

Human attitudes towards the conservation of protected areas: a case study from four protected areas in Bangladesh

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Abstract This study was based on interviews with 388 randomly selected households living near four protected areas in northern and south-eastern Bangladesh: Chunati Wildlife Sanctuary, Teknaf Game Reserve and two forest reserves. The respondents were generally poor and their perception of conservation varied across the study areas. Respondents were generally reluctant to embrace conservation and their attitude towards the conservation of protected areas depended on a set of demographic and socio-economic factors. People in northern Bangladesh had somewhat more positive attitudes towards conservation than those in the south-east. The two most important variables explaining respondents' attitudes towards conservation were the distance they lived from protected areas and their monthly income. People who are poor and who live closer to the protected areas disliked the conservation measures most.

Keywords Bangladesh, conservation attitudes, human attitudes, protected areas

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

Introduction

Conflicts between humans and wildlife over the use of natural resources have significant impacts on natural ecosystems and may cause the suppression or even local extinction of wildlife populations (Woodroffe et al., 2005). The creation of protected areas is a limited solution to this problem because effective conservation usually requires peaceful coexistence between people and wildlife, even outside protected areas. National parks, wildlife sanctuaries and game reserves are critical components of biodiversity conservation programmes. However, numerous problems, including the relationships between local residents and protected areas, have diminished their effectiveness (Newmark, 1996). During the past 2 decades intensive research has focused on understanding the attitudes, needs

and aspirations of local people (Newmark et al., 1993; Badola et al., 1998; Silori & Badola, 2000; Infield & Namara, 2001; Mehta & Heinen, 2001; Silori, 2001; Sekhar, 2003; Arjunan et al., 2006; Baral & Heinen, 2007a,b; Kideghesho et al., 2007; Røskaft et al., 2007; Spiteri & Nepal, 2008). Responding to local needs is a prerequisite for maintaining sustainability in protected areas (de Boer & Baquete, 1998) and the concerns of local residents must be addressed in long-term conservation and integrated into management strategies (Newmark et al., 1993; Kideghesho et al., 2007).

Thus, community-based protected area management using the co-management approach has grown out of attempts to find new solutions for the failure of the so-called fences and fines approach to conservation. The co-management approach is based on the idea that human communities adjacent to protected areas derive benefits from natural resources. These benefits motivate them to look after the resources and reduce their conflicts with wildlife. In this concept local people must have direct control over the use and benefits of natural resources so that they will value them and desire to use them in a sustainable manner. Local residents possess more intimate knowledge of their surroundings than state agencies. Moreover, local people are more likely to manage resources sustainably if their livelihoods depend on these resources. Managers must therefore find ways to increase the participation of local people in resource management.

Historically, protected areas in Bangladesh have been managed using approaches that exclude local people, whose interests have been viewed as incompatible with the conservation of protected areas. In 2004, with funding from the US Agency for International Development, the Nishorgo Support Project initiated a pilot programme using a co-management approach in five protected areas (including Teknaf Game Reserve and Chunati Wildlife Sanctuary). This approach builds partnerships between the Forest Department and key local and national stakeholders, especially with the people who live in and around protected areas. The project provided support for alternative income generating activities (such as cow fattening, nursery development, fish farming, and poultry rearing) for the members of community-patrolling and forest user groups. Nevertheless, the project has faced several challenges that have negatively affected the status of the natural resources, including the ownership and control of, and access to, local resources.

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Received 29 January 2010. Revision requested 14 June 2010.
Accepted 20 July 2010.

To design appropriate conservation strategies and policies to address the needs and expectations of local residents it is essential to understand their perceptions. However, the concept of human perceptions or attitudes is complex and varies between disciplines (Røskoft et al., 2007). Many approaches have been employed to understand the relationships between protected areas and local people, including describing the ways in which residents use their resources (de Boer & Baquete, 1998) and quantifying crop damage and livestock depredation by wildlife (Newmark et al., 1993; Studsrød & Wegge, 1995; Hill, 1998; Gadd, 2005; Holmern et al., 2006; Nyahongo et al., 2009). In addition, researchers have considered local residents' perception of conservation projects and the effects of such projects on their attitudes towards protected areas (Mehta & Kellert, 1998; Gillingham & Lee, 1999; Songorwa, 1999; Infield & Namara, 2001). However, relationships between people and protected areas are often confrontational and remain a major obstacle to successful conservation. These conflicts are multifaceted and poorly understood (Berkes, 2004) but studies have focused on the loss of access for traditional natural resource extraction and on the damage to crops and livestock inflicted by wildlife (de Boer & Baquete, 1998; Gillingham & Lee, 1999; Holmern et al., 2006; Nyahongo et al., 2009). Little attention has been paid to the non-economic benefits of protected areas that residents of developing countries may value, yet residents do value protected areas for non-economic reasons, including ecosystem services, wildlife conservation and benefits for future generations (Heinen, 1993; Newmark et al., 1993; Studsrød & Wegge, 1995).

Because the nature of conflicts between people and protected areas varies regionally and according to the social values and economic status of local communities, it is imperative to design protected area programmes to suit local needs. The aim of this study was to identify the nature of conflicts between local people and four contrasting protected areas in south-eastern and northern Bangladesh. We interviewed residents to identify the challenges and benefits related to protected area management and to explore how people perceive conservation projects. We hypothesized that conservation attitudes depend on the distance that people live from a protected area.

Study areas

This study was conducted in three protected areas in south-eastern Bangladesh (Teknaf Game Reserve, Chunati Wildlife Sanctuary, and a forest reserve adjacent to Dulahazara Safari Park) and in a forest reserve in northern Bangladesh (Fig. 1). The characteristics of these four areas are summarized in Table 1.

Teknaf Game Reserve, which encompasses 10 forest blocks in three forest ranges (Whykong, Silkhali and



FIG. 1 The locations in Bangladesh of the four protected areas around which the attitudes of people towards conservation were studied.

Teknaf) near the border with Myanmar, is managed by the Bangladesh Forest Department. It was established to protect the Asian elephant *Elephas maximus*. According to Article 2 of the Wildlife Preservation Act (1974) a Game Reserve is an area designated by the government to protect wildlife and to increase populations of important species, and within which the capture of wildlife is illegal. Teknaf Game Reserve is c. 48 km south of Cox's Bazar and is managed by the Cox's Bazar South Forest Division. The reserve is part of a hill range that slopes to rugged hills and cliffs on the central Teknaf Peninsula. Deep gullies and narrow valleys are crossed by numerous streams flowing down to the River Naf in the east and to the Bay of Bengal in the west. Most of the streams are seasonal and dry up during the non-monsoon season.

Chunati Wildlife Sanctuary, which also contains elephants, is managed by the Division of Wildlife and Nature Conservation of the Bangladesh Forest Department. A Wildlife Sanctuary is an area closed to hunting, shooting and trapping of wildlife, designated by the government as an undisturbed breeding ground, primarily for the protection of wildlife but also encompassing all natural resources, including vegetation, soil and water (Article 2,

TABLE 1 Summary description of the four protected areas (Fig. 1), and socio-economic data for the villages and villagers in the vicinity.

| | Teknaf Game Reserve | Chunati Wildlife Sanctuary | SE forest reserve | N forest reserve |
|--|-------------------------------------|-------------------------------------|--------------------|-------------------------------------|
| Management objective | Game Reserve | Wildlife Sanctuary | Natural forest | Natural forest |
| IUCN category (IUCN, 1994) | VI | V | 1b | 1b |
| Management authority | Forest Department | Forest Department | Forest Department | Forest Department |
| Area (km ²) | 116 | 78 | 27 | 5 |
| Altitude range (m) | 52–72 | 29–74 | 12–31 | 34–61 |
| Year designated | 1983 | 1986 | 1897 | 2006 |
| Access to the park | No entry | No entry | With permit | With permit |
| Buffer zone ¹ | Yes | Yes | No | Yes |
| NGOs working in the buffer zone | NSP ² | NSP ² | None | None |
| Extraction ³ | Dead wood & fodder from buffer zone | Dead wood & fodder from buffer zone | Dead wood & fodder | Dead wood & fodder from buffer zone |
| Household density (km ⁻²) ⁴ | 60.9 | 131.3 | 118.4 | 130.3 |
| Human density (km ⁻²) ⁴ | 392.5 | 785.9 | 753.1 | 655.3 |
| Male (%) ⁴ | 51.8 | 51.1 | 51.6 | 50.7 |
| Female (%) ⁴ | 48.2 | 48.9 | 48.4 | 49.3 |
| Literacy (%) ⁴ | 16.6 | 34.0 | 24.7 | 18.7 |

¹Transition zone between human settlements and protected area

²Nishorgo Support Project

³Illegal extraction of firewood and timber

⁴From the 1991 census (BBS, 1992)

Wildlife Preservation Act, 1974). The sanctuary is 70 km south of Chittagong City, to the west of the Chittagong–Cox's Bazar highway. The area is generally hilly, with shallow to deep gullies and gentle to steep slopes, and is traversed by numerous streams.

The forest reserve in the south-east is located within the Fasiakhali Range of the Cox's Bazar North Forest Division. The topography is undulating, with low hills < 100 m high; c. 15% of the area is inundated during the rainy season. Some narrow valleys retain water throughout the year, with perennial streams that have shallow pools. The reserve contains tropical evergreen forest with a rich flora and fauna.

The forest reserve in the Assam–Meghalaya region in the north includes parts of the Kangsha, Dhansail, Rangtia and Fakirabad unions (small administrative units in rural Bangladesh that consist of several villages) within the Jhenaigati subdistrict and of the Nayabill union within the Nalitabari subdistrict of the Sherpur district. The forest consists of a scattered secondary sal *Shorea robusta* forest. Sal forests are tropical moist deciduous forests consisting of patches of sal coppice and occasionally other tree species.

Methods

Respondents

Indigenous tribal people who have resided around the northern forest reserve for a long period of time are defined here as local people. In the early 1950s the Forest

Department had insufficient guards to protect Teknaf Game Reserve, Chunati Wildlife Sanctuary and the south-eastern forest reserve. Therefore, poor and landless people were resettled in these areas to provide protection. We define the current residents of these areas as local because they were born there and because they have land rights in the areas where they were resettled by the Forest Department but they do not have the right to sell or lease the given land to anybody. The Forest Department provided these people with c. 1 ha of land per household for agricultural activities to facilitate permanent residence so that the resettled communities could assist in patrolling the protected areas. People who have migrated to the vicinity of the study areas beginning in the early 1980s and who have settled there without the approval of the Forest Department are defined as immigrants. Most of these immigrants have resettled near the protected areas under the protection of various political and social platforms without the approval of the Forest Department. They have migrated from disaster prone areas, and political parties often consider them potential voters. These immigrants do not possess legal documents to support their land rights. We refer to both local people and immigrants as villagers.

Sampling and data collection

We obtained demographic data and a list of villagers for each village around the study areas from the local Union Councils. For each of the protected areas we recorded the position, with a global positioning system, of every

household within 1 km of the boundary of the protected area and plotted the location of each household on a map. We then conducted a total of 388 in-depth interviews using a semi-structured questionnaire (Appendix). The respondents included men and women over 18 years of age selected by random sampling in 99 villages (34 around Teknaf Game Reserve, 15 around Chunati Wildlife Sanctuary, 39 around the south-eastern forest reserve and 11 around the northern forest reserve) within 11 unions and eight subdistricts around the four study sites. The interview questionnaire included questions about socio-demographic variables, and questions to examine how people perceive the benefits and problems of protected areas and their opinions about the conservation of these areas. Usually heads of household were interviewed. In their absence any member of the household (mostly housewives) who was willing to participate was interviewed. Interviews were carried out both in the morning (to facilitate interviews with female respondents) and in the afternoon (mostly with males), resulting in similar numbers of men (193) and women (195). The respondents were chosen for interviews based on the distance of their household from the park boundary (< 0.5, 0.5–1.0 or > 1.0 km). They were further categorized on the basis of age (< 45 years or > 45 years), household size (small family or large family), gender (male or female), religion (Muslim, Hindu or Christian), education (illiterate or literate), occupation (farmer or non-farmer: businessman, housewife, teacher, student, service provider, political leader or daily labourer), land-holding status (0, 0.01–0.20, 0.21–0.40 or > 0.41 ha), settlement status (local or immigrant), monthly income (< USD 70 or > USD 70), ethnicity (Bengali or indigenous tribal) and population density of the village in which they lived (low or high). We also classified the study areas based on their degree of protection designated by the Bangladesh Government: high protection (Teknaf Game Reserve, Chunati Wildlife Sanctuary and south-eastern forest reserve) or low protection (northern forest reserve).

Data analyses

We analysed the data using SPSS *v. 16.0* (SPSS, Chicago, USA). We explored differences between the four protected areas in demographic and socio-economic characteristics, people's perceptions of benefits and problems, and attitudes towards conservation using χ^2 tests of independence. We used logistic regression analyses to quantify the contribution of protection status of protected areas, demographic and geographical factors (13 independent variables) in explaining the variation in perceived benefits and problems, and attitudes, towards the conservation of protected areas. For logistic regression analysis we combined the distance that respondents live from the protected area boundaries into two categories (< 0.5 km and > 0.5 km) and categorized the

study areas into two regions (south-eastern, with high protection, and northern, with low protection), and land-holding status of respondents into landless and landowners. We utilized the odds ratio to compare the probabilities of different perceptions using dichotomous categories of socio-demographic variables. An odds ratio of 1 implies that a particular perception is equally likely in both groups. An odds ratio > 1 implies that the perception is more likely in the first group. Conversely, the perception is less likely in the first group when the odds ratio is < 1. When regression coefficient (B) is negative the odds ratio must be inverted to indicate the odds. We used pseudo R^2 (of both Cox & Snell and Nagelkerke) as a metric for the goodness of fit to evaluate the predictive capacity of the model to explain variation in perceptions.

Results

Demographic and socio-economic analyses

The demographic and socio-economic characteristics of the respondents varied, significantly in most cases, between the four protected areas (Table 2). Mean age and family size were $39.1 \pm \text{SD } 13.0$ years and $6.3 \pm \text{SD } 2.6$ persons, respectively. The sex ratio of the respondents was approximately 1:1 but varied between areas. Most of the respondents were Muslims and were poor, illiterate non-farmers with little land. The majority of the respondents were residents or local people.

Benefits

Among the perceived benefits of protected areas three broad categories emerged: (1) extraction of timber and firewood, (2) financial incentives for alternative income generating activities, and (3) a healthy environment (improved stoves using biogas, clean drinking water, hygienic sewage systems, medical facilities and a children's school). However, the majority of respondents reported that the conservation programme provided no benefits with respect to timber and firewood extraction (66.2%), financial incentives for alternative income-generating activities (94.3%) or a healthy environment (90.2%). The percentage of people receiving benefits was largest near Teknaf Game Reserve and lowest near the northern forest reserve (Table 3).

A logistic regression analysis of the influence of the independent variables on respondents' perceptions of the three categories of benefits (Table 4) showed that the distance that the respondents lived from the protected area boundary, gender, land-holding status, and settlement status contributed significantly to the variation in perceptions regarding the extraction of timber and firewood. Occupation and total village population contributed significantly to the variation in perceptions regarding financial

TABLE 2 Demographic and socio-economic data (12 variables in all), obtained from and during interviews (see text for details), for 388 households around the four protected areas (Table 1, Fig. 1) with χ^2 tests of independence between the four areas. See text for the definition of non-farmer.

| Variable | Teknaf Game Reserve (n = 69) | Chunati Wildlife Sanctuary (n = 31) | SE forest reserve (n = 88) | N forest reserve (n = 200) | All protected areas (n = 388) | χ^2 | P |
|-------------------------------------|------------------------------|-------------------------------------|----------------------------|----------------------------|-------------------------------|----------|--------|
| Age | | | | | | | |
| % young (< 45 years) | 78.3 | 71.0 | 64.8 | 74.0 | 72.4 | | |
| % old (> 45 years) | 21.7 | 29.0 | 35.2 | 26.0 | 27.6 | 4.0 | 0.257 |
| Household size | | | | | | | |
| % small family (<4 members) | 14.5 | 12.9 | 11.4 | 37.0 | 25.3 | | |
| % large family (>4 members) | 85.5 | 87.1 | 88.6 | 63.0 | 74.7 | 30.3 | 0.0001 |
| Gender | | | | | | | |
| % male | 71.0 | 61.3 | 47.7 | 41.5 | 49.7 | | |
| % female | 29.0 | 38.7 | 52.3 | 58.5 | 50.3 | 19.7 | 0.0001 |
| Religion | | | | | | | |
| % Muslim | 100.0 | 100.0 | 100.0 | 33.5 | 65.8 | | |
| % Hindu | 0.0 | 0.0 | 0.0 | 31.5 | 16.2 | | |
| % Christian | 0.0 | 0.0 | 0.0 | 35.0 | 18.0 | 190.2 | 0.0001 |
| Education | | | | | | | |
| % illiterate | 92.8 | 96.8 | 96.6 | 90.0 | 92.5 | | |
| % literate | 7.2 | 3.2 | 3.4 | 10.0 | 7.5 | 4.8 | 0.190 |
| Occupation | | | | | | | |
| % farmer | 20.3 | 41.9 | 27.3 | 43.5 | 35.6 | | |
| % non-farmer | 79.7 | 58.1 | 72.7 | 56.5 | 64.4 | 15.7 | 0.001 |
| Land | | | | | | | |
| % landless | 52.2 | 29.0 | 43.2 | 20.0 | 31.7 | | |
| % landowner | 47.8 | 71.0 | 56.8 | 80.0 | 68.3 | 31.5 | 0.0001 |
| Settlement status | | | | | | | |
| % local | 58.0 | 64.5 | 56.8 | 94.0 | 76.8 | | |
| % immigrant | 42.0 | 35.5 | 43.2 | 6.0 | 23.2 | 69.3 | 0.0001 |
| Distance from protected area | | | | | | | |
| % < 0.5 km | 81.2 | 64.5 | 61.4 | 29.0 | 48.5 | | |
| % > 0.5 km | 18.8 | 35.5 | 38.6 | 71.0 | 51.5 | 68.9 | 0.0001 |
| Monthly income | | | | | | | |
| % poor (< USD 70) | 81.2 | 71.0 | 70.5 | 71.0 | 72.7 | | |
| % rich (> USD 70) | 18.8 | 29.0 | 29.5 | 29.0 | 27.3 | 3.0 | 0.384 |
| Village population | | | | | | | |
| % low (< 1,000) | 65.2 | 9.7 | 31.8 | 95.5 | 68.8 | | |
| % high (> 1,000) | 34.8 | 90.3 | 68.2 | 4.5 | 31.2 | 170.2 | 0.001 |
| Ethnicity | | | | | | | |
| Bengali (%) | 100.0 | 100.0 | 100.0 | 32.0 | 64.9 | | |
| Indigenous tribal (%) | 0.0 | 0.0 | 0.0 | 68.0 | 35.1 | 196.8 | 0.0001 |

incentives. Gender alone contributed significantly to the variation in perceptions regarding a healthy environment. The odds that respondents living closer to the protected area boundary reported a higher level of benefit from timber and firewood because of the conservation programme were 1,000 times greater than those for respondents living further away. Landless respondents reported more timber and firewood benefits than landowners, and immigrants' perceptions were similar to those of landless respondents. The odds that female respondents reported more benefits from timber and firewood compared to males were 26.1, whereas the odds that male respondents reported a high level of benefits from a healthy environment were 2.6 times

greater than those for female respondents. Non-farmers expressed a higher level of benefits from financial incentives than farmers, and residents of small villages expressed similar perceptions.

Problems

Among the perceived problems associated with protected areas, three categories also emerged: (1) crop raiding by wildlife, (2) damage to, or destruction of, homes by wild elephants, and (3) fear of collecting water and firewood in the evening because of wild elephants. Almost half of the respondents claimed that they experienced problems from

TABLE 3 Percentage of respondents listing at least one benefit related to firewood and timber extraction, financial incentives and a healthy environment (see text for details) from each of the four protected areas (Table 1, Fig 1), and χ^2 tests of independence between the four areas.

| Benefit | Teknaf Game Reserve (n = 69) | Chunati Wildlife Sanctuary (n = 31) | SE forest reserve (n = 88) | N forest reserve (n = 200) | All protected areas (n = 388) | χ^2 | P |
|----------------------|------------------------------|-------------------------------------|----------------------------|----------------------------|-------------------------------|----------|--------|
| Firewood & timber | 59.4 | 48.4 | 55.7 | 13.0 | 33.8 | 80.7 | 0.0001 |
| Financial incentives | 18.8 | 6.5 | 8.0 | 0.0 | 5.7 | 35.3 | 0.0001 |
| Healthy environment | 26.1 | 22.6 | 13.6 | 0.5 | 9.8 | 47.5 | 0.0001 |

their nearest protected area because of crop raiding by wildlife, including wild elephants, and one-third reported fear of evening elephant attacks. A quarter of the respondents reported that wild elephants had damaged or destroyed their houses but the percentage of people with this problem was not statistically different between the protected areas (Table 5). Crop raiding by wildlife was highest around Teknaf Game Reserve and lowest around the northern forest reserve. The majority (97.9%, n = 188) of respondents living within 0.5 km of the protected area complained of problems with crop raiding, whereas few (3.5%) of those living farther away had similar complaints ($\chi^2 = 345.3$, df = 1, $P < 0.0001$). Similarly, the largest percentage of those who complained about fear of elephant attacks lived within 0.5 km of the protected areas (52.7%). Only 11.5% of those living > 0.5 km from a protected area boundary expressed this fear ($\chi^2 = 76.2$, df = 1, $P < 0.0001$).

A logistic regression analysis of the influence of the independent variables on respondents' perceptions of these problems showed that distance from protected area boundary and gender contributed significantly to the variation in all three categories (Table 6). In addition, education and occupation contributed significantly to the variation in perceived problems with crop raiding by wildlife, ethnicity

and education contributed significantly to the variation in problems associated with the destruction of homes by wild elephants, and financial status, degree of protection of protected areas, occupation and ethnicity contributed significantly to the variation in the perceived risk of evening elephant attacks. The odds that respondents living close to the park boundary reported high levels of problems associated with crop raiding, destruction of homes and fear of evening elephant attacks were 10,000 times, 18.5 times and 14.1 times greater, respectively, than those for respondents living farther away. Male respondents reported higher levels of crop raiding, damage to homes and fear of elephant attack than female respondents. The ethnicity of the respondents also significantly explained the variation in perceptions related to damage to homes and fear of attack by wild elephants, as Bengalis reporting these problems were 8.1 times greater and 4.8 times greater compared to indigenous people, respectively. Education status was also a significant factor; the odds that illiterate respondents reported high levels of problems related to crop raiding by wildlife and destruction of homes by wild elephants were 333 times and 17.5 times greater, respectively, than those for literate respondents. Occupation status significantly explained the variation in perceptions of crop raiding and fear

TABLE 4 Results of logistic regression analyses to examine the effects of 13 independent variables (see text for details and Table 2) on three perceived benefits of conservation: timber and firewood extraction, financial incentives, and a healthy environment. Only the independent variables making a significant contribution are shown.

| | B | SE | Wald | df | P | Odds ratio ¹ |
|---|-------|------|-------|----|--------|-------------------------|
| Timber & firewood extraction² | | | | | | |
| Distance of home from protected area | -6.92 | 1.19 | 34.02 | 1 | 0.0001 | 0.001 |
| Gender | 3.26 | 0.72 | 20.30 | 1 | 0.0001 | 26.07 |
| Land | -2.21 | 0.60 | 13.39 | 1 | 0.0001 | 0.110 |
| Settlement status | 1.29 | 0.58 | 5.08 | 1 | 0.024 | 3.661 |
| Financial incentives³ | | | | | | |
| Occupation | 2.48 | 1.08 | 5.27 | 1 | 0.022 | 11.912 |
| Village population | -1.79 | 0.79 | 5.07 | 1 | 0.024 | 0.166 |
| Healthy environment⁴ | | | | | | |
| Gender | -0.98 | 0.45 | 4.74 | 1 | 0.029 | 0.377 |

¹A measure of association between the dependent variable and each independent variable. When B is negative, the odds ratio must be inverted (1/odds ratio) to indicate the relevant odds.

²Cox & Snell $r^2 = 0.607$; Nagelkerke $r^2 = 0.841$

³Cox & Snell $r^2 = 0.155$; Nagelkerke $r^2 = 0.438$

⁴Cox & Snell $r^2 = 0.166$; Nagelkerke $r^2 = 0.351$

TABLE 5 Percentage of respondents listing at least one problem related to crop raiding by wildlife, destruction of homes by wild elephants and fear of evening elephant attacks for each of the four protected areas (Table 1, Fig 1), and χ^2 tests of independence between the four areas.

| Problem | Teknaf Game Reserve (n = 69) | Chunati Wildlife Sanctuary (n = 31) | SE forest reserve (n = 88) | N forest reserve (n = 200) | All protected areas (n = 388) | χ^2 | p |
|--|------------------------------|-------------------------------------|----------------------------|----------------------------|-------------------------------|----------|--------|
| Crop raiding by wildlife | 85.5 | 67.7 | 58.0 | 30.0 | 49.2 | 72.9 | 0.0001 |
| Destruction of homes by wild elephants | 33.3 | 16.1 | 21.6 | 26.0 | 25.5 | 4.4 | 0.222 |
| Fear of evening elephant attacks | 33.3 | 54.8 | 51.1 | 18.5 | 31.4 | 39.4 | 0.0001 |

of elephant attack. The odds that non-farmers reported high levels of crop raiding compared to farmers were 8.1, and the odds that farmers reported high levels of fear compared to non-farmers were 3.1. Furthermore, financial status and the degree of protection of the protected area also significantly contributed to the variation in fear of elephant attack. Poor villagers reported more fear of elephant attack than rich villagers. Residents in the south-east (highly protected areas) expressed similar perceptions to those of residents in the north (less protected areas).

Attitudes

Approximately two-thirds of the respondents indicated attitudes opposed to the conservation programmes, with

significant differences between the four protected areas (Table 7). A logistic regression analysis revealed that the variable explaining most of the variation in attitudes towards the conservation programme was the distance the respondent lived from the park boundary (Table 8). The odds that respondents living further from the park boundary favoured the conservation of the protected area were 322 times greater than for respondents living closer. Financial status was the second most important predictor of this attitude. The odds that wealthy or rich respondents favoured the conservation programme were 7.4 times higher for poor respondents. The land-holding status of the respondents and village size were the third and fourth most important predictors, respectively. Landowners favoured the conservation programmes more than landless

TABLE 6 Results of logistic regression analyses to examine the effects of 13 independent variables (see text for details and Table 2) on three perceived problems related to conservation: crop raiding by wildlife, destruction of homes by wild elephants and fear of evening elephant attacks. Only the independent variables making a significant contribution are shown.

| | B | SE | Wald | df | p | Odds ratio ¹ |
|---|--------|------|-------|----|--------|-------------------------|
| Crop raiding by wildlife² | | | | | | |
| Distance of home from protected area | -10.49 | 1.74 | 36.29 | 1 | 0.0001 | 0.0001 |
| Gender | -3.66 | 1.26 | 8.46 | 1 | 0.004 | 0.026 |
| Education | -5.73 | 2.16 | 7.02 | 1 | 0.008 | 0.003 |
| Occupation | 2.09 | 0.91 | 5.28 | 1 | 0.022 | 8.119 |
| Destruction of homes by wild elephants³ | | | | | | |
| Distance of home from protected area | -2.92 | 0.43 | 45.11 | 1 | 0.0001 | 0.054 |
| Ethnicity | -2.09 | 0.59 | 12.26 | 1 | 0.0001 | 0.123 |
| Gender | -1.03 | 0.34 | 9.00 | 1 | 0.003 | 0.357 |
| Education | -2.86 | 1.15 | 6.24 | 1 | 0.012 | 0.057 |
| Fear of evening elephant attacks⁴ | | | | | | |
| Distance of home from protected area | -2.64 | 0.39 | 43.89 | 1 | 0.001 | 0.071 |
| Gender | -2.57 | 0.41 | 39.65 | 1 | 0.001 | 0.076 |
| Financial status | -1.65 | 0.39 | 17.17 | 1 | 0.001 | 0.192 |
| Degree of protection of protected areas | -1.82 | 0.57 | 10.18 | 1 | 0.001 | 0.161 |
| Occupation | -1.12 | 0.37 | 9.43 | 1 | 0.002 | 0.326 |
| Ethnicity | -1.57 | 0.56 | 7.89 | 1 | 0.005 | 0.208 |

¹A measure of association between each independent and dependent variable. When B is negative, the odds ratio must be inverted (1/odds ratio) to indicate the relevant odds.

²Cox & Snell $r^2 = 0.705$; Nagelkerke $r^2 = 0.940$

³Cox & Snell $r^2 = 0.284$; Nagelkerke $r^2 = 0.419$

⁴Cox & Snell $r^2 = 0.368$; Nagelkerke $r^2 = 0.517$

TABLE 7 Percentage of respondents favouring or disfavouring protected area conservation in terms of the benefits and problems with respect to their nearest protected area, for each of the four protected areas (Table 1, Fig 1), and χ^2 tests of independence between the four areas.

| Opinion | Teknaf Game Reserve (n = 69) | Chunati Wildlife Sanctuary (n = 31) | SE forest reserve (n = 88) | N forest reserve (n = 200) | All protected areas (n = 388) | χ^2 | p |
|-----------|------------------------------|-------------------------------------|----------------------------|----------------------------|-------------------------------|----------|--------|
| Disfavour | 91.3 | 77.4 | 75.0 | 58.5 | 69.6 | | |
| Favour | 8.7 | 22.6 | 25.0 | 41.5 | 30.4 | 29.1 | 0.0001 |

respondents, and those living in larger villages expressed similar attitudes. The final significant predictor was the degree of protection of protected areas. The odds that respondents in the north (less protected areas) showed more positive attitudes were 21.7 times greater than for respondents in the south-east (highly protected areas).

Discussion

The current human population of Bangladesh is > 162 million, giving an approximate population density of 1,475 people per km² (BBS, 2009). Of the total land area of 14.4 million ha, only 2.4 million ha are under forest or tree cover. As a result, forests cannot fully meet local requirements for firewood. In our study the distance that respondents live from a protected area boundary was an important factor influencing the magnitude of perceived benefits related to the collection of timber and firewood from a protected area. The majority of landless, poor and immigrant residents interviewed live close to a protected area boundary. This close proximity provides opportunities to extract resources such as firewood and timber illegally. To halt such illegal extraction protected area authorities in the Nishorgo Support Project have provided financial support to poor, landless people and to poor farmers of the forest-user groups who participate in alternative income-generating activities (Fox et al., 2007).

However, members of the forest-user groups expressed dissatisfaction with the amount of support and lack of financial incentives for alternative income-generating activities provided by the Nishorgo Support Project in

Teknaf Game Reserve and Chunati Wildlife Sanctuary. Our personal observations and informal discussions with villagers revealed that local politics and corruption play a role in depriving these people of their rights. For example, the selection of villagers to participate in the co-management conservation programme was highly biased. In some cases, relatives of village leaders were appointed to the co-management committees. Some villagers who were not members of the co-management group reported that their voices were ignored in the decision-making process and that most of the disadvantaged, landless, poor people were excluded from the benefits of the conservation programme.

We found that gender plays a role in the perception of benefits related to the collection of timber and firewood from the protected areas. Women reported greater benefits related to timber and firewood extraction than men. This difference may have occurred, however, because women have more restricted access to relevant information and were thus unable to give a reliable answer. The social status of women in Bangladesh is low, especially in rural areas. Rural women are one of the most deprived sections of society, facing social oppression and economic inequality. Most of these women are extremely poor (Parveen & Leonhäuser, 2004).

The perception of problems related to protected areas was mainly determined by how far the households were from the four areas studied. Villagers living close to a protected area complained more about problems with crop raiding, destruction of homes and fear of attack by wild elephants compared to those living further away. The villagers reported that agriculture was not profitable close

TABLE 8 Results of a logistic regression analysis showing the effects of 13 independent variables (see text for details and Table 2) on attitudes (favour or disfavour) towards conservation programmes in terms of the benefits and problems from the protected areas. Only the independent variables making a significant contribution are shown.

| Socio-economic variables | B | SE | Wald | df | P | Odds ratio* |
|---|------|------|-------|----|--------|-------------|
| Distance of home from protected area | 5.78 | 1.09 | 28.34 | 1 | 0.0001 | 322.35 |
| Financial status | 1.99 | 0.48 | 17.34 | 1 | 0.0001 | 7.37 |
| Land | 1.87 | 0.64 | 8.62 | 1 | 0.003 | 6.50 |
| Village population | 3.15 | 1.23 | 6.53 | 1 | 0.011 | 23.29 |
| Degree of protection of protected areas | 3.08 | 1.27 | 5.86 | 1 | 0.015 | 21.67 |

*A measure of association between each independent and dependent variable. When B is negative, the odds ratio must be inverted (1/odds ratio) to indicate the relevant odds. Cox & Snell $r^2 = 0.473$; Nagelkerke $r^2 = 0.669$.

to the protected areas because of the intensity of crop damage by wildlife. Consequently, more people living close to protected areas were involved in day labour rather than in farming. Most day labourers and farmers complained that they were obliged to take loans of BDT 10,000–15,000, at high interest, from local moneylenders each sowing season but crop loss caused by wildlife meant that most of them failed to repay the loan on time. These respondents were then obliged to engage in day labour to repay their loans. Male respondents reported more problems with crop raiding, damage to houses and fear of elephant attack than did female respondents. Men are the primary gatherers of resources and frequently encounter wild elephants; this difference in gender roles may explain the difference in perceived problems. The ethnicity of the respondents also significantly affected the perceived risk of attack by wild elephants. Bengalis feared elephant attack more than indigenous people. This difference may be explained by the fact that indigenous tribal people have culturally had experience with elephants over a longer period of time.

Although conservation is important and beneficial as a strategy to ensure the protection of people and their crops from raiding wildlife (Hill, 1998), in this study villagers expressed dissatisfaction and discontent with bearing the costs associated with animals managed by the government. However, elsewhere, villagers may support conservation if they receive compensation for crop and house damage (Wang et al., 2006). In this context, it is important to improve management–people relationships in conservation (Newmark et al., 1993). The top-down approach needs to change, involving resource users at every stage of management to ensure positive outcomes for all parties, including the sustainable conservation of biodiversity, the mitigation of problems, and enhancement of benefits to villagers from the conservation activities of protected-area management (Akhter & Sarker, 1989).

We feel that systems of protected areas should be consolidated, expanded and improved in accordance with good governance principles while respecting the rights, interests and concerns of all stakeholders, including rights to participate in decision making in the establishment and management of protected areas. The sharing of protected area management ownership, responsibilities, benefits and costs should be distributed among relevant bodies and people according to their legitimate entitlements, which should be defined through a negotiation process that specifically involves disadvantaged groups. This would result in stronger engagement of civil society in conservation. Current efforts to involve surrounding communities in protected area management are often limited to consulting the affected communities, requesting their help in implementing predetermined activities or assigning them certain benefits (often unrelated to the costs incurred) without effective discussion and negotiation of options

(Kideghesho et al., 2007). Efforts must be made to understand local perceptions and to use this understanding as a starting point to improve park–people relationships (McClanahan et al., 2005). Such efforts, including co-management approaches, can yield strong, efficient interventions that are meaningful to local communities and to their relationships with protected areas.

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Appendix

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Biographical sketches

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