



Trenches like fences make good neighbours: Revenue sharing around Kibale National Park, Uganda

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ABSTRACT

Revenue sharing aims to balance the disadvantages people encounter living next to protected areas while fostering improved conservation behaviours. In Uganda, 20% of protected area entrance fees are shared with local governments to benefit communities adjacent to national parks. The process to distribute funds and implement projects was investigated by interviewing Uganda Wildlife Authority wardens, local government and village residents around Kibale National Park, Uganda. The perceived benefit of revenue sharing by officials and local communities was collected through interviews and a household survey, while the influence of the program on conservation objectives was assessed by measuring illegal resource extraction from the national park adjacent to study villages. It was found that the program is evolving into an effective mechanism for sharing benefits, but that better project management and increased accounting transparency could further improve the program. If the projects specifically dealt with the problem of crop raiding by park-protected animals, then villagers did benefit and lower levels of illegal activity were found inside the park. Generally household perceived benefit was low, however reduced in-park illegal activity was recorded where the village chairperson perceived higher benefit from the program, implying that the village leadership may be influencing the conservation behaviours within the community. Compared with other incentive options such as loss compensation, direct payment, and collaborative management, revenue sharing appears to be an effective and practical choice, given the limited funding available to the wildlife authority to benefit local communities while trying to improve conservation behaviours.

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Introduction

In areas where protected species co-exist with the ever increasing pressures of human expansion and anthropogenic change, biodiversity conservation often relies on local perceptions of the economic benefits and losses associated with wildlife protection (Ninan, Jyothis, Babu, & Ramakrishnappa 2007). Setting aside land to protect species habitat is the primary focus of conservation strategies; however, local communities can perceive the loss of access to these lands as limiting their ability to survive and build economies based on natural resource extraction from, or agricultural development of, these protected areas (Adams & Infield 2003).

Communities situated on the boundaries of protected areas often disproportionately bear the cost of conservation (Ninan et al. 2007; Nyhus, Osofsky, Ferraro, Madden, & Fischer 2005). Protected animals may roam outside the park boundaries, trampling and eating crops, predated livestock and even maiming local residents (Nyhus, Sumianto, & Tilson 2000; Treves & Karanth 2003). The cost

of these incursions can be high for subsistence farmers. Conservation compensation is a policy that attempts to partially off-set these losses for communities that reside next to protected areas. Such compensation can benefit the poor by providing economic benefit in exchange for good conservation behaviour, although since the compensation is usually less than the incurred loss, this can be perceived as “a form of economic coercion rather than a just resolution to resource management conflict” (Schroeder 2008, p. 592). In sub-Saharan Africa, compensation if it exists is typically a percentage share of revenues from hunting (Lewis & Alpert 1997), or eco-tourism (Alpert 1996; Archibald & Naughton-Treves 2001; Schroeder 2008).

Ugandan conservation policy is dependent upon enforcement of park boundaries, yet the Uganda Wildlife Authority (UWA) has been moving towards a more community-based conservation approach. UWA introduced conservation compensation in 1996 and is currently legislated to share 20% of park entrance fees with local governments for the benefit of communities located in parishes directly adjacent to protected areas (Uganda Wildlife Statute 1996). The Ugandan program's objective is to improve relations with neighbouring communities, demonstrating that conservation can provide economic benefit, in the hope that local

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people will protect the park (UWA 2000). To date, US\$750,000 has been disbursed nationally to the local government councils around Uganda's National Parks.

Other countries, besides Uganda, have introduced revenue sharing. In Madagascar, a program was piloted in Ranomafana National Park where park revenues were equally shared between the conservation authority and local communities, creating a mechanism for local people to participate in conservation while simultaneously benefitting from community development (Peters 1998). Revenue sharing has also been introduced in Kenya and Tanzania however the percent that is shared with local residents is typically less than 15% (Alpert 1996; Honey 1999). The effectiveness of these schemes has been dependent on having a local governance structure capable of executing the program with the necessary transparency so as not to be construed as coercion (Alpert 1996; Schroeder 2008).

Revenue sharing in Uganda was studied during the early days of program implementation, finding the program improved relationships between park authorities and local communities and had the potential to positively influence conservation attitudes (Archibald & Naughton-Treves 2001). However, the focus on funding schools and health clinics, coupled with the small amount of money disbursed did not appear to reduce illegal extraction activities, and benefits needed to be better allocated to those who lost most due to the existence of the park (Archibald & Naughton-Treves 2001; Mugisha 2002; Chhetri, Mugisha, & White 2003). Conclusions on the effectiveness of the revenue sharing program were mixed, with generally positive opinions provided by UWA staff and government officials (Archibald & Naughton-Treves 2001), while household surveys found little difference in conservation attitudes between those who benefitted from revenue sharing and those who did not

(Mugisha 2002). This lack of attitude change could have been due to a lack of knowledge that the funding source was the national park (Archibald & Naughton-Treves 2001).

Focusing on revenue sharing around Kibale National Park, this paper provides an update of the Ugandan revenue sharing program ten years after the first distributions occurred and answers the following questions: What projects have been funded?, How are the projects chosen and implemented?, Is the program perceived as beneficial by officials and communities near the park?, and Does the revenue sharing program influence conservation outcomes? All previous revenue sharing studies in Uganda (Adams & Infield 2003; Archibald & Naughton-Treves 2001; Mugisha 2002) have used interviewee and survey respondent attitudes to assess the influence of the program on conservation outcomes. However, since attitudes do not necessarily translate into actions, measured levels of illegal resource extraction within the boundaries of the park were used to assess whether the revenue sharing program does support conservation objectives.

Methods

Study site

Kibale National Park (KNP) is located in western Uganda (Fig. 1). Gazetted as a national park in 1993, the 795 km² park is a rich area for primate biodiversity (Struhsaker 1997), with habituated chimpanzees being the primary draw for foreign tourists. Although some areas were harvested for timber until the mid 1970s, commercial logging has now stopped, with the exception of paid access agreements to extract exotic trees. However, illegal hunting and

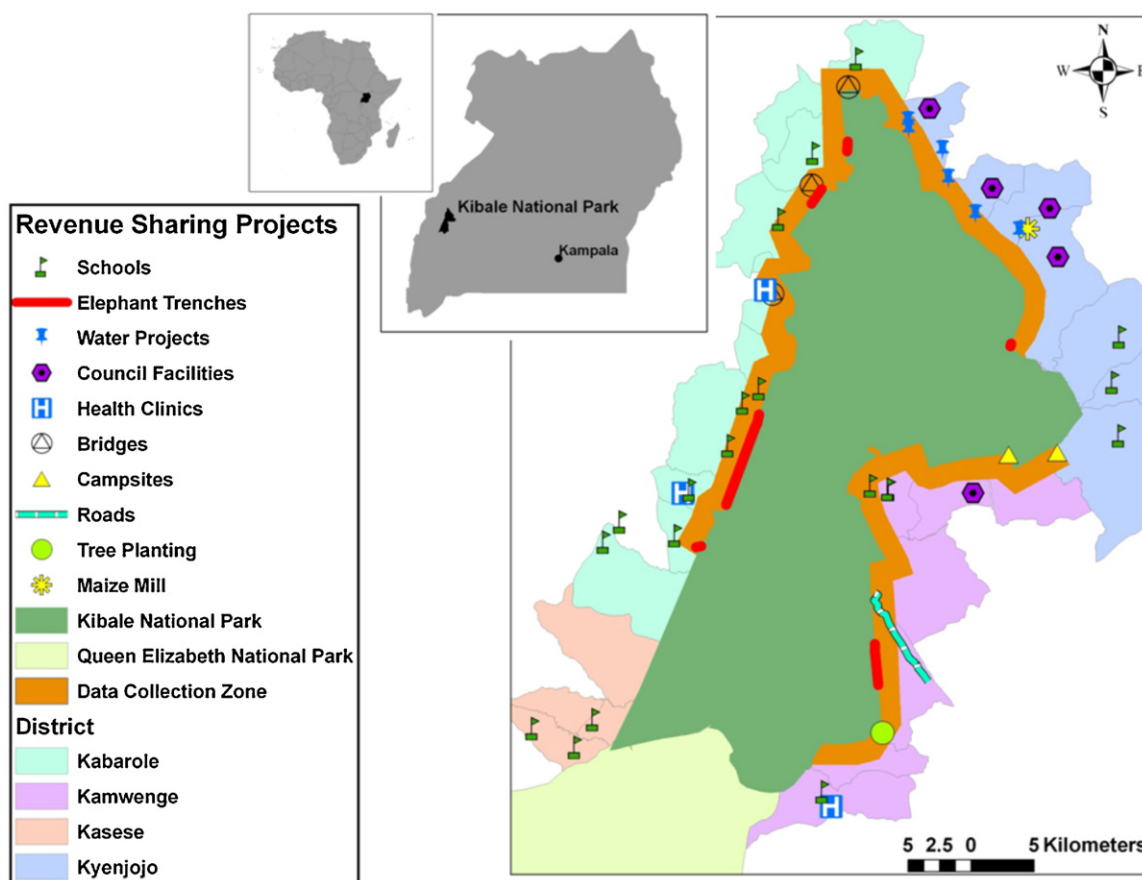


Fig. 1. Kibale National Park, adjacent parishes and revenue sharing locations.

harvesting of trees for building materials, fuel wood and charcoal production persists (Naughton-Treves, Kammen, & Chapman 2007; Struhsaker 2002). The primarily protectionist conservation policy is defined through national legislation (Uganda Wildlife Statute 1996), but contains some community-based strategies including access agreements for certain forest resources, community outreach, education, and the revenue sharing program.

In Uganda, five council levels comprise the hierarchical decentralised governance structure (Saito 2003). The highest level is the district council, followed by the county, sub-county, parish, and the village council. Four districts surround KNP, and benefit from the tourist proceeds through the revenue sharing program: Kabarole; Kamwenge; Kyenjojo; and, Kasese (Fig. 1). Kasese was excluded from this study based on proximity to Queen Elizabeth National Park and having only received 8% of the revenue sharing funds distributed by KNP. In the remaining three districts, 25 parishes border KNP within which 25 villages volunteered to participate in the study from May to August in both 2008 and 2009. Sixteen of the villages had benefitted from a revenue sharing project either in or near their village, while nine villages had not.

Local people live in villages of about 100 households, governed by the village council, led by the village chairperson, who manages community activities and can discipline village members. For this study, a village is defined by the spatial extent of households associated with a village name under the leadership of one village chairperson. Since benefits from the revenue sharing program are limited to parishes located next to the park, study villages were chosen based on some village members holding and/or cultivating land directly adjacent to the park boundary. Villages were located approximately every 5 km within the data collection zone (Fig. 1), but are not explicitly identified, since the reporting of illegal resource extraction might lead to retribution from the wildlife authority (Robbins, McSweeney, Waite, & Rice, 2006). Most local inhabitants are subsistence farmers, although additional income is available from cash crops and off-farm work on tea plantations, planting trees for a carbon off-set program, as research assistants and in the tourism industry (Harterter 2010; Mulley & Unruh 2004).

Data collection and analysis

Project location and valuation

To map the spatial extent of the revenue sharing program, a global positioning system (GPS) waypoint was recorded for each project, located from a disbursement record provided by UWA. The monetary benefit assigned to each village was based on use of the project by the village. If only 20% of the enrolled students at a funded school came from the study village, only 20% of the money was considered to have benefitted the village. Alternatively, if an elephant (*Loxodonta africana* Blumenbach) trench built between a study village and KNP to help keep the elephants from destroying village crops was funded, then the full cost of the trench was assigned to that village.

Program knowledge and perceptions

A semi-structured interview was conducted with four UWA wardens (one national warden, three KNP wardens) and three levels of government (three district, 10 sub-county and 25 village chairpersons), asking about their knowledge of the program, operational process and perceived influence of the program on conservation behaviours. The benefit of revenue sharing for local people, as perceived by the interviewed official, was quantified using a five-point Likert scale ranging from no benefit (1) to a lot of benefit (5).

A focus group was conducted in 15 villages (60%) to understand knowledge, perceived benefit, and influence of the revenue sharing

program on conservation attitudes. The village chairperson, as per cultural norms, approved and organised the meetings, inviting men and women from a range of age groups representing a cross-section of the village. The total number of people present ranged from 16 to 51, with women in attendance at 14 of the meetings where they represented up to 65% of the participants. Discussion was facilitated by a senior field assistant in two local languages.

In each village, 24 household surveys were conducted to answer the following questions: 'Are you aware of any projects in your region that have been funded by the revenue sharing program (Yes/No)?', 'How much does your household benefit from revenue sharing projects (not at all, a little, some, reasonably or a lot)?', 'Since you live next to the park, do you consider the park to be a very good, good, neutral, bad or very bad neighbour?' A total of 596 surveys were collected using a stratified random sample, wealth stratified based on house construction categorisation, where mud and wattle construction indicated a poorer household and brick construction a richer household (Harterter 2009). The survey was administered by four Ugandan field assistants, three men and one woman, in two local languages.

Survey data were aggregated to the village scale for statistical comparison with project monetary value and observed illegal extraction, as these variables could not be attributed to any one household. Since the type of project implemented might influence the household perceived benefit of the program, household perceived benefit of revenue sharing was compared using a Kruskal–Wallis test (non-parametric analogue of ANOVA), based on the type of project implemented. Only projects attributable to more than 30 households were compared, and households in villages with multiple completed projects were excluded. Since groups were of unequal size, post hoc testing was accomplished by pair-wise comparison of groups using Mann–Whitney rank sum testing. Since this involved 15 pair-wise tests (six project type groups), a Bonferroni correction was applied, tightening the criteria for significance to $p < 0.003$.

Illegal extraction

Using a method developed in Bwindi Impenetrable National Park (Olupot, Barigvira, & Chapman 2009), the boundary of KNP was accessed adjacent to each village and an observational transect of 600–850 m was conducted to record the following data: number of trees harvested; number of illegal entry trails; number of livestock seen grazing inside the park; and, number of poaching signs (e.g., pit traps and snares). Each entry trail was followed to its terminus to record the same information, unless the trails were created for researchers or UWA patrols, then only the first 200 m was checked for illegal activities.

Illegal trails and tree harvesting were found adjacent to all villages, with higher concentrations observed along the western boundary of the park. In-park livestock grazing was primarily in the southern half of the park, while animal poaching was highest along the north-eastern boundary. To represent an overall measure of illegal access for each village, the individual measures of illegal resource extraction were combined into an index of human disturbance for each village (HDI).

$$HDI_i = \frac{TH_i - \overline{TH}}{\sigma_{TH}} + \frac{ET_i - \overline{ET}}{\sigma_{ET}} + \frac{IPG_i - \overline{IPG}}{\sigma_{IPG}} + \frac{\bar{P}_i - \bar{p}}{\sigma_P}$$

where HDI_i = human disturbance index for village i ; TH_i = number of trees illegally harvested per km of boundary for village i ; \overline{TH} = mean number of trees illegally harvested per km of boundary for all villages; σ_{TH} = standard deviation of the number of trees illegally harvested per km of boundary for all villages; ET_i = number of illegal entry trails per km of boundary for village i ; IPG_i = number of domestic animals seen grazing inside the park for village i ; P_i = number of poaching signs found near village i .

Table 1
Knowledge of revenue sharing program by chairpersons.

	District chairperson responses (n = 3)	Sub-county chairperson responses (n = 10)	Village chairperson responses (n = 25)
Source of funds			
20% is the amount shared ^a	100%	100%	32%
Source is entrance fees ^a	100%	40%	8%
Source is all UWA revenues	0%	40%	28%
Don't know source of funds	0%	20%	64%
Who influences project decision?			
UWA	0%	0%	20%
District chairperson	67%	20%	8%
Sub-county chairperson	67%	70%	68%
Parish chairperson	33%	50%	28%
Village chairperson	100%	80%	56%
Villagers	33%	40%	20%
Mandate for revenue sharing			
Legislation ^a	100%	55%	24%
UWA or KNP	0%	36%	40%
Negotiated by local government	0%	0%	12%
Negotiated by local people	0%	0%	9%
Don't know	0%	9%	16%

^a Correct answer as per Uganda Wildlife Statute (1996).

Results

Revenue sharing projects

Fifty-five revenue sharing projects were implemented around KNP, with the US\$150,000 distributed, between 1999 and 2008 (Fig. 1). Schools have been the most frequent beneficiaries, building classrooms, latrines and teacher housing. Seven villages received money to build elephant trenches to reduce crop raiding, some receiving multiple disbursements to extend trenches. Five council facilities benefited from the program, upgrading and furnishing four parish halls, and constructing one sub-county headquarters. One health clinic has been constructed, and two other health clinics received rain water collection systems. The remaining projects include: five protected water wells; three bridges; two tourist camps; one road; one tree planting project; and, one maize mill. The latest disbursement was released in July 2009 and planned projects include elephant trenches and income generation projects to provide livestock, coffee seedlings, and a beekeeping operation to frontline villages. Projects were well distributed around the periphery of the park (Fig. 1) and within 7 km of the park boundary, with 36% located within 1 km of the park, the area most affected by wild animal crop raiding (Naughton-Treves 1998).

Distribution and implementation process

The money available for revenue sharing is a function of the number of visitors attracted to KNP and the visitor fees charged. Visitors pay a park entrance fee (US\$25 in 2008) and activity fees for chimpanzee trekking (US\$80), but only 20% of the entrance fee is transferred to the revenue sharing program. Most chairpersons knew the amount shared was 20%, but that the revenue was restricted to entrance fees was less well known and least clear when speaking with village chairpersons (Table 1). Thirty percent of the district and sub-county chairpersons interviewed stated they would like to see more revenue shared. Nationally, UWA revenues still do not cover their operating expenses as the Ugandan government and international donors still provide 48% of the operating budget (UWA 2007). Thus, there appears little potential for increasing the percentage of money shared with local communities at this time.

If distributed annually, funds are too small to do substantial projects. For KNP, UWA adopted a policy that disbursement would occur when the funds collected exceeded US\$54,000, resulting in

disbursements about every two years. The money is distributed based on each parish bordering the park receiving an equal sum; however, with 28 parishes bordering KNP, the 2009 distribution translated to about US\$2,000 per parish, insufficient to fund meaningful projects. Therefore, the sub-counties rotate the benefit between parishes, and when coupled with increased park visitor numbers, this has resulted in the average funds per project increasing from US\$690 in 2003 to US\$4,600 in 2009.

In discussions with UWA, chairpersons and villagers, the process to decide on what to spend these funds was structured as follows: UWA provide the funds to local government, district level leadership distributes to the sub-counties and audits the process, sub-county leadership make the project decisions, while villagers and their village and parish chairpersons make project proposals for the sub-county's consideration. Although this is the general process, the consistency of implementation varied.

By legislation, UWA has no legal mandate to decide how the money is spent. When asked who influences the project decision only a few village chairpersons responded UWA (Table 1). In August 2007, an auditing role was defined for the district level leadership, "due to a lack of accountability at the sub-county level" (UWA Official, 2/6/08). Only in the district where the district chairperson said he had "veto power if they do not choose a good project" (5/6/09), did village chairpersons say that the district had any decision making power in the process.

A majority of chairpersons acknowledged that deciding on the project was the role of the sub-county leadership (Table 1). All village chairpersons said they had the opportunity to propose projects to the sub-county, but only 56% said they were allowed to vote on which project to implement. Limiting the decision process to sub-county leadership led to resentment from villagers because "those who decide about the revenue sharing project live far from the park and they do the planning without living with the problems of being next to the park" (Village Focus Group, 23/6/08). In two sub-counties, the process was more democratic, with a majority decision taken in an open meeting attended by all residents bordering the park.

Many people were concerned that the funds were being mismanaged, a perception fuelled by a lack of visibility of the funds, poorly managed projects and a sense that sub-county leadership lacked empathy for local people. It was primarily in villages where unfinished projects were located where resentment towards the sub-county's handling of funds was present. Sixteen of the 55 revenue sharing projects were unfinished, abandoned, or not yet

Table 2
Perceived benefit of the revenue sharing program.

Group	N	Perceived benefit of the revenue sharing program ^a				Average fund visibility US\$ ^b
		Mean	Min	Max	Variance	
UWA wardens	4	3.8	2.0	5.0	1.60	\$150,000
Local government chairpersons						
District	3	3.2	2.5	4.0	0.58	\$37,097
Sub-county	9	3.3	2.0	5.0	1.32	\$11,290
Village						
All study villages	25	2.6	1.0	4.0	1.15	\$585
Only villages with a project	16	2.8	1.0	4.0	1.10	\$914
Community household						NA ^c
All study villages	588	1.48	1.0	5.0	0.96	
Only villages with a project	353	1.5	1.0	5.0	0.99	
Low wealth	133	1.38	1.0	4.0	0.72	
Medium wealth	175	1.57	1.0	5.0	1.11	
High wealth	45	1.62	1.0	5.0	1.29	

^a Perceived Benefit Scale: 1 = no benefit; 2 = a little benefit; 3 = some benefit; 4 = reasonable benefit; 5 = a lot of benefit.

^b An exchange rate of 1860 Ugandan Shillings to the US Dollar was used.

^c Although the disbursement is announced by UWA on the radio, most villagers are not aware of the cost of the projects.

operational in 2009. Incomplete projects mainly resulted from funds being too small for the planned project, although there were three projects where managerial incompetence and possibly corruption was suspected.

Local people felt that the sub-county leadership could not empathise with the community's need for defences against crop raiding. Although one district chairperson agreed that elephant trenches were the best projects to fund, other district chairpersons claimed that "building trenches to protect the people is the duty of UWA and that the trench construction should not be paid for by the revenue sharing program" (8/7/2008). Many people perceive that wild animals belong to the government and therefore should be controlled by UWA, just as local farmers are expected to control their livestock (Naughton-Treves 1998). One district chairperson said that "using the revenue sharing money to fund trenches is as if I buy cattle then expect my neighbours to pay for putting up the fence that keeps them on my land" (5/6/2009). This opinion is reflected in the projects undertaken with only 32% of the revenue sharing money spent on trenches where trenches are seen as UWA's responsibility, while 81% of funds went to trenches where the district chairperson supported using revenue sharing for crop raiding defences.

Twenty of the 25 village chairpersons identified "trenches or any other methods that will stop crop raiding" (Village chairperson, 18/6/2008) as the preferred use for revenue sharing funds, adding as a second or third choice that they would like to see the money used for health units, schools, roads, water projects, or a community hall. Use of funds for government facilities was not seen as acceptable: "There were sub-counties before the park existed and they had their headquarters paid for, why should UWA fund government buildings?" (Village chairperson, 27/6/2008). The priority

for village focus groups was also stopping crop raiding. Elephant trenches were seen not only as a defence but also as a means of generating income in the village: "Let the local people who face crop raiding be given a chance to excavate the trench" (Village Focus Group, 13/7/08). Other projects were a lower priority for most villagers: "People pay taxes and that is what should pay for schools" (Village Focus Group, 23/6/08).

Although the mandate for the revenue sharing program comes from national legislation, this knowledge deteriorated as one moved down the leadership ladder (Table 1), with some village chairpersons explaining that UWA and specifically KNP had decided to share the money with them or that local government or the people themselves had negotiated with the park to share revenues. The changing understanding of the mandate led to different interpretations of the program. District chairpersons saw revenue dispersal as a right, whereas village chairpersons saw the money as a favour from the park and as a result "we cannot destroy the park because we get benefit" (28/7/08).

Perceived benefit of revenue sharing

The mean perceived benefit tended to decrease as one moved from the authorities to the villagers (Table 2). The percent of households claiming to have benefitted from revenue sharing was equitably distributed between household wealth categorisations (low = 29%, medium = 33%, high = 27%). In villages where revenue sharing projects had been implemented, the mean perceived benefit of poorer households was less than richer households, but the difference was not significant (Kruskal–Wallis, $p = 0.203$). Although generally lower, the village averaged household perceived benefit did correlate with the benefit of the revenue sharing program

Table 3
Household perceived benefit of revenue sharing.

Project	N	Perceived benefit of revenue sharing ^a		
		Mean	Min	Max
Maize mill	24	1.79	1	4
Tourist camps	24	1.79	1	4
Medical clinic	46	1.74	1	5
Elephant trench	141	1.68	1	5
School	187	1.57	1	5
Roads and bridges	70	1.56	1	5
Water projects	48	1.40	1	4
Council facilities	94	1.23	1	4
Tree planting	24	1.17	1	4

^a Perceived Benefit Scale: 1 = no benefit; 2 = a little benefit; 3 = some benefit; 4 = reasonable benefit; 5 = a lot of benefit.

Table 4
Village-scale perceived benefit and illegal resource extraction.

	N	Mean	Min	Max
Village-averaged household perceived benefit ^a of revenue sharing	25	1.48	1.00	2.87
Village chairperson's perceived benefit ^a of revenue sharing	25	2.62	1.00	4.00
Number of trees illegally extracted per km of boundary	25	143.6	10	614
Number of illegal entry trails per km of boundary	25	3.8	0	27
Number of domestic animals seen grazing in the park per village	25	19	0	200
Number of poaching signs found per village	25	1.2	0	14
Village Human Disturbance Index	25	0	−2.32	5.07

^a Perceived Benefit Scale: 1 = no benefit; 2 = a little benefit; 3 = some benefit; 4 = reasonable benefit; 5 = a lot of benefit.

as perceived by the village chairperson ($r_{\text{Spearman}} = 0.440$, $p = 0.028$, $n = 25$).

A correlation between the monetary allocation visible to each UWA warden and chairperson (Table 2) against their perceived benefit of the revenue sharing program, was significant ($r_{\text{Spearman}} = 0.330$, $p = 0.035$, $n = 41$), suggesting that people with greater visibility of program funds perceive more benefit. Dividing the village distribution by the number of households in a village equates to about US\$10 per household over the last 10 years. As a result, the villagers considered the benefit to be very little. The percent of households in a village with knowledge of a revenue sharing project also correlated with the monetary value of the projects undertaken in or near each village ($r_{\text{Pearson}} = 0.448$, $p = 0.025$, $n = 25$), and the village mean perception of the park as a neighbour was better as monetary value rose ($r_{\text{Pearson}} = 0.415$, $p = 0.039$, $n = 25$). This increase in program visibility and attitude towards the park supports the procedures adopted to do fewer but more substantial projects.

Household respondents, aware that the project had been done by the revenue sharing program, had higher perceived benefit of the program (Mann–Whitney U , $p < 0.001$, $n = 588$). Even though 88% of village chairpersons confirmed they held meetings to announce that a project had been funded by the park, only 40% of household survey respondents were aware that projects had been funded by revenue sharing. Some chairpersons were insistent that projects had to happen directly in their village to benefit, and the village chairperson's perceived benefit marginally decreased the further from the village a revenue sharing project was located ($r_{\text{Pearson}} = -0.396$, $p = 0.050$, $n = 25$).

The highest mean household perceived benefit of the revenue sharing program was found in villages receiving income generating projects (maize mills and tourist camps), followed by medical clinic projects and elephant trenches (Table 3). The projects with the least perceived benefit were council facility renovations, and tree planting. Household perceived benefit of revenue sharing did vary significantly by project (Kruskal–Wallis, χ^2 (six project groups) = 53.23, $p < 0.001$). Elephant trenches and medical clinics were the only projects considered significantly more beneficial than no project (both Mann–Whitney U , $p < 0.001$), while elephant trenches were also perceived as more beneficial than schools (Mann–Whitney U , $p < 0.001$), and council facilities (Mann–Whitney U , $p < 0.001$). The preference for elephant trenches was emphasised by one of the village chairpersons: “Yes, the children go to the schools, but if going on an empty stomach because of crop raiding then they need trenches more” (1/7/08).

Influence on conservation

Even though the perceived benefit by villagers was low, UWA is convinced that revenue sharing is having a positive influence on conservation: “There has been an improvement in the attitudes of the local communities towards the parks, less illegal activity, improved community livelihoods and increased participation in park management where the program exists” (UWA Official,

10/8/09). Local government and villagers alluded to the moral obligation that resulted from having received the revenue sharing benefit, particularly in villages where elephant trenches had been built or were planned to be built in the coming dry season: “It is our duty to protect the park if UWA gives us money for the trench” (Village Focus Group, 29/6/08).

When asked in the focus groups how conservation behaviours had improved as a result of the revenue sharing program, villagers explained that “we do not kill animals” (28/7/08), and “we make sure that we don't start fires, and report poachers or people cutting trees” (10/7/08). However, a strong theme emerged from focus group discussions that “only if the animals stay in the park can we become good conservationists” (23/6/08). This again highlighted that elephant trenches would be most valued by villagers and would have the greatest influence on conservation outcomes: “We would love the park better if we had trenches. Building schools and facilitating other programs other than the trench does not change the conservation attitudes of the people” (Village Focus Group, 1/7/08).

The measured levels of illegal human disturbance adjacent to each of the study villages (Table 4) was used to test if the revenue sharing program was effectively contributing to improved conservation in the park. The perceived benefit of the revenue sharing program by the village chairperson significantly correlated with the number of livestock seen grazing in the park ($r_{\text{Spearman}} = -0.488$, $p = 0.013$, $n = 25$), the number of poaching signs found ($r_{\text{Spearman}} = -0.406$, $p = 0.044$, $n = 25$) and the human disturbance index ($r_{\text{Spearman}} = -0.459$, $p = 0.021$, $n = 25$), indicating that when the chairperson perceived higher benefit the human disturbance in the park adjacent to their village was less.

The only two projects that had been implemented in more than six villages and could therefore be tested for equality of means were schools and elephant trenches. Only the elephant trench realised higher village-averaged household perceived benefit (t -test, $p = 0.002$), higher village chairperson perceived benefit (t -test, $p = 0.028$), and a lower human disturbance index (t -test, $p = 0.016$). In fact, no signs of poaching or livestock grazing were found along park boundaries where trenches had been built. However, it is recognised that trenches may not only be a physical barrier to the elephants raiding crops but also a barrier to humans and livestock. Therefore, the building of crop raiding defences in the form of elephant trenches appears to be the most effective allocation of the revenue sharing money.

Discussion

Comparison with revenue sharing critiques

In many areas of the world, the primary critique of revenue sharing programs is that the distribution of community projects is either too sparse or too homogeneous to account for the unequal distribution of household losses incurred due to the existence of protected areas (Adams & Infield 2003; Archibald & Naughton-Treves 2001; Spiteri & Nepal 2006). The revenue sharing projects around KNP

have been well distributed around the periphery of the park, but only a third of projects were located within the area of highest incurred losses due to crop raiding (Naughton-Treves 1998). The significantly higher perceived benefit in villages where defences have been built to deal with crop raiding supports the conclusion that revenue sharing needs to be targeted towards those who live closer to the park, and hence bear the greatest cost of conservation.

Prior studies have also concluded that community incentive benefits are too small to improve conservation attitudes or reduce illegal activities (Archibald & Naughton-Treves 2001; Kaltenborn, Nyahongo, Kidegesho, & Haaland 2008; Spiteri & Nepal 2008). For the revenue sharing program around KNP, UWA and local leadership believed the program benefits local people and improves conservation attitudes, a finding consistent with Archibald and Naughton-Treves (2001), and reduced human disturbance was recorded where the village chairperson perceived higher benefit from the program. However, villagers indicated that losses incurred by living next to the park far outweighed the benefit of the revenue sharing program resulting in very low household-scale perceived benefit; a finding consistent with studies around other protected areas in East Africa (Kaltenborn et al. 2008; Mugisha 2002; Schroeder 2008). Since, the decision to poach animals or harvest wood is made by the individual, the lack of correlation between human disturbance and benefit perceived by the household suggests that revenue sharing projects may not be sufficiently influencing conservation behaviours of the individual. However, since the chairperson is the arbiter of discipline in the villages, the perceived benefit of revenue sharing by the chairperson may be translating, at least partially, into the actions of village residents. Additional research asking villagers what causes or deters them from entering the park would be required to confirm this. However if true, the village chairperson could be instrumental in shaping the conservation attitudes and behaviours within their village, acting as a conservation advocate for UWA.

Inclusion of local communities in the project decision process is critical to conservation effectiveness (Agrawal & Gibson 1999; Honey 1999; Kaltenborn et al. 2008; Spiteri & Nepal 2006). The most important finding of this research is that the type of project chosen for implementation with the revenue sharing funds does matter. The only project that was preferentially desired by villagers, showed significantly higher perceived benefit of the program by the household and the village chairperson, as well as lower levels of human disturbance inside the park was the building of elephant trenches to reduce crop raiding. It is therefore recommended that fund distribution be allocated based on local community preferences and for the communities around KNP this means the funds should be spent on the building and maintenance of elephant trenches, or other crop raiding defence projects.

This research suggests that increasing the amount of money distributed should improve the perceived benefit of the program. However this increase is impractical to expect while UWA's operating budget is still subsidised by the Ugandan government and international donors. In lieu of increased funds, perceptions of the revenue sharing program could be improved through better accounting transparency, project implementation and oversight. The practice of rotating the benefit between parishes to retain sufficient funds to provide tangible benefits to the local communities should be continued, and trying to gain consensus with villagers and village chairpersons about the projects chosen should be expanded to all sub-counties, as this approach resulted in more positive perceptions of the program by local communities.

Weak institutions to manage incentive based compensation schemes have been reported to lead to mistrust of conservation authorities (Archibald & Naughton-Treves 2001; Kaltenborn et al. 2008; Spiteri & Nepal 2006) and in Kenya to down-sizing of the revenue sharing program (Honey 1999). Around KNP, project

management issues were encountered in 30% of the projects implemented to date, including incomplete projects, missing materials and poor contractor oversight. Program management training for sub-county leadership, inclusion of the village chairpersons in the implementation process, and the use of local village labour could improve the program implementation in the eyes of frontline villagers.

Comparison with other conservation strategies

Community-based conservation (CBC) encompasses many different approaches to community inclusion in conservation management (Adams & Hulme 2001); however, there are three principle forms of CBC (Barrow & Murphree 2001): protected area outreach; collaborative management; and, community-based natural resource management (CBNRM). Protected area outreach, the primary form of CBC in East Africa, retains conservation as the primary goal, but tries to address concerns with environmental justice, and conflicts with local communities, by providing benefits to help offset losses incurred as a result of the protected area (Adams et al. 2004). More equitable than pure protectionism, outreach maintains strict park boundaries and prosecutes illegal entry. CBNRM is presented as a more socially just approach to conservation, devolving the management of resources from the state to the community (Borgerhoff Mulder & Coppolillo 2005). However, benefit distribution can be inequitable (Fisher, Maginnis, Jackson, Barrow, & Jeanrenaud 2008), inter-community conflict can be normative (Kellert, Mehta, Ebbin, & Lichtenfeld 2000), development and conservation objectives can be inconsistent (Berkes 2004), and the improvement of local livelihoods often takes priority over conservation objectives (Barrow & Murphree 2001). As a result, protected area outreach may be a more suitable option for protected areas with endangered species, high human population density along the park borders, and ethnically diverse, economically disparate communities (Heinen 1996), as is the case for KNP (MacKenzie, unpublished data). The sharing of tourism or hunting revenues is just one possible means of providing benefits to local communities through protected area outreach. Other mechanisms include direct compensation for losses incurred (Jackson, Mosojane, Ferreira, & van Aarde 2008), direct payment for conservation (Ferraro & Kiss 2002), and developing employment or market opportunities for local communities in the tourism industry (Brockington, Duffy, & Igoe 2008).

Although many focus group participants requested direct compensation for crop raiding losses, the cost of such a program would require a lot more money than is currently available through revenue sharing. Losses to park-protected animals have been estimated for KNP to be between US\$5–50 per raid (Naughton-Treves & Treves 2005), with multiple raids per year, this far exceeds the revenue sharing disbursement around KNP calculated to be approximately US\$1 per household per year. In addition to covering losses, compensation programs also incur transaction costs, to guard against fraudulent claims (Bulte & Rondeau 2005), to verify damage (Nyhus et al. 2005), and to guard against 'moral hazard'; where the farmer stops protecting their crops, because everyone is compensated (Bulte & Rondeau 2005; Nyhus et al. 2005). Loss compensation can also create disincentives to conservation by encouraging people to put more land into agriculture and promoting in-migration (Bulte & Rondeau 2005). Coupling the high cost of direct compensation with reports of increasing intensity of crop raiding around many African reserves (Thouless & Sakwa 1995; Tweheyo, Hill, & Obua 2005), and the lack of funding available to conservation authorities in developing countries (Tchamba 1996), the sustainability of direct compensation is questionable. Revenue sharing, if directed towards the building and maintenance of crop

raiding defences, provides the ability to mitigate the crop raiding losses at a far lower cost than compensation.

Direct payment for conservation is based on the premise that if people receive financial benefit, they will conserve the area that is the source of that benefit (Ferraro & Kiss 2002; McNeely 1988; Nyhus et al. 2005). To make these payments effective, the amount of money has to be sufficient to change behaviours, conservation results have to be measured because payment has to be contingent upon performance, and the land tenure of the local people who will be paid has to be well established to guard against in-migration of people wanting to share in the pay-out (McNeely 1988). Given the general lack of financial resources available to initiate direct payment schemes (James, Gaston, & Balmford 1999), conservation authorities are limited to strategies that can be funded by their own revenues. In the case of KNP, the money spent on the revenue sharing program, if disbursed to individuals is not enough to change behaviours, and although UWA attempt to monitor the conservation status of the park, detailed monitoring upon which to base payments would require more manpower. Finally, land tenure in Uganda is far from stable (Deininger & Castagnini 2004; Mugambwa 2002), and given the in-migration rate over the last generation to the borders of KNP has exceeded 50% (MacKenzie, unpublished data), management of a direct payment scheme would be very difficult to establish.

The development of market opportunities for local residents to participate in the tourism industry has been highlighted as a means to tie the fortunes of the protected area to those of neighbouring communities (Brockington et al. 2008). Tourism employment and market access tend to be spatially localised to areas adjacent to tourism facilities and wildlife viewing activities (Boo 1990), and requires local residents to speak English, a skill typically acquired in school and more prevalent in wealthier households. Therefore, the elites within communities tend to capture the benefits of tourism development (Southgate 2006). Revenue sharing provides a mechanism to more equitably distribute benefit from tourism revenues both spatially around the park, and between low, medium and high wealth households, as demonstrated by this study.

Collaborative management is an alternative community-based conservation strategy that allows local residents to have limited access to specific resources inside the protected area, with the understanding that the local community will help police the park (Chhetri et al. 2003). Rural African communities are dependent upon natural resources that exist within protected areas (Adams & Infield 2003; Hartter 2010; Naughton-Treves et al. 2007), and access to these resources is perceived as a valuable benefit, especially by the poorest households (Archibald & Naughton-Treves 2001). The cost of this strategy is limited to the additional manpower required by the conservation authority to manage the program. However, the authority also assumes the risk that increased park access could lead to increased illegal activities by those who are not part of the resource access agreement association. Resource access agreements are active in KNP, with UWA permitting access to place beehives, collect basket making materials, harvest exotic tree species, and fish in two lakes inside the park. Illegal tree harvesting was found to be lower near communities with beekeeping agreements, but higher near communities with exotic tree harvesting agreements (MacKenzie, Chapman, & Sengupta 2011). Although the cost of collaborative management is less than revenue sharing for the wildlife authority, the conservation effectiveness may be highly dependent upon the type of resource accessed, and the benefit only accrues to individuals who are members of the resource access association.

Revenue sharing provides a mechanism for equitable benefit distribution, as revenue is shared around the entire periphery of the park, and the benefit of the projects is accrued evenly between wealth categories. Revenue sharing also does not require

the wildlife authority to take on the additional conservation risks associated with increased access to the park that collaborative managements can involve. Therefore, compared with other conservation strategies, revenue sharing appears a more practical option for protected areas conserving endangered species, given the limited funding available to conservation authorities in developing countries.

Conclusions

The implementation of the Ugandan revenue sharing program has evolved over the decade since its inception. UWA and local leadership have contributed to this evolution demonstrating a desire to progressively improve the structure, implementation process, and effectiveness of the program to address the needs of frontline villagers. This study has demonstrated that the revenue sharing program around KNP does provide benefit to local people and improves conservation behaviours, if the projects specifically deal with the villagers' primary problem of crop raiding by park-protected animals.

Given the limited financial resources available to the Uganda Wildlife Authority, revenue sharing appears to be the most effective use of funds to benefit local communities while trying to improve conservation outcomes, when compared with other options such as loss compensation, direct payment, and collaborative management. Local perceptions of the program could be further improved by ensuring community involvement in the project decision making process, improving financial transparency, improving the project management skills of those responsible for project implementation, and focusing the projects closer to the park boundary to benefit those who lose most to crop raiding.

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References

- Adams, W. M., & Hulme, D. (2001). If community conservation is the answer in Africa, what is the question? *Oryx*, 35, 193–200.
- Adams, W. M., & Infield, M. (2003). Who is on the Gorilla's Payroll? Claims on tourist revenue from a Ugandan National Park. *World Development*, 31, 177–190.
- Adams, W. M., Aveling, R., Brockington, D., Dickson, B., Elliot, J., Hutton, J., et al. (2004). Biodiversity conservation and the eradication of poverty. *Science*, 306, 1146–1149.
- Agrawal, A., & Gibson, C. C. (1999). Enchantment and disenchantment: The role of community in natural resource conservation. *World Development*, 27, 629–649.
- Alpert, P. (1996). Integrated conservation and development projects: Examples from Africa. *Bioscience*, 46, 845–855.
- Archibald, K., & Naughton-Treves, L. (2001). Tourism revenue-sharing around national parks in western Uganda: Early efforts to identify and reward local communities. *Environmental Conservation*, 28, 135–149.
- Barrow, E., & Murphee, M. (2001). Community conservation: From concept to practice. In D. Hulme, & M. Murphee (Eds.), *African wildlife and livelihoods; the promise and performance of community conservation* (pp. 24–37). Cape Town: David Philip Publishers (Pty) Ltd.
- Berkes, F. (2004). Rethinking community-based conservation. *Conservation Biology*, 18, 621–630.
- Boo, E. (1990). *Ecotourism: The potentials and pitfalls* Washington, DC: World Wildlife Fund.

- Borgerhoff Mulder, M., & Coppolillo, P. (2005). *Conservation: Linking ecology, economics, and culture*. Princeton, New Jersey: Princeton University Press.
- Brockington, D., Duffy, R., & Igoe, J. (2008). *Nature unbound: Conservation, capitalism and the future of protected areas*. London: Earthscan.
- Bulte, E. H., & Rondeau, D. (2005). Research and management viewpoint: Why compensating wildlife damages may be bad for conservation. *Journal of Wildlife Management*, 69, 14–19.
- Chhetri, P., Mugisha, A., & White, S. (2003). Community resources use in Kibale and Mt. Elgon National Parks, Uganda. *Parks*, 13, 28–49.
- Deininger, K. W., & Castagnini, R. (2004). *Incidence and impact of land conflict in Uganda*. Washington, DC: World Bank, Development Research Group, Rural Development.
- Ferraro, P. J., & Kiss, A. (2002). Direct payments to conserve biodiversity. *Science*, 298, 1718–1719.
- Fisher, R., Maginnis, S., Jackson, W., Barrow, E., & Jeanrenaud, S. (2008). *Linking conservation and poverty reduction: Landscapes, people and power*. London: Earthscan.
- Hartter, J. (2009). Attitudes of rural communities towards wetlands and forest fragments around Kibale National Park, Uganda. *Human dimensions of wildlife. Human Dimensions of Wildlife*, 14, 433–447.
- Hartter, J. (2007). *Landscape change around Kibale National Park, Uganda: Impacts on land cover, land use, and livelihoods*. PhD thesis, University of Florida.
- Hartter, J. (2010). Resource use and ecosystem services in a forest park landscape. *Society & Natural Resources*, 23, 207–233.
- Heinen, J. T. (1996). Human behaviour, incentives, and protected area management. *Conservation Biology*, 10, 681–684.
- Honey, M. (1999). *Ecotourism and sustainable development: Who owns paradise?* Washington, DC: Island Press.
- Jackson, T. P., Mosojane, S., Ferreira, S. M., & van Aarde, R. J. (2008). Solutions for elephant *Loxodonta africana* crop raiding in northern Botswana: Moving away from symptomatic approaches. *Oryx*, 42, 83–91.
- James, A. N., Gaston, K. J., & Balmford, A. (1999). Balancing the earth's accounts. *Nature*, 401, 323–324.
- Kaltenborn, B. P., Nyahongo, J. W., Kidegesho, J. R., & Haaland, H. (2008). Serengeti National park and its neighbours – Do they interact? *Journal for Nature Conservation*, 16, 96–108.
- Kellert, S. R., Mehta, J. N., Ebbin, S. A., & Lichtenfeld, L. L. (2000). Community natural resource management: Promise, rhetoric, and reality. *Society & Natural Resources*, 13, 705–715.
- Lewis, D. M., & Alpert, P. (1997). Trophy hunting and wildlife compensation in Zambia. *Conservation Biology*, 11, 59–68.
- MacKenzie, C. A., Chapman, C. A., & Sengupta, R. (2011). Spatial patterns of illegal resource extraction in Kibale National Park, Uganda. *Environmental Conservation*, 38 doi:10.1017/S0376892911000282
- McNeely, J. A. (1988). *Economics and biological diversity: Developing and using economic incentives to conserve biological resources*. Gland, Switzerland: IUCN.
- Mugambwa, J. T. (2002). *Principles of land law in Uganda*. Kampala, Uganda: Fountain Publishers.
- Mugisha, A. (2002). *Evaluation of community-based conservation approaches: Management of protected areas in Uganda*. PhD thesis, University of Florida.
- Mulley, B. G., & Unruh, J. D. (2004). The role of off-farm employment in tropical forest conservation: Labor, migration, and smallholder attitudes towards land in western Uganda. *Journal of Environmental Management*, 71, 193–205.
- Naughton-Treves, L. (1998). Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. *Conservation Biology*, 12, 156–168.
- Naughton-Treves, L., & Treves, A. (2005). Socio-ecological factors shaping local support for wildlife: Crop-raiding by elephants and other wildlife in Africa. In R. Woodroffe, S. Thirgood, & A. Rabinowitz (Eds.), *People and wildlife: Conflict or coexistence?* (pp. 252–277). Cambridge (UK): Cambridge University Press.
- Naughton-Treves, L., Kammen, D. M., & Chapman, C. (2007). Burning biodiversity: Woody biomass used by commercial and subsistence groups in western Uganda's forests. *Biological Conservation*, 134, 232–241.
- Ninan, K. N., Jyothis, S., Babu, P., & Ramakrishnappa, V. (2007). *The economics of biodiversity conservation: Valuation in tropical forest ecosystems*. UK: Cromwell Press.
- Nyhus, P. J., Osofsky, S. A., Ferraro, P., Madden, F., & Fischer, H. (2005). Bearing the cost of human-wildlife conflict: The challenges of compensation schemes. In R. Woodroffe, S. Thirgood, & A. Rabinowitz (Eds.), *People and wildlife: Conflict or coexistence* (pp. 107–121). Cambridge: Cambridge University Press.
- Nyhus, P., Sumianto, & Tilson, R. (2000). Crop-raiding elephants and conservation implications at Way Kambas National Park, Sumatra, Indonesia. *Oryx*, 34, 262–275.
- Olupot, W., Barigiyira, R., & Chapman, C. A. (2009). The status of anthropogenic threat to the people-park interface of Bwindi Impenetrable National Park, Uganda. *Environmental Conservation*, 36, 41–50.
- Peters, J. (1998). Sharing national park entrance fees: Forging new partnerships in Madagascar. *Society & Natural Resources*, 11, 517–530.
- Robbins, P., McSweeney, K., Waite, T., & Rice, J. (2006). Even conservation rules are made to be broken: Implications for biodiversity. *Environmental Management*, 37, 162–169.
- Saito, F. (2003). *Decentralization and development partnerships: Lessons from Uganda*. Tokyo: Springer-Verlag.
- Schroeder, R. A. (2008). Environmental justice and the market: The politics of sharing wildlife revenues in Tanzania. *Society & Natural Resources*, 21, 583–596.
- Southgate, C. R. J. (2006). Ecotourism in Kenya: The vulnerability of communities. *Journal of Ecotourism*, 5, 80–96.
- Spiteri, A., & Nepal, S. K. (2008). Evaluating local benefits from conservation in Nepal's Annapurna conservation area. *Environmental Management*, 42, 391–401.
- Spiteri, A., & Nepal, S. K. (2006). Incentive-based conservation programs in developing countries: A review of some key issues and suggestions for improvements. *Environmental Management*, 37, 1–14.
- Struhsaker, T. T. (1997). *Ecology of an African rain forest*. Gainesville: University of Florida Press.
- Struhsaker, T. T. (2002). Strategies for conserving Forest National Parks in Africa with a case study from Uganda. In J. Terborgh, C. van Schaik, L. Davenport, & M. Rao (Eds.), *Making parks work: Strategies for preserving tropical nature* (pp. 97–111). Washington, DC: Island Press.
- Tchamba, M. N. (1996). History and present status of the human/elephant conflict in the Waza-Logone region, Cameroon, West Africa. *Biological Conservation*, 75, 35–41.
- Thouless, C. R., & Sakwa, J. (1995). Shocking elephants: Fences and crop raiders in Laikipia District, Kenya. *Biological Conservation*, 72, 99–107.
- Treves, A., & Karanth, K. U. (2003). Human-carnivore conflict: Local solutions with global applications. *Conservation Biology*, 17, 1489–1490.
- Twehoyo, M., Hill, C. M., & Obua, J. (2005). Patterns of crop raiding by primates around Budongo Forest Reserve, Uganda. *Wildlife Biology*, 11, 237–247.
- Uganda Wildlife Statute. (1996). *FAOLEX*. Food and Agriculture Organization of the United Nations Legal Office. Retrieved March 25, 2008, from <http://faolex.fao.org/docs/texts/uga9000.doc>
- UWA. (2007). *Annual financial report*. Kampala: Ugandan Wildlife Authority.
- UWA. (2000). *Revenue sharing programme around protected areas*. Kampala: Ugandan Wildlife Authority.