Conflict between people and protected areas within the Bénoué Wildlife Conservation Area, North Cameroon

Robert B. Weladji and Martin N. Tchamba

Abstract Knowledge of conflicts between people and protected areas is required for the design of sustainable conservation strategies for the management of most protected areas. This study identifies the causes of conflicts between local people and the Bénoué Wildlife Conservation Area (BWCA), which includes the Bénoué National Park, in northern Cameroon. Informal interviews and questionnaires were administered to 114 households in three communities, and to 17 Park staff and seven professional hunting guides. Crop damage affected 86% of the surveyed households, with 31% of crop income lost on average, and with the damage varying significantly between communities. Elephants, baboons, patas monkeys, warthogs and green parrots accounted for 97% of crop damage, with the staple foods maize and millet being most affected. Of the respondents, 28% experienced livestock depredation, with 18% of livestock income lost on average. The civet cat was the main predator. The involvement of local people in illegal activities, their lack of access to natural resources, and damage by wildlife were identified as principal causes of conflicts. Local people, park staff and professional hunting guides had diverse and differing perceptions about the causes of the conflicts, and made various suggestions for reduction of wildlife damage including animal scaring and controlled shooting. We conclude that, under current wildlife policy, conflict between people and BWCA is difficult to resolve. To reduce conflicts and promote sustainable conservation, we suggest co-management of wildlife involving all stakeholders, establishment of crop damage control teams, and promotion of tangible benefits to local people. There may be a requirement for site-specificity in management strategies.

Keywords Bénoué Wildlife Conservation Area, Cameroon, crop damage, human-wildlife conflict, livestock, protected areas.

This paper contains supplementary material that can only be found online at http://journals.cambridge.org

Introduction

Most of Africa's protected areas were created by colonial administrators without taking into account the concerns of local communities, and in most cases people were displaced or deprived of the traditional use of resources, causing them to suffer economic hardship (Gurung, 1995). Today crop damage and livestock depredation by wildlife are major sources of economic losses (Newmark *et al*., 1994; Tchamba, 1996), and local communities have in their turn threatened protected areas by poaching and by causing habitat loss through encroachment of farms into protected areas (Balakrishnan & Ndhlovu, 1992; Njiforti, 1996). Assessing information on such conflicts between people and protected areas is important for designing sustainable conservation and management strategies (Newmark *et al*., 1994; Ite, 1996; Naughton-Treves, 1998). In northern Cameroon, however, where conflicts between people and protected areas are threatening sustainable conservation, information on the nature of the conflict is lacking.

In the far north of Cameroon recent studies on human-wildlife relations have provided evidence of increased damage to crops by elephants (Tchamba, 1996). Elsewhere in northern Cameroon, however, where 35% of land is protected in the form of National Parks, hunting concessions and forest reserves, little is known about the status of human-wildlife conflict. Setting aside substantial areas formerly used by the community has reduced the options for activities such as agriculture, livestock rearing, fisheries, traditional hunting, and forest-related activities (Koulagna & Weladji, 1996).

New plans to create a Rhinoceros Sanctuary within the Bénoué Wildlife Conservation Area (BWCA) (Anon., 2000) may impose greater restrictions on the use by

Robert B. Weladji[1] (Corresponding author) NORAGRIC, Centre for International Environment and Development Studies, Agricultural University of Norway, PO Box 5001, N-1432 Ås, Norway.

Martin N. Tchamba WWF – Cameroon Programme Office, PO Box 6776, Yaoundé, Cameroon.

[1]Present address: Department of Animal Science, PO Box 5025, N-1432, Agricultural University of Norway, Ås, Norway.
E-mail: robert.weladji@ihf.nlh.no

Received 22 October 2001. Revision requested 22 March 2002. Accepted 30 August 2002.

© 2003 FFI, *Oryx*, **37**(1), 72–79 DOI: 10.1017/S0030605303000140 Printed in the United Kingdom

local communities of resources to which they have informal rights of tenure, and may intensify human-widllife conflict (De Boer & Baquette, 1998). Loss of the use of land may have serious long-term consequences for the local population, who depend on the BWCA for resources such as fuelwood, thatch, fish, bushmeat, medicinal plants, and pasture. Because local people have always resided within the BWCA, excluding them from access to resources without providing them with substitutes may be detrimental to conservation. Antagonism may arise because of increased competition between wildlife, livestock and people. Local community support may be of high importance in enhancing and sustaining conservation in the BWCA, as elsewhere in Africa (Brown & Wyckoff-Baird, 1995; Ite, 1996; Naughton-Treves, 1998). Co-management, in which local communities are involved in wildlife management in some way, has been suggested as a strategy for the resolution of conflict between protected areas and local communities (De Boer & Baquette, 1998; Udaya-Sekhar, 1998), although it may require considerable financial and political support (Naughton-Treves, 1999). Such an approach could be appropriate in northern Cameroon.

In the study reported here we identified the main conflicts between people and the BWCA. Our objectives were to estimate the extent of crop and livestock losses attributed to wildlife, investigate the impacts of local people on the BWCA, and identify the perceptions of local people, Park staff and professional hunting guides on solutions to reduce the conflicts.

Study area

The 8,438 km^2 of the Bénoué Wildlife Conservation Area (BWCA) encompasses the Bénoué National Park (BNP) and its surrounding hunting concessions, which are the transitional areas between the Park and cultivated land (Fig. 1). The BNP, created in 1968, was derived from the Bénoué Forest and Wildlife Reserve, which was until 1932 a hunting reserve owned by local communities and controlled by village chiefs. Local communities were resettled when the BNP was created. National Parks and hunting concessions are categories of protected area recognized by Cameroon's Wildlife Act. The main activities in Parks are protection, tourism and management. Hunting concessions are leased to private operators, generally professional hunting guides, for hunting and game safaris. The protection regime in these protected areas is generally poor because of limited personnel and inadequate equipment for patrolling.

The BWCA is well known in West Africa for its populations of large mammals, particularly the relict population of the West African black rhinoceros *Diceros bicornis longipes*, African wild dogs *Lycaon pictus*, elephant *Loxodonta africana africana*, and hippopotamus *Hippopotamus amphibius* (Anon., 1998). There are several villages around the Park, some of them within the hunting concessions of the BWCA. People's main livelihood strategies include small-scale agriculture, fishing and gold mining. The dominant ethnic groups are FulBés (the largest group), Dourou, Guizigua, Boum, Toupouri and Mesmé. Major crops include maize and millet, the staple foods, and also cotton, yams and sweet potatoes. Goats, sheep, pigs, poultry and to some extend cattle (mainly in Na'ari; Fig. 1) are the main livestock (Weladji, 1998).

Methods

Three communities were selected for household questionnaire surveys. Gamba to the south-west of the Park, Na'ari on the northern side, and Mbao to the south-east (Fig. 1). Gamba is located along a national road and therefore has more market opportunities than Na'ari, situated 70 km from the same road, but with access to it. Conversely Mbao is relatively inaccessible and has limited market opportunities. These communities have limited and inequitable access to land. The average annual income per household is 490,830 FCFA (Franc Communauté Financière Africaine, US $1 = 700 FCFA), greater than the minimum wage level in the country (282,168 FCFA), but with a high degree of inequality between households (Weladji, 1998).

The surveys were conducted from July 1997 to October 1997. Our key informants included village chiefs, who were interviewed prior to the formal survey. Seventeen park staff and seven professional hunting guides were interviewed on their perceptions of the impact of the local people on the protected area, their awareness of wildlife damage, and their suggested measures to reduce the losses.

The *sa'are* was used as the household sample unit. *Sa'are* means residential cluster in FulBé society, where many households from one family may cohabit. An inventory of the *sa'are* was made (Gamba, Na'ari and Mbao had 270, 250 and 19 households respectively), and 114 households (21%) were randomly selected for interviews: 46 in Gamba, 50 in Na'ari and 18 in Mbao. Questions (Appendix) were addressed to heads of households, usually men, as the women in these mostly Muslim communities were not greatly involved in public debate (Weladji, 1998). Information was collected on the crops grown and their yields, crop types, acreage, damage caused to each crop and the species of wildlife responsible, protection measures adopted and suggested measures of reducing losses, livestock type and number, number killed by wildlife and the species responsible, and current market prices. The impact of local people

https://doi.org/10.1017/S0030605303000140 Published online by Cambridge University Press

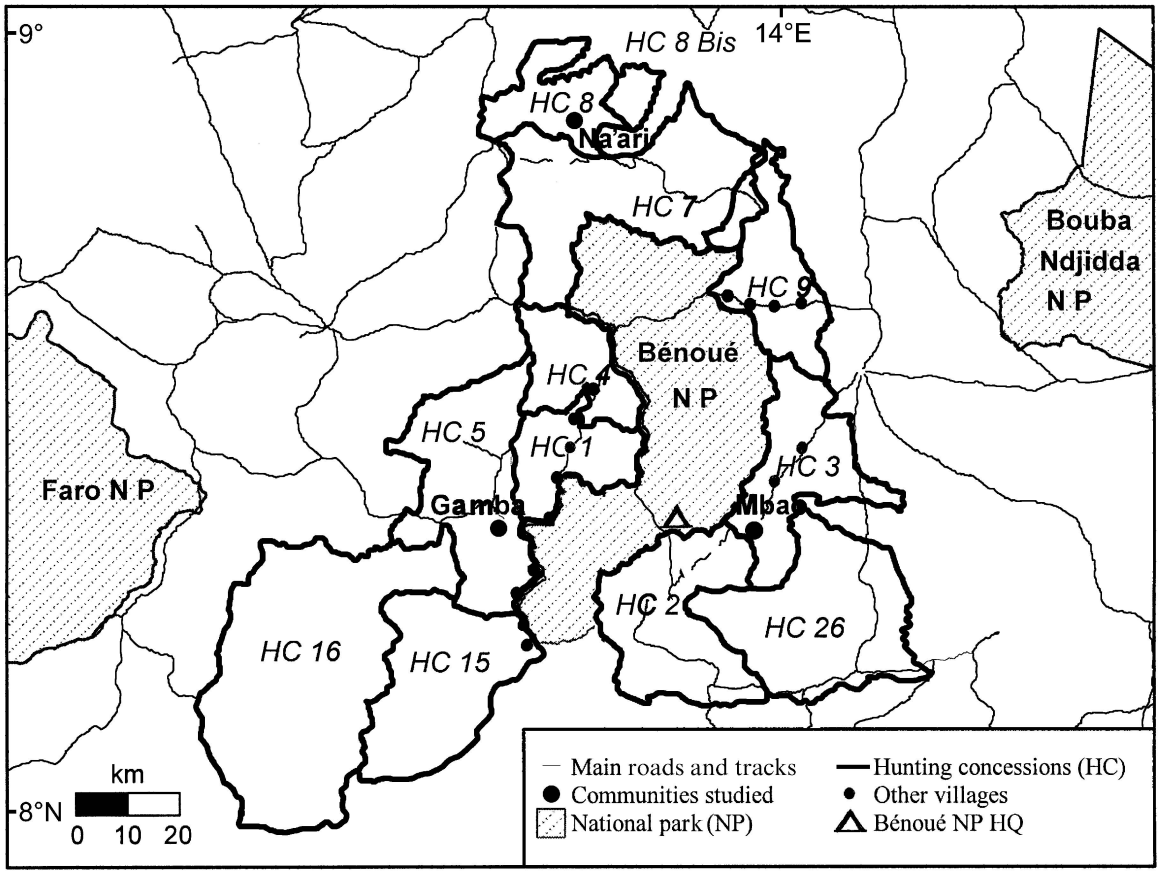

Fig. 1 Map of the Bénoué Wildlife Conservation Area, which comprises the Bénoué National Park and several hunting concessions, indicating the location of the three surveyed communities and the Park Headquarters.

on the protected area was assessed indirectly through questions concerning bushmeat consumption and origin, ownership of hunting guns, presence of traditional hunters in the community, possibilities for farm extension, and fuelwood, pole and thatch collection sites. The major constraints that local people faced due to the BWCA were also assessed, and miscellaneous field observations were made whenever possible and necessary during the course of the surveys.

Because some of the questions that we asked required recall of information, the quality of the data that we collected could have depended on the respondents' ability to remember and to estimate. We reduced this problem by involving as many household members as possible in each interview.

The responses were summarized and analyzed using the statistical software MINITAB (1998). The level of damage to crops was measured as the percentage of income lost, which was estimated from the proportion of the crop area damaged and the amount earned from the undamaged area. By multiplying the current market price of each livestock species predated by the number predated and summing for each household, we estimated the income lost due to wildlife predation of livestock. The level of damage was categorized as 'important' if the loss was >0 and $<25\%$, 'considerable' if it was 25–50% and 'severe' if it was $>50\%$.

Results

Eighty-six percent of households experienced crop damage: 91% in Gamba, 76% in Na'ari and 100% in Mbao, with a significant difference between the communities ($\chi^2 = 8.14$, $P = 0.02$, d.f. $= 2$). Thirteen animal species were responsible for damage (Table 1), with elephants, baboons, patas monkeys, green parrots and warthogs accounting for 97% of the cost of damage. The pattern of the level of damage by different species varied significantly between the three communities ($\chi^2 = 122.68$, $P < 0.001$, d.f. $= 6$). Elephants were responsible for the greatest proportional loss of crop income in Mbao and Na'ari, but no elephant damage was reported in Gamba, where baboons inflicted the highest proportion of loss (Fig. 2).

https://doi.org/10.1017/S0030605303000140 Published online by Cambridge University Press

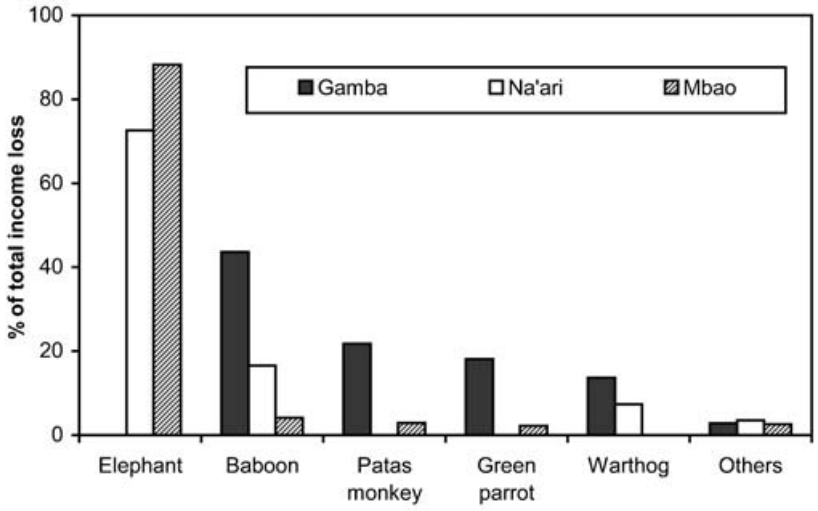

Fig. 2 Percentage of losses of crop income attributed to individual species of wildlife in each of the three communities studied in the Bénoué Wildlife Conservation Area.

Table 1 Percentage of households affected by crop damage and percentage of the estimated costs of damage caused by each of 13 wildlife species, in the three communities combined in the Bénoué Wildlife Conservation Area.

Species	Households affected (%)	Cost of damage (%)
Elephant *Loxodonta africana*	39.5	48.3
Baboon *Papio anubis*	50.0	23.7
Patas monkey *Erythrocebus patas*	24.6	9.4
Green parrot *Poicephalus senegalus*	25.4	7.8
Warthog *Phacochoerus aethiopicus*	22.8	7.8
Porcupine *Atherurus africanus*	10.5	1.7
Rat *Cricetomys* sp.	2.6	0.4
Weaver bird *Ploceus* sp.	1.8	0.2
Francolin *Francolinus* sp.	1.8	0.1
Jackal *Canis* sp.	0.9	0.2
Green monkey *Cercopithecus aethiops*	0.9	0.2
Hippo *Hippopotamus amphibius*	0.9	0.2
Ground squirrel *Xerus erythropus*	0.9	0.02

Table 2 Amount of crop damage by wildlife, calculated as lost income, suffered by affected households (see text for details) in each of the three communities studied in the Bénoué Wildlife Conservation Area, expressed as the percentage of households experiencing different levels of damage.

Level of damage	Gamba	Na'ari	Mbao	Total
None	8.7	24.0	0.0	14.0
'Significant' (<25%)	43.5	30.0	22.2	34.0
'Considerable' (25–50%)	26.1	14.0	5.6	18.0
'Severe' (>50%)	21.7	32.0	72.2	34.0

The level of crop damage varied between communities, with 72% of households in Mbao suffering severe loss of crop income, 44% in Gamba suffering a significant loss, and with a relatively even spread of damage levels in Na'ari (Table 2). Eleven crop types were damaged by wildlife (Table 3), with damage to maize, millet, yam and cotton accounting for 88% of the cost. Each species of wildlife had particular impacts on specific crops (Fig. 3). Francolins and ground squirrels damaged only groundnuts, green parrots had a severe impact on maize and millet, whereas elephants, baboons and monkeys damaged several crops. The level of income loss was greater in Mbao than in Gamba and Na'ari (Table 4). The average annual loss of crop income per household was estimated at 184,042 FCFA, with significant variation between households (ANOVA $F = 3.87$, $P = 0.024$, d.f. $= 113$). The level of loss was negatively correlated with the number of households per community ($r^2 = -0.99$, $P = 0.023$, d.f. $= 2$), but not with distance to the Park headquarters ($r^2 = -0.69$, $P = 0.51$, d.f. $= 2$).

Transmission of trypanosomiasis from wildlife was reported only by respondents from Gamba (3%). Fifty, 28 and 15% of respondents from Na'ari, Gamba and Mbao, respectively, experienced livestock depredation by wildlife. Twenty-four percent of the respondents reported predation by civet cats, 4% by hyaenas, 2% by snakes and 1% by baboons (some respondents reported more than one predator). Poultry, sheep and goats were the main prey. Predation resulted in an average of 18% of expected income from livestock being lost, with the level being greatest in Mbao (Table 4).

It was difficult to obtain peoples' views regarding poaching or hunting, but informal discussions revealed the presence of a few known poachers in each community. Eighty-eight percent of Park staff and 86% of professional hunting guides reported that people both from the communities within the BWCA and from nearby urban areas were responsible for poaching, but had different views about why people poached. Fifty-nine percent of Park staff believed that local people

https://doi.org/10.1017/S0030605303000140 Published online by Cambridge University Press

Table 3 Percentage of households in the three communities combined in the Bénoué Wildlife Conservation Area affected by wildlife damage to 11 crops, with estimated percentage of total crop areas damaged, and the cost of damaged expressed as a percentage of the estimated total income lost.

Crop	Households affected (% of total)	Damage (% of total crop area)	Cost of damage (% of total income lost)
Maize *Zea mays*	59.7	35.0	37.1
Millet *Sorghum* spp.	39.5	32.3	31.6
Yam *Dioscorea rotundata*	25.4	6.4	12.0
Cotton *Gossipium* spp.	33.3	10.6	7.6
Groundnut *Arachis hypogea*	22.8	7.7	5.1
Cassava *Manihot esculenta*	13.2	5.1	4.2
Cowpea *Vigna* sp.	4.4	2.3	1.9
Sweet potato *Ipomea batatas*	0.9	0.2	0.2
Beans *Phaseolus vulgaris*	0.9	0.4	0.2
Banana *Musa* spp.	0.9	0.03	0.04
Aubergine *Solanum melongena*	0.9	0.1	0.03

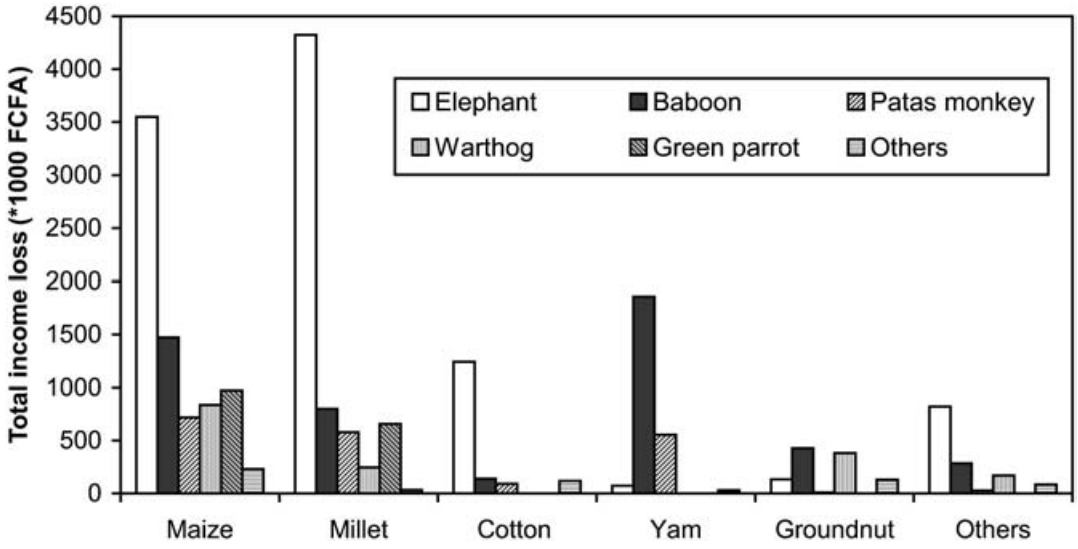

Fig. 3 Total losses of income for particular crops caused by species of wildlife in the Bénoué Wildlife Conservation Area, for the three studied communities combined.

Table 4 Estimated losses of annual crop and livestock income (*1,000 FCFA) per household due to damage and predation by wildlife (see Table 1) in each of the three communities studied in the Bénoué Wildlife Conservation Area.

	Gamba	Na'ari	Mbao	Total
Crop income				
Income loss	8,283.5	6,764.5	593.3	20,980.8
Actual income from crop	24,551.9	18,552.8	365.2	46,756.9
Expected income	32,835.4	25,317.3	958.5	67,737.6
Percentage of income loss	25.2	26.7	61.9	31.0
Livestock income				
Income loss	120.5	140.0	73.0	333.5
Actual income from livestock	492.0	928.1	57.6	1,477.7
Expected income	612.5	1,068.1	130.6	1,811.2
Percentage of income loss	19.7	13.1	55.9	18.4

poached mainly for subsistence, whereas 86% of professional hunting guides thought that they poached principally for cash. Fourteen percent of the professional hunting guides accused Park staff of being involved in poaching. There was no significant difference between the views of Park staff and professional hunting guides concerning the trend of poaching and other illegal activities ($\chi^2 = 1.75$, $P > 0.05$, d.f. $= 2$), which, according to 42% of respondents, was increasing. Although none of the respondents admitted being involved in poaching, arrests have been reported (Anon., 1997). Eighteen cases were registered from July 1996 to June 1997, of which 53% were from the communities neighbouring the protected areas, and the remainder included the military, hunting guides, game guards, and people from urban

https://doi.org/10.1017/S0030605303000140 Published online by Cambridge University Press

areas. We observed that there was increasing farm encroachment and new settlements in the hunting concessions.

Local people preferred animal scaring and controlled shooting as a means of minimizing losses (Table 5). Few people considered compensation to be an appropriate solution, and some were against it. Some respondents suggested fencing the protected area (Table 5). Park staff felt that scaring animals (82% of respondents), and controlled shooting (59% of respondents) were the most important measures for reducing wildlife damage, and only one respondent was optimistic about the efficiency of compensation. Conversely, most of the professional hunting guides (86%) felt that there should be compensation for losses due to wildlife damage, and 29% of them supported controlled shooting and 14% animal scaring.

Discussion

Our results show that, similar to findings from other African protected areas (Balakrishnan & Ndhlovu, 1992; Newmark *et al*., 1994; Naughton-Treves, 1998), wildlife is inflicting substantial losses on crops and livestock in the Bénoué Wildlife Conservation Area. Crop damage may be affecting food security, because it was the staple foods (maize and millet) that were most affected. Elephants and baboons were the main problem wildlife species, consistent with the general observation that larger animals receive greater attention in farmers' complaints (Bell, 1984). In contrast to some studies, birds were identified as significant pests, with the green parrot being one of the five species that inflicted most damage to crops. Although farmers may consider damage by larger wildlife to be the responsibility of the Government, they often consider birds in the same way that they consider insect pests, as their own responsibility.

Table 5 Measures suggested and opinions expressed (% of households) for the reduction of wildlife crop damage in each of the three communities studied in the Bénoué Wildlife Conservation Area.

	Gamba	Na'ari	Mbao	Total
Animal scaring	0.0	72.0	77.8	43.9
Controlled shooting	28.3	16.0	50.0	26.3
Shooting of all responsible animals	37.0	0.0	11.1	16.7
Fencing protected areas	0.0	20.0	5.6	9.7
Research to identify sustainable strategies	15.2	2.0	0.0	7.0
Against compensation	6.5	10.0	0.0	7.0
For compensation	8.7	4.0	5.6	6.1
Distribution of guns to kill problem wildlife	10.9	0.0	0.0	4.4
Immigration to increase the size of the village	0.0	2.0	5.6	1.8
Reduction in the size of the Park	2.2	0.0	0.0	0.9
Provision of salt licks during rainy season	0.0	2.0	0.0	0.9

In villages neighbouring protected areas large carnivores often have the greatest affect on livestock (Parry & Campbell, 1992; De Boer & Baquete, 1998; Udaya-Sekhar, 1998), but the civet cat was the main predator on poultry, sheep and goats in the BWCA. Other negative effects of BWCA mentioned by local people, but not quantified in this study, included the loss of cultural rights and values, and of indigenous knowledge and skills, and the direct harassment of people by wild animals (see also Tchamba, 1996).

Of the three communities surveyed, Mbao was closest to the Park headquarters and experienced the severest crop losses. This may be because wild animals were often concentrated to some extent in the vicinity of the Park headquarters, where they receive the greatest protection from both poachers and legal trophy hunters (Pierre Dongmo, Conservator of the BNP, pers. comm. 1997). People from Gamba did not suffer any losses due to elephants because the village is located along a national road where elephant density was low, as in other similar areas (Barnes *et al*., 1991). That damage by elephants was localized is consistent with other studies (Tchamba, 1996; Naughton-Treves, 1998).

Despite the fact that farmers watched their farms and used various strategies to scare animals, there was a perception that crop damage was increasing. Some animals, especially primates, often await the departure of farmers before moving into fields (Kavanagh, 1980). Use of fences was ineffective because most animals could easily cross over them (Udaya-Sekhar, 1998), and because of the limited availability of appropriate plant materials that could be used for constructing stronger fences (Tchamba, 1996). The inverse relationship between the level of loss and the number of households per community suggests that a greater number of people deters wildlife, especially large mammals such as elephants. However, careful consideration is required before this should be considered as a strategy to reduce human-wildlife conflict (Newmark *et al*., 1994), because it could increase the demand for land and other resources. Conversely, Naughton-Treves (1998) found no effect of human population density on damage levels or on the animals recorded as crop raiders in Uganda.

We noted that, in order to satisfy their basic needs, local people resorted to both 'illegal' encroachment of farms into the BWCA, and poaching, with the latter taking place mostly during the rainy season when hunting and tourist activities were closed. Poaching, however, also appeared to be carried out by other

https://doi.org/10.1017/S0030605303000140 Published online by Cambridge University Press

groups, including people from nearby urban areas and the military. Bushmeat represents *c.* 24% of the animal protein intake in the region (Njiforti, 1996).

Animal scaring was favoured as a strategy to minimize losses, especially to elephants, but there were often only one or two game guards for several villages (one game guard per *c.* 6,700 ha in 1997), rendering this method ineffective in reducing crop damage (Tchamba, 1996). Cameroon's Wildlife Act allows controlled shooting of problem animals, but the procedure to implement this is bureaucratically complicated. It is the larger animals that are usually culled, the meat of which is not particularly desirable (Njiforti, 1996), and therefore culling is not necessarily seen as a benefit. Local people in the BWCA were sceptical about compensation schemes for crop damage, probably based on past experiences and the lack of a fair scheme for distribution of compensation. Administrative and political authorities, rather than local people, are often the main beneficiaries. The fact that elephants are responsible for the greatest percentage loss to crops means that fences were largely ineffective (Thouless & Sakwa, 1995), and were not favoured as a means to prevent crop raiding. Settlement of rights to collect fuelwood or thatch, especially for farmers experiencing severe losses, may be a suitable method of compensation. Harvest of grass for thatching and other purposes has been widely acclaimed as a form of compensation in National Parks in Nepal (Sharma, 1991).

This study indicates that there are substantial conflicts between local residents and the BWCA. Local people suffer losses of crops and animals, and also loss of access to natural resources. The protected area therefore has an impact on people's livelihoods, and they are consequently encroaching on the BWCA by poaching and farm expansion. Such activities have long-term implications for the maintenance of the BWCA. A new approach is required that attempts to resolve this human-wildlife conflict whilst minimizing the cost to local people. There were differences between the three communities studied in the nature of the problems that they experienced, the pattern and level of damage, and people's adaptation or response to pressure from the protected area. This suggests that strategies for resolution of the conflicts between local people and the BWCA should include site-specific solutions. For example, Mbao, the community that experienced the greatest amount of damage by elephants, would benefit from the establishment of an elephant control team. Efforts to reduce conflicts could include assistance with the guarding of crops and for the development of strategies to alleviate damage, increased benefits such as regulated access to the natural resources of BWCA and increased recruitment from amongst local people, and the involvement of local people in wildlife management. Additionally, because support from local people may enhance the survival of the BWCA (Brown & Wyckoff-Baird, 1995; Ite, 1996) and because they have shown interest in participating in wildlife conservation (Weladji, 1998), we recommend co-management of the human-wildlife conflict as an approach to sustain wildlife conservation. The three major stakeholders (local people, professional hunting guides and wildlife authorities) should be involved. The first steps in such a development should be (1) an investigation of all causes of conflict between local people and the BWCA, (2) an examination of local traditional uses of natural resources, and (3) the initiation of research programmes into the local behaviour and movement patterns of elephants and baboons, the two wild species that cause the most damage to crops.

Acknowledgements

The Norwegian Agency for Development Cooperation (NORAD) financed this study. We extend our thanks to Pål Vedeld, Stein Moe, Koulagna Denis, Gufu Oba, Hubert Planton and two anonymous referees for constructive comments that improved the paper. Hubert Planton helped with the map.

References

Anon. (1997) *Rapport annuel d'activités. Exercice 1996/1997*. Unpublished Report, Délégation Provinciale de l'Environnement et des forêts du Nord, Garoua, Cameroon.

Anon. (1998) *Rapport d'inventaire faunique dans le parc national de la Bénoué*. Unpublished Report, WWF-Cameroon Programme office/Nothern Savannah Project, Garoua, Cameroon.

Anon. (2000) *Cameroon Black Rhino Conservation Strategy Technical Mission*. Meeting Final Report, 13–15 November 2000. WWF Cameroon Programme Office, Yaoundé, Cameroon.

Balakrishnan, M. & Ndhlovu, D.E. (1992) Wildlife utilization and local people: a case study in Upper Lupande Game Management Area, Zambia. *Environmental Conservation*, **19,** 135–144.

Barnes, R.F.W., Barnes, K.L., Alers, M.P.T. & Blom, A. (1991) Man determines the distribution of elephants in the rain forests of northeastern Gabon. *African Journal of Ecology*, **29,** 54–63.

Bell, R.H.V. (1984) Man-animal interface: an assessment of crop damage and wildlife control. In *Conservation and Wildlife Management in Africa: Proceedings of a US Peace Corps Workshop, Malawi* (eds R.H.V. Bell & McShane Caluzi), pp. 387–416. US Peace Corps, Washington, D.C., USA.

Brown, M. & Wyckoff-Baird, B. (1995) *Designing Integrated Conservation and Development Projects, Revised Edition*. Corporate Press, Landover, USA.

De Boer, W.F. & Baquete, D.S. (1998) Natural resource use, crop damage and attitudes of rural people in the vicinity of the Maputo Elephant Reserve, Mozambique. *Environmental Conservation*, **25,** 208–218.

Gurung, C.P. (1995) People and their participation: new approaches to resolving conflicts and promoting cooperation. In *Expanding Partnerships in Conservation* (ed. J.A. McNeely), pp. 223–233. Island Press, Washington, DC, USA.

Ite, U.E. (1996) Community perceptions of the Cross River National Park, Nigeria. *Environmental Conservation*, **23,** 351–357.

Kavanagh, M. (1980) Invasion of the forest by an African savannah monkey: behavioral adaptions. *Behaviour*, **73,** 238–260.

Koulagna, K.D. & Weladji, R.B. (1996) Gestion participative des Aires Protégées de la Province du Nord Cameroun. *Editions SNV Cameroon, 12/96*, Maroua, Cameroon.

Minitab (1998) *Minitab for Windows, release 12.22.* Minitab Inc., State College, USA.

Naughton-Treves, L. (1998) Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. *Conservation Biology*, **12,** 156–168.

Naughton-Treves, L. (1999) Whose animals? A history of property rights to wildlife in Toro, western Uganda. *Land Degradation and Development*, **10,** 311–328.

Newmark, W.D., Manyanza, D.N., Gamassa, D.M. & Sariko, H.I. (1994) The conflict between wildlife and local people living adjacent to protected areas in Tanzania: human density as a predictor. *Conservation Biology*, **8,** 249–255.

Njiforti, H.L. (1996) Preferences and present demand for bushmeat in north Cameroon: some implications for wildlife conservation. *Environmental Conservation*, **23,** 149–155.

Parry, D. & Campbell, B. (1992) Attitudes of rural communities to animal wildlife and utilization in Chobe Enclave and Mababe Depression, Botswana. *Environmental Conservation*, **19,** 245–252.

Sharma, U.R. (1991) *Park-people interactions in Royal Chitwan National Park*. PhD thesis, University of Arizona, Tucson, USA.

Tchamba, M.N. (1996) *Elephants and their interactions with people and vegetation in the Waza-Logone region, Cameroon*. PhD thesis, University of Utrecht, Utrecht, Netherlands.

Thouless, C.R. & Sakwa, J. (1995) Shocking elephants: fences and crop raiders in Laikipia District, Kenya. *Biological Conservation*, **72,** 99–107.

Udaya Sekhar, N. (1998) Crop and livestock depredation caused by wild animals in protected areas: the case of Sariska Tiger Reserve, Rajasthan, India. *Environmental Conservation*, **25,** 160–171.

Weladji, R.B. (1998) *Interactions between people and protected areas: The case of the Benoue Wildlife Conservation Area, North Cameroon*. MSc thesis, Agricultural University of Norway, Aas, Norway.

Biographical sketches

Robert B. Weladji is a wildlife ecologist, working since 1994 for the Ministry of Environment and Forestry, Cameroon. His research focuses on the grazing ecology and management of ungulates in relation to climatic variability.

Martin N. Tchamba is a wildlife ecologist and Director of Conservation for WWF-Cameroon. He has established a long term monitoring program for elephants in northern Cameroon.

Appendix

The Appendix for this article is available online at http://journals.cambridge.org

https://doi.org/10.1017/S0030605303000140 Published online by Cambridge University Press