Human Dimensions of Wildlife, 15:45–54, 2010

ISSN: 1087-1209 print / 1533-158X online
DOI: 10.1080/10871200903115070

Routledge
Taylor & Francis Group

The Effects of Crop Raiding on Household Food Security in the Albertine Rift: A Case Study of Queen Elizabeth National Park, Western Uganda

AKANKWASAH BARIREGA,[1] MUKADASI BUYINZA,[2] FRANK KANSIIME,[3] AND GILBERT BASUTA-ISABIRYE[4]

[1]Wildlife and Animal Resource Management Department, Makerere University, Kampala, Uganda
[2]Community Forestry Department, Makerere University, Kampala, Uganda
[3]Institute of Environment and Natural Resources, Makerere University, Kampala, Uganda
[4]Zoology Department, Makerere University, Kampala, Uganda

We examined the effects of crop raiding by wild animals on household food security of the people in two sub counties adjacent to Queen Elizabeth National Park in Western Uganda. Data were collected from 541 households using a questionnaire and focus group discussions in a controlled and blocked household survey in Kichwamba and Nyakiyumbu sub counties in the Districts of Bushenyi and Kasese, respectively. Food security was examined by using dietary diversity indices. Crop raiding dominated by elephants resulted in 14% annual reduction in household food security of park-adjacent communities. It is recommended that a crop raiding mitigation fund be established to maintain elephant trenches and building capacity for local people to manage crop raiding and a multidisciplinary agriculture extension be started in the area to increase agricultural production and household incomes in order to prevent heavy dependency on protected area resources.

Keywords food security, crop raiding, Albertine Rift, Queen Elizabeth National Park, Uganda

Introduction

Beyond small-scale efforts to incorporate local communities in protected area management, biodiversity conservation is challenged to engage with two important United Nations Millennium Goals: (a) eradicate extreme poverty and hunger (b) ensure environmental sustainability. As the development community has increasingly focused on these goals, biodiversity funding has been linked to poverty alleviation and food security (Lapham & Livermore, 2003). Food security is achieved when adequate food (quantity, quality, safety, sociocultural acceptability) is available and accessible for and satisfactorily utilized by all individuals at all times to live a healthy and happy life (Rainer, 2002). Availability is achieved when sufficient food is available and all people within a

Address correspondence to Mr. Akankwasah Barirega, BSC, MSC, Wildlife and Animal Resource Management Department, Makerere University, P.O. Box 7062, Kampala, Uganda. E-mail: akankwasah@vetmed.mak.ac.ug

household have the means and resources to obtain appropriate foods (through production, purchase, or donation) for a nutritious diet. Poverty and food insecurity may force indigenous people to overburden the protected area resources and destroy their basis for survival. Under-nutrition rates are higher in the vicinity of biodiversity hotspots than for the country as a whole (McNeely & Scherr, 2001). Protected areas can contribute significantly to changes in diets that include increased dependency on purchased items and a decline in overall nutrition (Leatherman & Goodman, 2005).

Rural populations living near protected areas have a lower nutritional state than other people from the same ethnic background, with a significantly lower agricultural yield (Cernea & Schmidt-Soltau, 2003). Dietary diversity among hunter-gatherers and horticulturalists is higher than that of settled agriculturalists (MacLean-Stearman, 2000). Crop damage by large mammals and primates contributes significantly to food insecurity (Yudelman, Rata, & Nygaard, 1998; Naughton-Treves, Treves, Chapman & Wrangham, 1998; Mkanda, 1994; Nahonyo, 2001; Ntiamoa-Baidu, 1997.

Protected areas over an expanded area imply enhanced quantity and quality of livestock, especially if pastoralists have access to dry season grazing and water resources, but this will be partially offset by increased wildlife/livestock interactions leading to disease and predation (Boyd, Blench, Bourn, Drake, & Stevenson, 1999). For pastoralists, protected areas should improve food security through increased off-take of milk and meat. For agro-pastoralists, the impact of protected areas on food security is more variable, depending on whether they are able to take advantage of additional grazing and water resources. Impacts on agriculture will mainly involve increased risk of damage to crops by wild animals and associated consequences. Bushmeat consumption may decline for some or all households if protected areas regulation of wildlife use is strictly non consumptive. Permitting local hunting of common species and the distribution of meat from safari hunting or culling operations may mitigate this. In the long term, the intention would be for total stocks of wildlife to increase, allowing increased sustainable offtake. If local hunting is not permitted, households will have little or no control over the timing of bushmeat supplies.

Despite the widespread use of natural resources, protected area management plans and resettlement schemes pay little attention to the importance of such resources for local livelihood food security (Machlis, 1995; Pimbert & Pretty, 1997). Boyd et al. (1999) stress that impacts can be improved where the protected area increases access to valued grazing and water resources, where efforts are made to mitigate crop damage, predation and disease transmission, local hunting is permitted (especially of common species and crop pests) and a regular supply of meat from hunting and culling operations is ensured.

National estimates have shown that states can incur considerable opportunity costs from the loss of agricultural land to protected areas; the household costs, however, are not yet well studied (Norton-Griffiths & Southby, 1995; Howard, 1995). This opportunity cost of land has implications for food security of people around protected areas. Kaswamila and colleagues (2007) found that in Northern Tanzania, crop raiding by wild animals from Mkomazi Game Reserve and Lake Manyara National Park reduced household food security. He noted that crop damage by wild animals was on average 0.08 tons per year, an equivalent of two months loss of household food.

The specific objective of this research was to examine the effect of crop raiding on household food security of the people living adjacent to Queen Elizabeth National Park. The research questions were: (a) Does crop raiding affect household food security of park adjacent households? If yes, (b) What percentage reduction in food security results from crop raiding? (c) What can be done to mitigate the problem of crop raiding in the area?

Methods

Study Area

Queen Elizabeth National Park (QENP) is located within the Albertine Rift in Western Uganda (Zandri & Viscanic, 1992) and is the second largest National Park in Uganda, covering the districts of Kanungu, Bushenyi, Kasese, Rukungiri, Kamwenge, and Ibanda. In 1950, it was gazetted as a National Park after the merger between Lake Edward and Lake George Game reserves. The park is listed as a world biosphere reserve. We drew households from four parishes in Kichwamba Sub-county Bushenyi District that neighbor the park. These included Kichwamba, Kirugu, and Rumuri parishes. Kikumbo parish does not neighbor the park and experiences no crop raiding was used as a control. From Nyakiyumbu Sub-county in Kasese District, three parishes of Bukangala, Katholhu, and Kaghorwe were sampled. Bukangala and Katholhu are adjacent to the park and experience crop raiding while Kaghorwe, which does not neighbor the park and experiences no crop raiding, was used as a control parish for Nyakiyumbu Sub County. Nyakiyumbu and Kichwamba sub counties were chosen because they are prone to crop raiding.

Data Collection

Data were collected using household interviews during June and July 2008. Parishes adjacent to the National Park who experienced crop raiding were compared against more distant parishes with similar characteristics that do not face crop raiding. Adjacent parishes constituted those that share boundary with the park while distant parishes were those that do not share boundary with the park and do not experienced crop raiding.

Before administering the questionnaires (February 2008), the sample frame was selected, local research assistants were trained and the questionnaire was pre-tested. Focus group discussions of 30 people were conducted in each parish to corroborate information obtained from household interviews. Key informants (local council leaders, community conservation rangers) helped to identify illegal activities; information that was typically withheld by respondents. A total of 365 households were sampled from Kichwamba Sub County and 136 households sampled from Nyakiyumbu Sub County. A total number of 501 respondents were interviewed and the response rate was 100% for all sites.

We assessed household food security using the Dietary Diversity method described in Maxwell and Frankenberger (1992) and Rainer (2002). Dietary Diversity is the sum of the number of different foods consumed by an individual over a given period. We asked one or more persons within the household about different food items that they had consumed in the previous week. Higher dietary diversity implies more household food security. Food item lists were generated via household interviews and discussions with key informants during the pilot study. Weighted sums reflecting the frequency of consumption of different food items were calculated as a measure of food security.

Data Analysis

Data on dietary diversity was organized to enable assessment of differences between park adjacent study sites and the control sites. Means (*M*) and standard deviation (*SD*) differences between adjacent households and control data for food security were examined using one way analysis of variance (ANOVA) at 95% level of confidence. Because food security is

affected by land acreage owned (Spearman's rank correlation = .222, $p < .001$), a dietary diversity index per acre of land owned was used. Where the variances were non-homogeneous, robust tests of Brown-Forsythe and Welch were performed at 95% level of confidence to verify preliminary ANOVA findings. Correlations between variables were measured using Spearman's rank correlation at 95% level of confidence.

Results

Sample Characteristics

Nearly all the people in Kichwamba sub-county, Bushenyi district (99%, $n = 365$) were Banyankole by tribe. For Nyakiyumbu sub-county Kasese district, the dominant ethnic group was Bakonjo (98%, $n = 136$). A minority tribe encountered in Nyakiyumbu study area was the Basongola pastoralists (2%, $n = 136$). The average number of people per household in park adjacent households was eight people in Nyakiyumbu and seven people for Kichwamba sub county. For households distant from the park, the average number of people per household was six and seven for Nyakiyumbu and Kichwamba, respectively. The park adjacent households had slightly higher land acreage (2.7 acres for Nyakiyumbu, 1.7 acres for Kichwamba) than their counterparts in distant parishes that had 1.7 acres for Nyakiyumbu and 1.5 acres for Kichwamba sub county. In Kichwamba, 25% of people in households adjacent to the park and 23% of people from distant households had never gone to school. For Nyakiyumbu sub county, 26% of park adjacent households and 43% of distant households did not go to school at all. No person from Kichwamba households adjacent to the park had attained Uganda Advanced certificate of Education (UACE) and only one from Nyakiyumbu sub-county Kasese district.

Major Sources of Livelihoods

The dominant source of livelihoods for both Nyakiyumbu and Kichwamba sub counties was subsistence agriculture (58%, $n = 501$). Other sources of livelihood in the study area included commercial banana growing, cotton, and coffee farming accounting for 20%, 13%, and 9% total number of respondents, respectively. People in Nyakiyumbu sub county in Kasese district depended more on subsistence agriculture (96%, $n = 136$) compared to 43% ($n = 365$) of people living in Kichwamba sub county, Bushenyi district (Table 1). Other sources of livelihoods in the households in Kichwamba site included

Table 1
Major source of household livelihoods

	Response (%)	
Source of livelihood	Kichwamba $n = 365$	Nyakiyumbu $n = 136$
Subsistence agriculture	43	96
Cotton	16	4
Coffee	13	0
Banana	28	0

n = number of responsdents.

banana growing (28%), cotton growing (16%), and coffee growing (13%). Households in Nyakiyumbu site apart from subsistence agriculture, had cotton growing (4%) as the other only source of livelihood.

Effect of QENP on Dietary Diversity of Local Communities

Focus group discussions indicated that the single major factor affecting dietary diversity of the people living near the protected area in both Nyakiyumbu and Kichwamba sub counties was crop damage by wild animals. Households in parishes neighboring the park had less dietary diversity than households that were more distant to the park and faced no crop raiding. Households adjacent to the Park in Nyakiyumbu sub county had a lower dietary diversity index per acre (49.89 ± *SD* 35.40, *n* = 90) compared to Park adjacent households in Kichwamba sub county (78.92 ± *SD* 55.17, *n* = 275). Analysis of variance revealed that overall; the dietary diversity index per acre of households adjacent to the Park in Kichwamba sub county, Bushenyi district was significantly higher than that for households in Nyakiyumbu sub county, Kasese District ($p < .001$).

QENP and Dietary Diversity in Kichwamba Sub County, Bushenyi District

The mean weighted dietary diversity index per acre of households from park adjacent parishes was lower (*M* = 78.92 ± *SD* 55.17; range = 10.90–214.00) than that of households from parishes not adjacent to the park (*M* = 85.54 ± *SD* 54.46; range = 10.40–210.00). This is a 9% reduction in dietary diversity of the households adjacent to the park (Table 2).

The variances between the two groups were homogeneous ($p = .285$). Analysis of variance revealed that weighted dietary diversity index per acre for households from parishes distant from the park was significantly higher than that for parishes adjacent to the park ($p = .032$, $eta^2 = .03$). Dietary diversity/acre was used instead of dietary diversity because the Spearman rank correlation coefficient was positive and significant between the dietary diversity index and land acreage owned by a household ($r_s = .222$, $p < .001$).

The growing of some crops had been suspended by some people living in areas prone to crop raiding (Table 3). Major crops foregone had included cassava (34%, *n* = 275) followed by sweet potatoes (6%, *n* = 275). Most people living near the park in Kichwamba

Table 2
Effect of wild animal crop raiding on household dietary diversity/acre

	Dietary diversity index/acre			
	Kichwamba *n* = 365		Nyakiyumbu *n* = 136	
Category of parish	Mean	*SD*	Mean	*SD*
Parishes with wild animal crop raiding	78.92	55.17	49.89	35.40
Parishes without wild animal crop raiding	85.54	54.46	60.24	34.56
p-value at 95% confidence	.032		.010	
Eta^2	.03		.19	

n = number of respondents, *SD* = standard deviation.

Table 3
Crops whose growing is suspended due to crop raiding

Crop suspended	Response (%)	
	Kichwamba *n* = 75	Nyakiyumbu *n* = 136
Millet	1	2
Maize	2	0
Cotton	3	0
Bananas	4	0
Beans	0	0
Sweet potatoes	6	3
Irish Potatoes	2	0
G nuts	3	7
Cassava	33	7

n = Respondents.

Table 4
Local peoples suggestions to mitigate crop raiding

Mitigation measure	Response (%)	
	Kichwamba *n* = 275	Nyakiyumbu *n* = 136
Ranger guards	41	10
Compesation scheme	19	26
Fencing	20	19
Kill the animals	9	43
Dialogue	4	0
Trenches	6	2

n = Respondents.

sub county (98%, *n* = 275) were aware that the Park presence affected their dietary diversity and or food security negatively. They adopted guarding of crops as a short-term survival strategy. Guarding methods included physical chasing away of animals, maintenance of trenches, and use of scare crows. Some respondents (42%, *n* = 275) suggested armed ranger guards by Uganda Wildlife Authority (UWA) as the medium term mitigation measure to crop raiding among other suggestions (Table 4). Crop and livestock loss had not only resulted in the loss of food and wildlife; people revenged crop damage by killing wild animals.

QENP and Dietary Diversity in Nyakiyumbu Sub County, Kasese District

The mean weighted dietary diversity index per acre of land for households from park adjacent parishes was lower (M = 49.89 ± SD = 35.40; range = 2.20–178.00) than households from parishes not adjacent to the park (M = 60.24 ± SD = 34.56;

range = 7.50–160.00). QENP could be influencing food security of adjacent households by up to 20% (Table 2).

Dietary diversity/acre of households from park adjacent parishes was significantly lower than that for households from parishes not adjacent to the park ($p = .010$, $eta^2 = .19$). The Spearman's rank correlation coefficient was significant and positive correlation between the dietary diversity index and land acreage owned by a household ($r_s = .276$, $p = .01$).

About three-quarters (77%) of households in the adjacent parishes were aware that the park reduced their dietary diversity. Households tended to not mitigate crop raiding in the area. Even trenches dug by UWA to prevent wild animals crossing into peoples' gardens had been neglected and crop damage by wild animals continued to be a food security threat.

Discussion

Sample Characteristics

The observed household size suggests rapid population growth in the area. This possesses a threat to the protected area since these people need land for expansion. The high percentage of people in age groups 21–40 years implies that the population is steadily growing and yet the household land acreage was not correspondingly increasing.

There was a general low level of education among the population neighboring the park. This finding held for both adjacent and distant households meaning that crop raiding was not necessarily keeping children guarding crops at the expense of education. In Kichwamba, the people adjacent to the park have lower education levels as opposed to distant households. This is probably because of a high attempt to guard against crop raiding. This was not the case in Nyakiyumbu. This low level of education makes it hard for people to grasp conservation ideology easily. This calls for appropriate conservation education packages in the form of local drama and demonstration facilities.

Major Sources of Livelihoods

The observed restricted livelihood options for both Kichwamba and Nyakiyumbu means that the people are still dependant on protected area. Livelihood diversity implies availability of more survival options while limited sources of livelihood means that household's survival options are restricted and thus high dependence on natural resources (Western, Wright, & Strum, 1994).There is thus a need for sensitization of the people about sustainable ways of living with protected areas in a mutual and cordial relationship.

Livelihood options for Nyakiyumbu people were narrower than that for households in Kichwamba. This is probably because of differences in community mobilization efforts by the Local Government, varying soil profiles and differences in culture. This calls for more conservation education effort and other conservation interventions as a matter of urgency. The fact that the majority of the households in either site still depend on subsistence farming for survival is an indication of a poor community by Uganda standards. Poor communities will rarely support conservation programs unless there is an element of integrated conservation and development projects.

Effect of Crop Raiding on Food Security of Park Adjacent Communities

The households from parishes adjacent to the park had a lower dietary diversity index compared to that of households that were far way from the park by a difference of 8% for Kichwamba sub-county and 20% for Nyakiyumbu sub county. This implies that the protected area reduces the food security of the neighboring households by an overall annual average of 14%. The underlying factors behind the reduced food security for households adjacent to protected areas are crop raiding and livestock depredation by wild animals from the protected area as was also reported by Mkanda (1994); Nahonyo (2001); Naughton-Treves et al. (1998); Naughton-Treves, Rose, and Treves (1999); Ntiamoa-Baidu (1997); and Yudelman et al. (1998).

Crop raiding indeed was an existing problem in these two study sites. Elephants, buffaloes, hippos, and baboons were the major crop raiders (in that order), while hyenas, lions, and leopards were the major livestock predators, with goats being the most affected. These findings are in agreement with what Kaswamila et al. (2007) found in areas around Lake Manyara National Park and Mkomazi game reserve in North Eastern Tanzania. They are also consistent with Galvin, Ellis, Boone, Magennis, & Smith et al. (1999); Leatherman and Goodman (2005); and McNeely and Scherr (2001).

Nyakiyumbu sub-county households are more food insecure than Kichwamba because many people (58%, $n = 365$) in Kichwamba have attempted to mitigate crop raiding by guarding their crops as opposed to households in Nyakiyumbu sub county (9%, $n = 136$). This is probably because of differences in education levels and exposure to community conservation education. The general conservation attitude in Nyakiyumbu sub county was lower (35%, $n = 136$) than that of Kichwamba sub county (47%, $n = 365$). Households in Nyakiyumbu sub county were not willing to maintain elephant trenches as opposed to their counterparts in Kichwamba sub county.

This essentially means that the frequency of crop damage by wild animals is high in Kasese compared to that in Bushenyi. In either case, however, it was clear that people from distant households come to farm in park adjacent areas because of limited land in these other areas but also owing to the fact the flat land surrounding the protected areas in these two sites is managed communally and form part of the most arable part of the area in the two study sites, implying that tenure rights are not limited to the fast parish. This implies that UWA's interventions, which are aimed at people from the first adjacent parish, may not be reaching the target community. This also means that people from distant households could be illegally extracting resources from the park without UWA's knowledge. However, this did not affect the outcome of this study because these effects were blocked for in the study design.

Crop raiding reduces the amount of food in a household by way of damaged food crops by wild animals. Cash crops damaged also would raise money to buy more food for the households. In addition, crop raiding limits a range of crops that would be grown and consequently this reduces the dietary diversity.

Conclusion and Recommendations

Given the short study period, small sample size, and the level of accuracy of using dietary diversity as proxy for food security, it is probable that Queen Elizabeth National Park is reducing household food security of adjacent people by up to 14% annually.

UWA should establish a fund to mitigate against the cost of crop raiding. This can be achieved through maintenance of trenches and training people in guarding crops

since this is the biggest factor affecting people's livelihoods. Revenue-sharing money should be directed toward needs-based crop raiding mitigation interventions. UWA should establish a link with National Agricultural Advisory Services (NAADS) and Plan for Modernization of Agriculture (PMA) secretariats so that they can prioritize the people whose food security is affected by protected areas. A multidisciplinary participatory approach to extension is needed—combining educational methodologies, communication, and group techniques with a strong emphasis on meeting people's needs directly by raising farmers' net income, generating rural employment, and increasing social equity.

References

Boyd, C., Blench, R., Bourn, D., Drake, L., & Stevenson, P. (1999). Reconciling interests among wildlife, livestock and people in eastern Africa: A sustainable livelihoods approach. *Natural Resource perspectives No. 45, June 1999*. Overseas Development Institute, Portland House Stag Place London SW1E 5DP, UK.

Cernea and Schmidt-Soltau, (2003). The end of forced resettlements for conservation: Conservation must not impoverish people. *Policy Matters*, *12*, 42–51.

Galvin, K. A., Ellis, J., Boone, R. B., Magennis, A., Smith, M., & Lyun, S. J. (1999). In Cernia and Schmidt-Soltan (2003). The end of forced resettlements for Conservation: Conservation must not impoverish people. *Policy Matters, 12*, 42–51.

Howard, P. (1995). The economics of protected areas in Uganda: Costs, benefits and policy issues. University of Edinburgh.

Kaswamila, A., Russell, S., and McGibbon, M. (2007). Impacts of wildlife on household food security and income in Northeastern Tanzania. *Human Dimensions of Wildlife*, *12*(6), 391–404.

Lapham, N., & Livermore, M. (2003). *Striking a balance: Ensuring conservation's place on the International Biodiversity Assistance Agenda*. Washington, DC: Conservation International.

Leatherman, T. L., & Goodman, A. (2005). Coca-colonization of diets in the Yucatan. *Social Science & Medicine 61*(4), 833–846.

Machlis, G. E. (1995). Social science and protected area management: The principles of partnership. In J. A. McNeely (Ed.), *Partnership for conservation: An introduction* (pp. 45–57). Washington DC: Island Press.

MacLean-Stearman, A. (2000). A pound of flesh: Social change and modernization as factors in hunting sustainability among Neotropical indigenous societies (pp. 73–84). In J. G. Robinson & E. L. Bennett (Eds.), *Hunting for sustainability in tropical forests*. New York: Colombia University Press.

Maxwell, S., & Frankenberger, T. (1992). *Household food security: Concepts, indicators, measurements*. Rome: IFAD and UNICEF.

McNeely, J., & Scherr, S. J. (2001). *Common ground common future: How ecoagriculture can help feed the world and save wild biodiversity*. Washington, DC: IUCN.

Mkanda, F. X. (1994). Survey of man–hippopotamus conflicts in Malawi. *African Journal of Ecology*, *32*, 75–79.

Nahonyo, C. L. (2001). *Human–elephant conflict in the Greater Ruaha ecosystem, Tanzania*. Ph.D. thesis. Canterbury, UK: University of Kent.

Naughton-Treves, L., Rose, R., & Treves, A. (1999). *The social dimension of human–elephant conflict in Africa: A literature review and case studies from Uganda and Cameroon*. Gland, Switzerland: IUCN African Elephant Specialist Group.

Naughton-Treves, L., Treves, A., Chapman, C., & Wrangham, R. (1998). Temporal patterns of crop raiding by primates: Linking food availability in croplands and adjacent forest. *Journal of Applied Ecology*, *35*, 596–606.

Norton-Griffiths, M., & Southby, C. (1995). The opportunity costs of biodiversity conservation in Kenya. *Ecological Economics*, *12*, 125–139.

Ntiamoa-Baidu, Y. (1997). *Wildlife and food security in Africa*. Rome: FAO.

Pimbert, M. P., & Pretty, J. N. (1997). Parks, peoples and professionals: Putting participation into protected-area management In K. B. Ghimire & M. P. Pimbert (Eds.), *Social change & conservation* (pp. 297–330). London: Earthscan.

Rainer, G. (2002). Food and nutrition security in poverty alleviation: Concepts, strategies, and experiences at the German Agency for Technical Cooperation. *Asia Pacific Journal of Clinical Nutrition*, *11*(Suppl.), S341–S347.

Western, D., Wright, R. M., & Strum, S. C. (Eds.). (1994). *Natural connections: Perspectives in community-based conservation*. Washington, DC: Island Press.

Yudelman, M., Rata, A., & Nygaard, D. (1998). *Pest management and food production*. Washington, DC: International Food Policy Research Institute.

Zandri, E., & Viscanic, P. (1992). *Vegetation survey and mapping in the Queen Elizabeth National Park, Kyambura and Kigezi Game Reserves*. Uganda National Parks. EDF Project, Kampala, Uganda.