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Impacts of community-based conservation on local communities in the Annapurna Conservation Area, Nepal

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Abstract. Approaches to the management of protected areas that involve the participation of local communities are now being widely promoted. However, the impacts of such community-based conservation initiatives on local communities remain poorly defined. This research examines the socio-economic impacts of community-based conservation within the Annapurna Conservation Area (ACA), Nepal, through semi-structured interviews and a questionnaire survey with local residents, situated both within and outside the protected area. Results indicate that local communities have received a number of benefits from conservation, including improvements in access to forest resources, improved basic infrastructure such as drinking water, trails and bridges, and improvements in health, sanitation and social services. However, relatively few people (14.9%) within ACA receive direct financial income from tourism. Local communities also experience a number of costs of being involved in conservation, the most significant of which is increased crop damage by wildlife. Eighty-four percent of respondents within ACA have experienced problems of crop damage, accounting for 6% (rice) to 23% (maize) of total production. Depredation of livestock by wildlife is also experienced; mean losses per household being the equivalent of £3.9 (Rs. 479.70) each year. However, 66% of respondents within ACA reported that they had never experienced this problem. These results indicate that the socio-economic benefits of community-based approaches to conservation can outweigh the costs, even though the latter are significant. However, a participatory approach to management of problematic animal species will need to be developed within ACA, if conflicts between local communities and protected area management are to be avoided in future.

Introduction

The designation and management of protected areas has become one of the main instruments for the conservation of biodiversity, and now constitutes a principal element of development planning in many countries (Pimbert and Pretty 1997). However, many protected areas were originally established by either displacing local communities or without giving sufficient consideration

to their livelihoods (Ghimire and Pimbert 1997). Designation of protected areas can result in a variety of negative consequences for rural communities such as the restriction of access to traditionally used resources (Mishra 1982b), the disruption of local cultures and economies by tourists (Hough 1988), increased depredation of crops and livestock by wild animals (Mishra 1982b) and displacement of people from their traditional lands, leading to social and cultural disruption and enforced poverty (Calhour 1972 and Lusigi 1984 cited in Hough 1988). Many protected areas consequently suffer from poaching, logging, agricultural encroachment or other forms of degradation (Wells and Brandon 1992; Terborgh and Schaik 2002).

Such concerns have led to a growing recognition that for protected areas to be effective, local people need to be closely involved in their management (Brandon and Wells 1992; Wells and Brandon 1992; DNPWC 1996; Oviedo and Brown 1999; Rao et al. 2002b). Approaches are required that effectively engage local people in management and decision-making, and that enable their livelihood needs to be adequately met. The concept of linking conservation with development has resulted in a major shift in conservation management, based on the assumption that if local communities derive some benefits from conservation, they will be more likely to contribute to conservation of biodiversity (Mishra 1982a; Sherpa et al. 1986; Lehmkuhl et al. 1988; Brandon and Wells 1992; Wells and Brandon 1992; IUCN 1998; Dudley et al. 1999; Stolton and Dudley 1999; Salafsky and Wollenberg 2000). The need to recognise and guarantee the rights of local communities in relation to natural resources and biodiversity conservation is also now widely appreciated (IUCN 2003).

Local people are increasingly being accepted as 'partners' in wider efforts towards sustainable management, an approach generally termed 'community-based conservation' (Mehta and Kellert 1998). The approach is based on the principle that conservation strategies should emphasise the role of local communities in decision-making (Adams and Hulme 1998). By definition, the conservation should be of, by and for communities (Murphree 1994), with the communities involved as active partners in protected area management (Songorwa et al. 2000). Community-based conservation programmes achieve their goals by: (1) allowing people living in and around protected areas to participate in land-use policy and management decisions; (2) giving people proprietorship or ownership over wildlife resources; and (3) providing local people with economic benefits from wildlife conservation (Hackel 1998).

Community-based approaches to protected area management have now been established in many areas, most notably in Africa, such as the CAMPFIRE, ADMADE and LIRDP programs. These initiatives have reported decreases in poaching, improved conservation through an increase in wildlife game scouts, provision of direct economic benefits from trophy hunting and implementation of development schemes (Metcalfe 1994; Lewis and Alpert 1997; Wainwright and Wehrmeyer 1998). Experience from these schemes has shown a degree of success, at least where big game animals are present (Hackel 1998). However, there are growing concerns that these schemes have succeeded

in protecting some of the larger mammals not by their ability to distribute socio-economic benefits but by virtue of their increased enforcement levels (Gibson and Marks 1995). In some cases, it has been reported that there has been no decrease in wildlife poaching as a result of the programmes, as poachers have shifted their tactics and prey selection (Gibson and Marks 1995). In many initiatives, communities are apparently not actively participating in planning and management (Metcalfe 1994; Wainwright and Wehrmeyer 1998; Songorwa et al. 2000). Local level institutions are also sometimes lacking, and as a result, management decisions are controlled by district- or state-owned institutions (Metcalfe 1994). There is also evidence of conflicts between rural peoples' economic needs and the implementation of community-based conservation (Hackel 1998). It has even been suggested that community-based conservation has rarely improved the standard of living of local communities (Wainwright and Wehrmeyer 1998).

Information on the effectiveness of the conservation-based approach is generally lacking (Hackel 1998), and therefore it is difficult to define under which situations the approach is most likely to be successful. Despite a lack of evidence regarding its effectiveness, the community-based approach is increasingly being promoted in many areas, including countries throughout Asia. In Nepal, most of the protected areas were originally established following a strict protectionist approach enforced by the armed forces. Despite the success achieved in protection of certain flagship species, a number of problems have emerged, including displacement of local communities, poaching of protected species, and confrontation between protected area guards and local communities. To address these problems, the Nepal government has recently introduced community-based approaches to protected area management.

The aim of this research was to examine the impact of the community-based approach on local communities within a protected area in Nepal. The research was undertaken in the Annapurna Conservation Area (ACA), the first conservation area declared in Nepal that involves the local communities directly in conservation. The overall responsibility for managing ACA lies with the King Mahendra Trust for Nature Conservation (KMTNC), a Nepali non-governmental organisation, but at a local level, natural resource management is the responsibility of local communities, whose activities are monitored by the Trust. Communities are involved in conservation planning and management, as well as being permitted to continue their traditional land use practices. Communities within ACA are also responsible for the implementation of integrated conservation and development programmes that are supported financially by income derived from tourist revenues (KMTNC-ACAP 1997, 1999). The objective of the research was to analyse the key factors that encourage local people to become involved in conservation and the costs and benefits of conservation to the local communities. Analyses were based on semi-structured interviews and a questionnaire survey with local communities situated both within and outside the protected area.

Study area

The Annapurna Conservation Area (ACA) is the largest protected area in Nepal, covering 7629 km^2, and is located in hills and mountains of west-central Nepal (83°57′ E, 28°50′ N), covering five districts (Nepal being divided into political units such as Zone, District and Village; District is the second largest political unit with more than one Village Development Committee. There are 14 zones and 75 Districts in Nepal). The area is bounded to the north by the dry alpine deserts of Dolpo and Tibet, to the west by the Dhaulagiri Himal and the Kaligandaki Valley, to the east by the Marshyangdi Valley and to the south by the valleys and foothills surrounding the town of Pokhara. ACA is well known both nationally and internationally for its scenic beauty, unique ecology and rich cultural heritage, including within its boundaries some of the world's highest mountains and the world's deepest river valley. The geology, physiography and climate all vary markedly across ACA, owing to the high altitudinal range and dissected topography, providing a wide range of different habitats and environments. Surveys of biodiversity within the area have been very limited to date, but more than 472 bird species, 21 species of amphibians, 32 species of reptiles and more than 101 species of mammals have so far been recorded (Inskipp and Inskipp 2001; KMTNC 1997). ACA is inhabited by approximately 120,000 people from five major ethnic and other tribal groups. Traditionally, the people of the region are highly dependent on natural resources, particularly native forests.

The present research focused on the southern slopes of the Annapurna range (Figure 1), which is the area most affected by ACA management policies. Study sites were selected on the basis of existing information and preliminary field visits, following consultation with conservation area management and district development committee members. Care was taken to select study communities that are characteristic of ACA on the basis of ethnic composition, resource use patterns, topography, climate, altitude and vegetation type. The study areas lie within the subtropical to temperate climatic zones, with a mean annual temperature of 16.3 °C and a mean annual rainfall of approximately 5000 mm. The study sites were divided between two areas, surrounding the villages of Ghandruk (Kaski district) and Bhujung (Lamjung district), respectively. Within both of these areas, villages inside and outside ACA were selected, with 14 villages selected in total. These were (with districts in parentheses) (i) inside ACA: Baghum (Lamjung), Bhujung (Lamjung), Chhomrong (Kaski), Dangsing (Kaski), Ghandrung (Kaski), Landrung (Kaski), Sabet (Kaski); (ii) outside ACA: Aantighar (Kaski), Bhulbhule (Lamjung), Maling (Lamjung), Mauja (Kaski), Ngadi (Lamjung), Sarangkot (Kaski), Taksar (Lamjung).

The study villages lie between 820 and 2100 m a.s.l., with most lying between 1600 and 1800 m a.s.l., and were between 3 and 8 h walking distance from the nearest road passable to motorised vehicles. The mean number of households per village was 92 ± 11.3, with a mean of 6.5 individuals per household. The

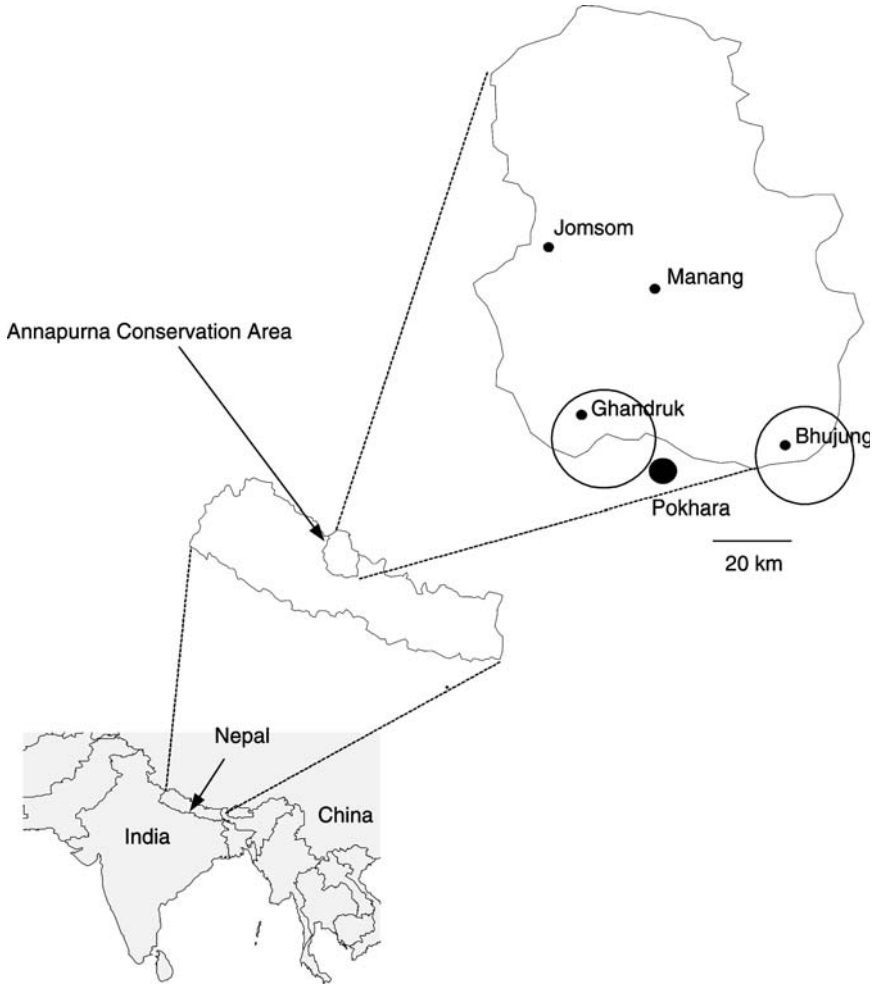

Figure 1. Location of the Annapurna Conservation Area.

main ethnic group in all cases was Gurung, but Magar, Brahman and Chhetri groups were also present. In addition, the Damais, Kamis and Sarki caste groups were present in all villages; many providing agricultural labour but typically owning little land themselves. All of these village communities are dependent on wild resources for fuelwood, fodder and timber. Natural forests are a common property resource, accessible to all members of the community. Agricultural land is always privately owned, but may include woodlots of planted trees. Agriculture is practised on terraced hill slopes. The principal crops grown are maize, millet and rice. Livestock farming (principally buffalo and cattle) is also carried out in all of the villages.

Before its declaration as a protected area, the resources within the ACA were managed by the government's District Forest Office. Although a few communities continued a traditional common property management system, in practice, the government did not have any control over the resources of the area. To improve the livelihood of local communities and to conserve the resource-rich mountain ecosystems, the government declared the area as a protected area with a new category. The 1973 National Parks and Wildlife Conservation Act was amended in 1989 to provide a legal basis for establishing multiple use conservation areas. The local communities of the protected area were encouraged to conserve and use the resources as part of this process.

The villages within ACA are currently the focus of integrated conservation and development programmes being implemented by the ACA Project (ACAP), which is managed by the KMTNC. Financial support is received from tourism revenues and international donors such as DFID (the UK government), WWF (USA), CIDA (Canada), SNV (the Netherlands), GEO and DSW (Germany). Study villages outside ACA also receive financial support for development, primarily from the national government and some donors such as the British Gurkha Welfare Office, HELVETAS (the Swiss government) and JICA/JOVC (the Japanese government). The ACA management helped local communities to reduce pressure on the natural forests by providing alternatives such as development of community and private woodlots for fodder and fuel wood and the provision of alternative energy sources. As a result of the conservation policy adopted by ACA, communities were made more responsible for the management of their resources, and benefited from improved availability of and access to natural forest resources.

Data collection and analysis

Social survey methods involved a combination of participatory research methods followed by structured interviews and a questionnaire survey of a sample village from each site. A structured questionnaire was developed during a pilot survey in conjunction with park staff. The issues raised in the pilot sessions were also incorporated in the questionnaire, which was tested and modified during the pilot survey. The information generated from participatory rural appraisal (PRA) was validated by results from other surveys. A variety of participatory tools was used (following Chambers 1997). Information on perceived costs and benefits to local communities was obtained by drawing an interactive cost-benefits chart. General patterns of forest resource use were obtained by using a participatory pie chart tool. Different locally available materials such as grains and stones were used to facilitate this tool.

Semi-structured interviews were applied to gather information on rationale for involvement in conservation, conservation benefits and costs of conservation. The interviews were conducted from November 2001 to February 2002

based on a pre-designed questionnaire (full details are provided by Bajracharya 2004). Respondents were asked a series of pre-established questions with pre-set response categories (Punch 1998). The questions were presented in an informal way to establish greater trust and dialogue, and to increase opportunities for other information to emerge. The interview team consisted of three persons experienced in questionnaire surveys, able to develop an appropriate rapport with the respondents. The interviews were conducted in Nepali or in local Gurung dialect. The structured questionnaires included both fixed-response and open-ended questions. In some cases, the respondents were invited to score the extent to which they agreed with the statement offered. A five-point Likert scale was used in this context, with 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The questions were written in Nepali.

Random stratified sampling was carried out within each village, stratifying households according to different social groups such as conservation leaders, elected leaders, tourism entrepreneurs, women and occupational groups, as defined by the park office and Village Development Committee (VDC) office. Households in each stratum were then selected randomly such that 15% of the total households in each village were interviewed (Sah and Heinen 2001). In each survey village, interviews purposely included at least two chairpersons from among various functional local institutions such as village development committee (local village government), conservation area management committee, mother's group, tourism management group and youth group identified during the PRA exercises.

An assessment of impact of wildlife conservation on communities was undertaken by conducting household interviews in the sampled villages. A structured questionnaire was posed orally to an adult individual in 150 households selected by stratified random sampling to ensure representative proportions of households from different geographical areas and across the main ethnic groups. It should be noted that the study areas were relatively homogeneous both in terms of the environment (forest cover) and population (ethnic groups). The survey covered 10% of all households in the sampled villages; this represented around 1% of the total number of households and 10% of the villages throughout ACA and in those areas studied outside. Information was collected on socio-economic issues such as crops grown and yields; livestock ownership; damage caused by wildlife on each major crop and livestock; species causing damage; percentage losses and protection measures adopted and attitudes toward wildlife conservation.

The data were analysed using SPSS v. 10.0 (SPSS Inc., Chicago, Illinois, USA). χ^2 tests were used to analyse frequencies. A *t*-test was used to compare means. Normality of the data was tested using the Anderson–Darling test. If the observations were not normally distributed, the data were log transformed prior to analysis. Nonparametric tests (Mann–Whitney *U*-tests) were used if the data were not normal even after transformation.

Results

Rationale for involvement in conservation

The semi-structured interviews indicated that the main reasons given by the respondents in ACA (n = 114) for their involvement in conservation were sustainable use of wild resources (72%), conservation education and awareness (65%), integration of local needs with conservation (50%) and infrastructure development (42.1%). The percentage of respondents citing these reasons for involvement in conservation were significantly lower outside ACA (n = 85, $p < 0.01$ in each case, χ^2-test). Devolution of management authority to the local communities (27.2%), involvement of women in conservation and development (23.7%) and community ownership of resources (22.8%) were also cited by ACA residents as important reasons to be involved in conservation activities, the former two reasons again being cited by a significantly higher percentage of respondents inside ACA than outside ($p < 0.001$ in each case, χ^2-test). Income from tourism was cited by a relatively low percentage of respondents (14.9 vs. 1.2% within and outside ACA respectively; p = 0.001, χ^2-test).

Benefits of conservation policy

The principal benefits of the conservation policy have been the reduced depletion of natural resources and increased wildlife, achieved by providing alternative fuelwood, fodder and other energy supplies. As a result of conservation policy, there has been an increase in fodder and fuelwood trees on private woodlots, regeneration of trees on degraded land, greatly increased local institutional development, an increase in forest cover, easier availability of fodder and fuelwood in the forest, improved water resources, an increase in wildlife populations, infrastructure development, and improvements in health and sanitation. These were all reported as benefits by the PRA participants. Results from PRA indicated that local communities in ACA depend on natural forests for '*Nigalo*' (a non-timber forest product, *Arudinaria* spp.), wild vegetables, timber, fodder and fuelwood, the latter two products being quantitatively the most important. The ACA management has also facilitated the restoration or strengthening of traditional resource management systems.

A majority of the respondents believed that access to major resources such as fuelwood and fodder has improved since involvement in ACAP. More than three quarters of the respondents in ACA (89.5%) compared to 36.5% outside strongly agreed with the statement that they have easy access to fuelwood and fodder. Support for social services through improvement in infrastructures in the villages was a further perceived benefit of involvement in conservation. The overwhelming majority of respondents in ACA (94%) either strongly agreed or agreed with the statement regarding satisfaction of village development

activities, whereas 78% of respondents reported that basic infrastructure such as drinking water, trails, bridges and health facilities had improved following the conservation intervention. Respondents outside ACA similarly reported that they have received support for infrastructure development through various government agencies and other sources. However χ^2 tests indicated that a greater proportion of ACA respondents perceived livelihood benefits compared to those outside ACA with respect to improvement of access to the village ($\chi^2 = 14.3$, $p < 0.0001$); bridge improvement ($\chi^2 = 44.3$, $p < 0.0001$), village sanitation improvement ($\chi^2 = 28.11$, $p < 0.0001$), and electricity provision ($\chi^2 = 21.67$, $p < 0.0001$). However, no significant differences were found with respect to drinking water improvement ($\chi^2 = 0.53$, $p = 0.47$), provision of health facilities ($\chi^2 = 0.44$, $p = 0.51$) or support for school improvements ($\chi^2 = 2.20$, $p = 0.14$).

Agriculture is the major economic activity in the area. More than half of the respondents (66.7%) in ACA reported that they had received support for agricultural development such as training in sustainable farming, access to vegetable seeds and seedlings, and technical help to establish a vegetable nursery. Only 36.5% of respondents outside ACA reported the same. A higher proportion of respondents in ACA reported that they received support than those outside ($\chi^2 = 17.86$, $p < 0.0001$), 13.2% reporting that they received improved varieties of cereal crop seeds and 38.6% receiving support for seasonal vegetable seeds and seedlings. Overall, within ACA, 81.6% reported that the number of economic opportunities in villages has increased. In contrast, only 34.3% outside reported this. ACA has also provided direct employment opportunities; among 242 ACA staff, almost half of them (49.6%) are local staff from the area.

Costs of conservation

The participatory research revealed that the major costs of conservation were an increase in crop damage by wildlife, a decrease in fodder grass species in forests, a decrease in wild mushroom availability in forests and a decrease in crop production as a result of shading by the on-farm plantations of trees.

More than a quarter of respondents (28.9%) in ACA reported that they have encountered livelihood difficulties since 1989, when ACA was declared. However, a χ^2-test revealed that this value was significantly lower inside than outside ACA ($p = 0.005$). Almost half of the respondents outside ACA (48.2%) reported that they have encountered difficulties as a result of the Government's forest conservation programme, principally the restriction of forest utilisation and a lack of grazing land (Table 1). Forest areas outside ACA do not have any legal designation but are generally under government control through the activities of the District Forest Offices. The government has recently been promoting community forestry to protect forest areas in the vicinity of settlements, which aims to manage and utilise forest resources for

Table 1. Potential difficulties experienced by local communities following introduction of conservation measures, identified through semi-structured interviews.

Difficulties	Inside ACA (%) (n = 114)	Outside ACA (%) (n = 85)	χ^2	p-Value
1. Restriction of forest utilisation	10.5	32.9	15.23	< 0.0001
2. Control of hunting	7.0	10.6	0.80	0.375
3. Lack of grazing land	3.5	27.1	23.03	< 0.0001
4. Restriction of commercial harvesting	3.5	4.7	0.18	0.671
5. Frequent intervention by conservation authorities	0.9	0	0.75	0.387
6. Decrease in forest-based small-scale industry	0.9	3.5	1.74	0.187
7. Crop damage and livestock depredation	15.8	12.9	0.317	0.573

and by the community but there are no integrated conservation efforts outside ACA. The results illustrated in Table 1, experienced outside ACA, may therefore reflect perceptions of community forestry initiatives. These difficulties were perceived to be significantly less of a problem within ACA ($p < 0.001$). However, crop damage and livestock depredation were reported as significant problems by the respondents in ACA (15.8%).

Most respondents in ACA (84%, n = 89) reported that they have experienced problems of crop damage by wildlife such as monkeys, deer, etc. at least some of the time. In general, the incidence of crop losses appeared to be more severe inside ACA than outside (Figure 2), where 28% reported that crop damage was either rarely or never experienced, compared to only 2% within ACA. Generally, perceptions of crop losses by wildlife varied considerably among study villages (Figure 3). This evidence suggests that crop damage by wildlife has intensified as a result of ACA. The incidence of crop damage also differed between villages; in six villages, 100% of respondents stated that they experienced crop damage at least some of the time.

Millet (*Sorghum* spp.), paddy rice (*Oryza sativa*), maize (*Zea mays*) and potato (*Solanum tubersum*) were the key crops damaged by wildlife, which are the main crops grown in ACA. Among the respondents in ACA, more than 97% (n = 89) reported that they cultivated maize and millet, and 51% cultivated potatoes. Of the total respondents, almost three quarters (74%) reported loss of maize by wild animals, whereas 38 and 42% reported loss of rice and millet, respectively. Crop losses were also estimated as a proportion of total production, based on the difference between reported yield and possible yield in the absence of crop damage on individual plots as reported by the respondents (Studsrod and Wegge 1995). Losses inside ACA ranged from 6% (rice) to 23% (maize) of total production (Figure 3). In the case of maize, millet and potatoes, the proportional losses were significantly higher inside ACA than outside (p = 0.001, 0.005 and 0.008, respectively, Mann–Whitney U-tests).

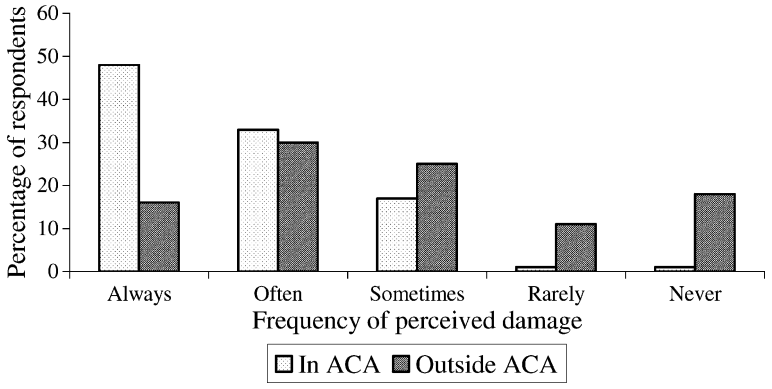

Figure 2. Frequency of perceived damage of crops by wildlife based on a questionnaire survey.

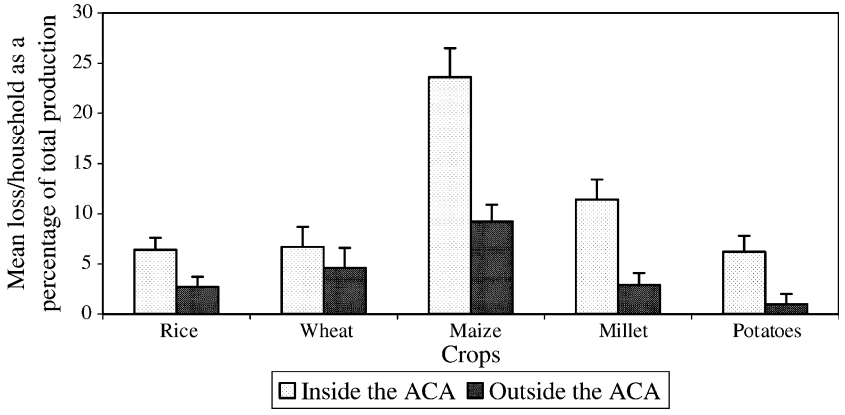

Figure 3. Estimated mean crop losses by each household in the study area based on a questionnaire survey.

Five species of animal were reported as significant causes of crop damage, both within and outside ACA (Figure 4). The Rhesus macaque (*Macaca mulatto*) and porcupine (*Hystrix indica*) were reported to be the most important causes of crop damage by respondents within ACA (87 and 72% respondents, respectively). These animals are difficult to drive away and often damaged substantial quantities of crops. The barking deer (*Muntiacus muntjak*), Himalayan black bear (*Ursus thibetanus*) and Common langur (*Semnopithecus entellus*) were also considered to be significant causes of crop damage by respondents (Figure 4). Approximately three quarters of the respondents within ACA either strongly agreed or agreed with the statement that pest wildlife species, especially the rhesus monkey and porcupine should be culled, while more than half of the total respondents outside ACA either strongly agreed or agreed with this statement. A Mann–Whitney *U*-test showed that the

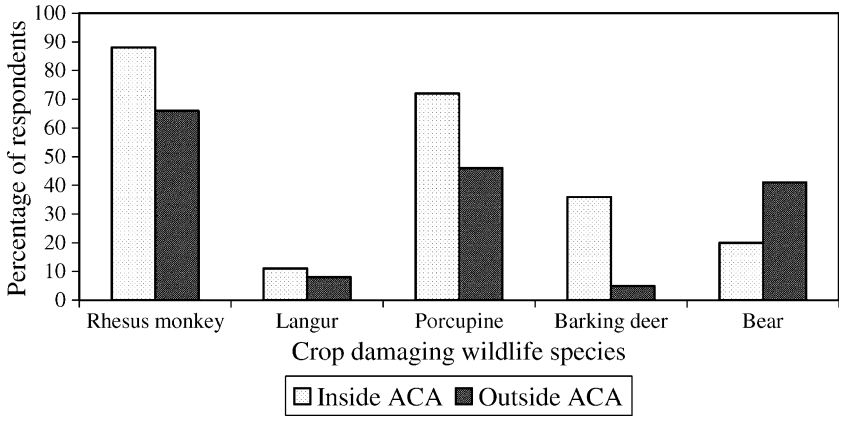

Figure 4. Respondent's ranking of the major crop damaging wildlife species as indicated in a questionnaire survey.

proportion that agreed was significantly higher in ACA ($U = 1904.5$, $p = 0.001$). The results show that there is a clear perception of wildlife damage within ACA and that this view is substantiated by physical evidence of crop loss, affecting a significant proportion of crop production.

Results indicated that the problem of livestock depredation by wild predators exists in ACA, but was not perceived to be serious by respondents, with a majority (66% within ACA, 64% outside) reporting that they had never experienced livestock depredation incidents (Figure 5). During discussions forming part of the PRA exercises within ACA, participants reflected that livestock depredation had decreased over the past two decades.

The majority of respondents both inside (94.4%) and outside ACA (97%) indicated that they raised livestock. Buffaloes were the main animals in both within and outside ACA. The mean ($\pm$ SE) livestock unit (LSU), which is calculated as a buffalo = 1.5 LSU; cattle = 1 LSU and goat and sheep = 0.20 LSU (source: Sekhar 1998), was 6.5 ± 1.0 and 4.1 ± 0.42 LSU per household within and outside ACA, respectively. There was no significant difference in livestock-holding inside and outside ACA. Despite buffaloes being the main livestock in the study area, none of the respondents either within or outside ACA reported killings by wild animals during the past three years. However, respondents in both areas reported occasional killing of cattle, goats and sheep. The establishment of the conservation area therefore appears not to have affected wildlife-livestock conflicts. The mean number of cattle, goats and sheep killed by wild animals was found to be no different within and outside ACA (Table 2).

On average, a household within ACA lost total animals valued at the equivalent of £3.9 (Rs. 479.70) each year. Similarly, a household outside ACA lost the equivalent of £3.6 (Rs. 442.80) each year. These estimates are based on prices provided by the respondents and the ACA Natural Resources Conservation section (Buffalo = £131.1; Cow = £12.2; Ox = £65.0; Goat = £24.4

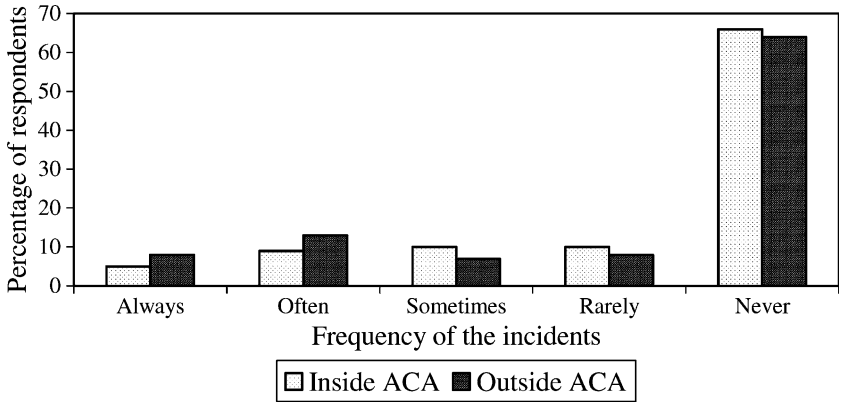

Figure 5. Frequency of livestock depredation by wild predators perceived by local communities as indicated in a questionnaire survey.

Table 2. Estimated livestock killing by wildlife over a three-year period (1999–2001), based on results from a questionnaire survey.

Households	Inside ACA (n = 89)	Outside ACA (n = 61)
Mean Livestock unit (LSU)	6.5	4.1
Livestock killed		
Buffaloes	0	0
Cattle	9	2
Goats and sheep	30	24
Total kills	39	26
Total kill in LSU	15	6.8
Average LSU loss (mean ± SE)	0.16 ± 0.04	0.12 ± 0.04

Livestock unit (LSU) is calculated as a buffalo = 1.5 LSU; cattle = 1 LSU and goats and sheep = 0.20 LSU. *Source*: Sekhar (1998).

and Sheep = £28.5; and 1 pound = Rs. 123.00). The common leopard (*Panthera pardus*) is the only carnivorous species held responsible for killing livestock in the area.

A further factor mentioned by respondents with respect to crop losses was the impact of shade from tree plantations. The local communities in ACA reported during the PRA exercises that crop yields decreased by a quarter in the farms adjacent to private or community woodlots. This was not a concern outside ACA as there are no such woodlots. It was also reported that the effects of tree-shade were more significant for small landholders.

Discussion

It is generally believed that local communities are more likely to support conservation initiatives if they receive direct benefits from them (McNeely

1995). The cost-benefit ratio of conserving a protected area must ultimately be positive for the local communities if conservation is to be effective in the long term (McNeely 1995). The results presented here show that local communities in ACA have received various direct and indirect benefits from their involvement in the protected area, which can be broadly categorised into consumptive use benefits, benefits from improved social services, and benefits from increased economic opportunities. In general, most of the benefits received by local communities in ACA were non-monetary and for subsistence purposes.

Fuelwood, fodder, timber, wild vegetables and other non-timber forest products, particularly *nigalo* (*Arudinaria* sps.), are major consumptive uses of natural forests in ACA. Among these products, fuelwood and fodder are the most important resources for subsistence use by local communities. The communities in ACA considered the implementation of un-bureaucratic and self-governing local management of the resources and improved rights of access to wild forest resources were the major consumptive use benefits of ACA. Imposition of the protected area regulations has not prohibited subsistence use of these resources. This is very different from other protected areas in Nepal where resource management and protection are carried out directly by the government without formal involvement of local communities (Sharma and Wells 1996; Nepal 2002). The current results also contrast with many communities living within or outside protected areas in other areas, where access to wild resources is often possible only under strict licenses or through illegal actions (Mishra 1982a; Sharma 1990; Hough 1991; Abbot and Mace 1999; Fortin and Gagnon 1999; Straede and Helles 2000). Bajracharya et al. (2005) indicate that as a result of introduction of community-based conservation approaches in ACA, fuelwood harvesting has declined, which can be attributed to measures such as the introduction of alternative forms of energy, conservation education and the development of fuelwood in private woodlots.

Improvements in basic social services such as sanitation and drinking water, primary healthcare and basic education, improve human development outcomes and also help to reduce poverty by raising human capability levels (UNDP 2002). Social development services with a strong system of local management are major visible and important benefits received by local communities within ACA. The present findings were broadly consistent with those of Mehta and Heinen (2001), indicating that the majority of ACA villages have adequate sanitation and drinking water facilities, trails, bridges, primary healthcare, primary education both for children and adults, provision of electricity and most importantly a system of community management of these services. The community-based approach to conservation has therefore helped to improve the living standards of local communities within ACA.

The majority of village infrastructure development projects are either financed through the revenue from park entry fees or from the support of international donors. A substantial proportion of the annual funding for conservation activities in ACA was, until the recent Maoist action, financed through tourist revenues (Gurung 2005). Similar infrastructural development

benefits have been reported from other community-based projects elsewhere (Metcalfe 1994; Pearl 1994; Wainwright and Wehrmeyer 1998; Infield and Namara 2001; Kangwana and Mako 2001). An overwhelming majority of respondents in the conservation area expressed satisfaction with social service developments. Services such as trails, schools, bridges, health-posts, water and electricity were either nonexistent or were highly seasonal before the inception of ACA. The official records of ACA also support these results (KMTNC-ACAP 1997, 1999, 2001; Kim and Karky 2001). ACAP has insisted on community participation, in cash or labour, in these social development projects to avoid investing as 'gifts' (Feldmann 1994). Community involvement in social services has been reported as insignificant elsewhere in Nepal (UNDP 2002). On the other hand, some infrastructure developments such as drinking water schemes, health facilities and school development were reported also to have improved outside ACA. Various donor agencies and some government agencies are actively working on delivering development programmes outside ACA. However, the majority of the study villages outside ACA do not currently have access to adequate health and educational facilities.

The major economic benefits received by local people within ACA were the investments made to improve social services, agriculture and livestock improvement, development of employment opportunities and provision of various training schemes. ACAP's annual investment in conservation and development, which is financed either through sharing revenue from the entry fee levied on tourists or from the support of international donors, is a major economic benefit to local communities. Unlike most national park entry fees (Metcalfe 1994; Lewis and Alpert 1997), these fees do not to go to national government treasury but are retained by KMTNC for conservation projects in ACA. This arrangement is unique in Nepal and is little-known elsewhere (Sharma and Wells 1996). Over the last 13 years (1989/90 to 2000/01), slightly more than £3.8 million (NRs. 471 million) revenue was collected from visitors and about £2.7 million (NRs. 330 million) was received from international donors. Of the total income during the period, £5.8 million was invested in conservation and development programmes. However, although agriculture and livestock farming are the major economic activities in the conservation area, it is clear that support to local communities regarding these activities is still a weak aspect of the ACA programme.

It has been reported that with the exception of lodge operation and other tourism businesses, many community members in ACA have not yet been able to benefit financially from conservation (Nepal et al. 2002). The current results also indicated that the majority of residents in ACA, with the exception of tourism entrepreneurs, have not received direct monetary benefits from conservation. However, evidence suggests that economic opportunities such as horticulture, poultry, bakery, and employment opportunities for skilled persons have been increased within the ACA villages. Nepal et al. (2002) reported that more than 1500 local people are employed by lodges alone in the southern slopes of the Annapurna area. Employment of the local communities within

the ACA management was also found to be significant. Of the total 242 ACA staff, 49.6% are locally hired. In contrast, it has been reported that local employment has been entirely neglected in management of protected areas in some other countries such as China (Ghimire 1997).

Despite the many important benefits of protected areas, local communities often have to bear a variety of different costs after an area is declared as a protected area, as a number of different negative consequences may ensue (McNeely 1995; Ghimire and Pimbert 1997; Lusigi 1982; Mishra 1982a; Hough 1988; McNeely 1995; Spergel 1997). The community-based conservation approach is designed to mitigate these costs by providing compensation or appropriate substitutions to reduce the need of local communities to exploit wild resources within protected areas. A surprisingly high proportion of the respondents within ACA reported that they have not encountered any major difficulty as a result of the protected area designation, although crop damage by wildlife in ACA was found to be a significant problem. This result needs to be treated cautiously, as respondents may have been reluctant to speak against the conservation programme. Nevertheless, it is possible that strengthened access to wild resources such as fuelwood and fodder, and tangible improvements in basic social services supplemented by increased conservation awareness have outweighed any difficulties encountered. This suggests that if local communities perceive direct benefits from conservation of wild resources, they may be more likely to accept a degree of crop damage (Naughton-Treves 1997).

Recent studies have reported similar crop losses in protected areas elsewhere (Studsrod and Wegge 1995; Naughton-Treves 1997; Sekhar 1998; Mehta and Heinen 2001; Miah et al. 2001; Rao et al. 2002a; Madhusudan 2003). The current results show that there is a clear perception of wildlife damage to crops within ACA and that this view is substantiated by physical evidence of crop loss, representing a significant part of income. The situation is significantly worse within ACA than outside, presumably as a result of conservation measures having resulted in increased populations of those species responsible for crop damage. The extent and intensity of crop damage may vary, depending on the cropping patterns (Rao et al. 2002a). The evidence suggests that crop damage has affected food security of the local communities, because staple food grains such as maize, millet and potatoes were the worst affected. The current results indicate that on average a household in ACA loses about a quarter of the annual maize production owing to wildlife damage, in an area where 18% of households were reported to be not able to meet their basic food needs (Banskota and Sharma 1995). The majority of local communities in ACA are at or below subsistence level (Gurung and DeCoursey 1994). Losses of crops to wildlife are therefore very significant to local communities. Discussions with the local communities indicated that the problem of crop damage has increased since the inception of ACA.

Studies have shown that crop damage by wild animals is one of the main reasons for park-people conflicts (Mishra 1982a; Sharma 1990; Osborn and Parker 2003; Weladji and Tchamba 2003). Despite the acute problem of crop

damage in ACA, local communities have not demanded compensation. However, during discussions local communities reported that an application for permission to kill crop-damaging animals has been made to the ACA management. Some questionnaire survey respondents expressed their frustration by criticising the ACA management for not giving proper attention to the issue. Therefore, crop damage could potentially be a major source of conflict between local communities and ACA management in future, if it is not properly addressed.

In contrast to reports from elsewhere (Studsrod and Wegge 1995; Sekhar 1998), only a few animal species were responsible for crop damage, particularly the Rhesus macaque and porcupine. However, respondents in Ghandruk, Landruk and Chhomrong villages also reported barking deer as a problem animal. Discussions with local communities indicated that the problem with the Rhesus macaque and porcupine existed before establishment of the conservation area, and they also reported a traditional system of controlling these animals, involving driving away or killing some of these animals annually. Trapping and killing of a few rhesus macaques was reported to be enough to keep away other animals from farmlands for a year. However, the legal prohibitions on killing of crop damaging animals appear to have resulted in increased crop damage. A high proportion of the respondents expressed the opinion that these crop-damaging animal species should be culled. This is not a surprising result and is a reflection of concerns over the present situation. Other recent studies have also shown a similar pattern of response from local communities (Mehta and Heinen 2001; see also Songorwa et al. 2000; Weladji and Tchamba 2003). Studies have shown that crop damage by wildlife is one of the main reasons for a negative attitude among local communities towards conservation even though they receive benefits from conservation (Parry and Campbell 1992; Heinen 1993; Newmark et al. 1993; Akama et al. 1995; Fiallo and Jacobson 1995; Studsrod and Wegge 1995).

It is important to note that according to 2002 IUCN Red List of Threatened Species (IUCN 2002), Rhesus macaque is in the lower risk category and Himalayan Black bear is classified as Vulnerable. Barking deer, leopard and porcupine are not considered threatened. However, present conservation regulations do not allow any wildlife to be controlled. According to the Conservation Area Management Guidelines, the ownership of wildlife remains with the government; hence permission from the government is generally required to control such problem animals. Discussions with PRA participants suggest that occasionally porcupine, Rhesus macaque, barking deer and Himalayan black bear are killed illegally when there are severe threats from these animals. The primary reason for these illegal actions is the protection of farm productivity and not direct monetary or subsistence benefits from the wildlife. Similar actions by local communities have also been reported from protected areas in India (Rao et al. 2002a).

In contrast, livestock losses either within or outside ACA were not found to be so significant; within ACA, the incidence of livestock depredation was

reported by less than a quarter of the respondents. Although it was reported previously that an increase in wildlife has in turn led to livestock depredation in ACA (Banskota and Sharma 1995), no evidence was found during the current research. In contrast, a study in Royal Bardia National Park, Nepal reported that about half of the households lost livestock to predators each year (Studsrod and Wegge 1995). However, in monetary terms, losses of domestic animals per household per year is higher in ACA than as reported by Studsrod and Wegge (1995), but lower than that reported by Sekhar (1998) in Sariska Tiger Reserve, India. A majority of the PRA participants in ACA believed that an increase in the population of ungulates, particularly barking deer, has reduced livestock depredation. They mentioned that in the past local people use to hunt barking deer, therefore leopards used to kill livestock. One explanation for a decrease in livestock depredation in ACA, therefore, could be that the prey–predator balance in ACA has altered.

However, there are other potential reasons for the results observed. Free grazing of domestic stock in forests has decreased considerably. As a result, competition between livestock and ungulates for grazing in the forest has been reduced. Evidence also suggests that there has also been a reduction in the number of small-bodied livestock such as goats and sheep thereby reducing the likelihood of depredation. Studsrod et al. (1995) reported that leopards kill small-sized animals such as goats and sheep. The common leopard is the only carnivore species held responsible for killing of livestock either in ACA or outside. In contrast, it has been reported from other protected areas that an increase in livestock population densities has also increased conflict with wildlife (Sekhar 1998). For example, Parry and Campbell (1992) reported that 59% of the households with livestock in Botswana complained of livestock losses during a year. The present evidence also does not support the suggestion that conflict with rural communities in ACA as a result of livestock depredation by large carnivores has increased in recent years.

Conclusions

The 1973 National Parks and Wildlife Conservation Act of Nepal was amended in 1989 to provide a legal basis for establishing multiple use conservation areas. With this amendment, conservation is not just limited to protection, but explicitly refers to protection and/or sustainable use of species and ecosystems. As a result of implementation of this policy in ACA, local communities have been given greater access to forest resources, and alternative sources of energy and fodder have been developed, which have reduced the impact of local communities on natural forest resources and associated biodiversity. The community-based approach to protected area management as implemented in ACA has also succeeded in delivering a range of benefits to local communities. These include consumptive use benefits, benefits from social services and increased economic opportunities. These improvements to the life

of local communities are associated with increasingly effective conservation of biodiversity within ACA. This is substantiated by a range of indicators such as reduced forest loss and increases in wildlife abundance (Bajracharya et al. 2005). However, local communities have also incurred significant costs, the most important of which is crop damage by wildlife. This implies that the management policy for ACA will need reviewing or modifying in future. One possible solution is to give more authority and responsibility to local communities to manage wildlife for their crop protection. However, this issue is controversial (Infield and Namara 2001), especially where some of the animals concerned are threatened with extinction. It has been argued that the future success of conservation in Nepal depends on the ability to provide local villagers with sufficient and varied resources to secure their livelihoods (Studsrod and Wegge 1995). The results of the current research suggest that if this is to be achieved, a participatory approach to management of problematic animal species will need to be developed.

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