

# Beyond buffer zone protection: A comparative study of park and buffer zone products' importance to villagers living inside Royal Chitwan National Park and to villagers living in its buffer zone

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## Abstract

Even after 30 years of strict de jure protection, today's de facto extraction of products from Nepal's Royal Chitwan National Park (RCNP) and their great economic importance to local households suggests that this reality should be explicitly internalised in managing this world heritage park. Several studies have quantified local people's use of protected areas and estimated the value of such areas to them. However, few studies incorporate economic analyses to investigate the effect of management interventions on local communities' resource use and collection behaviour. In Nepal, buffer zones and especially buffer zone community forestry are seen as means to define and demarcate places, where local people may legally extract goods that are either identical to or relevant substitutes for products that are collected in protected areas. The intention is to resolve park-people conflicts over resource use. This article presents the findings of an in-depth study of the importance of natural resources to the livelihoods of 18 households. One village was located inside RCNP with no realistic alternatives to Park resources, while the other is located in the buffer zone with equal distance to the Park, a national forest and their community forest. For each household, the collection of products, allocation of time, and purchase and sale of goods were recorded daily through 12 consecutive months and economic values were calculated on the basis of local market prices and recorded quantities. The study shows that products from RCNP are of great importance to the livelihoods of local people. Furthermore, we find that products collected in the national forest substitute products from the Park, while the substitution effect of the community forest is small. Accordingly, the study illustrates that, irrespective of buffer zone community forestry, there is still a gap between local people's need for supplementing natural resources and their rights to satisfy them on a legal basis, which is likely to be unsustainable in the longer term. This calls for a thorough evaluation of actual park-people relations and how these may be improved through local participation that goes beyond the current form of buffer zone community forestry and the admitted 7–14 annual days of open access grass cutting within the park.

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## 1. Introduction

It is widely recognised that protected areas affect the livelihoods of local people (villagers) (Lynagh and Urich, 2002; Tisdell and Zhu, 1998; Wild and Mutebi, 1997; Nepal and Weber, 1995, 1994; Kothari et al., 1995; Skonhoft, 1995; Brandon and Wells, 1992). Furthermore, several studies have attempted to calculate the economic value of

protected areas and the costs and benefits incurred by people living in the vicinity of such areas (Godoy et al., 2000; Shyamsundar and Kramer, 1997; Melnyk and Bell, 1996). In theory, such estimations of costs and benefits associated with establishing protected areas could be used to decide on how much the 'winners' (those benefiting from the establishment of protected areas) should 'pay' to compensate the 'losers' (local people whose livelihood options will be reduced as a result of establishing a protected area). This is basically the way economic compensation to private land owners is calculated in developed countries when society, for the common good, restricts management options, alters physical structures or takes-over private land holdings, either through negotiated agreements or expropriation.

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Rarely this has been the process in developing countries, owing to the fact that, before being gazetted as protected, such areas were in most cases already, *de jure*, state property (forest or hunting reserves) although often, *de facto*, utilised and sometimes even under some form of management by local people. Hence, the legal status of local people is and has generally been very weak in negotiations over if and how they might be compensated in association with declaring or enhancing a protected area (Grimble and Laidlaw, 2002; Hall and Rodgers, 1992).

Yet, in most cases local peoples' actual utilisation of natural resources does not end with an official declaration or expansion of a protected area, and in some situations a spatially and/or temporally defined utilisation of certain products has been granted to local people. This is, for example, the case for cutting of tall grasses in all of Nepal's five protected lowland areas bordering India: the Royal Sukla Phanta Wildlife Reserve; Royal Bardia National Park; Royal Chitwan National Park; Parsa Wildlife Reserve and, Kosi Tappu Wildlife Reserve (Rijal, 2004, pers. comm.). These official rights are, however, often, *de facto*, combined or supplemented with unofficial extraction of products (timber, fish, game and herbs) under informal agreements with representatives of park authorities or simply through trespassing (Dinerstein, 2003; Stræde and Helles, 2000; Heinen, 1993; Nepal and Weber, 1993).

Unofficial utilisation of protected areas does not automatically lead to their destruction just because it is illegal and, hence, uncontrolled. This depends on the volumes extracted, the productive capacity of the area and the general disturbance of flora and fauna that the utilisation of certain species causes. Yet, given the dynamic nature of how protected areas are, *de facto*, utilised it is obvious that close monitoring of park-people interactions should be performed to ensure (i) that local people's actual use of natural resources does not compromise the biological conservation objectives of the park and (ii) that opportunities for considering local people's interests and needs are not ignored (Wild and Mutebi, 1997).

Thus far, the focus has mainly been on the design of economic incentives to compensate people for top-down introduced restrictions in their traditional use of natural resources, which is normally the case when national parks are established or expanded. This may be in the form of sharing park revenues from tourist entrance fees, direct compensations for crop damage and livestock loss due to wildlife from the park and allocation of utilisation and management rights to government owned land outside the park. In addition, economic incentives have also been applied to influence the attitudes of local people towards becoming local guardians of biodiversity and less dependent on products from the wild for their livelihoods. This has generally taken the form of literacy classes, environmental education, creation of job opportunities either as tourist guides or in park patrolling, introduction of income generating activities and promotion of local people's

involvement in eco-tourism activities (Dinerstein, 2003; Skonhoft, 1995; Nepal and Weber, 1993; Brandon and Wells, 1992; McNeely, 1988).

The establishment of buffer zones with the dual objective of conservation and development has, since 1968, been introduced, where conserved regions meet with human populations (Lynagh and Urich, 2002). They are often considered a means to substitute local people's use of protected resources (Heinen and Mehta, 2000; Brown, 1997; Srivastava, 1997; Nepal and Weber, 1995; Berkmüller and Mukherjee, 1989; Reid and Miller, 1989). Furthermore, they may form the best possible ecological boundaries between protected areas and other lands as the biological integrity of protected areas will be heavily influenced by the management of land surrounding them (Wild and Mutebi, 1997; Vanclay, 1993). In Nepal, buffer zone community forestry has for some time been promoted under the assumption that it can supply adequate substitutes for the resources extracted from protected areas and, hence, fulfil the dual objective of nature protection and rural development (Nepal and Weber, 1994, 1995; Lemkuhl et al., 1988).

Although the overall policy and management objectives of establishing buffer zones around protected areas are largely similar across the globe, there are great differences among the geographical, legal and managerial characteristics of individual buffer zone areas. In geographical terms, buffer zones might be defined entirely inside, outside or overlap with the original boundary of the protected area. The legal and, hence, the official management authority over the buffer zone might rest entirely with the protected area managers (national parks department or equivalent), it may rest entirely with local communities or it may be shared between a number of different stakeholders.

The Royal Chitwan National Park (RCNP) in the lowland of Nepal is one of six protected areas in the highly productive Duar grassland ecosystem on the Indo-Gangetic Plain (Dinerstein, 2003). It supports the highest density of tigers in Asia, features a high ungulate and carnivore diversity, and provides a habitat for several endangered species (see below) (Dinerstein, 2003, Nepal and Weber, 1993). Nevertheless, RCNP is subject to extensive utilisation by local people and plays an important role in their daily lives (Stræde, 2000; Stræde and Helles, 2000). People still depend on the Park for a wide range of forest products and other natural resources, although the Park is 30 years old and has for 10 prior years enjoyed strict, *de jure*, protection as a guarded wildlife reserve for one-horned rhinoceros (Dinerstein, 2003; Stræde et al., 2002).

The overall objective of this case study was to investigate local people's actual use of natural resources from RCNP and its buffer zone. Based on the guidelines of Godoy and Lubowski (1992) a comparative study of two villages with very different access to natural resources from the wild, i.e. outside the households' own land was conducted. Specific objectives were to (i) quantify the impact on RCNP by people living in the two villages, in terms of encroachment

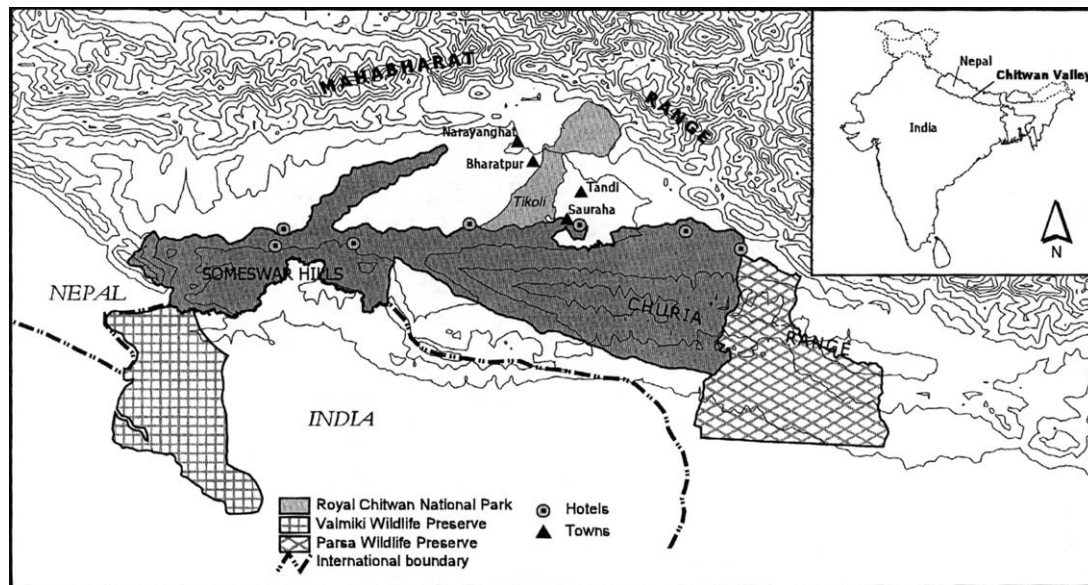


Fig. 1. Royal Chitwan National Park and neighbouring protected areas.

Source: Dinerstein (2003).

frequency and quantities extracted, (ii) estimate the economic importance to local people of products extracted from RCNP and its buffer zone, (iii) investigate whether differences in utilisation of resources in RCNP by local people can be attributed to the geographical position of their village (inside the Park or in the buffer zone) and (iv) to consider how local use of and preferences for natural resources may be incorporated into the management of RCNP and its buffer zone (Map 1).

## 2. Study area

RCNP, and part of its northern buffer zone, was chosen for this study because it is one of the world's outstanding protected areas and its resources have, since its establishment, been subject to extraction by the ever growing local population. This illegal, but fairly conspicuous use of the Park for cattle grazing, thatch and fodder grass cutting, firewood, collection, timber cutting, hunting and fishing has, over the years, caused concern among many observers (Dinerstein, 2003; Stræde and Helles, 2000; Kattel, 1995; Nepal and Weber, 1993). Furthermore, there were still some villages inside the Park, where the traditional use of resources was practised to a great extent. Finally, there is a relatively long experience in buffer zone community forestry (7–12 years, depending on the particular area) as a means to alleviate pressure on the Park's resources. Two areas were selected for the study: the village of Bachhauli located in the buffer zone, and the village of Padampur enveloped by and hence effectively located inside the Park. After completion of the fieldwork for this study, the villagers of Padampur were, according to an agreement with the Government of Nepal, resettled in 'New Padampur'

north of RCNP on re-classified national forest land within Jutpani Village Development Committee (VDC<sup>1</sup>), and bordering the Tikoli Forest (Map 2) (Dinerstein, 2003; Rijal, 2004 pers. comm.)

RCNP is situated in the Chitwan Valley in the inner Terai lowland of Nepal and is renowned worldwide for its variety and abundance of precious and rare fauna and flora (Mishra and Jefferies, 1991). The climate is subtropical with high humidity throughout the year. Mean annual rainfall is 1900 mm, with 80% as short and heavy rainfall in the summer monsoon from June through September. The minimum daily mean temperature is 15 °C in January and a maximum of 30 °C is reached in May–July (Rampur Weather Station, 1999).

RCNP is characterised by two major forest types: climax sal (*Shorea robusta*) forest on well-drained soils (Gurung, 1983; Mishra, 1982; Laurie, 1978) and riverine forest on the more moist areas, dominated by species such as *Dalbergia sissoo*, *Accia catechu*, and *Bombax ceiba* (Banskota et al., 1996; Rijal, 1994). Furthermore, grasslands cover large areas (Mishra, 1982; Mishra and Jefferies, 1991) and Chir pine (*Pinus roxburghii*) forest is found in the hills (Rijal, 1994).

Many endangered and threatened animal species are found in RCNP, some of which frequent the buffer zone regularly. One-horned rhinoceros (*Rhinoceros unicornis*), leopards (*Panthera pardus*) and tigers (*Panthera tigris*) visit and settle in community forests in the buffer zone. Animals found almost exclusively in the Park are gaur bison (*Bos gaurus*), sloth bear (*Melursus ursinus*), wild Asian elephant (*Elaphas maximus*), marsh mugger crocodile

<sup>1</sup> VDCs are the smallest official administrative units in Nepal.



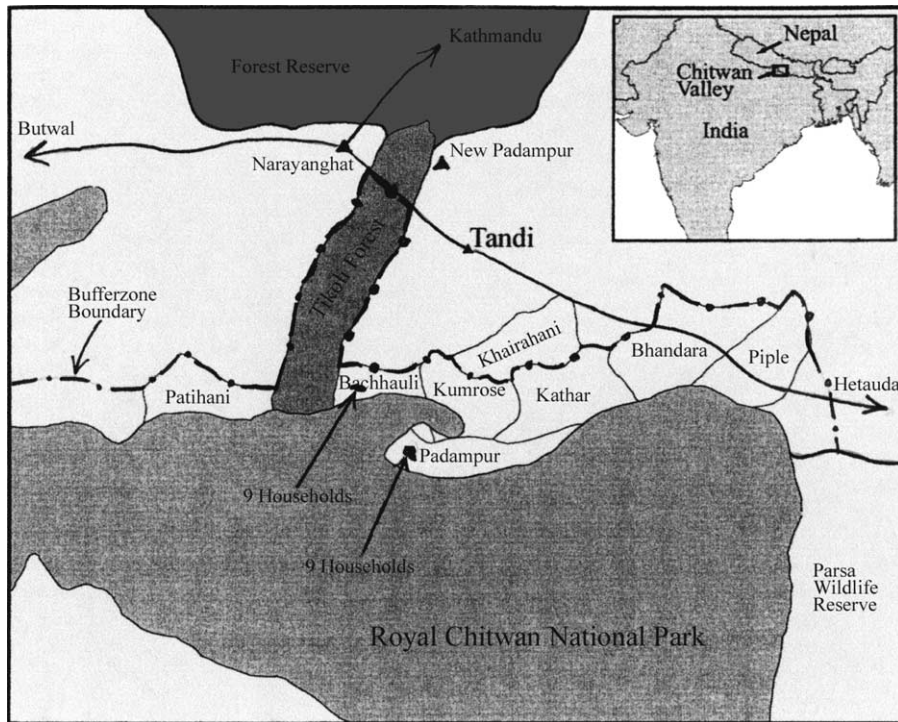


Fig. 2. North Eastern part of RCNP including its buffer zone, some of the VDCs in Chitwan District and the Tikoli forest.  
Source: Adapted from Dinerstein (2003).

(*Crocodylus palustris*), gharial (*Gavialis gangeticus*) and the Gangetic dolphin (*Platanista gangetica*). More than 526 species of birds have been recorded in the Park, many of which are also found in the buffer zone community forests (Dinerstein 2003; BCN, 1998; BES, 1998; Inskipp, 1988).

In 1951, a large-scale malaria eradication programme was launched in the Chitwan Valley. Its success allowed for the government-induced resettlement of people from the overcrowded middle hills north of the Terai in the then lightly populated Valley. As population density increased in the Terai, so did pressure on natural resources. Forests and core habitats for tiger and one-horned rhinoceros diminished rapidly, and in less than one decade these animals came close to extinction (Gurung, 1983). In 1962, the Government set aside an area of 544 km<sup>2</sup> of the Chitwan Valley as a wildlife sanctuary, with the main aim to protect the one-horned rhinoceros (Mishra, 1982). Hunting was banned, and armed guards protected the rhinoceros against poaching and its habitat against encroachment by villagers (Majupuria and Majupuria, 1998). In 1973, the sanctuary was expanded to 894 km<sup>2</sup> and declared a national park, which included the resettlement of approximately 29,000 people (Mishra, 1992). In 1984, RCNP was designated as a World Heritage Site (criteria ii–iv) (UNESCO, 1984), and through the RCNP budget, the Nepalese army has provided a battalion (more than 500 armed personnel) for law enforcement (WCMC, 1992). In 1976, the Grass Cutting Programme (GCP) was initiated as a response to severe park-people conflicts. The GCP opens RCNP for a short

period once every year (usually 14 days, but the park warden may reduce this to 10 or 7 days at his discretion), where villagers may collect four essential products that are not available to them elsewhere, namely thatch grass (mainly *Saccharum spontaneum* and *Imperata cylindrica* [Khar in Nepali], reeds (mainly tall and dense species such as *Saccharum narenga*, *Themeda* spp., *Arundo* spp., *Typha elephantina*, *Phragmites karka* and *Cyperus* spp. [khadai in Nepali]) rope bark (*Helicteres isora* [referred to as *Simthi* in Nepali]) and rope grass (*Eulaliopsis binata* [referred to as *Babiyo* in Nepali]). Yet, at the same time large quantities of fuelwood and a number of other products are collected illegally (Stræde and Helles, 2000). Between 1977 and 1978, the Park area was expanded to 932 km<sup>2</sup> and, as suggested by Nepal and Weber, 1994, 1993), a buffer zone covering approximately 750 km<sup>2</sup> was established around the Park in 1996 (Sharma, 1998).

Thirty six VDCs are partly or almost wholly overlaid by the buffer zone, which covers areas of national forest, rivers, community forest, open land, streams and lakes, a plantation and private lands as well (cf. Table 5). All the 36 VDC chairmen, who elect a chairman among themselves, and the Park Warden, who is member secretary, form the Buffer Zone Council. Fifty percent of the park revenue is designated for buffer zone development activities (schools, roads, tree planting, drinking water, etc.) and the buffer zone council is trusted with the overall administration of this money. In addition, the Park warden holds management authority over national forest within the buffer zone, which

includes the authority to hand over such areas, or fractions thereof, as buffer zone community forests (Rijal, 2004 pers. comm.).

Today, RCNP fits the description as an island in a sea of people. It is estimated that approximately 300,000 people of great ethnic diversity reside in the buffer zone. The buffer zone is not entirely identical to the area comprised by the 36 VDCs, and, hence, there is no socio-economic census available specifically on the buffer zone. However, in these VDCs, indigenous Tharus and immigrants, especially from the middle hills, each represent approximately 50% of the population. Only 48% is of working age, while 41% is younger than 15 and 25% younger than 10 years of age, giving an average age of 25 years; the average household has 7.1 members (Banskota et al., 1996). The average annual per capita gross income is less than US\$ 210 (NESAC, 1998).

There are great differences among the VDCs with regard to land uses, socio-economic characteristics, accessibility, ethnic composition, and use of natural resources from the Park. This variation has not yet been incorporated into the management of RCNP, leading to sub-optimal natural resources exploitation and precarious park-people relationships (Stræde and Helles, 2000).

### 3. Method

Our study generally follows the guidelines of Godoy and Lubowski (1992) for economic valuation of forest products and other natural resources extracted by local people in the tropics, but the aim is not to estimate the total economic value of RCNP and the buffer zone around it. Rather, we use this analytical framework to document and examine the economic incentives vis á vis natural resources from the Park and alternative sources that local people from two distinctively different villages are faced with. The study is based on primary data collected during fieldwork from February 1998 to August 1999 in RCNP and its buffer zone. The main data were obtained through an in-depth survey of 18 households over 12 consecutive months. The survey comprised six components: (i) recording of time and marginal costs, (ii) recording of all products and their quantities collected from the wild, i.e. outside the households' own land, (iii) collection of price information, (iv) recording of all sales and purchases done by each household, (v) structured interviews with each household, and (vi) literature review.

#### 3.1. Household survey

The survey included 18 households from two different villages that were selected with the objective to compare and analyse the substitution effect that access to non-Park natural resources is expected to have. The village of Padampur was enveloped by RCNP, with the Park's

resources being the sole source of products from the wild. The village of Bachhauli is located in the buffer zone, with equal distance to the Park's resources, a national forest and their community forest (c.f. Map 2). Both the national forest and the community forest fall within the buffer zone, but local peoples' extraction of products from and grazing of livestock within the national forest is officially not allowed.

Land holding was used as the stratification criterion for villagers' demand for products collected from the wild because this is locally considered the main wealth determinant and because it was assumed that people owning little or no land would collect comparatively more resources from the wild to sustain their livelihoods. The 18 households were selected such that each of the three different categories: landless, land poor, and land rich, were represented by three households in both villages (see Table 1). Land rich households had more than one bigha of land (equivalent to 0.68 ha), land poor had land holdings up to one bigha, while landless had no land.

Although the sample size is too small to make statistical analysis meaningful, the data reflects that land holdings are correlated with collection of products from the wild, but only in terms per capita value of collected products. At household level, the relation was exactly the opposite since, in terms of the value of products collected from the wild, the land rich households collected most with the land poor and the landless households collecting less and least, respectively (Table 4). The reason being a combination of the facts that the land rich households had more family members than the land poor, which had more family members than the landless and that all household categories, to a great extent, collected products from the wild (Tables 1 and 3).

For several reasons, the selection of households was done without random sampling and with a small sample size. First, this kind of study is not possible to undertake unless a strong relation of confidence and trust is built between the research team and the respondents because most of the activities would be illegal, a problem that Nepal and Weber (1993) encountered. Secondly, the costs of collecting and processing data in the course of the full-year survey with daily recordings and frequent visits by members of the research team restricted the number of households to a sample too small for conventional statistical testing. Thirdly, it was important to select households that were able and willing to participate for a full-year. Finally, random sampling may select households that are difficult to reach in the field (Godoy and Lubowski, 1992).

Whether the results of such a study can be extrapolated to count for the entire RCNP is naturally open to question, as this cannot be backed by sound statistics. On the other hand, since all households without exception and, hence, across all potential social strata in our study make extensive use of a number of products from RCNP, then, in terms of managing park-people relations, it would be irresponsible to dismiss such information as irrelevant. Accordingly, for policy and management purposes, we claim that our results are likely to

Table 1

Household categories and mean number of occasions throughout 1 year, where collection of one or more of the six product categories was carried out in RCNP and its buffer zone

Village	Households			Mean no. of collection occasions per household per year	Mean no. of collection activities per household per day	Mean no. of collection activities per capita per year
	Category	No.	Total no. of capita			
Bachhauli (Buffer zone village)	Landless	3	16	807	2.21	151.3
	Land poor	3	18	762	2.09	127.0
	Land rich	3	38	738	2.02	58.3
Mean		3	24	769	2.16	96.1
Padampur (National park village)	Landless	3	13	693	1.90	159.9
	Land poor	3	20	676	1.85	101.4
	Land rich	3	27	587	1.61	65.2
Mean			20	652	1.83	97.8

be *approximately right* while a statistically sound sample of villagers' use of RCNP might end up being *precisely wrong*. This is so because the nature and extent of peoples' actual uses of park resources would probably go unrecorded in a large-scale and statistically sound survey, since the respondents may *decide* to hold back such information during a brief encounter with enumerators, (c.f. Gill, 1993; Chambers, 1983).

Two months were used for selecting the households and making adaptations and corrections to the survey instrument on the basis of participant feedback. Apart from important feedback, this pilot period provided valuable impressions of each household's strengths and weaknesses in relation to their participation in the survey, e.g. how carefully they would do the recording. When a household was selected and had agreed to participate, a group discussion was held with the people in order to initially understand their perception of the Park. Then they were supplied with a blank piece of paper and asked to report for the following day the products they collected from the wild, how they spent their time during the day, and what products they sold or purchased. These initial records were subsequently used to finalise the survey form. Designing the form from the respondents' own reply categories and understanding of their own situation proved a useful approach to prevent fundamental deviations between the respondents' and researchers' perceptions of the survey. Hence, this process minimised the risk of derailing the survey over time. After a year with data collection, approximately 1 month was used to slowly phase out the survey and terminate the close collaboration with the households since it was felt that abruptly ending the collaboration would be socially and culturally insensitive.

The final survey forms were prepared in Nepali and compiled in booklets that were collected once a month from every household. In several households, the problem of adult illiteracy was overcome by having children of age 10–15 years doing the reporting and filling in of forms. Moreover, it was rapidly realised that children, who often participate in the collection of resources from the wild, took interest in

the work and made it a point to report accurately. Under close supervision of one particular local research assistant, all respondents were trained in counting, weighing, and measuring their products when they returned to the household. Respondents recorded all products in local names, which were then identified by the research assistant in co-operation with a botanist who has substantial experience in RCNP. A research assistant of the local Tharu tribe—well-known and respected in the community—was engaged as mediator and interpreter for the entire survey period, because it was crucial to data reliability that the households trusted those engaged in the survey and were confident that its purpose was not to impose additional restrictions on their use of natural resources.

After the 2 months of preparation, when all households were selected and the recording form finalised, a monitoring and supervision scheme was created for the following 12 month period. During the first 2 months, each of the 18 families was visited every other day, the 3rd month twice a week, the 4th month once a week. From the 5th month onwards they were visited three to four times a month. Occasionally, local festivals, weather conditions, flooding, etc. caused minor changes to the plan but, generally, the supervision schedule was followed throughout the year.

Households were paid a nominal amount of cash (equivalent to US\$ 0.05 per day) for their effort. It could be argued that this might have distorted their behaviour and use of natural resources, but this amount approximately equalled a half-hour labour wage (c.f. Table 6) and, on average, it was estimated that households used about 1 h per day to measure and report on collection. This was considered a reasonable compensation as only half of the time spent on measuring was then assumed to be at the expense of other productive activities. Furthermore, we considered this potential bias less important than the risk of stranding the survey halfway, i.e. if people stopped participating, due to lack of incentive. The research assistant translated all recordings into English immediately after the monthly records were replaced, such that uncertainties or

misunderstandings could be clarified at the very next visit to the household.

Products collected by each household were recorded into six different product categories: timber, fuelwood, fodder, fish, game, and non-timber forest products (NTFPs<sup>2</sup>). In addition, the site and landscape type, where the different products were collected was recorded. No deductions were made for product losses due to spoilage during transport or storage. In principle, this would result in quantities being over-estimated, but in practice this source of error is considered negligible as the relevant products (fish, game and some edible NTFPs) are mostly consumed or exchanged immediately when the collectors return to the village.

### 3.2. Market prices

Market prices of products were collected from three main markets twice every month. When products were for sale in the village, either by individual salesmen or in small roadside shops, prices were recorded as the farm gate prices. It was not sufficient to collect market prices, because only a fraction of products from the wild was actually sold in the market. Many products were sold, purchased or exchanged at village level, and other products were used for collectors' own consumption. Since respondents recorded all the household's sales and purchases, it was possible to establish supplementing prices of natural products or their relevant substitutes (shadow pricing). A local research assistant was engaged to collect market prices throughout the 12 consecutive months.

### 3.3. Time and other costs

Godoy and Lubowski (1992) recommend that the flow over time of products from the forest should be matched to the wage prevailing at the time when the product is extracted. The cost of collecting from RCNP and its buffer zone was calculated as the cost of material used and time spent on collection (Hyde and Amacher, 1996). Time was recorded for eight activity categories: herding, agriculture, housework, collection, fishing, hunting, wage labour (tourism), and wage labour (all other) as hours per activity. The cost of materials was identified through the records of what each household purchased, e.g. fishing hooks. The mean labour wage of one US\$ (70 Nepalese Rupees) for a ten hour workday was used as the opportunity cost of time. In this study, discounting is not applied, because the products collected were consumed or sold shortly after extraction.

### 3.4. Data validity

The reliability of data that stems from respondents' own record keeping may always be questioned. How accurately an event is recalled is likely to depend on the time-span between the event and the point of recollection. Respondents may not record or deliberately under-report illegal activities, such as hunting in protected areas, and products actually collected might go unrecorded, either because the respondents consider them insignificant/inferior or consume them en route, e.g. fruits collected and consumed during a hunting trip. Another potential problem is how time is recorded when two activities take place simultaneously, e.g. collection of NTFPs while herding. In principle, only the extra time spent on NTFP collection during another activity should be recorded as collecting NTFPs and, hence, deducted from the duration of the main activity (herding). In practice, this may, however, not make any sense to local people if, as in this particular case, they consider herding and fuelwood collection a joint activity because herding does not require the full attention of the herdsman/woman during the time it takes his/her livestock to forage.

Because of the close and regular supervision throughout the study and since all respondents were well informed about its purpose and procedures, we have little doubt that records were actually kept on a daily basis, which should eliminate the problem of inaccurate recollection. Great effort was put into making respondents comfortable with reporting actual albeit illegal activities, and the fact that hunting activities inside the Park were frequently reported suggests that this source of inaccuracy has been minimised, if not eliminated. Whether respondents underreported quantities and time spent on collection is difficult to assess because participant observation was not part of the applied methodologies. In a 1-year study of two flood plain villages in the Peruvian Amazon, where (i) daily record keeping by respondents, (ii) monthly interviews and (iii) participant observation was evaluated, Gram (2001) concluded that the estimated average time spent on gathering activities (not including hunting and fishing) was approximately 3–10 times higher when calculated on the basis of participant observation than when based on monthly interviews and daily record keeping, respectively. The main reason seemed to be that gathering of NTFPs during hunting and fishing trips were not recorded or considered relevant by the respondents. In conclusion, the possible data inaccuracies associated with the present study are likely to result in under-estimates rather than over-estimates of quantities collected and time spent on the recorded activities.

## 4. Results

Despite the strict protection status of RCNP, which, apart from the annual 7 to 14 days GCP, officially prohibits extraction of natural resources, the reality is that it supplies

<sup>2</sup> Because fish, game and fodder are treated separately in this study, the term NTFP is used for all remaining products, such as fruits, nuts, berries, resin, medicinal plants, and plants for religious purposes.



a wide range of products that contribute considerably to the livelihood and welfare of villagers in the Park as well as in the buffer zone. For villagers in the buffer zone, who have access to a large national forest area and a 401 ha community forest, the use of the Park was less extensive, but still important to them.

#### 4.1. Impacts on the national park and the buffer zone

This study only considers quantities and economic values of products extracted from RCNP and its buffer zone. However, the full ecological impact of resource extraction on RCNP also includes the stress and disturbance of wildlife that the sheer number and frequency of collectors' trips into the Park cause. Another important element of villagers' frequent trips into RCNP is that they or their livestock risk getting injured or killed by wildlife and their livestock might carry and transmit diseases to wildlife in the Park.

For villagers in the buffer zone (Bachhauli), the mean number of occasions, where collection took place ranged from 732 to 807 per household category<sup>3</sup> (Table 1). Thus, each household was, on average, engaged in 2.02–2.21 different collecting activities every day, e.g. fishing in the morning, fodder collection during the day, maybe combined with collection of fuelwood. Landless villagers had by far the most collection activities and the land rich the fewest. Between 7 and 16% of the collection time was spent inside RCNP. Households from Padampur (inside the Park) had fewer occasions of collection: 587–693 per household or 1.61–1.90 different collection activities every day throughout the year, but measured per capita for household categories the mean number of collection activities per year was almost similar to that of villagers from Bachhauli. In Padampur, the landless people were also by far involved in most collection activities and the land rich least frequently, yet the entire collection time was spent almost exclusively inside the Park, irrespective of who performed the collection (Tables 1 and 2).

##### 4.1.1. Timber

The number of occasions with timber collection was higher for households of Padampur, with landless households being most active. The timber was mostly poles and beams for house construction or small logs for making simple planks; most timber products were sold within the local community. The quantities of timber were small, and for Bachhauli the share from the Park was almost negligible (Table 3). For all household categories in Bachhauli, timber was extracted for subsistence use when needed, and not during any particular time of the year. Landless villagers of

Padampur was the only category that carried out timber extraction regularly throughout the year. Yet, they were the only household category that did not extract timber during the GCP. Instead, they used the open access that the GCP provided (Kattel, 1995) to collect other essential products. Altogether, 37 different tree species were used as timber. Sixty-seven percent of the timber extracted by households in Padampur was Sal (*Shorea robusta*), while the rest was divided between 31 different species. In the buffer zone, 51% of the timber was Sal, 29% Padke (*Albizia lucida*), and the rest consisted of five species. Generally, Sal was the single most important timber species, providing 65% of the total timber quantities extracted, and representing 60% of the days with timber extraction.

##### 4.1.2. Fuelwood

The mean number of occasions per household with fuelwood collection was 50% higher in Bachhauli than in Padampur and the mean per capita fuelwood collection in Bachhauli was 653 kg, which was approximately 25% higher than the mean per capita collection of 520 kg in Padampur. However, across categories the mean quantity of fuelwood extracted per collection was approximately 55 kg per household in both villages. Villagers of Bachhauli only directed 3.5–7.7% of the days with fuelwood collection to the Park, while the people of Padampur collected all their fuelwood in the Park. In Bachhauli, the total collection of fuelwood was 51% higher than in Padampur. In Bachhauli, fuelwood collection per household ranged from 4144 to 6209 kg. The mean annual per capita extraction of fuelwood by households in Bachhauli ranged from 490 to 998 kg of which only 5% came from the Park (Table 3) while more than 75% was collected in the national forest and less than 20% came from the community forest. In an area comparable to Padampur Edison et al. (1988) found a mean annual fuelwood collection per capita of 649 kg. In Padampur, we found a mean annual per capita collection of 520 kg, ranging from 448 to 710 kg, which may indicate a decline in the supply of fuelwood over one decade. For fuelwood purposes, 107 different species were used. It is noteworthy for both villages that, measured per capita, the landless collect considerably more fuelwood than the land poor, who in turn collect considerably more than the land rich. The main reasons being that fuelwood represents a potential source of cash income and that people also collect fuel (wood and crop residues) on their own land.

##### 4.1.3. Fodder

On average, villagers of Bachhauli went to collect fodder almost twice as often as villagers of Padampur, but mostly within the buffer zone, although fodder and NTFP collection are by far the most time consuming activities of villagers from Bachhauli inside RCNP (Table 2). In Padampur, villagers had no realistic alternative sources of fodder than the Park. Fodder collection did not include grazing of livestock in the Park. With one exception, all investigated

<sup>3</sup> The maximum number of occasions that collection of a particular product category could take place was 365, i.e. once a day: giving a total of 2190 for all six product categories for any given household. This does not mean full days of collection, but that some collection took place on the particular days.



Table 2

Mean number of occasions throughout 1 year, where collection of products from RCNP and its buffer zone has taken place, and the percentage of these occasions used on collection inside RCNP (%)

Village	Timber		Fuelwood		Fodder		Fish		Game		NTFPs	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Bachhauli (Buffer zone village)												
Landless	4.7	14.3	135.3	3.5	245.0	16.9	69.3	57.7	0.7	0.0	351.7	5.3
Land poor	2.3	0.0	83.7	4.8	213.7	20.3	105.0	43.5	0.7	0.0	357.0	8.0
Land rich	1.7	20.0	56.7	7.7	271.3	8.1	54.3	17.8	0.0	0.0	354.0	4.1
Mean	2.9	11.4	91.9	5.3	243.3	15.1	76.2	39.7	0.5	0.0	354.2	5.8
Padampur (National park village)												
Landless	28.3	100.0	85.3	100.0	154.3	100.0	59.7	100.0	4.7	100.0	360.7	100.0
Land poor	15.7	100.0	51.3	100.0	165.0	100.0	84.0	99.6	1.7	100.0	358.7	100.0
Land rich	9.0	100.0	52.0	100.0	74.3	100.0	81.7	98.4	7.3	95.5	363.0	100.0
Mean	17.7	100.0	62.9	100.0	131.2	100.0	75.1	99.3	4.6	98.5	360.8	100.0

households in Bachhauli preferred the national forest for grazing because access was open, i.e. they did not risk fines or confiscation of animals as in the Park. The landless household that preferred to graze their livestock in the Park argued that (i) the grass was better and more abundant, (ii) it was possible to collect fuelwood while herding, and (iii) the risk of getting caught was low. Today, the risk of getting caught is even lower as the army personnel in RCNP have been deployed to combat Maoist insurgents. This has reduced the park protection related patrolling to almost zero and the smaller guard posts inside the Park have been evacuated, as they were too vulnerable to Maoist attacks (Rijal 2004 pers. comm.; ENS, 2004).

For Bachhauli, 11.9–22.1% of the fodder was collected in the Park, while villagers of Padampur collected all their supplementing fodder from there (Table 3). The size of animal husbandry and the collection of fodder differed greatly between the two villages and among the household categories. Landless in Bachhauli collected 927 kg per livestock unit (LSU)<sup>4</sup>, land poor and land rich collected 692 and 359 kg per LSU, respectively. In total, households in Padampur collected less than half as much fodder as households in Bachhauli did. In Padampur, landless and land poor collected the same quantity of fodder per LSU, while the land rich collected very little fodder per LSU from the wild. Instead, they fed their animals on agricultural residuals from their own land. In Bachhauli, fodder from the wild supplied 8–19% of the optimal annual level of total digestible nutrition (Pandey, 1982), while in Padampur the range was 4–9% indicating that livestock from Padampur in comparison to Bachhauli is grazed rather than stall-fed. For fodder purposes, 227 different species were collected.

<sup>4</sup> The animal holding of the households was converted to Livestock Units (LSU) using the conversion factors of the Master Plan for the Forestry Sector (HMG, 1988). That is, one LSU = one cow = 0.67 buffalo = 5.00 goats or sheep.

#### 4.1.4. Fish

The mean annual number of fishing occasions was similar in both villages. Villagers of Bachhauli used the rivers, etc. of RCNP in 17.8–57.7% of the days with fishing, while villagers of Padampur made all their fishing trips inside RCNP. For land rich households in Bachhauli almost every fifth fishing trip went to RCNP waters, while half of the fishing trips made by landless and land poor went to these waters. To these household categories, fish seemed relatively more important in Bachhauli than in Padampur. Measured per capita, the landless and land poor in Bachhauli caught 20 and 61% more than the same categories in Padampur (Table 3). In total, 43 different fish species were caught.

#### 4.1.5. Game

Villagers of Bachhauli did little hunting in the Park, while on average those of Padampur went hunting five times per year although this is strictly forbidden. Land rich households in Padampur were most engaged in hunting and bagged considerably more game than any other category (Tables 2 and 3). Five animal species: Spotted deer, wild boar, Sambar deer, hare, and Barking deer accounted for 84% of the game extracted annually. However, with regard to hunting trip frequency, snails<sup>5</sup> and turtles were among the five most important. Interestingly, the quantities of game per capita bagged by landless, land poor and land rich households in Padampur differed a lot with the land rich bagging by far the most and the land poor bagging by far the least. Yet, the total per capita quantity of fish and game brought home by landless, land poor and land rich households in Padampur vary much less (13.54, 9.44 and 16.87 kg, respectively) (Table 3). This indicates that, to the land rich households of Padampur, hunting in RCNP was a particularly attractive source of protein or income (or both)

<sup>5</sup> Villagers relate snails and turtles to hunting and gathering.

Table 3

Mean quantities of products collected per household and capita from RCNP and its buffer zone through one year, including the percentage of each product category collected in RCNP (%)

Village	Timber			Fuelwood			Fodder			Fish			Game			NTFP		
	m <sup>3</sup>	m <sup>3</sup> per capita	%	kg	%		kg	kg per capita	%	kg	kg per capita	%	kg	kg per capita	%	kg	kg per capita	%
Bachhauli (Buffer zone village)																		
Landless	0.58	0.109	5.2	5321	998	4.9	6618	1241	19.5	56.4	10.58	55.0	1.0	0.19	–	1625	305	45.4
Land poor	0.19	0.032	–	4144	691	6.4	7005	1168	22.1	88.5	14.75	43.6	1.3	0.22	–	1217	203	80.0
Land rich	0.85	0.067	12.9	6209	490	3.8	18,793	1484	11.9	59.3	4.68	19.9	0.0	0.00	–	2278	180	73.1
Mean	0.54	0.068	6.0	5225	653	5.0	10,805	1351	17.8	68.1	8.51	39.5	0.8	0.10	–	1707	213	66.2
Padampur (National park village)																		
Landless	2.69	0.621	100.0	3077	710	100.0	2047	472	100.0	38.5	8.88	100.0	20.2	4.66	100.0	1741	402	100.0
Land poor	2.25	0.338	100.0	3281	492	100.0	4108	616	100.0	60.9	9.14	97.2	2.0	0.30	100.0	13,272	1991	100.0
Land rich	5.40	0.600	100.0	4032	448	100.0	2262	251	100.0	79.8	8.87	96.6	72.0	8.00	94.9	4582	509	100.0
Mean	3.45	0.517	100.0	3463	520	100.0	2806	421	100.0	59.7	8.96	97.9	31.4	4.71	98.3	6532	980	100.0

because little time is required to extract a sizeable benefit (almost 10 kg of game per hunting occasion per household), while fish was practically the only source of protein from the wild to the land poor and to the landless, game seemed to be an attractive supplement to fish. More importantly, however, except for the land rich households in Bachhauli, all household categories appeared to rely heavily on fish and game from the wild for their protein intake, with RCNP being an important source of origin (Table 3).

#### 4.1.6. NTFPs

NTFPs were the product category collected most frequently in both villages, and within each of them the number of days with collection was similar for all household categories (Table 2). Almost every day members of each household went to collect NTFPs. The collected quantity of NTFPs was highest in Padampur with landless people collecting the least and the land poor by far collecting the most. All NTFPs collected by people in Padampur were from the Park. In Bachhauli, people went to collect NTFP as often as those in Padampur, but only in 4.1–8.0% of the cases collection took place inside the Park (Table 2), yet in terms of quantities, 45.4–80.0% stem from RCNP (Table 3), which is explained by the massive outtake of grasses during the short GCP. In terms of quantities, grasses collected during the GCP account for the majority of NTFPs collected by all households, but the high frequency of NTFP collection by all households demonstrates how important these products are to people's livelihoods.

#### 4.2. Economic value of extracted products

The wide range of products collected from the wild contributed indispensably to villagers' livelihood and represented high economic values (Table 4). The mean value per household of all products was 24% higher in Padampur than in Bachhauli. While land rich households extracted resources for most value in both villages, the per capita value is, not surprisingly, lowest for this category.

The highest per capita economic value of extracted products was found for landless in Padampur. The six product groups had different economic importance to the household categories. In Bachhauli, fuelwood (landless), fodder (land rich) and fish (land poor) represent the highest values. In Padampur, NTFPs represented the highest value to landless as well as land poor people, while the land rich derived most value from timber, followed by game.

In value terms, the households in Padampur derived practically 100% from the Park, while park products accounted for 17–31% to the households in Bachhauli (Table 5). The value of products collected from the Park by households in Padampur was three to seven times higher than the value of Park products collected by households from Bachhauli. In Bachhauli, the national forest generated 29–43% of the total product value, while the community forest only generated 12–32%. Land rich households in Bachhauli derived most value from the community forest and 2.8–3.8 times more than the landless and land poor, respectively (Table 5). This unequal distribution stands out in comparison to values derived from other areas and suggests that benefits from community forestry may not be equitably shared among households within the village. The value of buffer zone products to villagers in Padampur was negligible, while the Park's forest delivered by far most value (66–74%) followed by a considerable contribution from the rivers (17–23%).

##### 4.2.1. Net value of collection

In order to estimate the net economic value of collected products, total costs of extraction were subtracted from the product value. There is some controversy over the relevance of subtracting the opportunity cost of labour because alternatives to collecting natural resources is often not a true option in many developing countries (Pearce and - Moran, 1995). Yet, from the time allocation records prepared by the households, it was clear that wage labour was a real option in the area. Observations in the field and the households' purchase records showed that, apart from

Table 4

Mean economic value (US\$) of products collected per household and per capita from RCNP and its buffer zone through one year

	Bachhauli (Buffer zone village)			Padampur (National park village)		
	Landless	Land poor	Land rich	Landless	Land poor	Land rich
Households (no.)	3	3	3	3	3	3
Capita (no.)	16	18	38	13	20	27
Timber	19.6	3.1	30.3	95.9	91.5	191.5
Fuelwood	138.7	92.2	148.0	83.1	81.9	107.3
Fodder	94.5	100.1	268.5	29.2	58.7	32.3
Fish	103.4	185.1	121.3	69.1	89.7	114.9
Game	2.3	3.0	0.0	46.2	4.6	164.6
NTFPs	52.5	82.1	77.9	155.8	339.8	132.5
Total per household	411.0	465.6	646.1	479.3	666.2	743.1
Total per capita	77.1	77.6	51.0	110.6	100.0	82.6

labour, there were very few costs related to collection activities, because the technology was primitive and tools, such as fishing nets or rods, were mostly home-made. In these cases, the cost of technology was calculated as the sum of material costs and the opportunity cost of time spent on producing the tools. In accordance with rational economic behaviour, the collection of products was associated with a positive net value for all household categories in both villages (Table 6).

Across all households in Bachhauli, the mean value per hour of products collected (US\$ 0.24) was more than two times the mean labour wage (US\$ 0.11), while in Padampur it was four times higher (US\$ 0.41 compared to US\$ 0.11). The opportunity cost of labour accounted for 51% of the gross economic value of collection for households in

Bachhauli, while in Padampur it accounted for only 26%. Although there are great differences in the gross value of products collected by the different household categories in Bachhauli, with the land rich generating most gross revenue, the resulting net economic value per household was fairly similar. This is because differences in collection efficiency (in value terms) are offset by differences in opportunity cost of labour (landless versus land poor and land rich) and the amount of time spent on collection (land rich versus land poor and landless). In Padampur, both the gross and the net value of collection was highest for the land rich, even though they spent the least time on collection, and it was lowest for the landless. This is explained through considerably higher collection efficiency (in value terms) by the land rich and less difference between opportunity

Table 5

Mean economic value (US\$) and percent of total values (%) of products collected per household and per capita from RCNP and its buffer zone through 1 year, and where the value came from

Area	Bachhauli (Buffer zone village)			Padampur (National park village)		
	Landless	Land poor	Land rich	Landless	Land poor	Land rich
<i>National park</i>						
Forest	46.2 (11%)	66.5 (14%)	89.0 (14%)	348.2 (74%)	469.5 (71%)	488.6 (66%)
Rivers	56.7 (14%)	71.2 (15%)	23.0 (4%)	80.7 (17%)	130.3 (20%)	172.1 (23%)
Streams and lakes	0.3 (0%)	8.3 (2%)	0.7 (0%)	19.2 (4%)	6.9 (1%)	38.4 (5%)
Hills	0.3 (0%)	0.4 (0%)	–	1.3 (0%)	0.4 (0%)	–
Former farmland	–	0.2 (0%)	–	2.6 (0%)	0.7 (0%)	0.3 (0%)
Grassland	–	–	–	26.2 (5%)	56.5 (8%)	32.0 (5%)
Icharni Island	–	–	–	0.8 (0%)	–	–
Private land	–	–	–	–	–	9.5 (1%)
Sum national park	103.5 (25%)	146.6 (31%)	112.7 (18%)	479.0 (100%)	664.3 (100%)	740.9 (100%)
<i>Buffer zone</i>						
National forest	178.4 (43%)	145.4 (31%)	185.8 (29%)	0.3 (0%)	–	0.3 (0%)
Rivers	48.9 (12%)	94.8 (20%)	68.0 (10%)	–	1.9 (0%)	1.1 (0%)
Community forest	72.4 (18%)	54.5 (12%)	205.1 (32%)	–	–	–
Open land	7.8 (2%)	1.2 (0%)	21.2 (3%)	–	–	–
Streams and lakes	–	7.2 (2%)	16.7 (3%)	–	–	0.8 (0%)
Danida plantation	–	15.9 (4%)	0.3 (0%)	–	–	–
Private land	–	–	36.3 (6%)	–	–	–
Sum buffer zone	307.5 (75%)	319.0 (69%)	533.4 (83%)	0.3 (0%)	1.9 (0%)	2.2 (0%)
Total per household	411.0	465.6	646.1	479.3	666.2	743.1
Total per capita	77.1	77.6	51.0	110.6	100.0	82.6

Table 6

Mean net economic value (US\$) of products collected per household from RCNP and its buffer zone through one year

Village	Strata	Gross value (US\$)	Collection time (hours)	Gross value per hour (US\$/hour)	Mean hourly labour wage (US\$/hour)	Total opportunity cost of labour (US\$)	Net value (US\$)
Bachhauli (Buffer zone village)	Landless	411.0	2211	0.20	0.08	176.4	234.6
	Land poor	465.6	1529	0.30	0.13	205.6	260.0
	Land rich	646.1	3051	0.21	0.13	395.9	250.2
	Mean	507.6	2264	0.24	0.11	259.3	248.3
Padampur (National park village)	Landless	479.3	1479	0.32	0.10	149.6	329.7
	Land poor	666.2	1759	0.38	0.10	170.9	495.3
	Land rich	743.1	1390	0.53	0.12	165.5	557.6
	Mean	629.5	1543	0.41	0.11	162.0	460.9

costs of labour and total time spent on collection among the household categories in Padampur than was the case for Bachhauli. Despite the differences between villages and household categories, Table 6 illustrates an important economic reality. For all households, the returns to labour by collecting products from the wild are significantly higher than that of wage labour.

#### 4.2.2. The economic importance of products collected in the wild

To put the importance of wild products into perspective, the gross collection value was compared with the cash income of each household category. The value of subsistence agricultural production is not included in this comparison because the households were not in a position, over the short term, to shift labour away from other activities and into agriculture. All realistic farming activities were already covered and expansion of agricultural land was not an option. Hence, the real choice for the households was whether to spend their excess working capacity on wage labour or collection of products from the wild. Accordingly, Table 7 reflects the mix of realistic economic alternatives that come on top of a subsistence agricultural income.

It is obvious from Table 7 that the value of collected products is very important to all household categories in both villages. On average, the total gross value of collection equalled 91 and 86% of the total annual cash income for households in Bachhauli and Padampur, respectively. The gross value of products from the Park equalled 12–56% of total cash income for households in Bachhauli and 52–266% for households in Padampur. It is not surprising that households, especially among the landless and land poor, in Padampur appear to rely heavily on Park resources. Yet, the substantial quantities and value of especially fodder, fish and NTFPs that all household categories from Bachhauli derive from the Park (Tables 3–7) strongly suggest that livelihood strategies in buffer zone villages still rely heavily on RCNP. Interestingly, the data suggests that collection of products from the wild played quite different roles to the land rich households in Bachhauli and Padampur, respectively. In Bachhauli, it appears to absorb surplus labour

capacity of these households as they have considerably more members and spend significantly more time on collection than any other household category. By contrast, land rich households in Padampur spent the least time of all on wild product collection, yet through this they generated more value than any other household category.

## 5. Discussion

Although villagers have officially been prohibited from using RCNP for more than 30 years, this study shows that their livelihood still depends significantly on products from the Park. The ecological sustainability of villagers' recorded collection of Park products was not evaluated. Instead, we have focussed on the economic importance to the villagers, because we believe it is the main driving force behind their legal or illegal extraction of Park products. Obviously, the ecological consequences of human activities inside RCNP cannot be ignored for this reason, but to us it is equally obvious that ignoring the economic importance of park products to the people living around RCNP is hardly a rational strategy to conserve its unique ecology either. The study documents a high frequency of human activity inside RCNP, especially by people whose village was located inside the Park, but also by villagers from the buffer zone, where an estimated 300,000 people reside. Padampur was the last remaining village inside RCNP and the final relocation of people from here marks the end of a strategy to 'clear' RCNP from settlements. Yet, in terms of managing the park-people conflicts, which should be a top priority for the long-term conservation of RCNP as a national park worthy of keeping its world heritage status, this relocation is of marginal importance.

Interestingly, the only substantial concern raised by the Bureau of the World Heritage Committee with regard to the state of conservation of RCNP is pollution of the Narayani River and an unexplained increase in the natural mortality rate of the rhinoceros (WH Committee, 1998). The Bureau was also 'informed of interest of the Department of National Parks and Wildlife of Nepal to use the large volume of



Table 7

Mean cash income compared with the gross value of products collected from RCNP and its buffer zone through one year by household categories (US\$)

	Bachhauli (Buffer zone village)				Padampur (National park village)			
	Landless	Land poor	Land rich	Mean	Landless	Land poor	Land rich	Mean
Wage labour income	396	218	451	289	103	149	60	59
Sale	95	45	462	201	77	449	1359	628
Total cash income	491	263	913	556	180	598	1419	732
RCNP collection	104	147	113	121	479	664	741	638
Percent of cash income (%)	21	56	12	22	266	111	52	87
Buffer zone collection	307	319	533	386	0	2	2	1
Percent of cash income (%)	63	121	58	69	0	0	0	0
Total gross collection value	411	466	646	508	479	666	743	629
Percent of cash income (%)	84	177	71	91	266	111	52	86

scientific data available on ecological and managerial aspects of RCNP for setting up a systematic monitoring regime of the Park' (WH Committee, 1998). We find this a surprisingly casual attitude to issues of park-people management, not least because WCMC (1992) expressed concern over the considerable antagonism between RCNP and local people, and the substantial illegal collection of firewood during the GCP. Yet, on the basis of (Lemkuhl et al., 1988), it was concluded 'that these issues are being addressed by the park authorities and the necessary establishment of community fuelwood plantations' (WCMC, 1992).

In this study, the effect of the buffer zone has been evaluated by comparing origin as well as quantities of products from the wild collected by people of Padampur and Bachhauli, respectively. As people from Padampur had no realistic sources other than RCNP, they practically derived all such products from the Park. In contrast, people from Bachhauli have their buffer zone community forest and the Tikoli national forest as real alternatives to RCNP. Considering the role community forestry is believed to play in managing park-people conflicts in Nepal, especially over fuelwood (Lemkuhl et al., 1988), the study reveals a somewhat disappointing picture. The presence of the national forest and the community forest has reduced buffer zone villagers' use of fuelwood from RCNP to, on average, 5% of their annual collection (Table 3), but the majority of fuelwood extracted especially by the landless and the land poor actually originated from the national forest. Recent research estimated that the extraction of fuelwood from the same community forest constituted only 5–10% of the villagers' annual fuelwood consumption (Stræde, 2000). In value terms, the national forest, with its de facto open access, was slightly more important to people in Bachhauli than the Park and much more important to the landless and the land poor than the community forest (Table 5). This is in line with the findings of Lynagh and Urich (2002) who in a study from the Philippines, find that, irrespective of an agricultural intensification project in the buffer zone around a national park, local people, especially the poorest, would continue to utilise the Park (in this case for cropping).

The community forest of Bachhauli is still dominated by stands less than 15-year-old, so it should in time be capable of providing more fuelwood and other products (Stræde et al., 2002). Yet, for Park management and policy purposes, a scientifically sound estimate of the long-term production from this and other community forests is needed to adequately assess their capacity to deflect fuelwood driven pressure on RCNP and the national forest. Such research should explicitly distinguish between (i) the potential and (ii) the most likely future production of fuelwood, taking into consideration decision-making powers and hence management objectives including the associated distribution of costs and benefits, (cf. Table 5 according to which the land rich appear to benefit significantly more than the other household categories from the community forest).

Seidensticker (1976) first presented evidence that RCNP supported a 61% higher livestock fodder biomass than other areas. Twenty-five years later, the present study documents that the Park still constitutes an important source of livestock fodder and in quantities that should warrant a sustainability assessment. A closely related issue is livestock grazing. In fact, there were 2.5 times more LSU in Padampur than in Bachhauli, but villagers of Padampur only collected half as much fodder per LSU, illustrating that they used the Park considerably for grazing. In the buffer zone, open grazing areas are relatively scarce, creating grazing pressure on the Park from Bachhauli residents, as they do not exclusively rely on stall-feeding. Grazing of domestic animals in the Park is a problem for two reasons. Firstly, the killing of livestock by tiger or leopard results in great resentment and hostility towards the Park among villagers, feelings that are difficult to reverse (Mishra et al., 1989; Mishra, 1982; McDougal, 1977). Secondly, domestic animal diseases constitute a health hazard to some of the Park's wildlife (J. Flamand<sup>6</sup>, personal communication, 1999). For religious, cultural, and economic reasons it would be a difficult management task to reduce the number of livestock in the Park. Cows are holy; it is a tradition in

<sup>6</sup> Veterinarian employed under the Zoological Society of London and RCNP Buffer Zone Veterinary Project.

the area, especially among the Tharus, to rear large cattle herds; and milk is an important element of the local diet as well as a cash earner. Accordingly, it is important to understand the magnitude of the fodder demand and recognise that fining villagers and confiscating their livestock is unlikely to solve conflicts over grazing and fodder collection. Promoting improved grazing and fodder production in the buffer zone and allowing some form of fodder collection inside RCNP appears a more feasible approach, especially when considering that the present number of people living in RCNP's buffer zone is likely to stay high or even increase in the foreseeable future.

Fishing is a traditional food source in the RCNP area. The study shows that fish from the main rivers both inside and outside RCNP are very important in terms of quantity as well as value to people in both villages (Tables 3 and 4). Considering that (i) fish is a major and highly valuable product to villagers, (ii) fishing is an activity in which villagers frequently engage, (iii) flooding and erosion is a general problem in the area, and (iv) the main Rapti River flows through the Park for more than 100 km, there is substantial reason to manage the river as an integrated part of the Park-buffer zone-people complex. This element has not yet received much attention in the management of RCNP.

Although villagers of Bachhauli and Padampur were equally engaged in NTFP collection, the economic value was much lower in Bachhauli, because their NTFPs were generally less valuable and collected in smaller quantities. The extraction of NTFPs from the community forest comprised only few and low value products, which supports that the forest, at least in its present stage and under the present management regime, is unable to deflect villagers' demand for most forest products, currently met from the national forest and the Park (Stræde et al., 2002).

Game and timber play a small role in the household economies of Bachhauli and to them the part of these products that originates from RCNP is almost negligible (Tables 3 and 4). This is in contrast to the households of Padampur, which all derived substantial values from timber extracted from the Park. To the landless and especially the land rich in Padampur, game from the Park constituted another important source of food/income (Table 4). Accordingly, this study suggests that villagers residing in the buffer zone do not depend much on timber and wildlife from RCNP for their livelihoods, whereas this was not the case for villagers residing inside the Park.

## 6. Conclusion

Contrary to an earlier study, which concluded that since villagers were not directly involved in tourism, their economic benefits from RCNP were minor (Brandon and Wells, 1992), our study shows that, in both absolute and relative terms, the Park delivers a substantial flow of highly

valuable economic benefits to villagers. As mentioned, the final relocation of all villagers from Padampur will not change this picture substantially. Rather it could be argued that this has resulted in a loss of cultural heritage special to the area around RCNP as the relocated villagers are forced to adopt completely different livelihood strategies in their new location (McLean and Stræde, 2003).

Accordingly, our findings support that most often there is a de facto interaction between parks and people, which is virtually impossible to repress (Wild and Mutebi, 1997; Heinen, 1993). The substantial economic importance of RCNP to local communities, and especially the high economic returns to labour of collecting products from the wild (two to four times higher than the income from casual labour), presents a plausible explanation why villagers often resist or circumvent conservation efforts of protected areas and, hence, why park-people conflicts occur in RCNP. Yet, at the same time this ought to be a strong policy argument for establishing a management regime that conserves the Park ecology while securing a long-term flow of benefits to local communities if this is at all possible without compromising the nature conservation objectives of the park. However, our findings also show that the relation between the number of encroachments on the Park, the quantities extracted and their economic value was not straightforward. The list of different species collected within each of the six product categories is extensive. Relatively few species accounted for most of the economic value and the chief part of the quantities extracted, but many more species are in demand and extracted. The majority of these species were not exploited for their monetary value and it appears unlikely that their quantities will seriously affect the ecosystems, but they must, nevertheless, be important to the villagers' livelihoods. Therefore, when defining a management approach to minimise park-people conflicts, it is paramount to distinguish between (i) products extracted because they are quantitatively important, and (ii) products extracted because they serve qualitative purposes (medicinal, religious or cultural) in villagers' livelihoods (Wild and Mutebi, 1997). Most of the quantitatively important products, such as certain timber, fuelwood and fodder species, could be and are to a certain extent being produced within the buffer zone or other products or different technology could substitute them. This study supports that the buffer zone around RCNP, but particularly the open access national forest rather than the community forest, deflects but does not fully substitute extraction of resources from RCNP. However, products of high socio-cultural value are likely to be much more difficult and in some cases impossible to substitute (Badola, 1998).

This merits a statistically sound quantification of the socio-economic and biological aspects related to (i) actual, albeit unplanned, human activity in and extraction of goods from the RCNP, (ii) the present extraction of goods from the buffer zone by area type (community forest, national forest, grassland, etc.) and (iii) the present and potential sustainable production capacity of RCNP and buffer zone areas. Such

information would, in combination with an understanding of the cultural and religious aspects of villagers' utilisation of natural resources in RCNP and its buffer zone, provide for Park and buffer zone management planning that adequately takes human and bio-physical realities on the ground into consideration.

Protected area management should serve the dual objective of catering to nature protection as well as rural development, and be a revolving planning and implementation process that acknowledges the complex and dynamic linkages between bio-resources and different local interests and perspectives (Grimble and Laidlaw, 2002). In practice, this requires a multi-faceted approach that differentiates between park and people interactions driven by socio-cultural needs and economically motivated demands for bulk products. Such an approach challenges the strict functional division of the protected area and its buffer zone, typically pursued by physical zoning, e.g. core protection areas, tourism areas, impact zones, buffer zones, and areas for forestry. Many zones have been defined to explain and cover the various interactions between parks and people living around them (Wild and Mutebi, 1997; Sharma, 1990; Berkmüller and Mukherjee, 1989; Mackinnon et al., 1986), but rarely do they refer to management zones inside the protected area.

At present, RCNP provides some bulk products like fuelwood and fodder resulting in great impact on the Park especially during, but not limited to, the GCP. Yet, if such products were provided or substituted differently than is currently the case, there would be more opportunities for the Park management to engage in multiple-use conservation aiming at doing more for the villagers with less negative impact on the Park's ecosystems.

This requires a landscape management approach which co-ordinates Park and buffer zone management planning. Some reduction of Park preservation, in terms of supplying specific Park products to the villagers during specified periods, should be considered. A reason could be that there is a need to rehabilitate the ecological functions and/or modify the management of surrounding national forests, community forests and other buffer zone areas to improve their social functions. For such an approach to succeed it is paramount to acquire fairly detailed and reliable (statistically and otherwise) knowledge on villagers' actual use of RCNP, and that the relevant official authorities are willing to and capable of collaborating with each other and with the local communities.

As mentioned earlier, acquiring statistically sound as well as reliable information about actual, yet illegal, uses of protected areas presents a particular problem for planners and policy makers. To us it seems that the only feasible way such information can be made available would be through a more active involvement of communities around protected areas in their management and not only in the management of buffer zones. In all likelihood this would require a grace period, where actual

activities can be reviewed by park staff and local communities together, with the overall objective of establishing a management regime that considers the protected area as well as its buffer zone and monitors resource outtake from various sources. In other words, getting reliable and adequate data for improving park-people management requires a change of management approach in the first place. This would provide a scientifically and institutionally sound basis for managing and monitoring the utilisation of and impact on the protected area. Equally important, it would form a credible forum for negotiating park and buffer zone management regimes with all stakeholders, including the donor community.

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