Environmental Conservation **28** (4): 345–356 © 2001 Foundation for Environmental Conservation DOI:10.1017/S0376892901000376

Wetland resource use and conservation attitudes among indigenous and migrant peoples in Ghodaghodi Lake area, Nepal

JAY P. SAH[1,2]* AND JOEL T. HEINEN[3]

[1]*Department of Biological Sciences, Florida International University, Miami, FL 33199, USA,* [2]*Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu, Nepal, and* [3]*Department of Environmental Studies, Florida International University, Miami, FL 33199, USA*

Date submitted: 13 March 2001 Date accepted: 5 September 2001

Summary

Nepal has a number of wetlands in the lowland region of the country along the southern Indo-Nepalese border that have experienced great pressures from growing human populations due in part to migration of people from the mountains. A questionnaire survey and informal interviews with key informants in 1998 were used to explore the socio-economic status of indigenous and non-indigenous inhabitants, use patterns of forest and wetland resources and attitudes about conservation in Ghodaghodi Lake, a proposed Ramsar site, in the lowlands of western Nepal. Tharus, indigenous to the region, represented 33% of the population; the rest were migrants from the mountains. Tharus had lower literacy rates, larger landholdings and kept different livestock species. Most Tharu families were dependent on extraction from wetlands; all groups used forests for fuelwood but mountain settlers used forests for fodder more than did Tharus. Most respondents expressed willingness to participate in the conservation of Ghodaghodi Lake; however, only 12%, mostly mountain settlers, had ever participated in formal conservation activities. Conservation attitudes were strongly influenced by educational level and resource use. Educated males of higher caste and mountain origin who had previously participated in formal management activities were more positive towards conservation than other groups. There is a need to implement a participatory integrated management plan, to include community development, education and off-farm income generation, to assure participation of Tharus and lower caste households of mountain origin in the conservation and management of wetlands and forests in the area.

Keywords: conservation attitudes, ethnicity, Nepal, resource use, Tharus, wetland conservation

Introduction

In designing integrated conservation and development projects, an understanding of relationships among ethnicity, socio-economic status, resource use patterns, and attitudes towards conservation is critical. Particularly of interest are cases in which resource users are composed of both indigenous and non-indigenous groups. There is some evidence that indigenous groups may practise traditional management techniques that are generally better adapted to the place in question, although this is not always the case (Chhetri 1994). Here we address this question generally in relation to wetland resources. Although wetlands have been the subject of many studies, those dealing with relationships between wetland conservation and use are limited (Pyrovetsi & Daoutopoulos 1989, 1997). In Nepal, which is famous for its mountains, the conservation of wetlands has never been high on the political agenda; forests and wildlife have been the focal point for most conservation in the country (HMG [His Majesty's Government of Nepal] 1973; HMG/IUCN [His Majesty's Government of Nepal/World Conservation Union] 1988; Bhandari 1994). Within the forestry sector too, the *terai* (lowlands) have been neglected; there were 2489 mountain community forestry user groups and only 267 in the terai in December 1994 (Shrestha 1995) despite a higher deforestation rate and the importance of forest for wetland conservation in the latter.

In Nepal, wetlands have been defined within a country context as landmass saturated with water due to high water table through either groundwater, atmospheric precipitation or inundation; it may be natural or artificial, permanent or temporary, static or flowing, freshwater or brackish (Shrestha & Bhandari 1992). The given definition has been adopted in several studies on wetlands in Nepal (Bhandari *et al.* 1994; BPP [Biodiversity Profiles Project] 1995; Sah 1997; Bhandari 1998), where wetlands are mostly located in the terai. BPP (1995) described 51 wetlands from the terai. Later, Bhandari (1998), in an intensive survey, described 163 wetlands from the same region and included many smaller wetlands ignored in BPP's study. There are more wetlands, and there is greater forest cover in western than in eastern Nepal (Bhandari 1998), due in part to later economic development and thus later migration from the mountains into western Nepal. The conservation of wetlands in the Nepalese terai is limited to two national parks and three wildlife reserves managed by the Department of National Parks and Wildlife Conservation. Within protected areas, extraction of most resources is prohibited (HMG 1973; Heinen & Mehta 1999). Wetlands outside protected areas but within forests are under the

* Correspondence: Mr Jay P. Sah Tel: +1 305 348 6066 Fax: +1 305 348 1986 e-mail: jsah01@fiu.edu

control of the Forest Department, whose legal mandate is oriented towards extractive uses. Most other Nepalese wetlands are open-access resources (Sah & Sah 1999).

The western terai, where indigenous Tharus constituted most of the population until two decades ago, has received many migrants from the mountains resulting in a population growth of 4.5% per year (CBS [Central Bureau of Statistics] 1995); the question thus arises whether changed demographic conditions affect traditional resource uses. Many studies show that poorer people are more dependent on natural products (Infield 1988; Newmark *et al.* 1993; McGregor 1995), although there are exceptions (e.g. Heinen 1993; Sah 1997). Thus resource use patterns in relation to economic status can be site-specific, and in some cases resource-specific.

Many studies in developing countries show that people receiving benefits from conservation projects are more likely to express positive attitudes towards conservation (Saharia 1982; Lewis *et al.* 1990; Studsrod & Wegge 1995). However, if benefits are not equally distributed, negative attitudes are frequently expressed in spite of benefits (Parry & Campbell 1992). In such cases, the lack of participation in decision-making may be a causal factor, as participation is considered important in successful conservation strategies (e.g. Cohn 1989; Durbin & Ralambo 1994; Happold 1995; Alpert 1996; Alexander 2000). Programmes that strive to integrate local people with development also require detailed information on relationships between resource use and attitudes.

Within Nepal, local people have been included in conservation and management processes in different contexts, especially with the passage of several recent amendments to the National Parks and Wildlife Conservation Act of 1973 (Heinen & Mehta 2000), and in community forestry (Hobley 1996). Thus, the Government has supported community-based conservation approaches generally, but participatory wetland management programmes are newly proposed (IUCN 1998) and funds are thus far lacking.

This paper addresses people's socio-economic conditions, resource use patterns and conservation attitudes around Ghodaghodi Lake, which is one of the three proposed Ramsar sites in Nepal. Ramsar sites are the wetlands of international importance designated by the contracting parties based on the criteria developed by Ramsar Convention on Wetlands. Ghodaghodi Lake is the largest natural lake in the terai and has religious importance. Wetlands in the area are the habitat of a number of aquatic plant and animal species, including the endangered marsh crocodile (*Crocodylus palustris*). The forests around Ghodaghodi Lake are contiguous to extensive forests along Siwalik Hills to the north and provide corridors for the movement of wild animals. Unlike the other two proposed Ramsar sites, Beeshhazar Tal in the buffer Zone of Royal Chitwan National Park and Jagdishpur Reservoir in the Kapilbastu District, Ghodaghodi Lake is unprotected.

As in other parts of the western terai, Ghodaghodi Lake area has also received migrants from the mountain, and experienced greater deforestation, expansion of settlements and cultivation in and around wetlands, all of which ultimately threaten wetland conservation. When decisions affecting wetlands are made with inadequate knowledge of attitudes about and practices of resource use, conservation programmes are unlikely to be successful. Thus, a survey of resource use patterns and attitudes can provide guidance for planning and management (Harcourt *et al.* 1986; Redford & Stearman 1989; Drake 1991). The objectives of this study were to determine the socio-economic conditions of people and their relationships with resource use patterns and participation in and attitudes about wetland conservation. We hypothesized that age, education, economic status, resource use, and participation in conservation activities would have positive influences on attitudes. We further hypothesized that these variables would differ among ethnic groups as a function of cultural management practices and status in the socially stratified context of South Asia, and that these differences would have direct implications for wetland management.

Methods

The study area

Ghodaghodi Lake area, located in the Kailali district of the western terai (Fig. 1), is 8 km^2 in area and is characterized by various types of wetlands (Table 1). In the present study, wetlands are swamps, marshes, or lakes of 3 ha or larger. The total wetland area is about 248 ha; the remainder includes barren land, forests dominated by *sal* (*Shorea robusta*), scrub and converted agricultural land. The altitude varies from 205 to 225 m. Wetlands in the area receive water from various sources including rain, surface flow, springs and floods from nearby rivers. The region is rich in aquatic and terrestrial flora and fauna (Acharya 1997; Bhandari 1998) and has a subtropical monsoon climate. Climate data from 1987 to 1996 recorded at the district headquarters show that average monthly maximum temperature ranges from 21.3 °C in January to 38.0 °C in May and average annual rainfall is

Table 1 Wetlands of varying sizes located in Ghodaghodi Lake area, Kailali district, Nepal. The numbers in parentheses under 'Hydroperiod' indicate the numbers of months that wetlands retain water: P = perennial, S = seasonal.

Wetlands	*Area (ha)*	*Hydroperiod*	*Wetland type*
Ghodaghodi Lake (GL)	138	P	Lake
Nakharodi Lake (NL)	70	P	Lake
Baishwa (B)	10	S (8–10)	Marsh
Budhi Nakharodi (BN)	6	P	Pond
Ojhwa (Oj)	6	P	Pond
Purbi Ojhwa (O)	5	S (6–8)	Marsh
Ramphal Tal (R)	5	S (10–11)	Marsh
Sunpokhari (S)	5	S (9–10)	Marsh
Chatiya Tal (CT)	3	S (6–8)	Marsh

https://doi.org/10.1017/S0376892901000376 Published online by Cambridge University Press

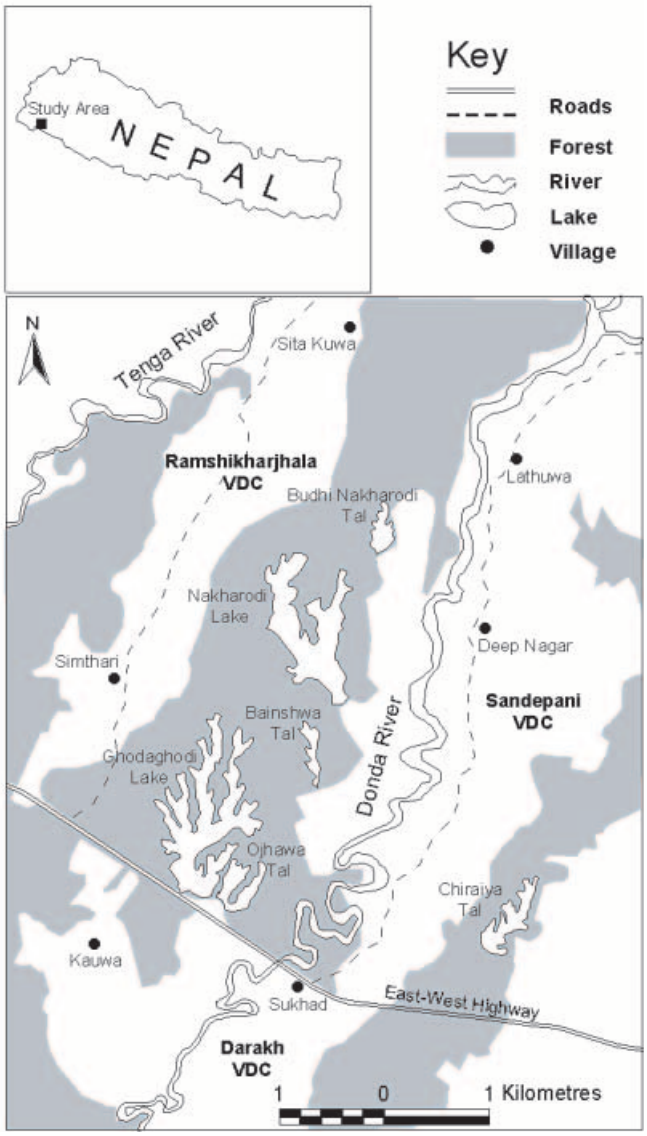

Figure 1 Map of Ghodaghodi Lake, with surrounding forests and villages.

1726 mm, of which 80–85% falls from June to September. Densely populated villages in three Village Development Committees (VDCs) are located nearby. VDCs are local administrative units, each comprised of one or more villages. Each VDC is further divided into nine wards. The national highway passing south of Ghodaghodi Lake and two feeder roads facilitate access to wetlands in the area.

Household survey

The study was conducted between January and April 1998. Literature surveys, site visits, and discussions with VDC representatives were initially carried out to get an idea of settlements around Ghodaghodi Lake, ongoing wetland management activities and management problems. Data on socio-economics, resource use patterns and attitudes were gathered through a structured questionnaire survey conducted in March and April 1998 by J.P. Sah, with the help of four field assistants, two Tharus and two of mountain origin. Two of them, one Tharu and the other of mountain origin were university graduates, and two were high school graduates. All assistants were male and were trained to administer the survey. Questions were written in Nepali language, but they were asked in Tharu or Nepali, depending on the ethnicity of households being surveyed. Prior to the survey, a pilot study was conducted with the four assistants in two villages to test the completeness of the questionnaire. After such study, some questions were modified to improve the clarity and to minimize bias in rating.

In total, 180 households were surveyed in 31 settlements located in seven wards (those adjoining wetlands; wards are the smallest administrative unit recognized in Nepal) of three VDCs, namely Darakh (61 households), Ramshikharjahala (38 households) and Sandepani (81 households). A list of households was obtained from VDC offices. Households were then selected randomly by lottery from each village such that 10% of households were interviewed. Usually, household heads (generally men) were interviewed; in some cases, the most senior member of the family at home was interviewed resulting in more male (147) than female respondents (23). The questionnaire included both fixed-response and open-ended questions. The latter were included to facilitate open discussion with respondents. Each questionnaire was divided into four general parts: (1) ethnic background, caste, household characteristics (gender, age and occupation of all household members) and education (ability to read and write, primary, lower-secondary, secondary or above secondary education); (2) economic activities such as land and livestock holdings; (3) resource use patterns; and (4) awareness about local environmental problems and attitudes about conservation. Respondents answered each attitude statement according to their strength of agreement by the following attitude level scores: 5 = strongly agree, 4 = agree, 3 = don't know, 2 = disagree, and 1 = strongly disagree (Likert 1974). Scaling was reversed for unfavourable statements such that higher scores indicated higher levels of awareness of local environmental issues and more favourable attitudes towards conservation in all cases.

In response to questions asked by a third party, many people may not reply truthfully if they fear actions against their interests, a general drawback of questionnaire surveys (e.g. De Boer & Baquete 1998; Mehta & Kellert 1998). Additional information on existing management practices and options was obtained from various sources. That included informal and open-ended interviews with chairpersons of three VDCs, representatives of four local non-governmental organizations (NGOs), rangers of local forest divisions, and high school teachers, field observations and focus group discussions in seven wards. J.P. Sah was also present at two community meetings organized by the IUCN during the study period. All of these allowed for the gathering of some new information and confirmation of data in the survey.

https://doi.org/10.1017/S0376892901000376 Published online by Cambridge University Press

Data analyses

Data were analysed by using the Statistical Package for the Social Sciences (SPSS) Version 10.0. Descriptive statistics were used to summarize and cross-tabulate data for χ^2 tests of independence. If two variables were not independent ($p < 0.05$), Cramer's V was employed as a measure of association, the values of which range from 0 (no association) to 1 (perfect association; Bishop *et al.* 1975). Mann-Whitney or Kruskal-Wallis tests were used if χ^2 results had expected frequencies of < 5. One-way analyses of variance (ANOVAs) were used to make comparisons among ethnic groups and VDCs of continuous variables such as land and livestock holdings.

Assessments of logical coherence of attitudes for internal consistency of responses were made using Cronbach's coefficient alpha (Cronbach 1951). The value of alpha depends on the average inter-item correlation and the number of items in the scale, and varies between 0 and 1. Since alpha is the estimate of reliability of the scale, the larger the value, the greater the reliability. Validity of the Likert attitude scale was tested by computing the correlation between responses to individual statements and the sum of responses to all statements, and the statements with *r*-value higher than 0.30 were only retained to calculate attitude index (Shrigley & Trueblood 1979). Attitude index for a respondent was calculated by summing up his/her responses on Likert attitude scale for all statements taken into consideration divided by the number of statements. Logistic regression was used to determine whether demographic and economic variables explained conservation attitudes. The factors examined as independent variables were: (1) distance from household to Ghodaghodi Lake, (2) gender, (3) age, (4) education, (5) land and livestock holdings, (6) residence period, and (7) resource use. Because binary variables are used in logistic regression, the dependent variable, namely the attitude level score, was recorded as a dummy variable with two categories divided at the median. Independent variables were also recorded as dummy variables, each with two categories.

Results

Socio-economic status

Among respondents, 81.7% were male, 18.3% were female and the mean age was 36.7 years. The major ethnic groups were Tharus and people of mountain origin. In total, 32.2% of surveyed households were Tharus. Among mountain settlers, 75.4% were Hindu higher castes (Brahmin and Chhetri), 11.5% were Hindu lower castes (Kami, Damai, Sarki, etc.), and 13.1% were Gurung, Magar, Newar and others, which are Tibeto-Burmese mountain groups (Bista 1987). Division in higher and lower castes is not recognized legally, but is practised socially. About 90% of mountain settlers had been in the area for less than 20 years, indicating that most migration took place after the start of highway construction in the late 1970s. One third of total mountain settlers, mostly of higher castes, came after 1990.

The population living in surveyed villages was 12 820. The mean household size was 7.1 individuals. Among ethnic groups, Tharus had the largest household size. Almost half of the population was illiterate. The mean literacy rate for people over six-years-old was 58.4% and the female literacy rate was 46.2%; only 7% of the population above 14-years-old had secondary or higher education. Mean literacy rate varied among ethnic groups and VDCs; for higher castes it was 68.5%, compared to 54.7% of lower castes and 46.3% for Tharus. Mean female literacy rates were 32.5% for lower castes and 37.8% for Tharus. Only 1.9% of the Tharu population (> 14 yr) had passed secondary school compared with 6.2% to 16.1% of other groups.

The major occupation (92.7% of respondents) was agriculture, while 6.7% of households were landless. The mean size of landholdings among households that had any cultivated land was 1.0 ha, but the distribution of land varied significantly among ethnic groups ($p < 0.001$). Tharus had larger mean landholdings (1.6 ha) than all groups of mountain origin, and mountain settlers of lower castes had smallest landholdings (0.44 ha).

Table 2 The number and percentage of households (n = 180) mentioning the use of forest and wetland resources.

Questions	*n*	*%*
Where do you get fuelwood from?		
Forests near lakes	66	36.7
Other forests	122	67.8
Driftwood from riverside	31	17.2
Own field	4	2.2
Market	7	3.9
Where do you get fodder from?		
Forests	132	73.3
Lake side/wetlands	49	27.2
Own agricultural fields	131	72.8
Others	29	16.1
Where do you take your livestock for grazing?		
Forests	88	48.9
Lakeside and wetlands	77	42.8
Riverside	60	33.3
Open grazing lands	36	20.0
Where do you get timber from?		
Forests near lake	54	30.0
Other forests	117	65.0
Do you collect medicinal plants or any other products from forests?	35	19.4
Do you carry out any of these activities in and around Ghodaghodi or other lakes?		
Fishing	54	30.0
Lotus collection	57	31.7
Snail collection	35	19.4
Boating	17	9.4
Turtle collection	1	0.6
Hunting birds	1	0.6
Bathing	134	74.4
Picnic/recreation	40	22.2
Religious ceremony	120	66.7
Others	16	8.9

https://doi.org/10.1017/S0376892901000376 Published online by Cambridge University Press

More than one-third (39%) of the cultivated land was without title, and land tenure, especially of titled lands, varied significantly among ethnic groups ($F_{4,163} = 6.9$, $p < 0.001$). Less than half of respondents (44.4%) replied that their agricultural production was sufficient for annual needs. Of the remaining respondents, half reported sufficient production for less than six months. Those households had members who worked as labourers either in local farms (60%) or in India (26%), or had small businesses (7%) or other work (7%).

Almost all households (98.9%) had one or more kinds of livestock. Since 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). Since a 400 kg steer is equivalent to 1 LSU (Raut 1997), in present study, 1 buffalo (1 LSU; Raut 1997) was considered equivalent to 1 steer, and one cow, calf, pig, and sheep or goat equivalent to 0.8, 0.4, 0.3 and 0.2 steer, respectively. The mean livestock holding per household was 4.03 LSU and this did not differ among ethnic groups except for buffalo and pigs. Higher Hindu castes had more buffalo, whereas Tharus had more pigs.

Resource use

People extracted forest and wetland resources for many purposes (Table 2). The Household Survey showed that different ethnicities had different preferences for using wetland and forest resources. Although ethnic groups did not differ in using forests for fuelwood or timber, there were differences among them in using forests for fodder and other products such as medicinal herbs (Table 3). Mountain settlers used forests for fodder collection more than Tharus did, but the opposite was true in the case of many non-timber forest products.

Both consumptive and non-consumptive uses of wetlands were observed. Consumptive uses included collection of fodder, snails and aquatic plants, livestock grazing and fishing. Livestock grazing was common in wetlands, but ethnic groups were different in terms of fishing and snail and aquatic plant collection. More than 80% of Tharu households fished and collected snails, whereas less than 5% of high caste and 15 to 20% of other mountain settlers fished, and none of them collected snails. Lotus (*Nelumbo nucifera*) leaves are used as plates at weddings and other occasions. Only 15 to 25% of mountain settlers used lotus leaves in comparison to 70% of Tharu households, who also collected lotus nuts and rhizomes for food.

There was no significant difference among ethnic groups in non-consumptive uses of wetlands (Table 3), however Tharus and mountain settlers carried out these activities in different ways for different purposes. People of mountain origin boated for recreation, but Tharus did so either as a part of their occupation or for fishing. The area is sacred to both Tharus and mountain settlers for different reasons. Tharus celebrated by bathing and worshipping a local deity on their New Year's Day in the second week of January. Mountain settlers worshipped at a Shiva Temple near Ghodaghodi Lake on the Hindu festival of Shivaratri in February, although all groups attended some celebrations on both occasions.

There were significant differences among VDCs in timber harvesting, non-timber forest product (NTFP) collection, livestock grazing in wetlands, fishing, snail and aquatic-plant collection, and non-consumptive uses of wetlands (Table 3). Some differences among wards in uses of forests and

Table 3 Results of Kruskal-Wallis tests of relationships between type of forest and wetland resource uses and ethnic groups, VDC, wards, and landholding and livestock holding classes and of Mann-Whitney statistics (U) showing the relation between resource uses and distance to the Ghodaghodi Lake. NS = not significant.

Type of use	*Ethnic groups*	*VDC*	*Wards*	*Distance*	*Landholding*	*Livestock holding*
Forest						
Fuelwood lake side	NS	NS	<0.001	<0.001	NS	NS
Fuelwood others	NS	0.036	<0.001	0.012	NS	NS
Fodder	<0.001	NS	0.017	NS	0.005	0.004
Grazing	NS	NS	0.029	NS	NS	0.003
Timber	NS	0.023	0.028	0.041	NS	NS
NTFP	<0.001	<0.001	0.004	NS	<0.001	NS
Wetlands consumptive						
Fodder	NS	NS	NS	NS	NS	0.003
Grazing	0.003	0.015	<0.001	0.009	NS	0.041
Fishing	<0.001	<0.000	0.001	0.031	0.003	NS
Snail collection	<0.001	0.010	0.029	0.027	0.003	NS
Plant products	<0.001	0.001	0.002	0.003	0.018	NS
Lakes non-consumptive						
Bathing	0.046	0.001	0.014	0.006	NS	NS
Recreation	NS	NS	NS	NS	NS	NS
Boating	NS	NS	NS	NS	0.027	NS
Religious ceremony	<0.001	<0.001	0.001	NS	NS	NS
Others	NS	NS	NS	NS	NS	0.045

https://doi.org/10.1017/S0376892901000376 Published online by Cambridge University Press

wetlands were also evident attributable to distance. Economic status was related to wetland and forest uses. Land holding size was related to the use of fodder and other NTFPs, and to the fishing and snail and aquatic plant collection (Table 3); higher numbers of small and medium landholders used fodder from forests compared to large landholders, but the opposite trend was observed in other uses. Households with large livestock holdings used forests for fodder more than those with small livestock holdings did (Table 3).

Management practices

Various management activities have been carried out in the area recently. A fence was constructed along the highway, as was a viewing tower and walkway on a ridge in the northern part of the Lake. Temple renovation was completed in the mid-1990s. The IUCN's Nepal office organized several meetings and formed a local-level conservation committee in order to develop a management plan for the area (IUCN 1998). Among surveyed households, however, only 22.2% replied that they had heard about wetland management activities and only 51% of those had participated by way of attending meetings (84.6%), taking part in lake cleaning (30.7%), and/or managing water for irrigation (53.8%). Reasons given for participation included wetland conservation (69.2%), increases in agricultural production (53.8%), community pressure (15.3%), and others (15.3%). Participation was related to gender, education and ethnicity, but not to age or landholdings (Table 4). Only males participated in management activities. There were differences among education and ethnic groups; for example, higher proportions of high-caste households of mountain origin participated in management activities. There were no differences among VDCs in the proportion of participating households. Participation was related to distance from households to Ghodaghodi Lake; closer households reported more participation (Table 4).

Table 4 Results of χ^2 tests (p = level of statistical significance; NS = not significant i.e. $\alpha = 0.05$; Cramer's V = degree of association of relationships between participation and socio-economic characteristics). Cramer's V was not calculated when p-value > 0.05.

Socio-economic variables	*p-value*	*Cramer's V*
Gender	0.009	0.195
Age	NS	–
Education	0.001	0.243
Ethnicity	0.010	0.225
Landholding	NS	–
VDC	NS	–
Distance to lake	0.004	0.215

Conservation attitudes

Attitudes were examined using statements that respondents were asked to rate on the 1 to 5 Likert Scale (Table 5). Conservation attitudes varied from 2.16 to 4.78 and Cronbach's alpha was 0.71. Logistic regression, using the

Table 5 Statements used to formulate index of attitudes towards conservation and percentages of responses to attitude statements (n = 180: * represents negative statement).

Statements	*Strongly agree*	*Agree*	*Don't know*	*Disagree*	*Strongly disagree*
1. There should be restriction on the use of fuelwood from the forests around the lakes	45.0	16.7	2.2	12.8	23.3
2. Extraction of fodder from the forests around the lakes should be controlled	59.4	8.9	2.2	10.6	18.9
3. It is not good to allow uncontrolled livestock grazing around the lakes	59.4	10.6	3.9	5.6	20.6
4. There is scarcity of lands to produce enough food, therefore people should be allowed to farm in place of forests and wetlands*	13.3	18.9	1.7	8.9	57.2
5. Licenses should be issued for fishing in the lakes in order to control the indiscriminate and over fishing	22.8	5.0	2.8	3.9	65.6
6. Ghodaghodi and other lakes in this region are important for birds	88.3	3.9	5.0	1.7	1.1
7. To conserve different kinds of wildlife, conservation of lakes is also important	86.1	7.8	4.4	1.1	0.6
8. Lakes in the Ghodaghodi area can be means of entertainment and tourism	77.8	7.8	7.8	5.0	1.7
9. Tourism can bring extra income for the people in this region	73.9	9.4	8.9	3.3	4.4
10. It is waste of money and resources to conserve wetlands and surrounding forests when people are poor and are short of land*	14.4	2.8	3.9	2.2	76.7
11. The use of forest and wetland resources and their conservation should be done together	87.2	5.6	3.9	2.8	0.6
12. You want to contribute in some way to the conservation of forests and wetlands	59.4	16.7	1.1	10.0	12.8

https://doi.org/10.1017/S0376892901000376 Published online by Cambridge University Press

Table 6 Logistic regression of relationships between socio-economic variables and conservation attitudes of local people. SE = Standard error, W = Wald statistic with χ^2 distribution, and p = level of statistical significance; NS = not significant.

Socio-economic variables	*SE*	*W*	*p*
Gender	0.501	2.078	NS
Age	0.360	0.817	NS
Education	0.385	7.804	0.005
Landholding	0.365	3.735	0.053
Ethnicity (mountain settlers)	0.418	1.497	NS
Participation	0.533	0.298	NS
Resource use	0.394	9.670	0.002

overall conservation attitude index as the dependent variable and socio-economic variables as independent variables showed that education and resource use significantly contributed to variation in attitudes; other variables were not significant (Table 6). Education showed a positive relationship, whereas resource use showed a negative relationship. There were higher proportions of males, mountain settlers, and respondents who had participated in management activities with more positive attitudes than females, Tharus and those who had never participated (Table 7).

As the statements used to determine attitudes covered different aspects of conservation, further analyses were done on sub-groups of related items. Restrictions on uses of wetlands and forests for fuelwood, fodder and livestock grazing made up one group, which included three items (Table 7). Cronbach's alpha was 0.71 and the mean attitude index value varied from 3.47 to 3.83. About 60–70% responded that there should be restrictions on resource use, and a similar proportion agreed that livestock grazing was not good for wetlands. Regression showed that education and resource use were important in explaining those responses (Table 8). One-third of respondents, mostly illiterate, having small landholdings and living close to lakes and forests, replied that they should get public land for cultivation. Most (70%) people asserted that licenses should be issued for fishing.

Table 7 Results of χ^2 tests of the significance (p values; NS = not significant, i.e. $p > 0.05$) of relationships between socio-economic variables and attitudes towards various aspects of conservation, formed by sub-grouping the related statements used to test conservation attitude.

Activities	*Gender*	*Age*	*Education*	*Ethnic groups*	*Landholding*	*Participation*	*Resource use*
1. Conservation of wetlands	0.029	NS	<0.001	NS	NS	0.039	0.003
2. Restriction on the use of resources	NS	NS	0.014	NS	NS	NS	0.003
3. Cultivation in forest and wetland area	NS	NS	0.045	NS	0.014	NS	NS
4. License for fishing	NS	NS	0.014	NS	NS	NS	NS
5. Importance of wetlands for wildlife	0.029	NS	0.002	NS	NS	NS	NS
6. Tourism development	NS	NS	0.007	0.001	NS	NS	NS
7. Participatory conservation	NS	NS	NS	NS	0.025	NS	NS

Table 8 Logistic regression of relationships between socio-economic variables and people's attitude towards restriction on resource use and tourism development in the Ghodaghodi Lake area. SE = Standard error, W = Wald statistic with χ^2 distribution, p = level of statistical significance.

Socio-economic variables	*SE*	*W*	*p*
Restriction on resource use			
Gender	0.498	0.664	NS
Age	0.389	1.159	NS
Education	0.409	4.194	0.041
Ethnicity (mountain settlers)	0.432	0.392	NS
Landholding	0.377	0.490	NS
Participation	0.608	0.629	NS
Resource use	0.420	11.162	0.001
Tourism development			
Gender	0.844	1.435	NS
Age	0.804	2.716	NS
Education	0.697	1.651	NS
Ethnicity (mountain settlers)	0.759	8.437	0.004
Landholding	0.669	2.161	NS
Participation	29.754	0.045	NS
Resource use	0.706	0.710	NS

The next group included two items related to attitudes towards the importance of wetlands for wildlife (Table 7). The mean attitude index for both was 4.78 and Cronbach's alpha was 0.51. Since there was less variability in these responses compared to others (above) relationships with socio-economic variables were weak. However, they were dependent on gender ($p = 0.029$); females had more negative attitudes about wetland conservation than males (Table 7). Two items related to attitudes towards tourism formed the next group. The mean attitude index was 4.45 and 4.55, respectively and Cronbach's alpha was 0.82. Logistic

https://doi.org/10.1017/S0376892901000376 Published online by Cambridge University Press

regression showed that ethnicity was related to this attitude (Table 8). The response to tourism-related items was dependent on both ethnicity ($p < 0.001$) and education ($p = 0.007$). More literate and respondents of mountain origin had positive attitudes towards tourism development than did others.

Participatory conservation, the group of the last three items, was related to resources and efforts needed for conservation, sustainable use of forests and wetlands, and people's willingness to contribute to conservation (Table 7). The mean attitude index for these items varied from 4.0 to 4.74 and Cronbach's alpha was 0.51. Logistic regression showed that no single socio-economic variable in the model explained variation in responses, and attitudes to participation were independent of all variables except landholdings; respondents with larger landholdings had more positive attitudes about participatory conservation (Table 7). More than 90% of all respondents agreed that uses and conservation of wetland and forest resources should be simultaneous activities and 76% showed interest in contributing to conservation activities, mostly in the form of donated labour. Higher proportions of literate people ($p = 0.02$), and those who had participated in any management activity ($p = 0.01$), showed interest in contributing to conservation when willingness to contribute was tested separately.

Discussion

Demographic conditions have changed significantly in Ghodagodhi Lake over the past several decades, and this has profound consequences for management of the area and attitudes about conservation. Of current residents, 64% were recently settled mountain-origin households. Indigenous Tharus were the majority until the late 1980s, but are now the minority (32.2%) due to migration of people from the mountains owing in part to highway construction and to the greater availability of land in the terai. The net result is that social conditions and many local resource uses have changed. Education is one such variable, and this alone can affect conservation attitudes, usually for the better (e.g. Mordi 1987; Fiallo & Jacobson 1995; Gillingham & Lee 1999). Parry and Campbell (1992) and De Boer and Baquete (1998), however, found that education did not affect conservation attitudes. In the present study, Tharus showed more negative attitudes towards conservation than others did. Similar results were found by Tremblay and Dunlap (1978) and Pyrovetsi and Dautopoulos (1997), who concluded that indigenous people may express anti-environmental attitudes for variety of reasons, including low education levels, lack of awareness about environmental issues and lack of participation; all were important here too.

The larger landholdings of Tharus were associated with longer residence. In the sample, 54.3% of the land belonging to mountain settlers was without title in comparison to 20.5% of Tharu land. The rate of tenancy has decreased in the western terai since the 1980s (Bista 1989). This, combined with demographic changes, has led to differences in some agricultural practices, which had been noted also in other regions (e.g. Richards 1996). Agricultural systems varied between Tharus and mountain settlers in that Tharus use oxen and few male buffalo mainly for draught animals, whereas mountain settlers keep cattle and female buffalo for breeding and milk production (Tulachan 1985). Tharus keep pigs, which do not require extensive grazing lands. Land and livestock holdings had no affect on conservation attitudes in the Ghodaghodi Lake area. This differs from other studies that reported more positive conservation attitudes among wealthier people (e.g. Mordi 1987; Newmark *et al.* 1993), and the people who owned land than those who did not (Infield & Namara 2001). This is probably a result of the fact that Tharus, with more negative attitudes, had large landholdings.

Resource use patterns in the area have shifted mainly from dependence on various wetland resources typical of Tharus to dependence on forests and wetlands for fodder typical of mountain settlers. Although there are no comparative data for this study site, forest dependency in other parts of Nepal is inversely related to land holding size (Shrestha 1986), which has declined in Ghodaghodi Lake area, and to livestock type, which has changed as well. The net result is greater forest and wetland degradation because of greater numbers of recent migrants, as reported from elsewhere (e.g. Richards 1996). In Ghodaghodi Lake, however, Tharus fish and use other aquatic resources extensively, and traditional patterns are shifting from consumptive uses to commercialization due to the development of nearby markets. Thus, traditional patterns are changing and in the absence of interventions will be likely to cause decline in wetland resources (see below).

Resource use showed a negative correlation with attitudes, which would seem to contradict the general hypothesis that those who could benefit most from conservation programmes will have better attitudes (e.g. Lewis *et al.* 1990; Brown 1991). Those who rely on wetlands in Ghodaghodi Lake area, however, are politically disempowered. Open-ended responses indicated that many Tharus believed their traditional usufruct rights would be restricted if formal conservation programmes were implemented.

Differences in attitude also depended on awareness about environmental issues, ongoing changes in politics and priorities of government developmental policies within the country. There is a vast difference between indigenous and mountain-origin households in terms of awareness; Tharus are more closed, shy and rarely visited by government officials (Bhandari *et al.* 1986). Language also acts as a barrier; many indigenous people do not speak Nepali, the national language, whereas over 98% of government employees involved in extension do not speak local languages. Use of the structured-questionnaire survey, a cost-effective method of studying attitudes (Mueller 1986), may also have had some influence on the results, as structured questions with multiple-choice answers usually inhibit interviewees from expressing their own opinion in their own words and cogni-

tive contexts. There were more male (81.7%) than female respondents (18.3%). This was expected as the head of a household was generally the male, and interviewing females in presence of their husbands was not feasible. This gender-biased sampling may have some influence on the results, as women are generally very involved in wetland and forest resource use.

While summarizing the results, we found that the demographic and socio-economic conditions, which had changed in Ghodaghodi Lake area in recent years, had influenced resource use patterns and people's attitudes towards conservation. Resource use from forests and wetlands was significantly related to ethnicity, land and livestock holdings, and distances from the Lake. Education had a positive influence, while resource use had a negative influence on people's wetland conservation attitude. Gender and peoples' participation also showed a relationship with conservation attitude. Males and the people who had participated in conservation activities had more positive attitude towards wetland conservation than females and the people who had not participated. The influences of other socio-economic variables, age, landholdings and residence period on overall wetland conservation attitude were not significant.

Policy implications

Since positive attitudes tended to increase with education level and knowledge about conservation issues, and education level in Ghodaghodi Lake is strongly related to ethnicity and social status, incentives should be provided to Tharu and lower-caste mountain settlers to send children to school. Availability of primary education in the local language could be an important way to motivate Tharus; similar programmes have recently been started in other parts of Nepal.

Attitudes towards wetland conservation are also based upon utilitarian values of wetland resources (e.g. Harcourt *et al.* 1986; Weber 1987; Infield 1988). In Ghodaghodi Lake, these vary for different communities. Management programmes should strive to reach awareness and agreement cross-culturally to achieve sustainable use of resources given different needs because of ethnicity.

A majority of people agreed that wetlands should be conserved, and more than 90% asserted that the use and conservation of wetlands should be carried out in concert. When a follow-up question asked how respondents thought conservation and management could be combined, many respondents, especially of mountain origin, gave examples of successful community forestry programmes. Under this programme, part of a national forest is handed over to the users' group entitled to develop, conserve, use and manage the forest independently for the collective interest (HMG 1995). Community forestry, also called participatory forestry (Hobley 1996), has been credited for enabling the forest conservation and regeneration that has taken place elsewhere in Nepal and India (Dahal 1994; Hobley 1996; Dasgupta 2000). This raises the possibility of turning forests over to local user groups, which would minimize the indiscriminate use of forests and help to conserve them in the watershed area of wetlands in the Ghodaghodi Lake area. However, respondents were unsure if wetlands could be managed in this fashion. There are few models to follow from other regions on this issue and more research on indigenous wetland management systems is warranted here and elsewhere.

One way to change attitudes is to change the underlying incentives for consumptive uses (Wells & Brandon 1992). Both community forestry and community wetland management should be initiated in the Ghodaghodi Lake area. Like the community forestry in the middle hills (Dahal 1994; Karki *et al.* 1994), sustainable harvest of wetland resources is likely to enhance attitudes among Tharus, and community forestry will affect all stakeholders within communities. Knowledge of biological productivity and sustainable yields of NTFPs in forests and wetlands is lacking and this should be acquired before implementing such policies. Since IUCN's focus in Nepal is on wetland conservation, international funds should be forthcoming for research. People of all ethnic groups also use wetlands and lakes for religious activities and a broader consensus about conservation and use of Ghodaghodi Lake may thus be achievable.

In a series of meetings with the residents of Ghodaghodi Lake area, people were receptive to the idea of wetland conservation and were ready voluntarily to cooperate (IUCN 1998); in the present study, 75% indicated they would contribute labour toward such efforts. However, those responses may be due to expectations of future economic benefits such as tourism. Expectations are more evident among literate people who have been exposed to other development projects, a phenomenon also reported elsewhere (e.g. Brown 1991; Ite 1996; Infield & Namara 2001). If expectations are not fulfilled, attitudes may worsen in the future. More than three years have passed since the initial conservation plan for Ghodaghodi Lake, but there has been no project implementation. The programmes formulated in the management plan (IUCN 1998) should clarify the situation so that present support is not eroded. Proportional participation is important to enable cultural factors to be incorporated into projects, as people differing in ethnicity will be likely to act according to perceptions of their best interests. Female and minority representation are now required by law in user groups instituted under Nepal's conservation area and buffer zone policies (Heinen & Mehta 1999, 2000) and could be required here.

While community participation in conservation has been successful in the mountains, the situation is different in the terai. Many mountain parks and conservation areas in Nepal attract tourists and thus the value of intact resources is frequently high. High economic values of harvested resources in the terai can provide a strong incentive to conserve, but also result in pressures from illegal harvest leading to degradation (Richards 1996). In the absence of strict controls or strong incentives for conservation, the latter has been the case across much of the Nepalese terai since the

mass-movement of mountain settlers. In developing countries, natural areas are invaded primarily out of necessity (Sai 1984). Therefore, it is apparent that conservation programmes intervene to reduce need, through, for example, improved cooking stoves and stall feeding.

The implementation of various income-generating activities should raise economic status independently of farm activities. More than 80% of respondents considered the Lake a unique place and recognized its tourism potential. There were currently no markets in this area, but ecotourism, has played a significant role in bringing benefits to communities in many places (Whelan 1991; Mehta & Kellert 1998), although not all (e.g. Boo 1990). Ecotourism, which has been called responsible travel that helps conserve natural environment and sustains the well being of local cultures, is not always an opportunity (Issacs 2000; Li & Han 2001). In Nepal's Royal Chitwan National Park, for example, Tharus get little benefit from tourism (R. P. Chaudhary, personal communication 2001). Thus mechanisms to promote more widespread and equitable benefits must be considered (Hartup 1994) as it is likely that educated people, especially higher-caste mountain settlers, would benefit more from tourism, which is largely the case in Chitwan (Bookbinder *et al.* 1998). Since Tharus are indigenous to the Ghodaghodi Lake area, guaranteed percentages of income from tourism should be earmarked for their cultural preservation, education and opportunity enhancement, which would help in improving their attitudes towards conservation.

Due to increasing demand for fish in local markets, it is likely that subsistence fishing by Tharus will be gradually replaced by commercial fishing. Fish farming, which has expanded greatly in the eastern terai (Thapa & Pradhan 1999), should also be considered in Ghodaghodi Lake area, but not in the lake itself, to reduce demand for natural resources. However, in such conditions, care has to be taken to avoid any adverse impact of species, to be introduced for commercial farming, on the native species in the Ghodaghodi Lake and other wetlands of the area.

A number of governmental agencies and NGOs have been involved in various activities in the Ghodaghodi Lake area. Included among them are the Forest, Tourism, and Irrigation Departments, VDCs, the United Nations Development Programme (UNDP), IUCN and local NGOs. However, much of the work thus far has been sporadic and uncoordinated. Because functions and responsibilities are unclear, it is common to find more than one organization doing similar work. There is no sole legal body responsible for managing Ghodaghodi Lake. Thus, a management committee involving user groups and representatives from various organizations should be formed and empowered. There is a long way to go in this endeavour for Ghodaghodi Lake, but Nepal has other successful programmes (e.g. Heinen & Mehta 2000; Hobley 1996), and thus there are models upon which to base such a scheme in spite of a dearth of wetland-specific programmes worldwide.

Conclusions

Changes in demography due to the immigration of mountain people have resulted in changes in social structures, economic opportunities, and wetland and forest resource uses. The conversion of forests and wetlands to agriculture poses serious threats to conservation. Our results indicate that conservation attitudes were mainly influenced by education and resource-use patterns, and only secondarily by ethnicity. Education and awareness programmes should focus on indigenous and lower-caste mountain residents to increase participation in conservation and management activities and to improve attitudes. Implementation of community forestry and community wetland management are proposed to promote sustainable resource use and thus help to maintain continuous involvement of local people in conservation. Similarly, tourism and fish farming should be promoted to increase off-farm income so that dependency on forest and wetland resources can be reduced.

Acknowledgements

We thank the National Geographic Society and San Diego Zoological Society for funding portions of this work. Mr Ram Lakhan Singh, Mr Nitya Nanda Bhatta, Mr Gopal K. C. and Mr Arjun Chaudhary served as field assistants. Mr Dina Nath Poudyal, Vice-chairman of Darakh VDC and Mr Sant B. Gurung, IUCN Field Manager for Ghodaghodi Lake, were helpful in providing logistic support.

References

Acharya, P. (1997) Wetland vegetation and its utilisation in Ghodaghodi and Nakharodi Tal, Nepal. M.Sc. Thesis. Central Department of Botany, Tribhuvan University, Kathmandu, Nepal.

Alexander, S.E. (2000) Resident attitudes towards conservation and black howler monkeys in Belize: the Community Baboon Sanctuary. *Environmental Conservation* **27**(4): 341–50.

Alpert, P. (1996) Integrated conservation and development projects. *Bioscience* **46** (11): 845–55.

Bhandari, B. (1994) Institutions and capability in wetlands management in Nepal. In: *Safeguarding Wetlands in Nepal,* eds. B. Bhandari, T.B. Shrestha & J. McEachern, pp. 119–136. Kathmandu, Nepal: IUCN/Nepal.

Bhandari, B. (1998) *An Inventory of Nepal's Wetlands*. Kathmandu, Nepal: IUCN/Nepal: 329 pp.

Bhandari, B., Kunwar, N. & Dongol, B.B.S. (1986) Rural poverty and the poor in Nepal: comparative case study of a Hill and Terai Village. Rural Poverty Research Paper Series 4, Winrock International, Kathmandu, Nepal.

Bhandari, B., Shrestha, T.B. & McEachern, J., eds. (1994) *Safeguarding Wetlands in Nepal.* Kathmandu, Nepal: IUCN/Nepal: 160 pp.

Bishop, Y.M.M., Fienberg, S.E. & Holland, P.W. (1975) *Discrete Multivariate Analysis: Theory and Practice*. Cambridge, MA, USA: The MIT Press: x + 557 pp.

Bista, D.B. (1987) *People of Nepal.* 5th edition. Kathmandu, Nepal: Ratna Pustak Bhandar: 210 pp.

Bista, R. (1989) Cross-sectional variations and temporal changes in

land area under tenancy and their implications for agricultural productivity. Natural Resource Management Paper Series 13. Winrock International, Kathmandu, Nepal.

Boo, E. (1990) Ecotourism: the potentials and pitfalls. Unpublished report, World Wildlife Fund-US, Washington, DC, USA.

Bookbinder, M.P., Dinerstein, E., Rijal, A., Cauley, H. & Rajouria, A. (1998) Ecotourism's support of biodiversity conservation. *Conservation Biology* **12**(6): 1399–404.

BPP (1995) Biodiversity assessment of Terai wetlands. BPP Technical Publication 1, Department of National Parks and Wildlife Reserve, Ministry of Forests, Kathmandu, Nepal.

Brown, J.L. (1991) Building community support for protected areas: the case of Tortuguero National Park, Costa Rica. M.A. Thesis, Clark University, Worchester, Massachusetts, USA: vii + 184 pp.

Carew-Reid, J. (1990) Conservation and protected areas on south Pacific islands: the importance of tradition. *Environmental Conservation* **17**(1): 29–38.

CBS (1995) *Population Monograph of Nepal*. Kathmandu, Nepal: HMG, National Planning Commission Secretariat.

Chhetri, R.B. (1994) Indigenous and community forestry management systems: reviewing their strengths and weaknesses. In: *Anthropology of Nepal: Peoples, Problems and Processes*, ed. M. Allen, pp. 19–35. Kathmandu, Nepal: Mandala Book Point.

Cohn, J.P. (1989) Iguana conservation and economic development. *Bioscience* **39**: 359–63.

Cronbach, L.J. (1951) Coefficient alpha and the internal structure of tests. *Psychometrica* **6**: 297–334.

Dahal, D.R. (1994) *A Review of Forest User Groups: Case Studies from Eastern Nepal*. Kathmandu, Nepal: International Centre for Integrated Mountain Development (ICIMOD): v + 219 pp.

Dasgupta, S. (2000) People's involvement in resource management in Madhya Pradesh. *Indian Forester* **126**(5): 525–36.

De Boer, W.F. & Baquete, D.S. (1998) Natural resource use, crop damage and attitudes of rural people in the vicinity of the Maputo Elephant Reserve, Mozambique. *Environmental Conservation* **25**(3): 208–18.

Drake, S.P. (1991) Local participation in ecotourism projects. In: *Nature Tourism*, ed. T. Whelan, pp. 132–63. Washington, DC: Island Press.

Durbin, J.C. & Ralambo, J.A. (1994) The role of local people in the successful maintenance of protected areas in Madagascar. *Environmental Conservation* **21**(2): 115–20.

Fiallo, E.A. & Jacobson, S.K. (1995) Local communities and protected areas: attitudes of rural residents towards conservation and Machalilla National Park, Ecuador. *Environmental Conservation* **22**(3): 241–49.

Gillingham, S. & Lee, P.C. (1999) The impact of wildlife-related benefits on the conservation attitudes of local people around the Selous Game Reserve, Tanzania. *Environmental Conservation* **26**(3): 218–28.

Happold, D.C.D. (1995) The interaction between humans and mammals in Africa in relation to conservation: a review. *Biodiversity and Conservation* **4**: 395–414.

Harcourt, A.H, Pennington, H. & Weber, A.W. (1986) Public attitudes to wildlife and conservation in the third world. *Oryx* **20**(3): 152–4.

Hartup, B.K. (1994) Community conservation in Belize: demography, resource use, and attitudes of participating landowners. *Biological Conservation* **69**: 235–41.

Heinen, J.T. (1993) Park-people relations in Koshi Tappu Wildlife Reserve, Nepal: a socio-economic analysis. *Environmental Conservation* **20**(1): 25–34.

Heinen, J.T. & Mehta, J.N. (1999) Conceptual and legal issues in the designation and management of conservation areas in Nepal. *Environmental Conservation* **26**: 21–29.

Heinen, J.T. & Mehta, J.N. (2000) Emerging issues in legal and procedural aspects of buffer zone management with case studies from Nepal. *Journal of Environment and Development* **9**(1): 45–67.

HMG (1973) National Parks and Wildlife Conservation Act 2029 (1973). *Nepal Gazette* **23**(47): 1–27.

HMG (1995) Forest Act 2049 (1993) and Forest Regulation 2051 (1995). Official translation. Ministry of Forest and Soil Conservation, Kathmandu, Nepal.

HMG/IUCN (1988) *Building on Success: The National Conservation Strategy for Nepal*. Kathmandu, Nepal: HMG/IUCN: 179 pp.

Hobley, M. (1996) *Participatory Forestry: the Process of Change in India and Nepal*. London, UK: Overseas Development Institute: viii + 337 pp.

Infield, M. (1988) Attitudes of a rural community towards conservation and a local conservation area in Natal, South Africa. *Biological Conservation* **45**: 21–46.

Infield, M. & Namara, A. (2001) Community attitudes and behaviour towards conservation: an assessment of a community conservation programme around Lake Mburo National Park, Uganda. *Oryx* **35**(1): 48–60.

Issacs, J.C. (2000) The limited potential of ecotourism to contribute to wildlife conservation. *Wildlife Society Bulletin* **28**(1): 61–69.

Ite, U.E. (1996) Community perceptions of the Cross River National Park, Nigeria. *Environmental Conservation* **23**(4): 351–57.

IUCN (1998) The Ghodaghodi Tal Conservation Area: a community centred management plan. Unpublished report, IUCN-Nepal, Kathmandu, Nepal: 72 pp.

Karki, M., Karki, J.B.S. & Karki, N. (1994) *Sustainable Management of Common Forest Resources: an Evaluation of Selected Forest User Groups in Western Nepal*. Kathmandu, Nepal: International Centre for Integrated Mountain Development (ICIMOD): viii + 174 pp.

Lewis, D., Kaweche, G.B. & Mwenya, A. (1990) Wildlife conservation outside protected areas – lessons from an experiment in Zambia. *Conservation Biology* **4**(2): 171–80.

Li, W. & Han, N. (2001) Ecotourism management in China's nature reserves. *Ambio* **30**(1): 62–63.

Likert, R. (1974) A method of constructing an attitude scale. In: *Scaling: A Sourcebook for Behavioural Scientists*, ed. G.M. Maranell, pp. 233–43. Chicago, USA: Aldine Publishing Company.

McGregor, J. (1995) Gathered produce in Zimbabwe's communal areas changing resource availability and use. *Ecology of Food and Nutrition* **33**: 163–93.

Mehta, J.N. & Kellert, S.R. (1998) Local attitudes toward community-based conservation policy and programmes in Nepal: A case study in the Makalu–Barun Conservation Area. *Environmental Conservation* **25**(4): 320–33.

Mordi, R. (1987) Public attitudes toward wildlife in Botswana. Ph.D. Thesis, Yale University, New Haven, Connecticut, USA: xiv + 344 pp.

Mueller, D.J. (1986) *Measuring Social Attitudes: A Handbook for Researchers and Practitioners*. New York, USA: Teacher College Press, Columbia University: ix + 123 pp.

Newmark, W.D., Leonard, N.L., Sariko, H.I. & Gamassa, D.G.M. (1993) Conservation attitudes of local people living adjacent to

five protected areas in Tanzania. *Biological Conservation* **63**(2): 177–83.

Parry, D. & Campbell, B. (1992) Attitudes of rural communities to animal wildlife and its utilisation in Chobe Enclave and Mababe Depression. *Environmental Conservation* **19**(3): 245–52.

Pyrovetsi, M. & Daoutopoulos, G. (1989) Conservation related attitudes of lake fishermen in Greece. *Environmental Conservation* **16**: 245–50.

Pyrovetsi, M. & Daoutopoulos, G. (1997) Contrasts in conservation attitudes and agricultural practices between farmers operating in wetlands and a plain in Macedonia, Greece. *Environmental Conservation* **24**(1): 76–82.

Raut, Y. (1997) Concept of stocking rate and carrying capacity: high stocking rate and its effects on pasture production and ecology. In: *A Textbook of Animal Husbandry, Part I: Pasture Production,* pp. 16–34. Kathmandu, Nepal: Department of Livestock Services, Ministry of Agriculture.

Redford, K.H. & Stearman, A.M. (1989) Local peoples and the Beni Biosphere Reserve, Bolivia. *Vida Sylvestre Neotropical* **2**(1): 49–56.

Richards, M. (1996) Protected areas, people and incentives in the search for sustainable forest conservation in Honduras. *Environmental Conservation* **23**(3): 207–17.

Sah, J.P. (1997) *Koshi Tappu Wetlands: Nepal's Ramsar Site*. Bangkok, Thailand: IUCN: xii + 254 pp.

Sah, J.P. & Sah, S.K. (1999) Wetlands of Nepal: biodiversity and its conservation. In: *Nepal-Nature's Paradise,* eds. T. C. Majupuria & R. Kumar, pp. 569–94. Gwalior, India: M. Devi Publishers.

Sai, F.T. (1984) The population factor in Africa's development dilemma. *Science* **226**: 801–5.

Saharia, V.B. (1982) Human dimension in wildlife management: the Indian experience. In: *National Parks, Conservation and Development: the Role of Protected Areas in Sustaining Society*, ed. J.A. McNeely & K.R. Miller, pp. 190–6. Washington, DC, USA: Smithsonian Institution.

Shrestha, K.B. (1995) Community forestry in Nepal and an overview of conflicts. *Banko Janakari* **5**(3): 101–7.

Shrestha, R.L. (1986) Socio-economic factors leading to deforestation in Nepal. Research and Planning Paper Series 2, Wetland International, Kathmandu, Nepal: 24 pp.

Shrestha, T.B. & Bhandari, B. (1992) Proceedings of the First Meeting on Wetlands Management in Nepal. IUCN and Department of National Parks and Wildlife Reserve, Kathmandu, Nepal: 36 pp.

Shrigley, R.L. & Trueblood, C.R. (1979) Designing a Likert-type scale to assess attitude toward metrication. *Journal of Research in Science Teaching* **16**(1): 73–8.

Studsrod, J.E. & Wegge, P. (1995) Park-people relationships: the case of damage caused by park animals around the Royal Bardia National Park, Nepal. *Environmental Conservation* **22**(2): 133–42.

Thapa, T.B. & Pradhan, G.B.N. (1999) Status of aquaculture and its potential for expansion under long-term perspective plan in Nepal. In: *Proceedings of the National Workshop on Prospect of Fisheries Development under the Agriculture Perspective Plan. November 4–5, 1998*, eds. D.B. Swar, G.B.N. Pradhan & J. Bisgaard, pp. 5–18. Kathmandu, Nepal: Fisheries Development Division, Department of Agriculture Development.

Tremblay, K.R. & Dunlap, R.E. (1978) Rural-urban residence and concern with environmental quality replication and extension. *Rural Sociology* **43**: 474–91.

Tulachan, P.M. (1985) Socio-economic characteristics of livestock raising in Nepal. Research Report Series 1, Wetland International, Kathmandu, Nepal: 27 pp.

Weber, A.W. (1987) Socioecologic factors in the conservation of Afromontane forest reserves. In: *Primate Conservation in the Tropical Rain Forest*, eds. C.W. Marsh & R.A. Mittermeier, pp. 205–29. New York, USA: Alan R. Liss.

Wells, M. & Brandon, K. (1992) People and parks: linking protected areas management and local communities. Unpublished report, World Bank, Washington, DC, USA: 99 pp.

Whelan, T. (1991). Ecotourism and its role in sustainable development. In: *Nature Tourism*, ed. T. Whelan, pp. 3–22. Washington, DC, USA: Island Press.