



Research article

Beyond conservation: Assessing broader development outcomes of protected areas in Nepal

Kamal Thapa^{a,*}, Amy Diedrich^{a,b}^a College of Science and Engineering, James Cook University, 1 James Cook Drive, Townsville, QLD, 4811, Australia^b Centre for Sustainable Tropical Fisheries and Aquaculture, James Cook University, 1 James Cook Drive, Townsville, QLD, 4811, Australia

ARTICLE INFO

Keywords:

Benefit and cost

Buffer zone

Integrated conservation and development projects

Nepal

Participation

National park

ABSTRACT

Protected Areas (PAs) are set aside for biodiversity conservation but at the same time they are recognized for their role in supporting development goals. However, the benefits provided by PAs also come with costs to local people. Integrated Conservation and Development Projects (ICDPs) are a PA management approach that aim to maximize local benefits through enhancing conservation and development outcomes, while also reducing costs. We implemented a household level survey in two PAs in Nepal managed using an ICDP approach to assess local people's perceived benefits and costs and determine if this approach was achieving its intended outcomes. Since both PAs are popular nature-based tourism (NBT) destinations, respondents were asked questions specific to this activity and others more general to the PA. The coded qualitative responses revealed ten categories of benefits and twelve categories of costs. Most respondents perceived extraction benefits from PAs, and when asked to reflect specifically on NBT, they mostly identified economic benefits. Crop and livestock loss was the main perceived costs from PAs, whereas sociocultural costs were the main costs from NBT. Chi square tests showed that proximity to the PA office and residency status had the most significant differences in perceptions of benefits and costs from both PAs and NBT. People perceived very few benefits related to participation, cost mitigation, and conservation, which does not match the intended outcomes of ICDPs. Although there may be practical implications for engaging distant communities in management, this may help to enhance conservation and development outcomes from PAs.

1. Introduction

Protected areas (PAs) are the corner stone of biodiversity conservation, helping to maintain key habitats, facilitate species migration and ensure natural ecosystem processes (CBD, 2021; Watson et al., 2014). PAs were originally conceived for the conservation of iconic landscapes, biodiversity and wildlife, but they are now expected to support conservation objectives along with socio-economic development and improving human welfare (Naughton-Treves et al., 2005; Watson et al., 2014). PAs also contribute to achieving multiple United Nations' Sustainable Development Goals (SDGs) (Jones et al., 2020) such as good health and well-being (SDG 3), life below water (SDG 14), and life on land (SDG 15).

Protected areas and nature-based tourism (NBT) bring varied outcomes for local people and society (Coad et al., 2008; Jones et al., 2020; Thapa et al., 2022). One study that objectively measured the benefits and costs of PAs showed that benefits exceeded costs (Ninan and

Kontoleon, 2016), but such benefits have been shown to be more likely to accrue to outsiders, while costs are mostly experienced by local people (Swemmer et al., 2017). In another case, costs and benefits within the PA community are inequitably distributed (Mackenzie, 2012). There are even asymmetries in the received benefits and costs among local people; with distribution variations related to the distance of households from PAs, whether people live within a tourism zone, and demographic factors (Bragagnolo et al., 2016; Holland et al., 2022; Mackenzie, 2012; Mackenzie and Ahabyona, 2012; Sarker and Roskaft, 2011; Tolbert et al., 2019). There are several gaps that limit our understanding of costs and benefits of PAs including the reality that more studies tend to focus on the benefits of PAs rather than the costs (Jones et al., 2020; Thapa et al., 2022). In addition, there tends to be a priority for more research on the impacts of protected areas on local people (Dudley et al., 2018). Such understanding is needed and can contribute to the design of benefit-cost sharing strategies within PA management.

To address the PA management challenge of enhancing benefits and

* Corresponding author.

E-mail addresses: thekamal@gmail.com, kamal.thapa1@my.jcu.edu.au (K. Thapa), amy.diedrich@jcu.edu.au (A. Diedrich).

mitigating costs, it has been proposed that conservation activities should simultaneously deliver socio-economic and development benefits to local people living in and around protected areas (Spiteri and Nepal, 2008a). Strategies linking conservation with development and poverty alleviation have been practised in various ways including establishment of Buffer Zones (BZ) in PAs (Budhathoki, 2004), community-based conservation (Brooks et al., 2013), community-based natural resource management (CBNRM) (Naidoo et al., 2011), co-management (Ward et al., 2018b), and Integrated Conservation and Development Projects (ICDPs) (Alpert, 1996; Gurney et al., 2014; Naughton-Treves et al., 2005). Further, alternatives to mainstream conservation have been recently proposed as convivial conservation to integrate both human and non-human nature (Büscher and Fletcher, 2019; Massarella et al., 2022).

ICDPs are incentive-based programs that aim to sustain the conservation while meeting livelihood needs of local people living adjacent to PAs (Nepal and Spiteri, 2011; Spiteri and Nepal, 2008a). The application of such programmes in PA management helps to promote local ownership and support by offering benefits such as compensation payments linked to conservation to local people (Badola et al., 2021; Spiteri and Nepal, 2008b). The dual, and possibly equal, focus on objectives of biodiversity conservation and development opportunities is what makes ICDP approaches strategic with respect to PA management (Alpert, 1996; Gurney et al., 2014; Wells et al., 1992). The underlying mechanism of ICDPs is the establishment of “core” areas that are strictly protected and inhabited “buffer zones” in the peripheral areas aimed at promoting sustainable natural resource use and socio-economic development (Naughton-Treves et al., 2005; Wells et al., 1992). However, outcomes of ICDPs are contextual, meaning that factors that influence success in one PA may or may not resemble those of ICDPs at other PAs. Experiences from the relatively limited success of ICDPs and related approaches have been too readily adopted in some PAs as a panacea for win-win solutions for biodiversity conservation and development (Christensen, 2004 cited in Muradian et al., 2013).

The delineation of BZs, local participation and delivering benefits to local people are the key criteria for ICDPs (Brooks et al., 2013; Mackinnon, 2001; Wells and Brandon, 1993). Participation is necessary to facilitate cooperation between PAs and local people to make law enforcement acceptable (Paudyal et al., 2018; Wells and Brandon, 1993). The level of participation and receipt of several benefits such as utilization of resources, economic benefits and social/human capital investment often leads to the success of conservation projects such as ICDPs (Brooks et al., 2013). When local people receive benefits from PAs, then they also tend to participate in conservation activities (Paudyal et al., 2018). As such participation of local people helps to achieve biological and socio-economic development goals (Oldekop et al., 2016).

Nature-based tourism is one of the most important economic activities in PAs implementing ICDPs (Stem et al., 2003). ICDPs also focus on improving local capacity so that local people are more able to experience the benefits of NBT (Brandon and Wells, 1992). In this way, NBT in PAs can help to address both the social development and conservation goals through capacity building for conservation and supporting livelihoods diversification with several other economic opportunities (Stronza et al., 2019; Thapa et al., 2022; Wardle et al., 2021). Economic benefits from NBT can motivate local engagement in conservation friendly practices (Krüger, 2005; Stem et al., 2003). However, there are also costs associated with NBT such as acculturation, conflict, social disturbance, soil erosion, habitat destruction, solid waste problem etc (Krüger, 2005; Thapa et al., 2022).

The ICDP approach is intended to create a win-win scenario for biodiversity conservation and livelihoods. However, this is often a misguided assumption (McShane et al., 2011) which can be difficult, if not impossible, to achieve (Adams et al., 2004). ICDPs with external funding often terminate after their grant expires and positive impacts may not last long (Gurney et al., 2014; Wells and Brandon, 1993), thus

raising the issue of impact sustainability of such projects. Protected areas with tourism have the potential to offer economic benefits to local people and generate participation in PA management (Wells and Brandon, 1993). However, ICDPs funded through internal sources such as tourism may be limited in their ability to deliver conservation and development benefits to local people (Wells and Brandon, 1993). This is because the funding from internal sources may be less than what is required to achieve conservation and development outcomes. In addition, whether local people receiving benefits from ICDPs also incur costs from protected areas is unclear since positive outcomes tend to be reported more often than the failures and costs related to community-based conservation interventions and protected area management (Brooks et al., 2013; Koot et al., 2020; Naidoo et al., 2019). This calls for a more balanced evaluation of protected areas that considers the balance among a multitude of outcomes, both positive and negative, for local communities.

Recent global reviews confirm that PAs and tourism therein bring both the benefits and costs to local people (Allendorf, 2022; Thapa et al., 2022). Documented benefits from PAs include opportunities for natural resource harvest, employment and income from nature-based tourism, and other local-level development projects that are linked to conservation (Bajracharya et al., 2006; Baral and Heinen, 2007; Ezebillo and Mattsson, 2010; Mackenzie, 2012; Tolbert et al., 2019). On the other hand, costs such as evictions, crop and livestock depredation, loss of human lives from PA wildlife, conflicts, and restrictions on natural resource use, may also occur as a result of PAs (Badola et al., 2021; Bajracharya et al., 2006; Baral and Heinen, 2007; Eustace et al., 2018; Mackenzie, 2012; Tumusiime and Vedeld, 2015; West et al., 2006).

Local people's perceptions of benefits depend on multiple factors. For example, in Costa Rica, people perceiving positive relationships between the community and the PA tended to perceive more socio-economic than environmental benefits (Molina-Murillo et al., 2016). Another study in Nepal, showed that more people (90%) perceived crop loss than extraction benefits (64%) or tourism benefits (62%) from PAs at the household level (Spiteri and Nepal, 2008a). Perceptions of costs and benefits can also be influenced by the question format and issues of interest raised by researchers, and whether people are being asked about household or community level impacts (Allendorf, 2022; Thapa et al., 2022; Tolbert et al., 2019). When asked specifically about tourism and PAs, perceptions of benefits and costs have been shown to be influenced by demographic factors such as age, income, education, gender, migration status and spatial location of villages from PAs (Badola et al., 2021; Bragagnolo et al., 2016; Mackenzie, 2012; Tolbert et al., 2019).

This research aimed to identify locally perceived benefits and costs from protected areas managed through an ICDP approach using two tourism focused PAs in Nepal. Three research questions were asked: 1) What are the perceived benefits and costs of protected areas and tourism by local people? 2) Are there any differences in perceived benefits and costs from protected areas and tourism with respect to demographic and spatial factors? and, 3) Is the ICDP approach to PA management meeting its intended objectives?

2. Background and study sites

Nepal's approach to PA management tries to address the debate of conservation and human use with the designation of uninhabited core zones (for strict protection) and surrounding inhabited BZs (for development and sustainable resource use). In the context of the conservation-poverty relationship, this simultaneously encompasses the idea of “poverty and conservation as separate policy realms” for the core zones as conservation is promoted independently of poverty reduction and “poverty as a critical constraint on conservation” in the BZs as ICDPs, revenue sharing and sustainable resource use is practiced in BZs (Adams et al., 2004).

National Parks (NP) in Nepal are strictly protected, with no permanent human settlements inside the boundary, although tourism is

allowed. However, there are exceptions to this in some national parks in the Himalayas, where local people are allowed to live and pursue their traditional way of life. Nepal's PA management system moved from strict conservation to a participatory approach after the adoption of buffer zone management regulations (1996) and guidelines (1999). These policies institutionalized the benefits and costs sharing mechanism in PA management by channelling back 30%–50% of PA income for investment in conservation and development activities into the buffer zone communities (Bhattarai et al., 2017; Budhathoki, 2004). These activities could be community development (eg. irrigation, roads), conservation programme (eg. plantation, recruit of forest guards), income generation and skill development (eg. vegetable farming, handicraft), and conservation education (Allendorf and Gurung, 2016). This ensures the financial availability and provide most of the income for conservation and development, and has become integral to PA management. Nepal is among the top third of countries implementing ICDPs (Brooks et al., 2013).

Nepal has an extensive network of protected areas that is distributed all over the country with current coverage of 23.39% of the total area (DNPWC, 2022). These are located mostly in the northern part (Himalayas) and southern lowland (Terai). While Nepal has five types of PAs, the majority are classified as national parks (Dudley, 2008). This study was conducted in two representative PAs in terms of geography and NBT, i.e. Bardiya National Park (BNP, in southern lowland) and Langtang National Park (LNP, in Himalayas). BNP was established in 1976 and covers an area of 968 sq km with an additional outer (buffer) zone of 507 sq km. Although the buffer zone was established in 1996, the northern part was only included in 2011 (DNPWC, 2022). The Churia/Siwalik hill area is partially covered in the northern region, and the eastern boundary is shared with Banke National Park. BNP is part of the Terai Arc Landscape, connecting national and transboundary protected areas of Nepal and India. The Royal bengal tiger (*Panthera tigris*) is the flagship species in BNP and also provides habitat for the Asian elephant (*Elephas maximus*), and the Greater one-horned rhinoceros (*Rhinoceros unicornis*), among other species. BNP is the second most visited national park among all the PAs in the Terai (lowlands). More than 24,000 tourists visited BNP in 2018/19 fiscal year, just before COVID-19, out of which international tourists were more than 8000 (DNPWC, 2022). Nature-based tourism (e.g. wildlife viewing, jungle walk, jeep safari) activities are limited to areas around the national park head office.

Langtang National Park was established in 1976 and covers an area of 1710 sq. km. with an additional surrounding buffer zone of 420 sq. km (DNPWC, 2022). The eastern part of the park adjoins Gaurishankar Conservation Area. LNP is an important region of the Sacred Himalaya Landscape connecting protected areas and landscapes of eastern Himalayas. Snow leopard (*Panthera uncia*) and Red panda (*Ailurus fulgens*) are the flagship species of LNP. LNP is the third most visited PA in the mountains of Nepal. 17,691 tourist visited LNP in 2018/19, just before COVID-19, among which more than 12,000 tourists were international (DNPWC, 2022). Nature-based tourism activities (e.g. trekking, hiking, mountaineering) are mainly confined in the Syabrubensi-Langtang-Kyangjin region with small portion in the Helambu region.

In the next subsections, we present the study methodology with brief descriptions of the study site(s), field data collection methods, and data analysis. Then, we present the findings of the study and discuss the results of the ICDP approach to PA management. This paper concludes with further recommendations for improving PA management to achieve both conservation and development objectives.

3. Materials and methods

3.1. Sampling strategy

Communities in each PA case study site were first clustered into three groups based on their proximity to the PA headquarters: 1) adjacent

(near); (2) mid-distance; and (3) far. Proximity was based on average travel time taken to reach to the PA headquarters as well as remoteness rather than Euclidean/geographical distance. In LNP, sites within a one-day travel (walk) or less than a day travel by bus/jeep ride was clustered as near, site within a one and half (to two) days of travel (walk and/or bus/jeep ride) was clustered as mid-distance and minimum of two days of travel (including long walk and/or bus/jeep ride) was clustered as far in LNP. In BNP, this was slightly different due to relatively accessible and lowland area. Near was clustered within half an hour of bicycle ride, mid-distance was within four hours of travel by bus/jeep/autorickshaw or motorcycle and far was at least a day travel (walk and/or bus/jeep ride). Sampling communities were then selected from within those clusters so that they represented different districts, different (rural) municipalities, and varying degrees of NBT. This led to a sampling of households in three wards¹ in BNP and four wards in LNP.

Convenience sampling was applied to survey the households in each of the three clusters in both protected areas. Given the relatively easy accessibility and higher number of households (17,172) and population in BNP (BNP, 2016), each cluster was sampled with a minimum assigned quota of 150 households. Due to rugged terrain, mountain/Himalayan landscape and lower number of households (14,963) and population in LNP (LNP, 2019), each cluster was sampled with minimum assigned quota of 110 households. We assumed it reasonable to have this minimum quota as this represented minimum of 12% of the households at each sampling wards (this was 20% of the total households when combined for all sampling wards) (Table 1). Either the head of the household or his/her representative older than 18 years old was invited to participate in the survey. We spread our sample households within the ward to cover as diverse respondents as possible such as by visiting households off the main trail and different part of villages, and surveying in different time of the day. We also aimed to alternate between male and female respondents as gender roles differ. Females tend to be directly involved in resource harvesting and also face confrontation with park officials while males often take part in village meetings and decision making etc. Alternating male and female was not always possible due to absence of female (or male) participants at home during the survey time. In some cases, female participants were reluctant to participate in the survey when there were male family members present at their home as they underestimated their ability to talk about their experience and knowledge on the grounds of low literacy level. In this

Table 1
Summary characteristics of protected areas and sampling wards.

PA: Bardiya National Park and Buffer Zone				
Proximity to PA HQ	Adjacent (Cluster 1)	Mid-distance (Cluster 2)	Far (Cluster 3)	Total
Tourism activities	Present	Absent	Absent	
Total households in the sampling wards	1338	665	295	2348
Household sample	167	150	159	476
PA: Langtang National Park and Buffer Zone				
Proximity to PA HQ	Adjacent (Cluster 1)	Mid-distance (Cluster 2)	Far (Cluster 3)	Total
Tourism activities	Present	Present (but low)	Absent	
Total households in the sampling wards	665	764	410	1839
Household sample	147	112	110	369

Source: Fieldwork, BNP (2016), LNP (2019).

¹ Ward is the smallest political and administrative unit in Nepal. Municipalities or Rural Municipalities (RM) are subdivided into several wards. Our sample represented three different municipalities or RM in each PA.

case, their male counterparts were surveyed. In total, 845 households were surveyed (Table 1).

3.2. Data collection

The survey was implemented from August to December 2021 at the household level. The questionnaire (Supplementary Information (SI) 1) included a mixture of categorical, ranking, Likert scale (Oppenheim, 2006), socioeconomic and demographic questions. The questionnaire consisted of both open and closed ended questions and sought to identify the types of benefits and costs of both protected areas and tourism perceived by local people. Respondents were asked to distinguish between benefits and costs experienced at a household and community levels (see questionnaire, SI 1). We chose an open-ended approach of asking about costs and benefits to allow respondents to respond freely rather than imposing our preconceived ideas of benefits and costs from PAs and/or ICDPs. We asked separate questions about tourism benefits and costs (SI 1) so as not to confound the responses specific to the ICDPs (ICDP criteria do not explicitly address tourism).

The survey was conducted face-to-face in the Nepalese language by an interviewer and took about half an hour to a maximum of one hour to complete. This research obtained human ethics approval (H8229) from James Cook University and research permission was also granted by Nepal's Department of National Park and Wildlife Conservation and respective national park offices.

3.3. Data analysis

The responses to the open-ended questions about benefits and costs from PAs and tourism were final coded into nominal categories such as development, extraction, economic, conservation, knowledge and awareness, loss (crop, livestock, human lives), property damage, resource use restrictions, socio-cultural, behavioural etc. For the benefits, we developed categories based on ICDP criteria (Table SI 2) and assigned responses from open ended questions to one of the ICDP categories for interpretation. ICDP categories were collated from the published literature on ICDPs. The costs, which are often not considered in the ICDP criteria did not fit in the predetermined categories and were coded separately. These were coded and grouped into similar types. For example, different types of loss to farm produce due to PA wildlife were categorised as 'crop loss' whereas different impacts of tourism such as loss of culture and import of foreign culture was categorised as 'socio-cultural impacts' in the cost categories (Table SI 3).

Both descriptive and inferential statistics were used to explore survey data. Because of the categorical nature of our response variable, chi-square (χ^2) test of independence was performed to test for associations in perceived benefits and costs of protected areas by demographic characteristics at the household and community level. We considered gender, age, ethnicity, education, residency status and proximity to the PA office (Table 2), because the PA impacts can vary depending on social groups (Chaudhary et al., 2018; Gurney et al., 2015) and proximity to PA office has a distance decay effect. These variables are also the key indicator of social structure of Nepalese society and different clusters of our sample wards are experiencing varying degrees of development (lead author's knowledge). Further, these variables are also found to be statistically significant in earlier studies and under scrutiny (Bragagnolo et al., 2016).

We performed χ^2 tests only on those categories of benefits and costs of protected areas and only benefit categories of tourism that were cited by at least 10% of the respondents (Table SI 4 and Table SI 5). This is because we considered categories of benefits and costs cited by fewer respondents to be less representative of overall impacts from PAs and tourism. We conducted χ^2 tests on the tourism cost categories when cited by at least two percent of the respondents only (Table SI 5). We used a 2% threshold to enable statistical analysis as the 10% threshold would not give us any cost from tourism due to lower proportion of perceived

Table 2

Respondents' socio-demographic characteristics across both PAs (n = 845).

Variable		Percent ^a
Age: Mean yr (SD): 43.57 (15.56)	Younger: ≤ 40 years	49
	Older: ≥ 41 years	51
Gender	Male	54
	Female	46
Residency status	Local origin	69
	Migrated	31
Ethnicity	High caste	29
	Other caste	71
Education	Non-schooling	53
	Schooling	48
Proximity to PA office	Near	37
	Mid-distance	31
	Far	32

^a Counts may be more than 100% due to rounding.

costs from tourism. We combined data from both PAs for this analysis as we were interested to know the overall perceived benefits and costs irrespective of the individual characteristics of these PAs because the same national policy governs each PA and buffer zone. The data from the survey were analysed using IBM SPSS statistics version 26.

4. Results

4.1. Perceived benefits from PAs at the household and community levels

A total of 1792 household level benefits and 2003 community benefits from PAs were reported (note that respondents gave more than one response). Similarly, 258 responses were reported as household benefit and 731 responses as community benefit from tourism in protected areas. Ninety-two percent of respondents cited at least one household benefit and 90% cited at least one community benefit from PAs. Only 21% of respondents replied with at least one household benefit and 46% replied with at least one community benefit from tourism in PAs.

More non-tourism related community benefits (eight categories) were perceived than household benefits (six categories) from protected areas (Table 3). These categories were clearly distinguished between extraction and non-extraction benefits. The largest category of perceived community benefits was extraction benefits followed by development activities/project. Similarly, the largest category of perceived household benefits were extraction benefits followed by development activities/project and economic.

On the other hand, seven categories of community benefits and five household benefits were perceived from tourism (Table 3). There were more community level economic benefits, followed by development activities/project, and knowledge and awareness from tourism. Other community benefits perceived from tourism were skills development, cultural, conservation etc (Table 3). Household benefits from tourism followed the similar pattern to community benefits but with low responses. There were more household economic benefits followed by development activities/project. Other household benefits perceived from tourism were skills development, conservation, and knowledge and awareness. Few people acknowledged conservation as a benefit, either at the household or community level, from either protected areas or associated tourism.

4.2. Perceived costs from PAs at the household and community level

A total of 946 household costs and 1314 community costs were reported from protected areas. The reported costs from tourism were considerably smaller, with 34 responses related to household costs and 106 responses for community costs. Seventy-one percent of respondents perceived at least one household cost and 87% perceived at least one

Table 3

Categorised responses across both study sites related to perceived benefits of protected areas and tourism at household and community level.

ICDP categories	Household benefit from PAs		Comm. benefit from PAs		Household benefit from tourism		Comm. benefit from tourism	
	% responses (N = 1792)	Nr of respondent ^a	% responses (N = 2003)	Nr of respondent	% responses (N = 258)	Nr of respondent	% responses (N = 731)	Nr of respondent
Comm dev	2.84	49	8.04	118	9.69	22	31.87	141
Extraction	96.20	772	88.42	682	0	0	0	0
Economic	0.50	9	0.75	15	88.76	160	62.93	339
Skill development	0.11	2	0.10	2	0.78	2	1.09	6
Knowledge and awareness	0	0	0.20	3	0.39	1	2.60	16
Mitigation	0.27	5	1.05	14	0	0	0	0
Conservation	0.05	1	1.40	28	0.39	1	0.27	1
Participation and membership	0	0	0.05	1	0	0	0	0
Cultural	0	0	0	0	0	0	0.82	6
Other	0	0	0	0	0	0	0.41	2

^a Number of respondents perceiving at least one benefit. Respondents were allowed to give more than one response.

community cost from protected areas. Only 3% of respondents perceived at least one household cost and 8% perceived at least one community cost from tourism. Thirteen categories of costs associated with protected areas and tourism were identified, among which eight were experienced from protected areas and five from tourism (Table 4).

Attacks on humans, including deaths, crop loss, and livestock loss were the main perceived costs from protected areas at the community level. The perceived costs at the household level were similar to community costs, however the number of respondents who perceived crop and livestock loss as a main household cost varied. Property damage was perceived as the third biggest cost at the household level from protected areas. Regarding tourism, five different costs were perceived at the community level but four different costs at the household level. No economic cost was perceived at the household level. Socio-cultural and environmental costs were the two main costs perceived at both levels, however more respondents perceived these as a community cost.

4.3. Participation and membership

Only one respondent mentioned a community benefit in the form of participation (in the decision-making process) and membership (with community-based organizations (CBOs) or non-governmental organizations (NGOs)) from protected areas and/or tourism in an open-ended question. However, we asked additional questions about whether respondents were participating in any village level development and conservation related decision making and whether they were members

of the executive committees of associated CBOs and/or NGOs. We found 13% of survey respondents were members of an executive committee of CBOs/NGOs and 14% were involved in decision making processes related to PAs.

4.4. Natural resource extraction

The open-ended responses showed that 91% of respondents perceived resource extraction from the protected area as a household benefit and 81% perceived this as a community benefit. Dependency of local people on a protected area’s natural resources was also apparent from their responses related to questions about their intention to harvest natural resources. Most respondents stated that national parks should allow local people to harvest various natural resources. On a five-point Likert scale (5 = strongly agree), about 80% either agreed or strongly agreed (mean score 3.63 ± 1.04) that PA authorities should allow them to harvest natural resources such as firewood, timber, and grass. However, more people (98.6%) in LNP (mean score 3.99 ± 0.21) held this view compared to those in BNP (65.4%) (mean score 3.35 ± 1.31).

4.5. Differences in perceived benefits in relation to demographic factors

The contingency analysis (χ^2 test) showed that proximity and residency status yielded the most significant differences in perceptions of benefits for both tourism and PA related benefits. There were significant differences in perceptions of extractive benefits from PA ($p < .001$) and

Table 4

Categorised responses across both study sites related to perceived costs of protected areas and tourism at household and community level.

Cost categories	Household cost from PAs		Comm. cost from PAs		Household cost from tourism		Comm. cost from tourism	
	% responses (N = 946)	Nr of respondent ^a	% responses (N = 1314)	Nr of respondent	% responses (N = 34)	Nr of respondent	% responses (N = 106)	Nr of respondent
Crop loss	78.75	590	61.42	709	0	0	0	0
Livestock loss	17.55	166	27.63	362	0	0	0	0
Human attack/loss	0.63	6	5.02	66	0	0	0	0
Property damage	1.37	13	4.19	54	0	0	0	0
Restriction on natural resource use	0.74	6	0.46	5	0	0	0	0
Unjustified penalty/royalty	0.11	1	0.15	2	0	0	0	0
Poultry/pet animal loss	0.74	7	0.30	4	0	0	0	0
Other (PAs related)	0.11	1	0.84	11	0	0	0	0
Behavioural	0	0	0	0	5.88	2	12.26	13
Economic	0	0	0	0	0	0	7.55	6
Environmental (solid waste)	0	0	0	0	26.47	9	31.13	33
Socio-cultural	0	0	0	0	64.71	19	47.17	45
Other (Tourism related)	0	0	0	0	2.94	1	1.89	2

^a Number of respondents perceiving at least one cost. Respondents were allowed to give more than one response.

economic benefits from tourism ($p = .001$) experiences at the household level. Similarly, there were significant differences in perceived extractive benefits ($p < .001$), and development benefits from PA ($p < .001$) and economic benefits from tourism ($p < .001$) experienced at the community level. Villagers closer to the PA head office perceived more benefits from tourism and development than distant villages, while people with local origin perceived more benefits than migrants. Ethnicity and education status showed significant differences in the perceived benefits from tourism as an economic benefit (both at household and community levels) as well as extraction benefit from PA at the community level. Gender showed significant differences only with respect to perceived extraction benefit from PA as a community-level benefit (Table SI 4).

4.6. Differences in perceived costs in relation to demographic factors

The χ^2 test showed that proximity to the PA office and residency status also had the most significant differences in perceptions of costs from both tourism and non-tourism related costs of PAs. Villages far from the PA office perceived more crop loss and livestock loss as costs at both household and community levels, whereas villages near to the PA office perceived more costs from tourism. Respondents with local origins perceived more crop loss at both household ($p = .011$) and community levels ($p = .002$) whereas respondents with migration status cited more sociocultural costs from tourism as both household costs ($p = .020$) and community costs ($p = .001$). We also found significant differences in the perceived crop loss from PA as a household cost by age group ($p = .007$) and education status ($p < .001$) and crop loss as community cost by gender and education status. Further, gender showed differences in perceived livestock loss as well. Ethnicity did not have any differences in the perceived costs from both tourism and PAs (Table SI 5).

5. Discussion

We found ten categories of benefits and thirteen categories of costs emerging from our open-ended questions about local people's perceived costs and benefits from PAs and associated tourism. Most respondents perceived extraction benefits as the main household and community non-tourism benefits from PAs, whereas economic benefits were the main perceived outcomes of tourism at both household and community levels. With respect to costs, most respondents perceived greater costs at the community level than within households for both tourism and non-tourism related costs of PAs. Crop and livestock loss were the main perceived community and household costs from PAs, whereas socio-cultural costs were the main perceived community and household cost from tourism. Proximity to the PA office and residency status had significantly explained differences in the perceptions of benefits and costs from both tourism and PAs. Age group did not have any differences in the perceived benefits while ethnicity did not have any differences in the perceived costs from both tourism and PAs.

We aligned relevant categories of perceived benefits emanating from the coded open-ended responses with the ICDP criteria (Table SI 2) to help evaluate if the current PA management in Nepal is delivering intended benefits from the ICDP approach. A very high proportion of the responses related to PAs benefits were categorised as extraction benefits followed by social and economic development outcomes. Likewise, perceived benefits from tourism were mostly related to economic development and social development. Other ICDP criteria categories were perceived in very small numbers, suggesting that PAs in Nepal may not be delivering as many benefits as intended from the implementation of the ICDP approach. For example, there were few perceived benefits attributed to conservation and participation. On the other hand, extraction benefits from PAs were perceived by an overwhelmingly large number of respondents. This may contradict with PA management objectives related to conservation. Because our study parks are IUCN category II (national park) whose primary aim of protection is to protect

biodiversity along with its underlying ecological structure and supporting environmental process and to promote education and recreation (Dudley, 2008, p. 16). Although the categories of reported benefits and costs were similar for both tourism and non-tourism related outcomes, we found that benefits tended to be perceived more often at the community-level than at the household level for both types of outcomes. This, however, aligns with what one would expect as an outcome of ICDPs because ICDPs aim to provide benefits at the community scale so that everyone in the community can receive benefits (Tolbert et al., 2019). In the following sub-sections, we discuss our results in the context of the conservation and development debate (e.g. the effectiveness of the ICDP concept), conservation costs to local people, participation, and demographic differences of perceived benefits and costs within the broad scope of PA management.

5.1. The balance of conservation and development benefits

High extraction of natural resources from PAs may not be sustainable in the long run as resource depletion may occur. In this context, there is a chance that the ICDP approach being applied in Nepal could increase threats to PAs due to its focus on meeting community needs. This may be the result of increasing levels of resource harvesting and utilization as people try new alternatives in addition to their previous activities (Mackinnon, 2001). It is suggested that, if PAs are to make real conservation impact, then minimizing opportunity costs (forgone benefits to local people) should be avoided (Smallhorn-West and Pressey, 2022). But, from the Nepalese experience, preventing the use of resources has been shown to be detrimental to conservation and this failure of strict conservation measures in the past led to the adoption of ICDPs and the buffer zone programme. There is also a risk that local people may perceive ICDPs as a development project rather than conservation project. For example, in a study of Virunga National Park in Africa, none of the local respondents perceived conservation of wildlife (e.g. mountain gorillas) as a benefit. Rather, half of the respondents reported infrastructure and development projects as the second most important community benefits after ecosystem services (Tolbert et al., 2019). In some cases, conservation activities such as environmental education, forest protection and PA management were least prioritized (Larson et al., 2016; Nepal et al., 2022). In line with this, our findings showed that local perceptions did not necessarily align with documented conservation outcomes as no one in BNP perceived tiger conservation as a benefit, despite the fact that tiger populations have been shown to double in recent years (DNPWC and DFSC, 2022).

In PAs that have been labelled as successful ICDPs (Baral et al., 2007; Brandon and Wells, 1992), the relative status of development and conservation activities tend to vary in relation to the age of the associated Conservation Area Management Committees (CAMCs). For example, development exceeded conservation activities in younger CAMCs in Annapurna Conservation Area, whereas institutional strengthening (such as capacity building and organizational development) was the main activity in mid-term CAMCs, and conservation activities exceeded development in older CAMCs (Baral et al., 2007). ICDPs and BZs projects may need at least a decade to contribute to conservation, whereas development benefits might be more immediate (Baral et al., 2007; Sayer, 1991). Owing to this experience, we did not find local people perceiving conservation as a benefit in either PA, although the BZ declaration and hence the BZ programme was implemented more than two decades ago in both PAs. This raises the question about providing legal authority for PA management agencies to manage BZs (Wells and Brandon, 1993), if they do not lead to local people recognising conservation as a benefit. On the other hand, studies have shown that PA staff implementing ICDPs perceived conservation as a benefit (Michael et al., 2016), demonstrating that there can be a difference between how local people and managers perceive ICDPs. This could be due to the lack of linkage of ICDPs activities to conservation objectives, or people not being aware that ICDPs are able to contribute to conservation. Rather

people may perceive it as only a rural development project. This could be addressed through the connection of various activities with conservation which may then lead to more understanding of associated conservation benefits.

Buffer zone policy in Nepal aims to balance and integrate conservation and development through investment of PA income in the BZ communities. Even in the older and well-established PAs and BZs, there are flaws in the implementation of the BZ policy/guidelines, such as investment of budget in different categories did not follow the guidelines in strict sense and varies by PAs (Allendorf and Gurung, 2016). For example, Sagarmatha National Park invested heavily in development activities (70%) rather than conservation activities (18%) in the BZ (Silwal et al., 2022). This emphasis on development over conservation undermines the objectives of national park and needs timely intervention.

We found that less people perceived a smaller number of benefits from tourism in relation to PA related benefits. This is possibly because tourism is limited to certain areas of PAs whereas our sample is spread throughout the PAs. ICDPs also focus on improving local capacity to benefit from NBT (Brandon and Wells, 1992), because NBT is beneficial both to the local people and PA to meet conservation objectives. While local people may benefit economically from NBT, this also contributes to conservation and development as NBT generates funds through entrance fees (Baral and Dhungana, 2014; Thapa et al., 2022; Wardle et al., 2021). Most of the Nepalese PAs rely on entrance fees charged to visitors to fund their activities. However, over reliance on NBT for conservation and development could be counter-productive as not all PAs are equally important to tourism and unforeseen incidents such as natural disasters and the current COVID-19 pandemic means their income may plummet in the uncertain future. Reliance on entrance fees could be a problem for Nepalese PAs that lack tourism potential in achieving PA management success from ICDPs as they are not able to generate sufficient funds required to implement ICDPs. Studies also have shown that although people may perceive benefits from tourism, livelihood benefits to local communities may be limited (Gubbi et al., 2008) and merely contribute in meeting basic needs rather than wealth creation (Upadhaya et al., 2022). Monetary benefits from conservation may also be limited to tourism entrepreneurs (Bajracharya et al., 2006) thus leaving non-entrepreneurs behind. If tourism benefits from PAs are not distributed widely in the community, then tourism may not create a strong linkage with conservation.

5.2. Conservation costs to local people

Conservation and management of PAs comes at a significant cost to local people. Although a financial compensation is available in Nepal for wildlife induced damage such as crop/livestock loss and property damage, this was not perceived as a benefit. Cost mitigation activities were perceived as a community-level benefit by only 14 respondents, while only five respondents perceived cost mitigation as a household benefit. This could be due to the fact that compensation is only paid to local people when the damage is done by certain wildlife species, and because obtaining compensation from PA authorities is cumbersome, lengthy and often insufficient to cover the loss (Karanth et al., 2019; Shahi et al., 2022; Thapa, 2016). For example, one study showed that although the benefits such as community forests in the buffer zone and tourism related employment were recognized by local people, their perception of costs such as penalties imposed by PA authorities were higher and the compensation received for the wildlife damage costs were lower than their actual costs (LeClerq et al., 2019). In addition, the absence of alternative sources of natural resources often compels local people to enter PAs to harvest resources even if this is illegal (Karki, 2013; LeClerq et al., 2019).

We found crop loss and livestock loss being the top two costs from PAs at both household and community levels, whereas human attack/loss and property damage were additional community costs from PAs.

These findings corroborate with other studies about the costs of PAs (Bajracharya et al., 2006; Gubbi et al., 2008; Htay et al., 2022; Karanth et al., 2019; Shahi et al., 2022). This pattern of loss also matched with the official record and there were court charges for locals too. In the fiscal year (FY) 2021/2022, a total of 2097 cases of loss (including human injuries and death) were registered in BNP and 493 cases in LNP. As a compensation of losses for local people, the PA authority paid² USD 160,016 in BNP and USD 28,051 in LNP in the same FY (DNPWC, 2022).

Numerous studies in Asian PAs have documented costs related to crop loss. In one study in Myanmar, more than half the respondents perceived costs from PAs whereas in Indian PAs, more than three-quarters of the respondents reported crop loss in four PAs (Htay et al., 2022; Karanth et al., 2019). Similarly, a study in BNP in Nepal showed that an annual average monetary loss to households due to livestock depredation was USD 32, while the value of crop loss in Kibale NP was USD 74 per farmer over half a year (Mackenzie and Ahabyona, 2012; Shahi et al., 2022). Another study in Sagarmatha National Park in Nepal showed that few funds were made available for conservation related cost reduction such as addressing crop loss and livestock depredation (Silwal et al., 2022). This contradicts to the idea that loss mitigation activities could be more beneficial to local people, as this is favoured over benefit promotion activities through development projects (Mackenzie, 2012). When people experience more livestock loss from wildlife, they tend to perceive fewer benefits from PAs (Parker et al., 2022), therefore it is important to focus on costs/losses reduction from PAs to maximize the overall benefits.

5.3. Participation

Participation is important to garner local support for conservation, and can help reduce illegal activities such as poaching (Krüger, 2005; Wells and Brandon, 1993). Participation and integration of local people in management planning and activities can also help achieve biological and socio-economic development goals (Oldekop et al., 2016). This can create a positive feedback loop in that people are more likely to participate in conservation if they perceive benefits from PAs (Paudyal et al., 2018).

Involvement of local communities in decision-making processes of PA management and empowerment contribute to PA sustainability (Gatiso et al., 2022). Conservation participation such as plantation, waste management, community forestry etc in a national park in Myanmar was only about 44% (Htay et al., 2022). Moreover, participation tends to be higher with local people living near the PAs and those receiving PA benefits (Gatiso et al., 2022; Htay et al., 2022). Our results do not necessarily demonstrate this trend, as participation in the decision-making process was recognized by few respondents (14%), which did not align with a key criteria for ICDPs (Wells and Brandon, 1993), although most perceived some sort of benefit. Similar to our studies, Gaurishankar Conservation Area in Nepal had even less respondents (12%) who participated in either decision making or discussion (Paudyal et al., 2018). Another study by Silwal et al. (2022) also found that active support and participation of local people in buffer zone program was negligible and decisions were often made by local elites without listening to those who suffer from wildlife damage (Silwal et al., 2022). This is in contrast to the aim of PA authorities of Nepal that have facilitated the establishment of buffer zone user committees at the ward level and buffer zone management councils at the PA level to increase local participation (DNPWC, 2022).

Increased participation of local people in planning and decision-making process contributes to the acceptability of PAs or conservation strategies and enhances compliance of rules and regulations (Andrade

² 1 USD = 130.139 as of 06 March 2023. <https://www.oanda.com/currency-converter/en/?from=USD&to=NPR&amount=1>. This equates to Nepalese Rupees (NPR) 20,824,260 in BNP and NPR 3,650,550 in LNP.

and Rhodes, 2012; Gatiso et al., 2022). However, even if greater numbers of local people become members of community associations, actual membership in conservation related associations might be small (Tolbert et al., 2019). It is documented that empowerment of local people leads to positive socioeconomic outcomes which then contribute to positive conservation outcomes of PAs (Oldekop et al., 2016). Low participation in decision making may also mean that PA authorities may not want to delegate the decision-making power, preferring to treat local people as passive beneficiaries only. In this context, strengthening participation in PA management and decision making would help tackle problem of poaching as well as support for conservation. For example, in the northern region of BNP, local people hunt several wildlife species due to absence of PA staff, remoteness as well as lack of development opportunities (Bhattarai et al., 2016). Their meaningful participation could help curb this problem and turn local people from poachers into guards. Local institutions, such as buffer zoner users committees in Nepal, that are involved in PA management are demanding more autonomy in decision making, planning, budgeting and programme implementation but NP wardens seem reluctant to devolve the power (Paudel et al., 2010).

5.4. Demographic and spatial differences in perceived benefits and costs

Benefits from PAs often arise from tourism activities and development support from NGOs working in and around PAs (Karki, 2013; Sabuhoro et al., 2021; Tumusiime and Vedeld, 2015). ICDP benefits have been observed to be more prevalent in the villages adjoining park administrative offices and park boundaries than those distant from it (Ezebilo and Mattsson, 2010; Mackenzie, 2012). We found similar result as households situated near the PA office and the tourism destinations perceived more benefits from PAs and tourism than distant households. This also confirms with findings from the Sariska Tiger Reserve in India in which people living within the tourism zone benefitted more than those living outside tourism zone (Udaya Sekhar, 2003). Our findings also confirm with study in Chitwan National Park, where tourism related economic benefits were perceived by higher numbers of residents in tourism villages (Spiteri and Nepal, 2008a). However, it is also important to note that some studies have shown that the farther the villages from the PA boundary, the less problems are reported from PAs (Karanth et al., 2019; MacKenzie et al., 2017; Sarker and Roskaft, 2011). This could be due to less interaction of villagers with the PA and/or fewer problems with park wildlife. We found that more residents perceived loss in the distant zone from PA office than nearby residents (not necessarily PA core zone boundary).

In ICDPs, it may be challenging to be fair and effective in targeting communities and households for development activities. For example, should the poachers get priority or benefits be rewarded to forest protectors? Similarly, should poor people be targeted for poverty alleviation and social equity? ICDPs are often designed on the assumptions that poverty is the main threat to biodiversity conservation, and that providing development opportunities to local people will reduce pressure on PA resources (Mackinnon, 2001). This may not hold true in practice as studies have shown that villagers experiencing the high cost of conservation received fewer benefits whereas individuals receiving more benefits tended to be employed directly in tourism, PA-based employment and communities with resource use agreements with PAs (Mackenzie, 2012; MacKenzie et al., 2017; Spiteri and Nepal, 2008a). This problem of unfairness of benefit distribution could be solved by adopting equity principles in PA management as well as considering livelihood needs (Zafra-Calvo et al., 2017).

Studies on the perceptions of benefits and costs from PAs have had varied results for different demographic groups. For example, personal benefits decreased, and more losses were perceived from PAs by older age groups (Htun et al., 2012; Tolbert et al., 2019). Contrary to this, our study did not find any differences in the perceived benefits and costs from PAs among age groups. Regarding gender, females reported more

extraction benefits (timber and firewood) whereas males reported more problems from PAs (Sarker and Roskaft, 2011). Other studies have shown that women were less likely to report community benefits from PAs in Virunga-Bwindi massif (Tolbert et al., 2019) while men collected more medicinal plants than women with the increase in distance to forest (Mushi et al., 2020). Men have also been shown to be more likely to report cost (Ward et al., 2018a), which supports our findings. This trend could have been observed because of the gendered role in livelihood activities. For example, women in Nepal participate more in natural resource-based livelihood activities and their positive perceptions of PAs could be linked to resource harvest opportunities. Because of this, subjective evaluation of benefits may outweigh costs for women more than men.

Research has also shown differences in perceived benefits and costs with respect to indigeneity. For example, indigenous people perceived less costs, and more likely to acknowledge conservation benefits in locations such as Bangladesh and Sierra Leone (Larson et al., 2016; Sarker and Roskaft, 2011). In Ghana, more than two-thirds of non-indigenous community were dissatisfied with the distribution of tourism benefits (Afenyo and Amuquandoh, 2014). We found no significant differences in costs among caste groups but found large numbers of 'other caste' respondents benefiting from tourism. In LNP, communities are more homogenous and almost all of the respondents who have benefited from tourism are of *Tamang* ethnicity. In BNP, residents adjacent to PA office are inhabited by *Tharu* ethnicity who have benefitted from tourism from becoming nature guides and from homestay operations.

We found that a greater number of people with school education perceived economic benefits from tourism and people with a non-schooling background perceived more cost from PAs. This mirrors the results of other studies showing that people with higher education perceive more benefits and illiterate people report more problems from PAs (Htun et al., 2012; Sarker and Roskaft, 2011). As with school/higher education, conservation awareness increases which may lead to more perceived benefit from PAs. Finally, we found that people who originated from the PA villages were more likely to perceive costs, which is supported by other research showing long-term residents are more likely to be negatively affected by PAs (Newmark et al., 1993). The possible reason could be due to more sustained negative experiences of PAs among long-term residents.

6. Implications of the ICDP approach for conservation

ICDP approaches tend to focus on reducing natural resource dependency while promoting development projects to that also contribute to conservation. However, the higher dependency of local people on PA's natural resources is a common phenomenon in developing countries (Baral and Heinen, 2007; Tolbert et al., 2019). This may be challenging for higher level IUCN categories of PAs, such as national parks as the need to accommodate this may undermine conservation objectives. Therefore, while implementing ICDPs, resource dependent people should be engaged in the identification of alternative income generating activities that can reduce dependency on PA resources. Through ICDPs, benefit sharing activities are initiated which could potentially reduce resource utilization to encourage conservation and promotion of development projects. ICDP approaches also tend to emphasize community scale benefits over households in order to achieve wider impacts and encourage greater participation in conservation (Tolbert et al., 2019).

Although ICDPs are implemented at the local (PA) level, if they meet their goals of promoting better local support and hence positive outcomes of PAs, they have global implications for conservation and environmental management. For example, local engagement with activities such as forest restoration or improved ecosystem conditions in a national park in one part of the world would help curb carbon emission in other parts of the world. Therefore, where relevant to the PA context, the ICDP approach should be made a part of global environmental

governance to enhance conservation and development simultaneously. In this way, funding from the developed nations also help address financial shortfalls in implementing ICDPs or PA management while that the benefits can be enjoyed at the global scale as well.

Tourism in PAs can also support ICDPs in achieving conservation objectives such as through providing alternative income to people and financial resources for PA management. However, sustainability of PAs and tourism is largely influenced by the participation of local people and effective planning and management in tourism destinations (Afenyo and Amuquandoh, 2014; Krüger, 2005). Tourism's revenue contribution to local people can support transition towards non-destructive land use, and promote positive attitudes towards protected areas, thus reducing poaching and other illegal activities in the long run (Krüger, 2005; Tisdell, 2003; Xu et al., 2009). Moreover, local people in the communities where the tourism is flourishing tend to be less dependent on natural environment (Holland et al., 2022) which may support ecosystem restoration. Thus, promotion of benefits and mitigating costs to people from PA management is important to attain conservation success worldwide. For example, local people expect socio-cultural and economic benefits such as community development, local cultural inheritance and household income in exchange with conservation (Zhang et al., 2019) which ultimately contribute to achieve the global target of effective and area-based conservation.

7. Conclusion

We assessed local perceptions of the costs and benefits of PAs in Nepal, managed through the ICDP approach. Overall, we found more perceived benefits than costs accruing both within individual households and at the community level. Extraction and economic benefits were among the most frequently perceived, with some differences among demographic groups. For example, extraction benefits were perceived more by the residents living far away from the PA office and the zone of tourism activity, whereas development and economic benefits are perceived more by nearby residents. At the policy level, Nepal has followed the core concept of ICDPs that include buffer zone zonation in PAs, and compensation or substitution for losses and promoting socio-economic development. However, our study showed that local people are yet to perceive conservation, participation and cost mitigation as benefits from ICDPs. As some costs are inevitable with PA management regardless of the conservation strategies adopted, we contend that management should focus on reducing costs rather than maximizing benefits alone, as there were very few respondents citing cost mitigation. Although the buffer zone policy has been viewed as an important tool for PA management in Nepal, positive impacts of this approach were not confirmed in our study.

This study also has some limitations which could bias our findings on ICDPs as we relied on only two PAs that are also popular NBT destinations. There are many more PAs in Nepal where tourist visitation rates are very low or non-existent but that are also managed through ICDP approach. Further, in-depth qualitative interviews may have added more context to the results of our survey questionnaire. We surveyed people within the PA jurisdiction based on the distance (travel time) from the PA office rather than the actual (geographical) distance from the PA or forest boundary. This could also bias our findings on the benefits or costs perceived from the existence of the PAs. However, our survey strategy did allow us to explore the development benefits in different PA regions since the buffer zone budget disbursement may depend on the level of interaction with PA staffs and may have a distance decay effect. Future research in PAs that are not tourism destinations, those that have been established for a longer period of time, and those within different ecological and cultural contexts could add depth to the evaluation of the ICDP approach. Our research provides an approach to evaluate the effectiveness of the ICDP approach and contributed to a practical and theoretical understanding of its application to PAs. The findings would be useful for improving conservation and development

outcomes of PAs in Nepal.

Credit author statement

Kamal Thapa: Conceptualization, Methodology, Data curation, Data analysis, Writing- Original draft preparation, review and editing.; **Amy Diedrich:** Conceptualization, Methodology, Writing-reviewing and editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgements

We acknowledge the support provided by Dr. Elizabeth Tynan for proof reading and English edits and Henry Bartelet for comment on the earlier draft. Data collection in the field was supported by I. Acharya and other field volunteers. Field work was supported by The Rufford Foundation. Kamal Thapa is supported by postgraduate research scholarship from James Cook University.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jenvman.2023.117890>.

References

- Adams, W.M., Aveling, R., Brockington, D., Dickson, B., Elliott, J., Hutton, J., Roe, D., Vira, B., Wolmer, W., 2004. Biodiversity conservation and the eradication of poverty. *Science* 306, 1146–1149.
- Afenyo, E.A., Amuquandoh, F.E., 2014. Who benefits from community-based ecotourism development? Insights from Tafi Atome, Ghana. *Tourism. Plann. Dev.* 11, 179–190.
- Allendorf, T.D., 2022. A global summary of local residents' perceptions of benefits and problems of protected areas. *Biodivers. Conserv.* 31, 379–396.
- Allendorf, T.D., Gurung, B., 2016. Balancing conservation and development in Nepal's protected area buffer zones. *Parks* 22 (2), 69–82.
- Alpert, P., 1996. Integrated conservation and development projects - examples from Africa. *Bioscience* 46, 845–855.
- Andrade, G.S.M., Rhodes, J.R., 2012. Protected areas and local communities: an inevitable partnership toward successful conservation strategies? *Ecol. Soc.* 17.
- Badola, R., Ahmed, T., Gill, A.K., Dobriyal, P., Das, G.C., Badola, S., Hussain, S.A., 2021. An incentive-based mitigation strategy to encourage coexistence of large mammals and humans along the foothills of Indian Western Himalayas. *Sci. Rep.* 11, 5235.
- Bajracharya, S.B., Furlley, P.A., Newton, A.C., 2006. Impacts of community-based conservation on local communities in the annapurna conservation area, Nepal. *Biodivers. Conserv.* 15, 2765–2786.
- Baral, N., Dhungana, A., 2014. Diversifying finance mechanisms for protected areas capitalizing on untapped revenues. *For. Pol. Econ.* 41, 60–67.
- Baral, N., Heinen, J.T., 2007. Resources use, conservation attitudes, management intervention and park-people relations in the Western Terai landscape of Nepal. *Environ. Conserv.* 34, 64–72.
- Baral, N., Stern, M.J., Heinen, J.T., 2007. Integrated conservation and development project life cycles in the Annapurna Conservation Area, Nepal: is development overpowering conservation? *Biodivers. Conserv.* 16, 2903–2917.
- Bhattarai, B.R., Wright, W., Khatiwada, A.P., 2016. Illegal hunting of prey species in the northern section of Bardia National Park, Nepal: implications for carnivore conservation. *Environments* 3, 32.
- Bhattarai, B.R., Wright, W., Poudel, B.S., Aryal, A., Yadav, B.P., Wagle, R., 2017. Shifting paradigms for Nepal's protected areas: history, challenges and relationships. *J. Mt. Sci.* 14, 964–979.
- BNP, 2016. Bardia National Park and its Buffer Zone Management Plan (2016-2020). Bardia National Park Office, Thakurduwara, Bardia.
- Bragagnolo, C., Malhado, A.M., Jepson, P., Ladle, R., 2016. Modelling local attitudes to protected areas in developing countries. *Conserv. Soc.* 14, 163–182.
- Brandon, K.E., Wells, M., 1992. Planning for people and parks - design dilemmas. *World Dev.* 20, 557–570.

- Brooks, J., Waylen, K.A., Mulder, M.B., 2013. Assessing community-based conservation projects: a systematic review and multilevel analysis of attitudinal, behavioral, ecological, and economic outcomes. *Environ. Evid.* 2.
- Budhathoki, P., 2004. Linking communities with conservation in developing countries: buffer zone management initiatives in Nepal. *Oryx* 38, 334–341.
- Büscher, B., Fletcher, R., 2019. Towards convivial conservation. *Conserv. Soc.* 17, 283–296.
- CBD, 2021. Protected Areas - an Overview. Convention on Biological Diversity.
- Chaudhary, S., McGregor, A., Houston, D., Chettri, N., 2018. Environmental justice and ecosystem services: a disaggregated analysis of community access to forest benefits in Nepal. *Ecosyst. Serv.* 29, 99–115.
- Christensen, J., 2004. Win-Win Illusions. *Conserv. Pract.* 5, 12–19. <https://doi.org/10.1111/j.1526-4629.2004.tb00079.x>.
- Coad, L., Campbell, A., Miles, L., Humphries, K., 2008. The Costs and Benefits of Protected Areas for Local Livelihoods: a Review of the Current Literature. UNEP World Conservation Monitoring Centre, Cambridge, U.K.
- DNPWC, 2022. Annual report: fiscal year 2021/2022 (2078/2079 B.S.). In: Chaudhary, C.S., Sherpa, P., Mishra, P., Raut, S. (Eds.), Department of National Parks and Wildlife Conservation (DNPWC) (Kathmandu, Nepal).
- DNPWC, DFSC, 2022. Status of Tigers and Prey in Nepal 2022. Ministry of Forest and Environment, Department of National Parks and Wildlife Conservation and Department of Forests and Soil Conservation, Kathmandu, Nepal.
- Dudley, N. (Ed.), 2008. Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86pp. WITH Stolton, S., P. Shadie and N. Dudley (2013). IUCN WCPA Best Practice Guidance on Recognising Protected Areas and Assigning Management Categories and Governance Types, Best Practice Protected Area Guidelines Series No. 21, Gland, Switzerland: IUCN. xxpp.
- Dudley, N., Hockings, M., Stolton, S., Amend, T., Badola, R., Bianco, M., Chettri, N., Cook, C., Day, J.C., Dearden, P., Edwards, M., Ferraro, P., Foden, W., Gambino, R., Gaston, K.J., Hayward, N., Hickey, V., Irving, J., Jeffries, B., Karapetyan, A., Kettunen, M., Laestadius, L., Laffoley, D., Lham, D., Lichtenstein, G., Makombo, J., Marshall, N., McGeoch, M., Nguyen, D., Nogue, S., Paxton, M., Rao, M., Reichelt, R., Rivas, J., Roux, D., Rutte, C., Schreckenberg, K., Sovinc, A., Sutyryna, S., Utomo, A., Vallauri, D., Vedeld, P.O., Verschuur, B., Waitaha, J., Woodley, S., Wyborn, C., Zhang, Y., 2018. Priorities for protected area research. *Parks* 24, 35–50.
- Eustace, A., Wilbard Kisingo, A., Mbwiliza, J.S.F., 2018. Wildlife damage in villages surrounding the Serengeti ecosystem. *Parks* 24, 107–118.
- Ezebilu, E.E., Mattsson, L., 2010. Socio-economic benefits of protected areas as perceived by local people around Cross River National Park, Nigeria. *For. Pol. Econ.* 12, 189–193.
- Gatiso, T.T., Kulik, L., Bachmann, M., Bonn, A., Bosch, L., Freytag, A., Heurich, M., Wesche, K., Winter, M., Ordaz-Nemeth, I., Sop, T., Kuhl, H.S., 2022. Sustainable protected areas: synergies between biodiversity conservation and socioeconomic development. *People. Nat.* 4, 893–903.
- Gubbi, S., Linkie, M., Leader-Williams, N., 2008. Evaluating the legacy of an integrated conservation and development project around a tiger reserve in India. *Environ. Conserv.* 35, 331–339.
- Gurney, G.G., Cinner, J., Ban, N.C., Pressey, R.L., Pollnac, R., Campbell, S.J., Tasidjawa, S., Setiawan, F., 2014. Poverty and protected areas: an evaluation of a marine integrated conservation and development project in Indonesia. *Global Environ. Change-Hum. Pol. Dimens.* 26, 98–107.
- Gurney, G.G., Pressey, R.L., Cinner, J.E., Pollnac, R., Campbell, S.J., 2015. Integrated conservation and development: evaluating a community-based marine protected area project for equality of socioeconomic impacts. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 370.
- Holland, K.K., Larson, L.R., Powell, R.B., Holland, W.H., Allen, L., Nabaala, M., Tome, S., Seno, S., Nampushi, J., 2022. Impacts of tourism on support for conservation, local livelihoods, and community resilience around Maasai Mara National Reserve, Kenya. *J. Sustain. Tourism* 30, 2526–2548.
- Htay, T., Htoo, K.K., Mbise, F.P., Roskaft, E., 2022. Factors influencing communities' attitudes and participation in protected area conservation: a case study from Northern Myanmar. *Soc. Nat. Resour.* 35, 301–319.
- Htun, N.Z., Mizoue, N., Yoshida, S., 2012. Determinants of local people's perceptions and attitudes toward a protected area and its management: a case study from Popa Mountain Park, Central Myanmar. *Soc. Nat. Resour.* 25, 743–758.
- Jones, N., Graziano, M., Dimitrakopoulos, P.G., 2020. Social impacts of European protected areas and policy recommendations. *Environ. Sci. Pol.* 112, 134–140.
- Karanth, K.K., Jain, S., Weinthal, E., 2019. Human-wildlife interactions and attitudes towards wildlife and wildlife reserves in Rajasthan, India. *Oryx* 53, 523–531.
- Karki, S.T., 2013. Do protected areas and conservation incentives contribute to sustainable livelihoods? A case study of Bardia National Park, Nepal. *J. Environ. Manag.* 128, 988–999.
- Koot, S., Hebinck, P., Sullivan, S., 2020. Science for success—A conflict of interest? Researcher position and reflexivity in socio-ecological research for CBNRM in Namibia. *Soc. Nat. Resour.* 1–18.
- Krüger, O., 2005. The role of ecotourism in conservation: panacea or Pandora's box? *Biodivers. Conserv.* 14, 579–600.
- Larson, L.R., Conway, A.L., Krafte, K.E., Hernandez, S.M., Carroll, J.P., 2016. Community-based conservation as a potential source of conflict around a protected area in Sierra Leone. *Environ. Conserv.* 43, 242–252.
- LeClerq, A.T., Gore, M.L., Lopez, M.C., Kerr, J.M., 2019. Local perceptions of conservation objectives in an alternative livelihoods program outside Bardia National Park, Nepal. *Conserv. Sci. Pract.* 1.
- LNP, 2019. Annual Progress Report: Fiscal Year 2018/2019 (2075/2076 B.S.). Lamtang National Park Office, Dhunche, Rasuwa.
- Mackenzie, C.A., 2012. Accruing benefit or loss from a protected area: location matters. *Ecol. Econ.* 76, 119–129.
- Mackenzie, C.A., Ahabyona, P., 2012. Elephants in the garden: financial and social costs of crop raiding. *Ecol. Econ.* 75, 72–82.
- MacKenzie, C.A., Salerno, J., Hartter, J., Chapman, C.A., Reyna, R., Tumusiime, D.M., Drake, M., 2017. Changing perceptions of protected area benefits and problems around Kibale National Park, Uganda. *J. Environ. Manag.* 200, 217–228.
- Mackinnon, K., 2001. Integrated conservation and development projects, can they work? *Parks* 11, 1–5.
- Massarella, K., Krauss, J., Kiwango, W., Fletcher, R., 2022. Exploring convivial conservation in theory and practice: possibilities and challenges for a transformative approach to biodiversity conservation. *Conserv. Soc.* 20, 59–68.
- McShane, T.O., Hirsch, P.D., Trung, T.C., Songorwa, A.N., Kinzig, A., Monteferri, B., Mutekanga, D., Thang, H.V., Dammert, J.L., Pulgar-Vidal, M., Welch-Devine, M., Brosius, J.P., Coppolillo, P., O'Connor, S., 2011. Hard choices: making trade-offs between biodiversity conservation and human well-being. *Biol. Conserv.* 144, 966–972.
- Michael, A.S., Smriti, D., Sanjay, N., 2016. Local perspectives on benefits of an integrated conservation and development project: the Annapurna Conservation Area in Nepal. *Int. J. Biodivers. Conserv.* 8, 138–146.
- Molina-Murillo, S.A., Otárola, M.F., Shreeve, K.N., 2016. Understanding the link between protected areas and their relationship with surrounding communities: an exploration in Costa Rica. *Parks* 22, 79–88.
- Muradian, R., Arsel, M., Pellegrini, L., Adaman, F., Aguilar, B., Agarwal, B., Corbera, E., de Blas, D.E., Farley, J., Froger, G., Garcia-Frapolli, E., Gomez-Baggethun, E., Gowdy, J., Kosoy, N., Le Coq, J.F., Leroy, P., May, P., Meral, P., Mibielli, P., Norgaard, R., Ozkaynak, B., Pascual, U., Pengue, W., Perez, M., Pesche, D., Pirard, R., Ramos-Martín, J., Rival, L., Saenz, F., Van Hecken, G., Vatn, A., Vira, B., Uramo, K., 2013. Payments for ecosystem services and the fatal attraction of win-win solutions. *Conserv. Lett.* 6, 274–279.
- Mushi, H., Yanda, P.Z., Kleyer, M., 2020. Socioeconomic factors determining extraction of non-timber forest products on the slopes of Mt. Kilimanjaro, Tanzania. *Hum. Ecol.* 48, 695–707.
- Naidoo, R., Gerkey, D., Hole, D., Pfaff, A., Ellis, A.M., Golden, C.D., Herrera, D., Johnson, K., Mulligan, M., Ricketts, T.H., Fisher, B., 2019. Evaluating the impacts of protected areas on human well-being across the developing world. *Sci. Adv.* 5, eaav3006.
- Naidoo, R., Weaver, L.C., De Longcamp, M., Du Plessis, P., 2011. Namibia's community-based natural resource management programme: an unrecognized payments for ecosystem services scheme. *Environ. Conserv.* 38, 445–453.
- Naughton-Treves, L., Holland, M.B., Brandon, K., 2005. The role of protected areas in conserving biodiversity and sustaining local livelihoods. *Annu. Rev. Environ. Resour.* 30, 219–252.
- Nepal, S., Spiteri, A., 2011. Linking livelihoods and conservation: an examination of local residents' perceived linkages between conservation and livelihood benefits around Nepal's Chitwan National Park. *Environ. Manag.* 47, 727–738.
- Nepal, S.K., Lai, P.-H., Nepal, R., 2022. Do local communities perceive linkages between livelihood improvement, sustainable tourism, and conservation in the Annapurna Conservation Area in Nepal? *J. Sustain. Tourism* 30, 279–298.
- 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. *Biol. Conserv.* 63, 177–183.
- Ninan, K.N., Kontoleon, A., 2016. Valuing forest ecosystem services and disservices – case study of a protected area in India. *Ecosyst. Serv.* 20, 1–14.
- Oldekop, J.A., Holmes, G., Harris, W.E., Evans, K.L., 2016. A global assessment of the social and conservation outcomes of protected areas. *Conserv. Biol.* 30, 133–141.
- Oppenheim, A.N., 2006. Questionnaire Design, Interviewing and Attitude Measurement. Continuum, London and New York.
- Parker, B.G., Jacobsen, K.S., Vucetich, J.A., Dickman, A.J., Loveridge, A.J., Macdonald, D.W., 2022. Towards equitable conservation: social capital, fear and livestock loss shape perceived benefit from a protected area. *J. Environ. Manag.* 319, 115676.
- Paudel, N.S., Jana, S., Rai, J., 2010. In: Dhungana, H., Khatri, D.B., Giri, K., Karki, R. (Eds.), Protected Areas and Rights Movements: the Inadequacies of Nepal's Participatory Conservation. Forest Action, Kathmandu, Nepal, p. 22.
- Paudyal, R., Thapa, B., Neupane, S.S., Birendra, K.C., 2018. Factors associated with conservation participation by local communities in Gaurishankar Conservation Area Project, Nepal. *Sustainability* 10.
- Sabuhoro, E., Wright, B., Munanura, I.E., Nyakabwa, I.N., Nibigira, C., 2021. The potential of ecotourism opportunities to generate support for mountain gorilla conservation among local communities neighboring Volcanoes National Park in Rwanda. *J. Ecotourism* 20, 1–17.
- Sarker, A.H.M.R., Roskaft, E., 2011. Human attitudes towards the conservation of protected areas: a case study from four protected areas in Bangladesh. *Oryx* 45, 391–400.
- Sayer, J., 1991. Buffer zones in rainforests: fact or fantasy. *Parks* 2, 20–24.
- Shahi, K., Khanal, G., Jha, R.R., Joshi, A.K., Bhusal, P., Silwal, T., 2022. Characterizing damages caused by wildlife: learning from Bardia National Park, Nepal. *Hum. Dimens. Wildl.* 27, 173–182.
- Silwal, T., Devkota, B.P., Poudel, P., Morgan, M., 2022. Do buffer zone programs improve local livelihoods and support biodiversity conservation? the case of Sagarmatha National Park, Nepal. *Trop. Conserv. Sci.* 15.
- Smallhorn-West, P.F., Pressey, R.L., 2022. Why does conservation minimize opportunity costs? *Conserv. Sci. Pract.* 4, e12808.
- Spiteri, A., Nepal, S.K., 2008a. Distributing conservation incentives in the buffer zone of Chitwan National Park, Nepal. *Environ. Conserv.* 35, 76–86.

- Spiteri, A., Nepal, S.K., 2008b. Evaluating local benefits from conservation in Nepal's Annapurna Conservation area. *Environ. Manag.* 42, 391–401.
- Stem, C.J., Lassoie, J.P., Lee, D.R., Deshler, D.D., Schelhas, J.W., 2003. Community participation in ecotourism benefits: the link to conservation practices and perspectives. *Soc. Nat. Resour.* 16, 387–413.
- Stronza, A.L., Hunt, C.A., Fitzgerald, L.A., 2019. Ecotourism for conservation? *Annu. Rev. Environ. Resour.* 44, 229–253.
- Swemmer, L., Mmethi, H., Twine, W., 2017. Tracing the cost/benefit pathway of protected areas: a case study of the Kruger National Park, South Africa. *Ecosyst. Serv.* 28, 162–172.
- Thapa, K., 2016. Park–people interaction and public perceptions towards Parsa Wildlife Reserve, Nepal. *J. For. Livelihood* 14, 41–52.
- Thapa, K., King, D., Banhalmi-Zakar, Z., Diedrich, A., 2022. Nature-based tourism in protected areas: a systematic review of socio-economic benefits and costs to local people. *Int. J. Sustain. Dev. World Ecol.* 29, 625–640.
- Tisdell, C., 2003. Economic aspects of ecotourism: wildlife-based tourism and its contribution to nature. *Sri Lankan J. Agric. Econ.* 5, 83–95.
- Tolbert, S., Makambo, W., Asuma, S., Musema, A., Mugabukomeye, B., 2019. The perceived benefits of protected areas in the Virunga-Bwindi massif. *Environ. Conserv.* 46, 76–83.
- Tumusiime, D.M., Vedeld, P., 2015. Can biodiversity conservation benefit local people? costs and benefits at a strict protected area in Uganda. *J. Sustain. For.* 34, 761–786.
- Udaya Sekhar, N., 2003. Local people's attitudes towards conservation and wildlife tourism around Sariska Tiger Reserve, India. *J. Environ. Manag.* 69, 339–347.
- Upadhaya, S., Tiwari, S., Poudyal, B., Godar Chhetri, S., Dhungana, N., 2022. Local people's perception of the impacts and importance of ecotourism in Central Nepal. *PLoS One* 17, e0268637.
- Ward, C., Holmes, G., Stringer, L., 2018a. Perceived barriers to and drivers of community participation in protected-area governance. *Conserv. Biol.* 32, 437–446.
- Ward, C., Stringer, L.C., Holmes, G., 2018b. Protected area co-management and perceived livelihood impacts. *J. Environ. Manag.* 228, 1–12.
- Wardle, C., Buckley, R., Shakeela, A., Castley, J.G., 2021. Ecotourism's contributions to conservation: analysing patterns in published studies. *J. Ecotourism* 20, 99–129.
- Watson, J.E., Dudley, N., Segan, D.B., Hockings, M., 2014. The performance and potential of protected areas. *Nature* 515, 67–73.
- Wells, M., Brandon, K.E., Hannah, L., 1992. *People and Parks: Linking Protected Area Management with Local Communities*. The World Bank, Washington, D.C.
- Wells, M.P., Brandon, K.E., 1993. The principles and practice of buffer zones and local participation in biodiversity conservation. *Ambio* 22, 157–162.
- West, P., Igoe, J., Brockington, D., 2006. Parks and peoples: the social impact of protected areas. *Annu. Rev. Anthropol.* 35, 251–277.
- Xu, J., Lu, Y., Chen, L., Liu, Y., 2009. Contribution of tourism development to protected area management: local stakeholder perspectives. *Int. J. Sustain. Dev. World Ecol.* 16, 30–36.
- Zafra-Calvo, N., Pascual, U., Brockington, D., Coolsaet, B., Cortes-Vazquez, J.A., Gross-Camp, N., Palomo, I., Burgess, N.D., 2017. Towards an indicator system to assess equitable management in protected areas. *Biol. Conserv.* 211, 134–141.
- Zhang, Y., Xiao, X., Zheng, C., Xue, L., Guo, Y., Wu, Q., 2019. Is tourism participation in protected areas the best livelihood strategy from the perspective of community development and environmental protection? *J. Sustain. Tourism* 28, 587–605.