

Resources use, conservation attitudes, management intervention and park-people relations in the Western Terai landscape of Nepal

NABIN BARAL¹ AND JOEL T. HEINEN^{2*}

¹Department of Forestry, Virginia Polytechnic Institute and State University, 305 Cheatham Hall, Blacksburg, VA 24061, USA, and

²Department of Environmental Studies, Florida International University, Miami, FL 33199, USA

Date submitted: 1 March 2006 Date accepted: 10 January 2007

SUMMARY

Various conservation models have been implemented in Nepal since 1973, however their impacts on resources use and conservation attitudes are scarcely known. To address the hypothesis that conservation attitudes should improve around protected areas (PAs) with more social and economic interventions, stratified random questionnaire surveys of 234 households were conducted in two PAs in the Western Terai of Nepal: Bardia National Park (BNP), in which interventions have been more widespread for longer time periods, and Sukla Phanta Wildlife Reserve (SWR), in which interventions are relatively recent. Both are part of a major landscape-level conservation programme under implementation in Nepal, and both are under threat of political turmoil, uncontrolled immigration, inefficient land reform policies and unsustainable resource use. There was spatio-temporal variability in resource use patterns and dependence. People collected eight and seven types of resources in BNP and SWR, respectively, and people in BNP were more dependent on resources overall. About 72% of respondents mentioned the problem of inadequate firewood, and suggested the promotion of alternative energy and permission to collect from PAs as mitigating strategies. Of 11 attitude statements, five significantly differed between the two areas. Respondents from the BNP had more favourable attitudes about conservation than those from SWR, supporting the main hypothesis. Training received by respondents, damage by wildlife, dependence on resources and satisfaction towards user groups contributed significantly to the variation in conservation attitudes. The results suggest that the liberalization of PA management has enabled the use of resources, improved livelihoods to some extent and solicited more favourable conservation attitudes in Nepal.

Keywords: biodiversity conservation, conservation attitudes, Nepal, participatory conservation, protected areas management, resource use

INTRODUCTION

Nepal embarked on formal conservation of species and habitats with the 'fortress-and-fines' model in the 1970s, an approach that was easy to conceptualize and discouraged most forms of resource use from protected areas (PAs; Heinen & Mehta 2000), but the alienation of local people who lost extraction rights culminated in negative attitudes towards conservation and PA-people relationships were poor (Mishra 1982; Heinen 1993; Nepal & Weber 1995; Studsrod & Wegge 1995; Mehta 1996). Although the approach was successful in conserving endangered species of wildlife (Heinen & Yonzon 1994), it was severely criticized for imposing restrictions on local-level usury rights and debarring local people from participation (Heinen 1996; Heinen & Shrestha 2006). As a result of broader levels of decentralization and democratization, the government gradually changed its policy to inclusion of local people in PA management. However, there have been significant dissenting voices that suggest strict protection remains the highest priority for conservation interests (Brandon *et al.* 1998; Terborgh *et al.* 2002). With passage of the 1991 Conservation Area Management Regulation (CAMR) and 1996 Buffer Zone Management Regulation (BZMR), Nepal entered into the next generation of participatory conservation.

These regulations enjoined participation and empowerment of local people for the conservation, management and use of natural resources (HMGN [His Majesty's Government of Nepal] 1996). The ratification of BZMR vested the Department of National Parks and Wildlife Conservation (DNPWC) with legal power to declare and delineate buffer zones in the periphery of national parks and wildlife reserves and to earmark 30–50% of revenue generated by them to local communities residing in buffer zones for various activities prioritized by local people. It also allowed the concession of resource harvest such as firewood, timber, thatch and fodder for subsistence needs within buffer-zone forests. As per the BZMR, user groups (UGs) are formed at the hamlet level whose function is to assist the PA authority in community development and resource use. Various integrated conservation and development activities have been carried out in buffer zones to meet the dual goals of environmental protection and economic development.

The size of PAs in developing countries is, in many cases, too small to harbour viable populations of megafauna (Dinerstein & Wikramanayake 1993). One of the challenges

*Correspondence: Dr Joel T. Heinen e-mail: heinenj@fiu.edu

for conservationists is how to increase the functional size of PAs by increasing habitat potential in areas used by humans. Connecting existing PAs with habitat corridors in human-dominated landscapes is one obvious approach to this end. Managing landscapes as intact ecosystems in the long run is a goal. The Nepalese government realized the imperative of the landscape approach and implemented the Terai Arc Landscape (TAL) project in the Central and Western Terai: the lowlands along Nepal's southern border with India and one of the richest and most productive ecosystems in the eastern Himalayas ecoregion (Ministry of Forests and Soil Conservation [MFSC] 2004). It has an area of 49 500 km², and extends from the Bagmati River in Nepal to the Yamuna River in India. About half this area lies within Nepal, and comprises four protected areas, public forests, community forests and private lands. The goal of the TAL project is to create a single functioning landscape by connecting 11 protected areas in Nepal and India through corridors, but future courses of action will also depend on attitudes and participation of local stakeholders. Our broad goal is to evaluate how the evolution of various conservation models has facilitated resource allocation and influenced conservation attitudes. We hypothesized that, if participatory approaches to conservation have positive social effects, then participation and attitudes should be more favourable in buffer zones in which conservation and development projects were implemented earlier and/or to a greater degree.

METHODS

The study area

Both Bardia National Park (BNP) and Sukla Phanta Wildlife Reserve (SWR) are part of the TAL. BNP is in the mid-western, and SWR is in the far-western Nepalese Terai (Fig. 1). BNP was established in 1976 and is the largest PA in the Terai (currently 968 km², with a proposed extension of 550 km²), while SWR was established in 1973 and covers an area of 305 km² (Table 1). The landscape is important for the

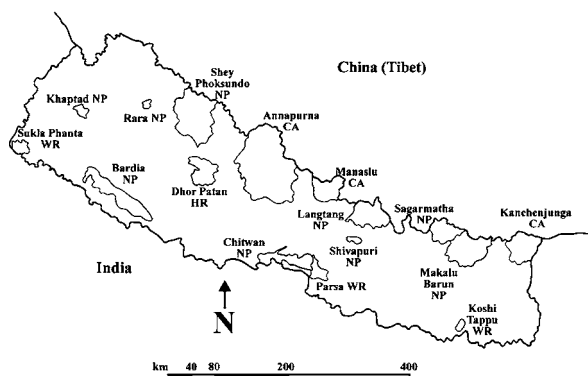


Figure 1 Map of protected areas of Nepal. NP = National Park, WR = Wildlife Reserve, CA = Conservation Area and HR = Hunting Reserve.

survival of endangered species such as the tiger *Panthera tigris*, one-horned rhinoceros *Rhinoceros unicornis*, Asian elephant *Elephas maximus* and swamp deer *Cervus duvauceli*. With 86 species of mammals, 550 birds, 47 herpetofauna, 126 fishes, and over 2100 flowering plants, species diversity is high (Baral *et al.* 2003; MFSC 2004). The proposed duration of the TAL is 50 years, and its major thrust is sectoral integration for planning, implementation, monitoring and evaluation.

The buffer zone of BNP (328 km²) was declared in 1996 in the west and south. It includes 17 village development committees and some 120 000 people live in 11 504 households. Ongoing community-based conservation programmes have been implemented since the early 1990s, funded by a number of international donors (Heinen & Mehta 2000; Heinen & Rayamajhi 2001). The buffer zone of SWR had not been declared at the time of our study, and only a few small community-based conservation programmes had been implemented in its proposed buffer zone since the late 1990s (Heinen & Rayamajhi 2001). The region has high population densities compared to BNP. People of different ethnicities and origins reside in these areas. Tharus are a native group found in Nepal and North India in scattered settlements in the proximity of forests of the Terai, from the Koshi River in the east to the Mahakali River in the west (Bista 1987; Cox 1990). Other groups include people of more recent immigrant origin from the mountains of Nepal.

Household surveys

From the archive of UGs, we stratified sample households by ethnicity (Hindu castes and ethnic groups). A structured questionnaire survey was administered February–May 2004 to a sample of 234 randomly selected households (125 in BNP and 109 in SWR) living in the buffer zones. Taking into account the high illiteracy rate in rural Nepal, questionnaires were written in Nepali, but were asked in Nepali or Tharu, depending on the ethnicity of the household being surveyed. Local words were used and technical jargon was avoided. One adult (≥ 19 years old) in each household was interviewed at the residence. Usually household heads (mostly male) were interviewed; in their absence, any member willing to participate was interviewed resulting in more male (186) than female (48) respondents.

Each questionnaire was divided into seven general parts: (1) ethno-religious background, household characteristics (gender, age and occupation of all household members), education level and migration status; (2) economic activities such as land-holdings, alternative sources of income and annual cash income; (3) agriculture and animal husbandry; (4) natural resources use; (5) conservation awareness; (6) participation and benefits (memberships, personal benefits, income generating activities and saving-credit programme); and (7) assessment of satisfaction towards user groups (UGs) and wildlife conservation issues. Most of the questions were closed-ended, although some open-ended contingency questions were also included (See Supplementary

Table 1 Comparison between Bardia National Park (BNP) and Sukla Phanta Wildlife Reserve (SWR). NGO = non-governmental organization. IUCN category, II = national park and IV = habitat/species management area.

	<i>BNP</i>	<i>SWR</i>
Location	81.46502 E and 28.44479 N	80.22640 E and 28.84955 N
Gazetted	1976	1973
Legal status	National park	Wildlife reserve
IUCN category	II	IV
Area	968 km ² + 550 km ² proposed	305 km ²
Buffer zone	328 km ² designated in 1996	243 km ² designated in 2005
Ethnic diversity	Moderate (51% Tharus; 39% Brahman/Chhetri)	High (10% Tharus; 72% Brahman/Chhetri)
Population density	189 people km ⁻² in 2001	235 people km ⁻² in 2001
NGOs present	Many	Few
Number of visitors	5254 (4393 foreigners) in 2003	203 (60 foreigners) in 2003

material at http://www.ncl.ac.uk/icef/EC_Supplement.htm, Appendix 1).

Surveys of UGs

The chairs of 14 and 15 UGs from the BNP and SWR, respectively, were also interviewed. They were asked about group formation, frequency of meetings, policies on non-timber forest products and their marketing, distribution of benefits, and attitudes towards the TAL project and conservation legislation. Whenever an opportunity arose, Nabin Baral also analysed the content of operational and five-year work plans and annual reports.

Data analyses

The education level of respondents was categorized into five groups. Respondents who did not know how to read and write were classified as illiterate, and those who could read or write, even if they had no formal education, were literate. Respondents who had 1–5 years of formal education fell into the primary category, those who had 6–10 years of formal education fell into the secondary category and those who had an associate degree or above were classified as college. As the values of different livestock and their impacts on natural resources vary, the number of livestock per household was expressed using the livestock size unit (LSU; Raut 1997). Since a 400-kg steer is equivalent to 1 LSU (Raut 1997), in the present study, one adult buffalo was considered 1 LSU, and one immature buffalo, cow, calf, pig and sheep or goat was equivalent to 0.5, 0.8, 0.4, 0.3 and 0.2 LSU, respectively. Poultry were not included in LSU calculations.

For conservation attitudes, a series of statements was presented and respondents were asked to agree or disagree. Statements covered broad conservation issues, such as the status of forests, custodianship of resources, perceptions of open access resources, wildlife populations and depredation, socioeconomic improvements, access to resources, intra and intergenerational equity, existence of PAs and willingness to contribute to conservation (see Supplementary material at http://www.ncl.ac.uk/icef/EC_Supplement.htm, Appendix 1). If the respondent agreed with the statement one point was awarded, otherwise no point was given. The

reverse was true for a negative statement. The scores of all statements were summed to derive an attitude score that could theoretically range from 0 to 11. The higher the attitude score, the more favourable the attitude the respondent held towards conservation.

There were eight types of resources harvested by respondents in BNP and seven types in SWR. Based on estimated harvest frequency of each, resources were assigned importance values. Thus, in BNP, a value of eight was assigned to the resource having the highest use-frequency and, in SWR, seven was assigned to the resource having the highest frequency. The weighted scores of types of resources harvested in a household were summed to calculate a resource-use score that could theoretically range from 0 to 36 in BNP and 0 to 28 in SWR. The higher the score, the more dependent respondents were on resource extraction. The frequency-based 'importance' assignment may not truly reflect impacts of resource use or scarcity; however, our expedient use of it simplified the analysis. Attitude and resource use scores had upper and lower limits. Building an ordinary least square regression model taking them as dependent variables violates underlying assumptions and gives biased results (Long 1997). Recognizing them as limited dependent variables, we built Tobit regression models using explanatory socioeconomic variables.

RESULTS

Respondents

The respondent mean age was 41.5 ± 12.3 , ranged from 19 to 75 years (Table 2) and did not differ between PAs; however, mean ages of men (42.8 ± 12.7) and women (36.9 ± 11.6 ; $t = -2.93$) differed ($p < 0.001$). Although discrimination based on caste and ethnicity was abolished by law, it is practiced socially. Brahman and Chhetri rank high and occupational castes (such as cobblers, ironsmiths and tailors) rank low in the Hindu caste hierarchy. Tharus are indigenous people of the Terai, and Hill tribes include ethnic groups of mountain origin such as Gurung, Magar and Newar. The two areas significantly differed in ethnic composition of respondents ($\chi^2 = 48.85$, $p < 0.001$). In BNP, 51% were

Table 2 Summary of mean \pm one standard deviation of some variables within Bardia National Park (BNP) and Sukla Phanta Wildlife Reserve (SWR). t = Student's t -test, z = z score, p = level of statistical significance.

Respondents' socioeconomic status	BNP	SWR	Statistics
Age (years)	41.5 \pm 12.3	41.7 \pm 13.1	$t = -0.10, p > 0.10$
Family size (number of members)	7.6 \pm 4.6	7.6 \pm 3.4	$z = -1.03, p > 0.10$
Landholdings (ha)	0.68 \pm 0.7	0.71 \pm 0.7	$z = -0.80, p > 0.10$
Livestock holdings (LSU)	4.4 \pm 4.7	4.0 \pm 2.1	$z = -0.44, p > 0.10$
Annual cash income (US\$)	444 \pm 386	664 \pm 544	$z = -2.94, p < 0.05$

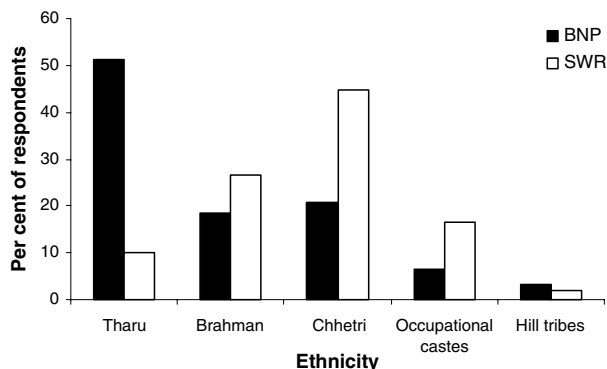


Figure 2 Frequency distribution of ethnicity in Bardia National Park (BNP) and Sukla Phanta Wildlife Reserve (SWR).

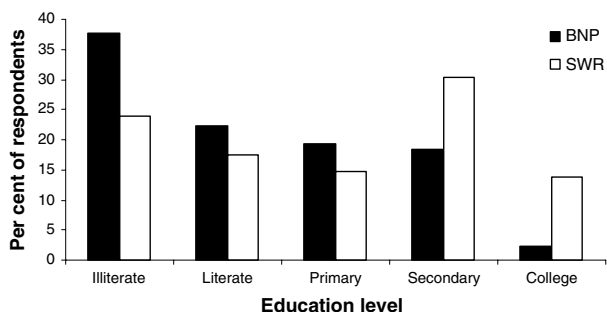


Figure 3 Frequency distribution of education level in in Bardia National Park (BNP) and Sukla Phanta Wildlife Reserve (SWR).

ethnic Tharus while in SWR 72% were Brahman and Chhetri (Fig. 2).

Level of education and PA were associated ($\chi^2 = 18.14, p < 0.001$). The illiteracy rate was higher (38%) in BNP compared to SWR (22%; Fig. 3). The illiteracy rate among Tharus (36%) was significantly higher than non-Tharus (29%; $\chi^2 = 19.04, p < 0.001$) and among women (76%) than men (40%; $\chi^2 = 25.20, p < 0.001$). Most respondents (77%) engaged in subsistence agriculture, 11% had jobs in public and formal private sectors and 12% were in other vocations.

Migration from the mountains started after eradication of malaria in the 1960s; 82.1% of respondents were immigrants of whom 65.6% were from the mountains and average residency of households was 24 years. Family size was 7.6 ± 4.1 members (mean \pm 1 SD) and did not vary between PAs. Family size (8.9 ± 5.4) of Tharus was larger than that of non-Tharus ($7.0 \pm 3.1; t = 3.33, p < 0.001$). The mean landholding was 0.70 ± 0.67 ha (range 0.03–4.74 ha). There was no difference

in landholdings between PAs, and between Tharus and non-Tharus ($p > 0.10$). The mean annual cash income was US\$ 544 ± 476 (range US\$ 28–2366) and it was higher in SWR than in BNP.

Most respondents (96.2%) had one or more kinds of livestock, and cattle, buffalo and goats were the most common. The mean LSU was 4.18 ± 3.75 (range 0.2–44) and did not differ between PAs or Tharus and non-Tharus ($p > 0.10$). Landholdings and livestock per household were positively correlated ($r = 0.43, p < 0.001$).

Resources use

Firewood was the main source of energy in the study area. Local people used thatch as roofing material, timber for house construction and furniture and grasses and tree fodder as livestock feeds. Green leaves were used to make plates for religious ceremonies, while dry leaves were used as livestock bedding and later composted. Both were categorized as 'leaf litter.' Honey, mushrooms, fruits and vegetables were dietary supplements and collectively termed 'edibles.' Local people made home-brewed alcohol with herbs.

Authorities permitted to collect thatch once a year inside the PAs, however in buffer zones local people were allowed to collect resources year around. Most households (96.6%) harvested one or more types of natural resources; eight types were extracted from the PA and buffer-zone forests of BNP and seven types from the reserve in SWR. In the SWR, local people did not collect timber from the reserve, while, in the BNP, they collected timber from the buffer zone. In BNP, 93% of households collected thatch followed by firewood (68%), leaf litter (62%), grasses (52%), edibles (42%), timber (41%), tree fodder (20%) and herbs (15%). In SWR, 78% of households collected thatch followed by firewood (58%), grasses (44%), leaf litter (34%), edibles (10%), tree fodder (2%) and herbs (1%). More households in BNP extracted thatch, leaf litter, edible plants, tree fodder and herbs compared to SWR ($p < 0.05$; Table 3). Resource use and ethnicity were associated ($\chi^2 = 77.93, p < 0.001$). Most Tharus (95%) collected green leaves for social functions, while most non-Tharus (88%) collected leaf litter to use as livestock bedding.

Respondents in BNP were more dependent on resources than in SWR and Tharus were more dependent than non-Tharus (Table 4). Resource dependency was negatively related to landholdings, but positively related to level of LSU. Dependency on resources decreased with increased income, but this was not significant. Occupation had no effect on

Table 3 Frequency of resources harvested by respondents in Bardia National Park (BNP) and Sukla Phanta Wildlife Reserve (SWR). p = level of statistical significance.

Resource categories	BNP ($n = 125$)		SWR ($n = 109$)		p
	Yes (%)	No (%)	Yes (%)	No (%)	
Firewood	68.0	32.0	57.8	42.2	0.106
Thatch	92.8	7.2	77.9	22.0	0.001
Grasses	52.0	48.0	44.0	55.9	0.224
Tree fodder	20.0	80.0	1.8	98.2	0.000
Leaf litter	61.6	38.4	33.9	66.1	0.000
Edibles	42.4	57.6	10.1	89.9	0.000
Herbs	15.2	84.8	0.9	99.1	0.000
Timber	40.8	59.2	–	–	–

Table 4 Tobit regression of resource use scores on socioeconomic variables. Log likelihood = -603.48 , likelihood-ratio $\chi^2 = 114.83$, $p < 0.001$, $n = 192$. B = estimated coefficient, SE = standard error of the coefficient, t = Student's t -test statistic, and p = level of statistical significance.

Explanatory variables	B	SE	t	p
Protected area (BNP = 0)	-7.468	0.995	-7.51	0.000
Occupation (agriculture = 0)	0.812	1.070	0.76	0.449
Ethnicity (Tharu = 0)	-3.998	1.086	-3.68	0.000
Family size (number of members)	-0.025	0.153	-0.17	0.869
Landholdings (ha)	-1.544	0.750	-2.06	0.041
Livestock holdings (LSU)	0.415	0.161	2.58	0.011
Annual cash income (log transformed)	-0.660	0.496	-1.33	0.185
Constant	35.210	2.703	13.03	0.000

Table 5 Per cent of respondents agreeing or disagreeing with conservation statements. p = level of statistical significance.

No.	Statement	BNP ($n = 125$)		SWR ($n = 109$)		p
		Disagree	Agree	Disagree	Agree	
1	Forests around your village have decreased in recent years	43.6	56.4	30.3	69.7	0.037
2	It is responsibility of local people to protect natural resources	04.1	95.9	11.0	89.0	0.047
3	If there is unlimited access to forests for fuel wood and fodder, forests will be disappeared soon	00.8	99.2	00.9	99.1	0.941
4	There are more wild animals now than ten years ago	09.1	90.9	56.0	44.0	0.000
5	What people and their livestock need are more important than saving plants and wild animals	67.8	32.2	66.1	33.9	0.783
6	My living condition improved since the protected area's creation	30.4	69.6	55.1	44.9	0.000
7	After the establishment of buffer zone forests/reserve you don't have problem of access to resources	19.3	80.7	40.7	59.3	0.000
8	It is important to set aside a place for the animals and plants to live in	19.2	80.8	22.2	77.8	0.569
9	It is important to protect the animals and plants so that our children may know and use them	21.6	78.4	17.6	82.4	0.443
10	There is an equitable distribution of common pool resources and benefits	17.7	82.3	19.4	80.6	0.739
11	You are willing to contribute for conservation cause	08.3	91.7	02.8	97.2	0.073

resource dependency, nor did family size (Table 4). We did not include the education variable because of computational difficulty at a household level.

Conservation attitudes

Perception of forest status, custodianship of resources, wildlife population trends, socioeconomic upliftment and resource use conflicts differed between PAs (Table 5) while problems with access, anthropocentric views, existence of PAs, inter- and intra-generational equity and willingness to contribute to conservation did not. A large proportion of respondents (70%) in SWR agreed that forests were dwindling, but 43% of respondents in BNP disagreed with that statement. A higher

proportion of women (77%) agreed that forests had dwindled in comparison to men (59%); Tharus and non-Tharus did not differ in this ($\chi^2 = 2.10$, $p > 0.10$).

A higher proportion of respondents in BNP (96%) than SWR (89%) agreed with the statement that local people shared responsibility for conserving natural resources ($\chi^2 = 3.96$, $p < 0.05$), and this did not differ with gender ($\chi^2 = 0.91$, $p > 0.10$), ethnicity ($\chi^2 = 0.11$, $p > 0.10$) or landholdings ($\chi^2 = 0.52$, $p > 0.10$). Although people suffered from wildlife damage, they were willing to share responsibilities for conservation ($\chi^2 = 0.52$, $p > 0.10$). When local people were satisfied with UGs, they were more likely to agree with sharing responsibilities for conservation ($\chi^2 = 5.16$, $p < 0.05$; Table 6).

Table 6 Tobit regression of conservation attitude score on explanatory variables. Log likelihood = -331.01, likelihood-ratio $\chi^2_{12} = 43.65$, $p = 0.0001$, $n = 194$. B = estimated coefficient, SE = standard error of the coefficient, t = Student's t -test statistic and p = level of statistical significance.

<i>Explanatory variables</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Protected area (BNP = 0)	-0.499	0.244	2.05	0.042
Gender (male = 1)	0.109	0.283	0.39	0.700
Age (years)	0.007	0.009	0.76	0.445
Education (years of formal schooling)	0.014	0.032	0.43	0.666
Occupation (non-agriculture = 1)	0.103	0.260	0.40	0.692
Ethnicity (non-Tharu = 1)	0.248	0.271	0.91	0.362
Landholdings (ha)	0.070	0.165	0.42	0.673
Resource dependency score	0.248	0.123	2.02	0.044
Annual cash income (log transformed)	0.167	0.109	1.53	0.127
Training (yes = 1)	0.622	0.225	2.77	0.006
Wildlife harassment (yes = 1)	-0.522	0.223	-2.34	0.020
Satisfaction towards UGs (yes = 1)	0.846	0.231	3.66	0.000
Constant	6.416	0.908	7.07	0.000

The perception of wildlife population trends differed between PAs ($\chi^2 = 58.58$, $p < 0.001$); 91% of BNP respondents agreed that wildlife populations had increased, while 66% disagreed in SWR. Respondents who had suffered from crop damage were more likely to agree that there had been an increase in wildlife populations ($\chi^2 = 16.35$, $p < 0.001$), as were respondents whose main vocation was agriculture ($\chi^2 = 6.26$, $p < 0.05$). Most (90%) Tharus, who tend to live close to forests, agreed that wildlife populations had increased, while only 59% of non-Tharus agreed.

The perceptions of socioeconomic development differed between PAs ($\chi^2 = 14.53$, $p < 0.001$). More BNP respondents (70%) agreed that living standards had improved after park establishment than SWR respondents (45%). There was no difference in attitudes about socioeconomic development between Tharus and non-Tharus ($\chi^2 = 1.57$, $p > 0.10$) or between men and women ($\chi^2 = 0.01$, $p > 0.10$). Those engaged in off-farm activities did not associate those opportunities with conservation ($\chi^2 = 0.56$, $p > 0.10$) and those who had not suffered from wildlife damage were more likely to agree that there were improvements in the socioeconomic status of local people ($\chi^2 = 4.69$, $p < 0.05$).

There was an association between resource conflicts and PA ($\chi^2 = 12.74$, $p < 0.001$); 81% of BNP respondents agreed that they did not have conflicts over resource use after Park establishment compared with 59% in SWR. Perceptions about resource access were unrelated to gender, ethnicity, landholdings or occupation. Tobit regression revealed that BNP respondents were more likely to hold favourable conservation attitudes than SWR respondents ($p < 0.05$), as they were more dependent on natural resources ($p < 0.05$). Respondents who had more favourable attitudes were more likely to be satisfied with UGs ($p < 0.01$), have participated in training ($p < 0.01$) and not been harassed by wildlife ($p < 0.05$). Gender, age, ethnicity, education, occupation, landholdings and income did not contribute to variation in conservation attitudes (Table 6).

Management practices

Of 29 UGs, 79% were formed by election among villagers and 21% by election among local leaders. Occupational

castes were represented in six and two UGs of BNP and SWR, respectively. No SWR UGs had Tharus on executive committees, but all in BNP had 1–9 Tharu members. In BNP, one UG met fortnightly, 12 monthly and one quarterly. In SWR, three met weekly, seven fortnightly, three monthly, and two were not meeting.

The BZMR requires each UG to prepare a five-year work plan and submit it to the Buffer Zone Management Council for approval and budget allocation. All BNP UGs had five-year work plans, but only 60% in SWR did. When asked which institutional arrangement would be most efficient to manage resources, 64% of UG chairs in BNP and 60% in SWR responded that local people were most effective. About 21% and 33% of UG chairs in BNP and SWR, respectively, considered government agencies most effective. Some UG chairs (14% in BNP and 7% in SWR) emphasized the need for coordinated efforts between agencies and local people for sustainable resource management. In BNP, 50% of UGs met subsistence needs of natural resources from buffer zones. In SWR, 60% of UGs were not able to fulfil loan demands of members. In BNP, 64% of respondents disagreed with the Regulations and Guidelines, however, 80% agreed with them in SWR.

DISCUSSION

People in BNP generally had more favourable attitudes than in SWR, supporting our main hypothesis. However, there are many similarities as well as differences between these PAs and results also show a strong need for site-specific planning advocated elsewhere (for example Shrivastava & Heinen 2005). BNP has more resources and lower population densities than SWR (Table 1), is a larger PA, has had longer-term and more intensive socioeconomic intervention and its UGs are more functional. Heinen (1996) suggested that more external economic intervention is needed for effective PA management in cases of higher populations and greater ethnically diversity. SWR is thus predicted to have more social problems and greater scarcity, and more intervention is justified in that PA. The history in this region has been the reverse.

Socially, women had subordinate roles and less power in decision-making, and men were usually household heads; thus there was unequal gender representation in the survey. This may have implications for generalization of results related to resource use because women are more involved in forest resource extraction (Mehta & Kellert 1998). The high literacy rate (68.8%) of the area compared to the national average (53.7%; Central Bureau of Statistics [CBS] 2002) is attributable to extension programmes and proximity with India; many conservation non-governmental organizations (NGOs) had undertaken adult literacy programmes in these areas. This policy is supported by the fact that intensive extension work resulted in significant improvement in conservation attitudes elsewhere (for example Infield & Namara 2001).

The population growth rate of the study area was 3.9% per year from 1991 to 2001, far higher than Nepal's 2.3% average (CBS 2002), owing mostly to high immigration. In the past, people immigrated to these areas to reclaim fertile agricultural lands, access physical facilities and take refuge from environmental hardships. The Maoist insurgency has further increased immigration (Baral & Heinen 2006) as camps were established in public forests to provide shelter to displaced people. High annual population growth around forest reserves as a consequence of civil strife has been documented elsewhere (Archabald & Noughton-Treves 2001) and is a main cause of failure of conservation and development programmes in such areas (Oates 1995). Ethnic heterogeneity caused by migration tends to dilute community solidarity (Ostrom 1990) and may cause inter-ethnic conflicts in resources use (Noss 1997). From conservation perspectives, the problems of immigration are: inflated population, higher discount rates, lowered commitments to conservation and increased pressures on natural resources (Gadgil *et al.* 1993; Kremen *et al.* 1994). Although non-indigenous people can develop knowledge of local environments over time (Browder 1995; Muchagata & Brown 2000), they tend to change social dynamics and alter structure and composition of resources as well (Nepstad *et al.* 1992) and their competence in resource use is unstudied in most places.

Resource-use patterns differed in many ways between Tharus and non-Tharus and are a function of economic status and cultural practice. Tharus earned significantly less annual cash income than non-Tharus and were measurably more dependent on, and knowledgeable about, natural resources. They also showed more sophistication in understanding issues related to forest management and wildlife populations in spite of lower literacy. Some Tharu cultural practices, such as not removing leaf litter from *Sal* forests which are vulnerable to nutrient depletion (Timilsina 2005), are more sustainable than those of recent immigrants. Tharus were also poorer, and this contradicts the view that wealthier people suffer more when restrictions on forest resources are imposed (Hegde & Enters 2000; Adhikari 2005).

The declaration of the buffer zone and the presence of NGOs help to explain more favourable attitudes in BNP compared to SWR. Firewood, thatch and timber are the

three most important resources for local people in both areas. This dependence is owing to the lack of alternatives, the inability to afford them and/or adherence to traditional systems (Badola 1998). Local people in BNP benefited directly from the declaration of the buffer zone in 1996 because revenue generated by the park has been earmarked for local development since then. In addition, local people had access to resources in buffer zone forests. During the time of this fieldwork, the proposed buffer zone of SWR had not been declared and there was scarcity of forests outside the reserve. The presence and activities of NGOs were pronounced in BNP while only one NGO was working in the proposed buffer zone of SWR, and its programmes were diffuse at that time. This differentially impacted both socioeconomic development and empowerment of local people.

Our findings did not support work showing that age, gender, education, caste/ethnicity, occupation and/or income are significant predictors of conservation attitudes (Fiallo & Jacobson 1995; Mehta & Kellert 1998; Gillingham & Lee 1999; Sah & Heinen 2001). Both rich and poor live under similar circumstances in these study areas and both suffer from crop and livestock losses to wildlife; income did not explain variation in attitudes. Likewise, the differences attributed to education probably relate to differences between PAs; people around SWR had more access to schools, higher educational attainment and poorer attitudes for other reasons. We found that training received, harassment by wildlife, access to resources and satisfaction towards UGs contributed to conservation attitudes. The main purpose of training is skill enhancement for income-generation, yet NGOs can take the opportunity to raise conservation awareness during sessions. Other work has shown that people who had participated in training elsewhere also held more favourable conservation attitudes (see Mehta & Kellert 1998).

Most households in the study area suffered from wildlife damage, which is strongly associated with negative conservation attitudes elsewhere (Heinen 1993; Newmark *et al.* 1993; Akama *et al.* 1995; De Boer & Baquete 1998). Benefits accrued through conservation at the societal level are frequently ineffective in offsetting local costs (Gibson & Marks 1995; Gillingham & Lee 1999; Adhikari *et al.* 2005). Yet a large proportion of respondents expressed satisfaction towards UG activities and this generated more favourable attitudes. UG formation provides a platform for wider participation and a venue in which to express grievances directly. When forests are handed over to UGs, as in the case of buffer zone, local people have control over resources. Our results and others (for example Mehta & Heinen 2001) suggest that they appreciate some degree of ownership and that this can enhance conservation efforts, the main goal of projects such as TAL.

CONCLUSIONS

More favourable attitudes of BNP respondents towards conservation could be explained by greater socioeconomic

development and accessibility of resources compared to SWR. Where livelihoods are threatened by crop and livestock loss to wildlife, negative conservation attitudes result. Restitution through effective grassroots organizations would help elevate the economic status of local people and improve attitudes.

Differences in responses between the BNP and SWR are reflected in resources use patterns, dependency, the amount and duration of socioeconomic intervention and conservation attitudes. Resource dependency, training received, wildlife damage incurred and satisfaction towards grassroots organizations all helped to predict conservation attitudes. Ethnic differences in resource-use patterns have implications for the conservation and management of resources and should be taken into account while formulating management strategies. Population growth poses additional challenges.

Buffer-zone creation has fostered social capital, facilitated resources use and promoted development. Organizational strengthening is thus appreciable in BNP but lacking in SWR. The success of UGs in meeting development goals may justify the declaration of buffer zones in other PAs as well. Policy interventions to ensure long-term success of landscape-level conservation are needed to decrease dependence on natural resources by promoting income-generating activities and alternative sources of natural resources, expand educational and training opportunities, curb forest encroachment, strengthen local organizations and foster cross-sectoral integration.

ACKNOWLEDGEMENTS

This study was funded by Florida International University (FIU) through a graduate assistantship to NB, and fieldwork grants by the National Fish and Wildlife Foundation's Save the Tiger Fund and Disney Wildlife Conservation Fund to JTH. Nabin Baral thanks Sigma Xi and the FIU Institute of Asian Studies for additional support. We thank Dr T. M. Maskey and officers and staff of Nepal's DNPWC for permitting the study, and The King Mahendra Trust for Nature Conservation and WWF-Nepal Programme for providing accommodation and literature. Dr S. R. Jnawali, Chiranjivi Pokharel, Naresh Subedi, Sushila Nepali, Thaneshawor Tiwari, Birendra Tiwari and Nilesh Timilsina provided time and expertise, and Kamal Thapa, Birendra Thapa, Janak Chaudhary, Rajendra Bhatta, and Dhan Chand helped administer the survey.

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