crop loss for farmers in and around study sites after unpredictable weather changes (or for some farmers around RMNP, declining soil fertility). It thus has the potential to drive illegal hunting.
- Around protected areas, almost as much hunting takes place outside (40%) as it does inside. This suggests a high rate of animals coming out of protected areas, increasing the possibility of human-wildlife conflict and opportunities for bushmeat hunting. Unless such movements are controlled or illegal hunting brought down in the neighboring villages, hunting will continue to be a major drain on wildlife populations in protected areas.

- Solutions to bushmeat hunting should, to be effective include a component of solutions to crop raiding and other forms of human-wildlife conflict

Bushmeat trade

- Trade in bushmeat does occur but is limited to animals hunted in the savanna/woodland sites. Animals hunted in RMNP are usually not traded.
- Trade of meat hunted around QECA is limited to the surrounding villages and townships. Occasionally, meat hunted in QECA is sold in the nearby DRC villages.
- Meat hunted in the Kafu Basin and MFCA is sold both in the neighboring villages and townships, as well as further a field. Distant areas where the meat is sold include Kampala, Gulu, Lira, and Kitgum.
- Bushmeat is sold more cheaply than livestock meat. According to surrendered hunters, this is only because it is illegal. This is in contrast to what has been found elsewhere in the world where illegality tends to drive prices up because of the risk of getting caught (Elizabeth Bennett, personal communication). The bushmeat market was underground and bushmeat is never sold openly.
- Dealing in bushmeat can be a major source of livelihood, contributing as high as 95% of the total annual household income to some hunters and fetching dealers profits of over 30% of the cost price.

Factors determining meat choice

- Cost may be a factor determining what meat households that have access to bushmeat buy.
- Other equally important factors at play are taste and preference. Households that eat bushmeat may prefer it to livestock meat for its perceived superior taste and perceived superior medicinal qualities.

Wider Issues

- In the past, taboos and population density may have helped to regulate access by indigenous people to wildlife resources in the Kafu Basin. This situation is changing with increasing population density, human-wildife conflict, and taboos being ignored by outside hunters.
- This trend is true of land use patterns as well. With a move towards intensive livestock keeping, conversion to sugarcane and tree plantations, and increase in small holder agriculture, land use conversion in the Kafu Basin is on the rise.
- For the Kafu Basin, there is need for a comprehensive collaborative approach. Such an approach has in the past been recommended by WCS for management of forest sites

around Nouabale-Ndoki National Park in the Republic of Congo (Bennett and Deutsch 2003). The approach is about engaging all actors (in the Kafu Basin, engaging particulary private companies and individuals). This can significantly increase the land area for wildlife conservation. The approach includes law enforcement, environmental education, alternative activities, and research. One cannot be cannot be undertaken effectively without the others. Implementation requires technical support in program design and implementation, and transparent monitoring.

6. Recommendations

(Please refer to appendix 2 for solutions suggested by surrendered poacher groups)

Further Research

For all areas, it has been shown that hunting for therapeutic and medicinal purposes drives hunting on top of the obvious need for bushmeat. It is therefore imperative to further investigate nutritional and medicinal properties of bushmeat types to obtain information that can be used to change attitudes if findings suggest that the beliefs are false, and where supported by scientific evidence should form a basis for rationalizing usage. There is also need for more research to increase understanding of urban bushmeat trade, understand constraints to implementation of existing wildlife law, and identify policy gaps. More research also needs to be undertaken in other major protected areas to determine intensity of offtake and major drivers. Areas north of MFNP, around LMNP (Lake Mburo National Park) and KVNP (Kidepo Valley National Park) should be priority for this as they contain the next largest concentrations of game preferably hunted for bushmeat. Beyond assessing offtake and drivers, there is need for more research in all sites to determine the sustainability of current levels of offtake and what offtake levels are potentially sustainable.

The Kafu Basin in particular has attracted little scientific interest up to this point, yet it serves as a real opportunity to explore and demonstrate ways in which conservation can work in a human-influenced landscape. There is urgent need to conduct species inventories and wildlife surveys in this area to understand species diversity, habitat needs, and wildlife population sizes to support rational use and management. In particular, there is need to understand:

- Nutritional sources, breeding requirements, and space requirements of wildlife dominating the Kafu Basin
- Types and extents of human-wildife conflicts
- Current land use types and management trends including fire regimes, extractive uses, and de-bushing
- Traditional values that people attach to wildlife
- Rancher/pastoralist-hunter relationships to see how the two can work together for mutual benefit and to the benefit of conservation
- Community perceptions about how use of game ranching, licensing hunting, and introduction of tourism can work as incentives to encourage wildlife conservation
- Bushmeat movement into urban markets, volumes and mechanics of the trade
- Interactions between plantations (sugarcane and pine) and wildlife. In particular, understanding ways in which wildlife negatively impacts plantation management, ways

in which wildlife benefits from plantations, and the extent to which plantations serve as wildlife sinks. This information is important for planning how to incorporate aspects of wildlife management into plantation management.

- Economic and environmental value of integrating wildlife management into land use practices here as opposed to total conversion to alternative uses

Intervention Actions

i) Law enforcement – there is need for sustained law enforcement effort as this is the main deterrent to illegal hunting. Specific aspects of law enforcement that need to be strengthened include the following: a) improving both the physical and technical capacity of UWA to manage hunting and illegal trade. Technical capacity is about field staff having the necessary knowledge and skills to do their job effectively, and physical capacity is about the management agencies having the necessary numbers of staff and equipment to allow the job to be done effectively. The technical aspect that needs improvement is intelligence gathering. UWA's community conservation and monitoring rangers should be trained on gathering information on hunting incidences, movement, and trade in wildlife products. Feedback from UWA personnel directly involved in this project suggests that this training could make a big difference to their effectiveness. The physical aspect is about increasing ranger numbers to control new threats, such as increasing use of guns for illegal hunting in QECA and the Kafu Basin. Private gun owners, security forces, and wildlife rangers are all potential sources of guns used in illegal hunting. Also, there is need to expand law enforcement to areas that are not being effectively covered, such as the two large Central Forest Reserves in Nakaseke district, b) responding to hunting hotspots. Some of the hotspots identified in this study are: Miduuma parish in the Kafu Basin (for hippos), as well as the Kinyogoga area, Kiryana Farm, and Lugogo swamp all in the Kafu Basin; and the Kanungu and Rukungiri areas adjacent QECA and Rwenshama enclave, Kazinga channel area, Kikorongo area, and Katwe area in QECA, and c) strengthening ability to track long distance movement of bushmeat using modern technologies. Experience from other countries suggests that use of molecular techniques can be informative in determining nature of urban trade and bushmeat hotspots. Sniffer dogs have also been used to detect bushmeat movement. Both of these techniques would pay-off if used here.

ii) Human-wildlife conflict – there is need to set up barriers and use wildlife guards to keep animals inside protected areas, with priority given to major points of exit from protected areas. This should be helped by as much as possible, discouraging communities from planting crops highly palatable to wildlife near protected area edges.

iii) Community mobilization – there is need for more environmental education, teaching people about wildlife values with local examples of how people are benefitting from wildlife. Local unfounded beliefs about medicinal and supernatural values of wildlife should be discouraged where these lead to illegal hunting. People need further sensitization about where hunting is not permitted and penalties that go with specific wildlife crimes. Community leaders should be encouraged to take lead in implementation of wildlife laws among their communities and should be answerable for violations of the law among the communities they serve. High level politicians should give political support to the lower cadres in the villages to enforce the wildlife law. There is need to educate security forces on the laws governing wildlife. There is need to maintain the signature campaign under which poachers are surrendering, and to help poachers live normal lives by supporting their projects. There is also need to recruit big plantation owners as partners of conservation and to increase positive interactions between people and parks by facilitating communities to visit parks

iv) Alternatives – results from this study have shown that it is usually small scale farmers that hunt and consume bushmeat, whereas pastoralists and ranchers tend not to. Households of hunters depend on bushmeat more than the other households in rural areas. There is need to help hunter's households with alternative meat and income sources. Licensing hunting for "big" days such as Christmas has been suggested by surrendered hunters from MFCA as a solution to illegal hunting and small animal projects (piggeries, goat keeping, and poultry) would potentially serve the multiple purposes of employment, income generation, and meat solutions. UWA should be open to some level of community hunting with quotas provided illegal hunting is brought under control and animal populations have sufficiently recovered. It may also be useful to consider the possibility of farming certain species – cane rats, duikers, porcupines, bushbucks. For pastoralists and ranchers, there is need to work towards solutions for wildlife attacks on livestock and to move towards increasing benefits from wildlife of those who own areas rich in wildlife. Some of the benefits include ranching and licensing hunting, live trade, carbon trade, and tourism

v) Strategic planning- there is need for a strategic plan for utilization of wildlife rich but privately owned landscapes such as the Kafu Basin. Such a plan should incorporate wildlife management into land use planning, integrating elements of maintaining resources key to wildlife with managing conflicts and off take. This should be spearheaded by district administrations and involve conservation and development partners.

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Appendices

Appendix 1: Species hunted and reasons for hunting as given by respondents during the household survey. Values represent numbers of respondents that cited the species for a specific reason.

MFCA						
	CR	Attacking people	LSR	Meat	Medicine	Wichcraft
Baboon	70		3	2		
Bush pig	69	2	1	35		
Vervet monkey	62		4	1		
Guinea fowl	35			25		
Squirrel	35			11		
Cane rat	15		1	14		
Porcupine	8			4		
Reedbuck	6			5		
Francolin	5			6		
Uganda kob	4			7		
Rabbit	4			3		
Gray-crowned crane	3					
Bushbuck	2			10		
Kite	2	1	27			
Warthog	2	2	1	5		
Buffalo	1	6		10		
Chimpanzee	1					
Duiker	1	1		8		
Eagle	1		1			
Giant forest hog	1					
Jackal	1		7			
Mole rat	1					
Monitor lizard	1		1		1	
Oribi	1			4		
Pangolin	1					
Waterbuck	1			1		
Wild cat	1	1	23			
Abdim stork			1			
Banded mongoose			2			
Crocodile		6		1	1	
Dikdik				1		
Elephant		1		4		

Appendix 1 continued

MFCA						
	CR	Attacking people	LSR	Meat	Medicine	Wichcraft
Hippopotamus		1				
Hyena			2			1
Leopard		1	4			
Marabou stork			1			
Mongoose			6			
Python		6	4	3		
Serval cat			1			
Sitatunga				1		
Topi				1		
Weaver birds			1			
White tailed mongoose			11	2		
Grand Total	**336**	**28**	**103**	**165**	**2**	**1**

Kafu Basin			
	CR	LSR	Meat
Bushbuck	43		67
Bush pig	34		43
Duiker	8		73
Leopard	5	9	1
Crocodile	4		
Porcupine	4		4
Vervet monkey	2		
Guinea fowl	1		5
Jackal	1	8	
Python	1	5	
Reedbuck	1		57
Cane rat			1
Common civet		1	
Hippopotamus			2
Oribi			82
Serval cat		1	
Sitatunga			16
Squirrel			1
Warthog			22
Waterbuck			3
White tailed mongoose		2	
Total	**104**	**26**	**378**

Appendix 1 continued

QECA				
Species	CR	Attacking people	Lsraiding	Meat
Bush pig	70	1		20
Baboon	43		2	
Guinea fowl	15			34
Buffalo	12	12		29
Uganda kob	12	2		74
Vervet monkey	8		1	1
Rt monkey	5			
Elephant	4			1
Rats	4			9
Cane rat	3			12
Blue monkey	2			
Giant forest hog	2			6
Squirrel	2			
Bird pests	1			
Civet cat	1			1
Hippopotamus	1			27
Lion	1	1	6	
Monkey	1			
Predatory birds	1			1
Warthog	1			22
W. tailed mong.	1		17	21
Wild cat	1		22	12
Banded mongoose				1
Bushbuck				8
Duiker				14
Eagle			5	
Francolin				11
Hyena			14	1
Hyrax				4
Jackal			1	
Kite			5	2
Leopard		13	12	
Mongoose			32	2
Monitor lizard		2		
Otter				3
Python			6	1
Rabbit				3
Slender mongoose			2	13
Waterbuck				1
White browed Coucal				
Grand Total	**192**	**31**	**125**	**334**

Appendix 1 continued

RMNP								
	Attack LS	Crop raiding	Attack people	Meat	Dog meat	Honey harvesting	Wichcraft	Medicinal
Vervet monkey	2	267		207				
Squirrel	5	244		111	5			
Cane rat	2	120		194	2			
Blue monkey	1	61		39	1			
Bird	3	50		53				
Bush pig		42		51				
Guinea fowl	1	41		132				
Francolin	2	37		210				
Chimpanzee		22		21		1		2
Porcupine		18		23				
Rt monkey		9		35				
Baboon		8		7				
Mouse bird		7		17				
Mongoose	277	6		22	82			
Bush rat		6						
Rats		6		3				
Jackal	8	3		2	2			
Duiker		3		4				
Hyrax		2		21				
Wild cat	54	1		7	31			
Fox	5	1		1				
Bush rats		1						
Bushbuck		1		2				
Bushrats		1						
Mouse		1		1				
Red colobus monkey		1		1				
White tailed mongoose	95			94				
Slender mongoose	28			28				
Mongoose	11							
Eagle	7			2				
Kite	7							
Serval cat	7			2	1			
Leopard	6		6					

Appendix 1 continued

RMNP								
	Attack LS	Crop raiding	Attack people	Meat	Dog meat	Honey harvesting	Wichcraft	Medicinal
Otter	1			1				
Birds				3				
Buffalo				2				
Black-and-white colobus				1				
Civet cat					1			
Monkeys				3	1			
Ratel							1	
Red colobus monkey				10				
Reedbuck				25				
Grand Total	522	959	6	1335	126	1	1	2

Appendix 2: Solutions to the problem of illegal hunting as suggested by surrendered poacher groups

	Number of times cited			
Solution	QECA	MFCA	RMNP	Total
Strengthen law enforcement (increase number of rangers and ranger outposts, shoot to kill policy for poachers, increase intelligence)		5		5
Increase conservation awareness (awareness of how the park benefits communities, of the wildlife law, and of impacts of hunting) and other community conservation programs	5	3	1	9
Strengthen and maintain the signature campaign (also use ex-poachers to do the campaign)		2		2
Facilitate surrendered poachers (by helping them develop and finance their income-generating projects like goat production, piggeries, and others)	5	7	1	13
Help find good markets for produce	2	1		3
License us and give us priority to fish or give us fish ponds	2			2
Employ more people in the local community (as rangers, etc)		4	1	5
Employ surrendered poachers to do park intelligence	1	2		3
Address the issue of poverty (at the moment, they can't afford alternative meat sources, some have little land, no access to loans, few alternatives for raising money for house hold needs)	4	2	1	7
Strengthen basic education (by building more schools to reduce cost of travel to primary and secondary schools)	3	1	1	5
Give us vocational training	1			1

Appendix 2 continued

	Number of times cited			
Solution	QECA	MFCA	RMNP	Total
Give us sources of alternative meat (like goat and pigs, poultry and others)	4	2	2	8
Publicise park laws and regulations	1			1
Address the issue of land degradation (declining soil fertility is reducing land productivity; this forces people to find alternative means of survival)			2	2
Give volunteering executives of surrendered poachers certificates	1		1	2
Support us when there is drought (because crops fail and this forces us to poach to earn a living)	2			2
License local community hunting for major public holidays (e.g. Christmas, New year, Easter as bushmeat is considered a delicacy, and therefore a treat on these days)		4		4
Strengthen park-community ties (by wardens visiting communities more frequently and organizing community visits to the park to enable them appreciate it)		2		2
*Allow people to rear wild animals (on their farms or ranches)		1		1
*Address the issue of crop raiding using barriers and compensation	1	1		2
*Address the issue of human-wildlife conflict	1			1

Appendix 3: Questionnaires

Socio-economics of human-wildlife conflict (with focus on bushmeat hunting, consumption and trade)

Household Survey Data Sheet

Focal Area: QECA, RMNP, MFCA, Kafu River Area (*circle or tick as applicable*)

Part 1- LC1 Characteristics (filled with help of LC1 official)

Name of Interviewer…….

Name of LC1……..

1. Designation of LC1 official interviewed			
2. Date of Interview (LC1)			
3. Parish (LC2)			
4. Sub county (LC3)			
5. District (LC5)			
6. GIS location of LC1			
7. Distance of the LC1 from the nearest Ungraded road…… *Mode of transport**…….. Graded road…….. *Mode of transport**…….. Tarmac road…….. *Mode of transport**……..	Min …….. ……..	Hrs …….. ……	Km …… ……
8. Distance of LC1 from nearest Trading centre…… *Mode of transport**…… Small town…….. *Mode of transport**	Min ……	Hrs ……..	Km ……

Urban centre (population >500,000)…… *Mode of transport**…… GPS Distance……..	…… ……	……. …….	…… ……
9. Distance of LC1 from nearest weekly market	Min	Hrs	Km
10. Distance of LC1 from nearest P7 school	Min	Hrs	Km
11. Distance of LC1 from nearest secondary school	Min	Hrs	Km
12. Distance of LC1 from nearest hospital	Min	Hrs	Km
How often do cars and motorcycles reach your village?……. (possibilities are every day, …times a week, ….times a month, ….times a year)			

*Mode of transport- 1=foot, 2=bicycle, 3=motorcycle, 4=car, 5=any kind of transport

Part 2. Household survey data- Socioeconomics of H-W conflict

(Filled with the help of the household head or representative)

Interview date…….

Interviewer…….LC1…….Scounty……District……..

Identity of the respondent……

A. Characteristics of the household

How many adults and children does the household have? Adults…….Children…….

How many of each sex: Adults (>18 years): 1) Males……..; Females…….

Children (<18 years): 1) Males…….; Females……..

B. Characteristics of Household Head

*Sex of respondent **1) Male; 2) Female***

1. What is the marital status of household head? *Codes: 1=Widow/widower; 2=divorced; 3=spouse working away; 4=never married; 5=married; 9=other*	
2. How long has the household head lived in the village?	Years
3. Tribe of the household head	
4. Highest level of education attained	

C. Assets

Land ownership/transactions

1. How many pieces of arable land did the household own or rent during the last year?

Piece#	Total area (acre)	Area Cropped	Area Under Fallow	Area Under Pasture		Rented out (acre)	Rented in (acre)	Shs received or paid per acre per year
1								
2								
3								
4								
5								
6								

2. Implements and other large household items

Please indicate the number and value of implements and other large household items that are owned by the household.

	No. of units owned	**Total value (current market value, not purchasing price)**
1. Car		
2. Tractor		
3. Motorcycle		
4. Bicycle		
5. Handphone/phone		
6. TV		
7. Radio/cassette		
8. Stove for cooking		
9. Fishing boat		
10. Boat engine		
11. Chainsaw		
12. Plough		
13. Hand cart		
14. Others (at least UGX 5,000)		

D. Products from PA

1. What are the most important wild products you use? (e.g. Medicines, ropes, thatching materials, poles, timber, firewood, bushmeat, bamboo

Rank	Product	Location collected[a]	Collector[b]	Amount sold per month, specify units		Price UGX per unit
				Amount	units	

[a]Location collected *(codes: 1=inside PA, 2=in farmland outside PA, 3=in ranch outside PA, 4=Other, specify* [b]Collector *Code: 1= Only the wife; 2= Both, but mainly the wife; 3=Both participate about equally; 4= Both, but mainly the husband; 5=Only the husband; 6= Other adults; 7=Children*

E. Income

1. From agriculture – crops:

Note: This includes both annual and perennial crops, i.e., it should include agro-forestry, woodlots etc (see crop code).

Please indicate the quantity and values of crops you harvested during the last 12 months.

Crops	**Crop code**	**Quantity**	**Units**	**Amount consumed by the family**	**Amount Sold**	**Price/unit ***	**Total value (prod.*price)** —fill out during data entry

*Note: Production = Family consumption + sale.

2. From livestock:

Please indicate the number of animals you have now, and how many you have sold, slaughtered or lost over the 12 months. For species code, see accompanying sheet

	Species code	**Start Number**	**Sold (live or slaughtered)**	**Lost (theft, died.)**	**No. donated as gifts**	**Produced, purchased, or**	**Gifts received**	**End number**	**Price unit***	**Total end value (end number* price)**
Cattle										
Goats										
Sheep										
Pigs										
Donkeys										
Ducks										
Chicken										
Others										

3. Please indicate the quantity and value of animal products that you have produced over the last 12 months.

Product	**Unit[a]**	**Production (number of units)**	**Number of units consumed by family**	**Number of units sold**	**Price/unit ***	**Total value (prod.*price)**
Meat						
Beef						
Goat						
Pork						
Mutton						
Fish						
Milk						
Ghee						

Eggs						
Hides						
Skin						
Manure						

[a]In kg, litres, trayfulls, sackfulls, or other measure, please specify…….*Collect market prices at village level

4. From own business:

Type of business	Gross income/per month	Cost/per month	Comment
1. Shop/trade			
2. Agric. Processing			
3. Honey/wax			
4. Handicraft			
5. Carpentry			
6. Transport (car, boat, etc.)			
Other, Specify….			

5. Other income:

Income source	Amount per month (UGX)
Government job	
NGO job	
Employment by other organization	
Pension	
Other employment Casual…….. Irregular……..	 ……. …….

6. Estimated gross income and expenses:

	Per month	**Last year**	**Comments**
Gross income (net sales)			
Expenses			

F. Problem animal issues:

1. Do wild animals live or visit your village? Code: 0=No; 1=Yes

If so, which ones? See species code sheet, check as relevant

Species	Species Code	Live	Visit

2. Do you have any problems with wild animals?

Code: 0=No; 1=Yes

3. If yes, which ones and what kind of problems?

Species	Species code	Problem

4. Can you rank these problem wildlife in your area based on the extent to which they are a problem to crops or livestock whereby rank 1 is the most problematic?

Species	Species code	Rank for crops	Rank for livestock

5. Apart from the loss of crops, are there any other ways in which your household is/has been directly affected as a result of problem animals? 0 = N0; 1 = Yes

6. Sometimes, your crops could have given better yield than you achieve. Can you state and rank reasons why crops sometimes yield less than they should be (apart from weeding and soil fertility)

Cause	Rank
Disease	
Drought	
Too much rain	
Insect pests	
Crop raiding by animals	
Other cause…….	
Other cause…….	
Other cause…….	

8. State whether the household faced any major crop loss or animal predation as a result of raiding in the last six months 0= *No; 1=Yes*

a. If yes, complete this table for livestock affected

Wildlife Species	Species code	Number of times raided livestock	Season (Wet or dry)	Months	Number of animals killed	Livestock code

b. Complete this table for crops affected ……..

Wildlife Species	Species Code	Crop affected (Include crop code)	Season (Wet or Dry)	Months	Quantity	
					% of crop lost	Acreage

11. a) What do you do to address the issue of crop raiding/animal predation?

……
……..

b) What else has been done to address the issue of crop raiding, and by who?

……
……..

12. Do you have any ideas of how crop raiding/animal predation could be controlled and by whom?.....
.....
.....

13. Do people hunt animals when raiding? 0=No, 1=Yes, 2=Don't know

14. Do people hunt animals at other times when not raiding? 0=No, 1=Yes, 2=Don't know

15. If people kill, poison, or catch alive wild animals (and birds) in your area, mention the reasons why

Species	Species code	1=Kill 2=Poison 3=Catch alive	Reasons

G. Bushmeat hunting and consumption

1. Do you know where the animals killed from?
Explain……
……

Please specify hunting locations and periods for each species in the table below

Wildlife Species	Species Code	LC1 or LC2 Name of hunting area	Hunting location*	Months	Climatic season	Crop season

*Hunting location codes, 1=Inside FR or NP; 2=Inside a livestock ranch; 3=Not in a ranch or PA but in bushes away from swamp; 4=Not in a ranch or PA but in a swamp; 5=in a crop field. Climatic season- 1=wet, 2=dry. Crop season 1=planting season, 2=growing season, 3=harvesting season.

2. Please rank hunting locations that you know well in your area according to where animals are most frequently killed

Hunting location	Rank
Inside forest reserve/national park	
In a livestock ranch	
Not in a ranch but in bushes away from swamp	
Not in a ranch but in a swamp	
In a crop field	
Other, specify…….	

3. Do the hunters in these areas come from far a way? 0=No, 1=Yes, 2=Don't know.

If they come from far away, which LC1, Parish, or Sub-county?
.....

4. Do you have any hunters in your village? 1=No, 2=Yes. If so, which animals are being killed by hunters from your village, where from, and how long it takes them to reach the hunting locations?

Animal species	Species Code	Location where killed	Why killed	Distance (hours/minutes) to hunting location

5. Do people this area eat the meat of the wild animals they kill? Codes 0=No, 1=Yes

6. Of the animals killed outside protected areas, can you state from your experience which animals are killed for the reasons given below? Also state what you know about how many were killed per month over the last 12 months and why

Species (Write Species Code)	Why killed*	Average killed per month over the last 12 months

*Codes for why killed, 1=Avert crop raiding, 2=Avert LS raiding, 3=Avert harm to people, 4=Primarily for meat, 6=For witchcraft, 7=Other reasons, state……..

7. Based on your experience, please rank wildlife species according to how commonly eaten and how they are preferred as food

Species	Species Code	Rank according to how commonly eaten	Rank according to preference as food

9. Are there ways that hunters affect you individually? 0=No, 1=Yes

If yes, explain…….

10. Are you against hunting of certain wildlife species? If yes, please state what problems, by wildlife species if possible

Wildlife species	Species code	Reason why you have a problem with hunters on this species

11. Are there any wildlife species that do you not have a problem being hunted by hunters?

Wildlife species	Species code	Reason why you do not have a problem with hunters targeting this species

12. If you have any problem with hunters please state what can be done to solve these problems and by who…….

……

13. Please rank by species, the reasons you know about why people eat wildlife

Species (Write species code)	Reasons for eating							
	Can afford	It is familiar	It is rare (adds variety)	It is traditional	Confers Prestige	Tastes good	Other, Specify	Other, Specify

14. Do you know where people go to buy bushmeat? If so,
where……
……

15. Does your family eat meat? 0=No, 1=Yes. If yes, how often does your family eat meat including bushmeat. Examples: everyday, …times a week, ….times a month, ….times a year, never, Other-specify……..

Type of meat	Livestock Code	Frequency
Cow		
Goat		
Mutton		
Pork		
Chicken		
Fish		
Other, Specify		
Bushmeat Species …… …… …… …… …… …… …… …… ……	Species Code …… …… …… …… …… …… …… …… ……	 …… …… …… …… …… …… …… …… ……

16. If bushmeat is sold within your reach, how often is it available for sale? Examples: everyday, …times a week, ….times a month, ….times a year, never, Other- specify……..

Bushmeat Species	Species Code	Frequency
…… …… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… …… ……

17. Average cost of meat over the last 12 months

Type of meat	Cost per unit measure
Cow	
Goat	
Mutton	
Pork	
Chicken	
Fish	
Other (specify)	
Bushmeat Species and species code …… …… …… …… …… …… ……	 …… …… …… …… …… …… ……

18. If you never eat bushmeat, state why? (rank 4 most important reasons)		Rank
	1. It is not available	
	2. It is illegal to eat it	
	3. Our culture does not allow	
	4. It is expensive	
	5. Other reason, specify……	
	6. Other reason, specify	

19. Please comment on trends in supply, availability, and affordability over the last 5 years

Trends in bushmeat supply for each species over the last 5 years. Is bushmeat more available now than over the last 5 years?

Species	Species Code	0=No / 1=Yes	Reason for Trend

Demand over the last 5 years. Do more people want bushmeat now than over the last 5 years?

Species	Species Code	0=No / 1=Yes	Reason for Trend

Affordability over the last 5 years. Do more people have money to buy bushmeat now than over the last 5 years?

Species	Species Code	0=No / 1=Yes	Reason for Trend

Thank you sir/madam

Data sheet for key informers—1

Informer code: ……

Study Area—1=MFCA, 2=Kafu Area, 3=QECA, 4=RMNP, 5=Kampala

Area 1 *GPS location* *Area 2* *GPS location* *Area 3* *GPS Location*

…… …… …… …… …… ……

…… …… ……

A. Informer's opinion based on experience-(*filled out by the informer prior to the survey*)

Main hunting locations/source				Species Killed	Consumption area 1=local 2=distant 3=Both	Local unit cost[b]	Unit cost at distant areas [b]		How transported[d]	How concealed[e]	Packaging[f]
Area [a]	Location						Cost	Distant area[c]			
	LC1	Parish	Subcounty								

[a] Identify whether a Protected area, Crop field or Ranch.,[b] per Kg, per Sackfull, per whole animal, [c]record area ID as 1, 2, 3, etc. [d]1=On foot; 2= Bicycle; 3=Motorcycle; 4=Taxi 5=Charcoal truck; 6=Pick-up; 7=Trailer 8=Private car; 9Other…….. [e] 1=By transporting it at night; 2=Disguising it as charcoal; 3=Mixing with livestock meat [f]1=Sacks, 2 other……

Identity of Distant Area

Distant Area	LC1	Parish	Subcounty	District
1. ……..				
2……..				
3……..				
4……				
5……				
6……				
7……				
8……				
9……..				

Reasons for consumption in different areas

Species	Local LC1	Reasons Eaten	Distant LC1	Reasons Eaten	Hunting months and seasons

Trends in bushmeat supply for each species over the last 5 years. Codes for trends : 1= Constant; 2=Increasing; 3=decreasing

Species	**Area**	**Trends**	**Reason for Trend**

Trends in bushmeat demand over the last 5 years. Codes for trends: 1= Constant; 2=Increasing; 3=decreasing

Species	**Area**	**Trends**	**Reason for Trend**

Affordability over the last 5 years. Are more people able to afford bushmeat now more than 5 years ago? Codes for trends 1=affordability has not changed; 2=more people can afford; 3=fewer people can afford

Species	Area	Trends	Reason for Trend

Hunting methods

Species	ID	Hunting Method

Datasheet for Key Informers—2

B. Specific information from informers near hunting sites (*monthly return*)

Informer code……Month and year……Study Area- 1=MFCA, 2=Kafu Area, 3=QECA, 4=RMNP

Is location inside or outside PA? Codes 1=Inside, 2=Outside

Animal name	Number killed	Hunting Site	Date of the kill	Method used	% eaten by hunters family	% sold		Unit Cost (State Unit)			Smoked or sold fresh? or both?$
						Locally	To distant areas	Cost near Hunting site	Cost in Distant areas		
									Cost	Area code*	

* Distant area code – see overleaf, $Codes for form of meat sold: 1=smoked, 2=fresh, 3=both

GPS Locations of hunting areas

ID	Name of area	GPS Location	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

*Distant Area IDs

ID	Name of distant area	GPS Location	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Datasheet for key informers—3

C. Quantities and prices at various locations

(filled out by informers in marketing centres including Kampala – return every month)

Area location

Informer code ……..Month and year……Study Area—1=MFCA, 2=Kafu Area, 3=QECA, 4=RMNP, 5=Kampala

LC1 …….. Parish …… Sub-county …….. District ……..

GPS Location ……

1. Quantities and transportation

Date received (if known)	Species	Quantity*	Point of origin	Mode of transportation	Mode of concealment

*Quantities in terms of sackfulls, number of animals, weight in Kg, or specify if other measure

2. Monthly Prices

Market name…….. Trading/urban centre……Recorder……

a) Bushmeat

Species	Retail		Wholesale		Restaurant price per meal
	Shs	Unit&	Shs	Unit&	

b) Domestic meat

Type of meat	Cost per unit quantity*	Restaurant price per meal
Beef		
Goat		
Mutton		
Pork		
Chicken		
Fish		

& Kg, sackfull, State other measure in table, *in Kg except for chicken – per chicken, and fish enough for a family of 5

Socio-economics of human-wildlife conflict

Based on hunter's knowledge and experience (Hunter group interviews)

Interview date…….

Interviewer…….

Village LC1……Parish……..Subcounty…….

District……..Focal Area- QECA, RMNP, MFCA, Kafu River Basin

Ex-hunter's Association……

1. i) Hunting methods by species

Species	Species Code	Hunting method	Reason why you prefer the method

Hunting method- 1=Dog, 2=Snare, 3=Trap, 4=Spear, 5=Gun, 6=Net, 7=Poison or Bait, 8=Bow and arrow, 9) Other

ii) Best time of the day to enter hunting area and reason if any
……

……..

iii) Best time to dispatch the animals and reason if any……..

……..

iv) Length of time stayed in the hunting area and reason if any…….
……..

v) Best time to leave hunting area and reason if any…….

……

2. Hunting periods

Are there times of the year when hunting is commoner than at other times? 0=No; 1=Yes

If yes, specify below

Species	Species Code	Is the animal hunted on seasonal basis? 0=No, 1=Yes	If so, state season and month		Reasons
			Season	Month(s)	

3. Please state, by species if possible whether you hunted for bushmeat, to control crop raiding, control livestock raiding, or attacks on humans are the reasons you hunted

Species	Code	Dead animal products	Crop raiding	Livestock raiding	Attacks on humans

4. Please state uses of all the parts of the animals killed by species

Species	Code	Body part	Use

5. i) Please rank the species killed according to the stated characteristics

Species	Code	Rank by Cost	Rank by income	Rank by taste	Rank by health	Rank by how commonly eaten	Rank by preference

ii) What ranks would you give the following by taste and preference if included among the species listed above?

Species	Code	Rank by taste	Rank by how commonly eaten (availability?)	Rank by preference
Cow				
Goat				
Sheep				
Pig				
Chicken				
Fish				

6. Compared to livestock meat, is bushmeat cheaper? Yes/No. If it depends on the species, please state which meat is more expensive than livestock meat……

……

Indicate the cost of bushmeat and livestock meat now, and when you were hunting

Type of meat	Cost per unit presently	Cost per unit when you hunted	Wild Animal	Cost per unit measure presently	Cost per measure when you hunted
Cow					
Goat					
Mutton					
Pork					
Chicken					
Fish					

7. Rank the following methods of selling bushmeat according to how commonly used

Type of market	Rank
1. Door to door delivery	
2. Sale at home	
3. Sale in urban area	
4. Sale based on order	
5. Sale in a local market	
6. Other, specify..	

8. Please rank bushmeat selling centres in order of importance with rank 1 being the most important

Name of centre	Rank as a market
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

9. Do you know if there is any attempt to conceal bushmeat while being transported? 0=No, 1= Yes. If so, state what methods (e.g. method -transport at night, disguised as charcoal; transport as livestock meat) by species if possible.

……

10. Please state the main hunting locations inside and outside the park

Inside park			Outside park		
Species	Code	Location	Species	Code	Location

11. Of the meat you hunted, state how much was consumed in your household, sold to other consumers in the villages, and how much was sold to urban centres

Species	Species Code	Percentage consumed in household	Percentage sold in your village and surrounding villages	Percentage sold to distant urban centres (state centre)

12. Income from bushmeat

i). Please state reasons why you hunted and rank them according to importance (Rank only those relevant to your situation.

	Rank
1. For meat	
2. For body parts other than meat for use at home	
3. For sale to raise money	
4. It was a traditional obligation to hunt	
5. For pleasure	
6. For status	
7. Other reasons	

ii). How do returns from bushmeat compare to the tabulated activities? (activities e.g. Farming, livestock production, beekeeping, labour sale, etc.

Activity	Codes for scores
1.	
2.	
3.	
4.	
5.	

Bushmeat is: 1=better, 2=about the same, 3=lower, 4=don't know

13. What should the Wildlife Authority/Government do to eliminate the problem of illegal hunting? *Please rank the 5 most important*		**Rank**
	i) legalize hunting	
	ii) better management of PA (avoid overuse)	
	iii) wildlife ranching	
	iv) better market access	
	v) other, specify	

14. Please comment on trends in supply, availability, and affordability over the last 5 years

Trends in bushmeat supply for each species over the last 5 years. Is bushmeat more available now than over the last 5 years?

Species	Species Code	0=No / 1=Yes	Reason for Trend

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Species	Species Code	0=No / 1=Yes	Reason for Trend

Thank you

Survey of individual ex-hunters

Name of area in which hunted (whether MFCA, etc)……..

Name of hunter……Hunters group……..……

LC1……..

Parish……

Sub-county……

Date of giving up hunting……..

Ethnic group……..

Length of stay in village……

Length of tenure as hunter…….

Marital status (married, unmarried, widowed, or other)……..

Family size and composition: Total……Male Ad……Fem Ad…….Childn……..

Size of land owned (acres)……..

Assets (e.g. radio, bicycle) and value…….……

Annual income from agriculture…….……

Annual income from livestock…….……

Annual income from business…….……

Annual income from employment…….……

Annual income from other sources…….……

Annual income from bushmeat (if can remember)……..

Total Annual Income……..

Income from Bushmeat as a% of total Total Annual Income…….

% of bushmeat of the meat consumed at home…….

Distance from PA (km)……..

How many times arrested and/or prosecuted……..……

Highest education level reached……

Reasons for giving up hunting i)……

ii)…….....

iii)……..……

iv)……

v)……..