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Perceived benefits, burdens and effectiveness of a buffer zone programme in improving protected area–people relationships

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Summary

Programmes focused on buffer zones (BZs) and park revenue-sharing (PRS) are aimed at sharing protected area (PA) benefits with local communities to meet their development needs and, in turn, improve the PA–people relationship. However, whether and how these programmes improve public attitudes towards PAs is little understood. We assessed how residents perceive the benefit and burdens of Nepal's BZ programme, which shares up to 50% of PA revenue with communities, and how this process relates to their perceptions of change in the PA–people relationship since the BZ programme was implemented. Survey results from 2122 households in the BZs of six PAs showed that residents' perceptions of PA–people relationships had improved since the BZ programme's implementation. Furthermore, the perceived trend in the PA–people relationship was positively related to the perception of benefits and satisfaction with coordination between the PA and local government; it was negatively related to perceived burdens of BZ-related laws in rural development, history of damage/loss from wildlife and misunderstandings of the purpose behind BZ funds being given to local communities. These findings provide valuable insights for PA managers in Nepal and worldwide in designing new or improving existing mechanisms of benefit-sharing with local people and to improve PA–people relationships.

Introduction

Protected areas (PAs) are established for the *in situ* conservation of biodiversity. PAs such as national parks and wildlife reserves are typically located in rural landscapes, where the emphasis on conservation complicates the PA–people relationship. Despite the purported economic (e.g., tourism, jobs) and ecological (e.g., ecosystem services) benefits of PAs, local villagers might view the presence of PAs negatively because an increase in the wildlife population could result in increased human–wildlife conflict around the PAs (e.g., crop damage, attacks on livestock and humans), and rural communities facing developmental and other needs (e.g., roads, bridges, quarry) consider PAs as obstacles to rural development and their communities' progress (Abukari & Mwalyosi 2020, Estifanos et al. 2020). In most developing countries, communities living around PAs depend on forest resources (e.g., firewood, farming) for their livelihood. However, PAs often exclude rural communities from traditional benefits and threaten their livelihood (Xu et al. 2006).

PA management's 'global benefits and local cost' nature means that sustaining local support for PA management is crucial in biodiversity conservation (MacKenzie 2012, Allendorf 2022). Local people perceive the burden of conservation as disproportionately falling on them relative to those who enjoy broader PA benefits. As a result, PA managers struggle to secure local support for conservation (Zhang et al. 2020). Traditional models of PA management relied on the belief that wildlife protection can only be achieved by separating people from wildlife. Such models deployed military forces to guard PA boundaries and adopted a 'fences and fines' approach to keeping local people out (Baral 2005, Brockington et al. 2008, Galvin & Haller 2008, Duffy 2014). However, this approach has led to increased PA–people conflict and reduced local support for conservation.

Since PA persistence is highly dependent on local residents' support (Wells & McShane 2004), effective PA management requires a good relationship with local communities and their active involvement in decision-making (Hummel et al. 2019). The participatory approach of collaborating with local people for biodiversity conservation builds a relationship of mutual benefit and trust (Butler 2011, Ho et al. 2016, Young et al. 2016), creates a sense of community empowerment (Plummer et al. 2012), accommodates inclusive decision-making (Berkes 2009,

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Borrini-Feyerabend et al. 2013, Sandström et al. 2014) and improves the well-being of local people who impact and are impacted by wildlife (Chen et al. 2012, Ming'ate et al. 2014, Naidoo 2019). Therefore, many modern tools in PA management, such as the buffer zone (BZ), focus on benefit-sharing and involving locals in decision-making to improve PA–people relationships (Ervin et al. 2010).

BZs are inhabited areas either inside or outside a PA that provide additional protection to the PA's core area (Vaso 2013), and a portion of the PA income (i.e., park revenue) is used to help improve the livelihoods and meet the developmental needs of the communities impacted by the PA within the BZ (Ebregt & De Greve 2000). In particular, park revenue-sharing (PRS) is a major feature of the BZ programmes implemented in several nations (Borrini-Feyerabend et al. 2013, Mwakaje et al. 2013, Munanura et al. 2016, Schnegg & Kiaka 2018, Queiros & Mearns 2019). When communities receive a portion of park revenue, they realize PAs' tangible benefits and also develop a greater appreciation of conservation (Alexander 2000, Bauer 2003, Chandralal 2010, Ahebwa et al. 2012). In addition, access to decision-making regarding conservation and development in and around a PA empowers local communities and makes them feel like a part of PA governance. The communities within the BZ, however, tend to give up more of their decision-making power and oversight to PA managers in their communities, especially on matters related to the use of natural resources (e.g., gravel and sand quarries, sawmills) and land-use activities with potential impacts on the PAs.

Local communities' perceptions are highly influenced by the costs/burdens and benefits they experience from introduced programmes such as BZs (Xu et al. 2006, Htun et al. 2012). Whether and how locals perceive the benefits and associated regulatory restrictions introduced by such programmes may influence their feelings and attitudes towards PAs. For instance, several studies show that when residents perceived benefits in improved awareness, infrastructure, income-generating training and tourism, their attitudes towards PA staff tended to be positive; but when they suffered burdens (e.g., wildlife damage), their attitudes towards PA staff were more likely to be negative (Larson et al. 2016, MacKenzie et al. 2017, Shahi et al. 2023). MacKenzie et al. (2017) also highlighted that to understand local residents' perceptions of benefits and burdens over time, it is necessary to study their changes in attitudes and behaviours.

In addition, local residents' perceptions of PA–people relationships since the BZ programme's implementation may also be influenced by knowledge, trust and satisfaction with the implemented programmes and involved stakeholders. Although many PAs have adopted BZ or PRS approaches, the effectiveness of such programmes in reducing PA–people conflict or improving PA–people relationships is still unclear (Dhakal & Thapa 2015, Lamichhane et al. 2019, Silwal et al. 2022). Understanding whether and how local people perceive the benefits and burdens of such programmes and how that relates to their perception of change in the PA–people relationship is important to identifying effective benefit-sharing strategies (Swemmer et al. 2015). Wider adoption of PA benefit-sharing policies such as BZ programmes will require evaluating how local residents from PAs that currently implement such programmes perceive their value (Tumusiime & Vedeld 2012, Snyman & Bricker 2019).

Nepal is one of the many countries where the BZ concept has been adopted to enhance PA governance. Like any other biodiverse country in the world, Nepal is also facing the issue of severe human–wildlife conflicts around PAs (Silwal et al. 2017, Lamichhane et al. 2019, Shahi et al. 2023). To mitigate the growing human–wildlife as well as PA–people conflicts and to promote wildlife conservation, the Government of Nepal added its Buffer Zone Programme (BZP) in their fourth amendment of the National Park and Wildlife Conservation (NPWC) Act in 1992. The BZP is currently implemented in 12 national parks and one wildlife reserve. Even though the revenue-sharing programme has created incentives to encourage local people to engage in conservation activities, human–wildlife and PA–people conflicts remain ongoing issues across the PA system. This contrasting evidence suggests that more investigation is necessary to understand the contribution of PA revenue-sharing policy. Therefore, to learn from the decades-long experience of the BZP in Nepal, this study aims to assess local residents' perceptions of the benefits and burdens of the BZP and to evaluate whether and how benefits and burdens relate to the perceived change in the PA–people relationship.

Methodology

Study area

For this study, six PAs – five national parks (Bardia, Chitwan, Langtang, Rara, Sagarmatha) and one wildlife reserve (Koshi Tappu) – were chosen to ensure representation from various physiographic locations, BZ sizes, annual flows of tourism revenue and years since the BZs were established (Fig. 1 & Table 1). Nepal is geographically diverse and divided into three geographical regions: the Himalayas in the north, Hills in the centre and Terai in the south. PAs cover c. 23.39% of the country's total area (Government of Nepal 2014).

The BZs in Nepal are managed through the BZ Management Regulations (1996), which provide a framework with three-tier BZ institutions: BZ User Groups (BZUGs), BZ User Committees (BZUCs) and BZ Management Committees (BZMCs). The BZUGs work at the settlement level and comprise local community members who are elected to represent their respective settlements. These groups are responsible for managing the BZs in their respective areas. The BZUCs comprise representatives from the BZUGs within the sector and are responsible for following the approved work plan, implementing projects, managing project operations and mobilizing community participation. The BZMCs oversee the BZs surrounding PAs and comprise representatives from the BZUCs within the PA, the local government (e.g., metropolitan or rural municipality) and PA management authorities (e.g., park wardens, law enforcement staff). The BZ institutions' three-tier organizational structure is designed to ensure that BZs are managed in a participatory, inclusive and sustainable manner with the active involvement of local communities and other stakeholders.

Nepal's BZP is a crucial component of national conservation efforts aimed at managing and protecting the BZs surrounding PAs and promoting sustainable use of natural resources. The BZP includes revenue-sharing, which provides 30–50% of the PAs' revenues (i.e., BZ fund) to local communities living in the BZ (Sharma 2001, Government of Nepal 2022). The revenue of a PA includes royalties attributable to visitor fees, fines, permits for extraction of natural resources (e.g., sand, gravel) within the BZ, filming and exploration uses. The BZ guidelines, per the NPWC Act, require BZ funds be allocated to five separate areas of conservation and development within the BZ: conservation (30%), community development (30%), income generation and skill development (20%), conservation education (10%) and

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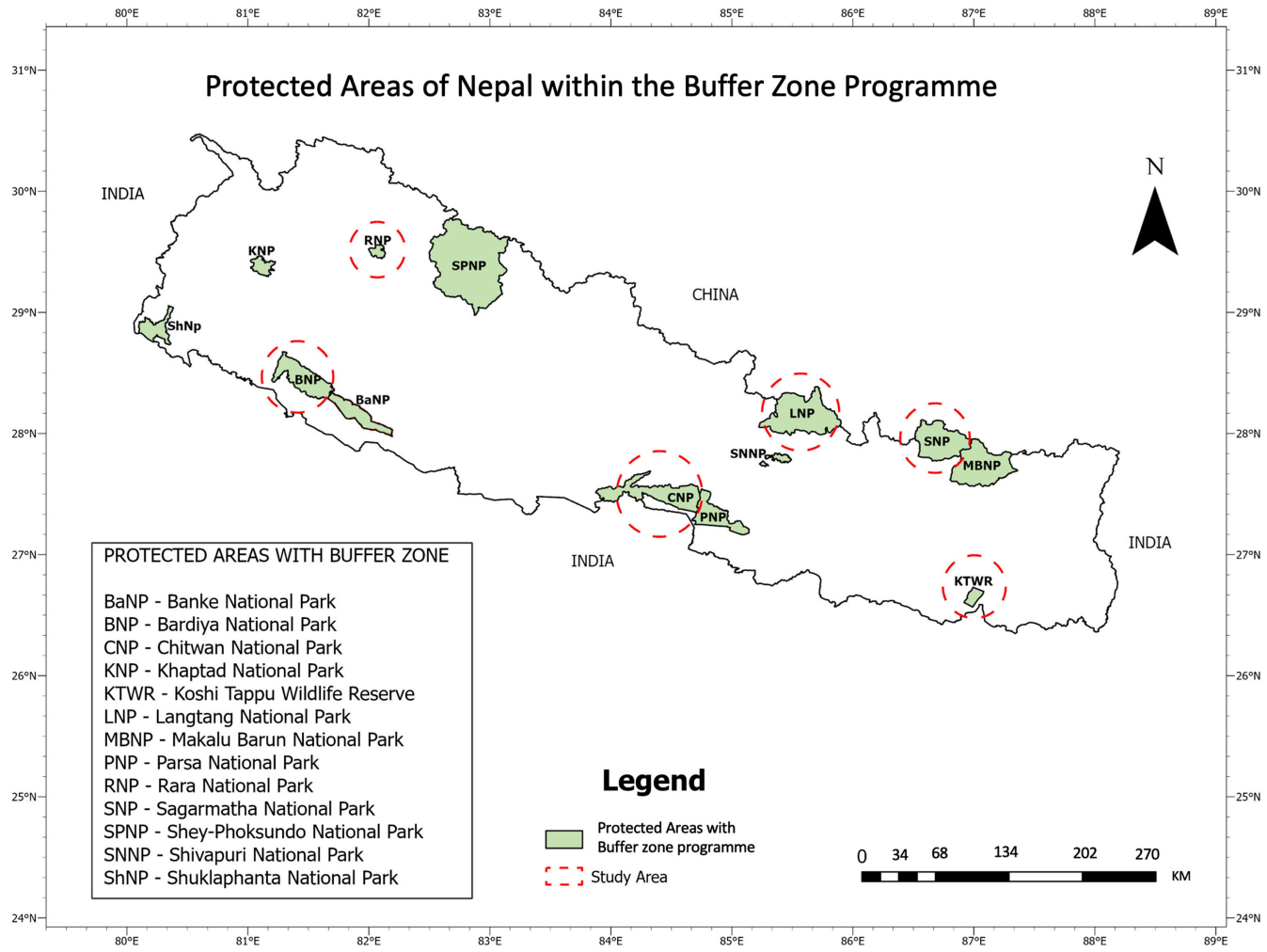


Figure 1. Location of Nepal's 13 protected areas, with the six protected areas selected for this study highlighted in dotted circles.
Map source: Department of National Parks and Wildlife Conservation, Nepal.

administration (10%). As part of the BZP, PA managers are given regulatory oversight within BZ communities for conducting anti-poaching activities, governing natural resources (e.g., river sediment, sand) extraction, partially restricting land use (particularly uses adversely impacting the PA such as grazing, timber harvesting and transportation of wood products) and regulating operation of businesses related to forest products (e.g., sawmills).

Data collection

We conducted a survey of households within the BZs of six PAs to assess local residents' perceptions of the temporal change in PA–people relationships. A 10-page questionnaire (Appendix S1) was developed to measure residents' perceptions of these changes through various indicators, such as perceived benefits of BZ programmes and burdens from associated regulations, knowledge of the BZ fund purpose, history of wildlife damage and education level. Household beliefs and attitudes regarding BZ fund use were measured by asking individuals to indicate their level of agreement with a series of statements that characterize their experience and satisfaction with the PRS and BZP. The initial survey was developed in English and then translated into Nepali to make it convenient for the field enumerators to interpret for local residents. Three bilingual research team members confirmed the accuracy of the translation. The survey pretest was done in 29 households from three PAs in late April 2022. After the pretest, the enumerators' feedback was collected and incorporated during the revision. Considering the low literacy rate among the rural residents in Nepal and the difficulty of accurately and precisely measuring the indicators of beliefs, perceptions, amongst other factors, a three-point scale was deemed more appropriate than higher point-scale questions, except for the dependent variables, for which a five-point Likert scale was used. The household survey conducted in the summer and autumn of 2022 collected data from 2122 households selected using a stratified random sampling approach, with 75% of the respondents being from within 1 km of the PA boundary and the remaining 25% being from 1 km beyond the PA boundary. These distances were selected because 75% of human–wildlife conflict incidences occur within 1 km of the PA (Silwal et al. 2017). The questionnaire and survey protocol used in this study were reviewed and approved by the University of Tennessee's Institutional Review Board for human subject research (Approval # UTK IRB-22-06922-XP).

Regression model

A conceptual model explaining the perceived change in the PA–people relationship was specified as in Equation 1:

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$$\text{Pereceived change in PA} - \text{people relation} = f(\text{benefits, burdens, knowledge of BZ fund purpose, institutional coordination, damage history, geographical region, education}) \quad (1)$$

Dependent variables

One of the challenges in modelling complex concepts such PA–people relations is that this construct has multiple dimensions, and no single indicator can fully measure such a concept. Job et al. (2021) pointed out the variation in the literature in terms of how the PA–people relationship is conceptualized and argued that it remains a complex construct representing local people's perceptions of acceptance/rejection as well as attitudes towards the PA. Accordingly, the perceived change in the PA–people relationship was characterized in terms of how the residents felt about recent trends in (1) the positive attitudes of residents towards the PA authority and (2) the number of neighbours upset with the PA staff. The respondents were asked to indicate how they believed 'the positive attitude of local people towards the PA staff' and 'the number of neighbours upset with the PA authority' have changed over the past 10 years using a five-point Likert scale (1 = decreased greatly, 5 = increased greatly). These two statements capture two related but different aspects of the PA–people relationships. The first statement captures the perceived change in attitudes towards the PA as an organization that has power and control; the second characterizes the perceived feelings of local people towards the PA staff who work directly with local people but may not necessarily have full authority. Feelings (which are often also referred to as emotions) and attitudes are considered two separate constructs in the human psychology literature (Yarwood 2022). The former are typically associated with immediate responses and result in instant effects on behaviour, whereas the latter are generated through a cognitive process and are more stable over time. As we accommodate two aspects of the PA–people relationship in the dependent variable, using a multivariate regression model is recommended when two related but different variables are modelled together (Hernández-Alava & Pudney 2016).

Notably, although the BZP was initiated more than two decades ago in many PAs, a 10-year period was specified to ensure that respondents were given a reasonable time frame for accurately recalling factors that impact their recent perceptions and attitudes, such as changes in wildlife populations, PA–people interactions and positive/negative changes related to the BZP in their areas. Capturing data from the most recent period was also more appropriate for this analysis, as such data might reflect what had happened most recently. However, it should be noted that such measures of perceived change may not necessarily reflect actual changes.

Independent variables

The following subsections describe the seven independent variables in Equation 1.

Benefit

Respondents' perceptions of BZ benefits were measured using the variables 'personal' and 'community'. For personal benefits, the respondents indicated their level of agreement with the statement, 'My family members have benefitted from the BZP'; for community benefits, they indicated their response to the statement, 'BZ funds have benefitted my community' (Thapa & Diedrich 2023). These statements were constructed to collectively measure the respondents' perceptions of benefits at the individual and community levels. The response categories included 1 (disagree), 2 (neutral), 3 (agree), 4 (don't know).

Burden

Respondents' perceptions of the burden associated with the BZP and laws were measured with responses to two statements. The first was 'The perceived extent to which BZ laws have added complication to the utilization of natural resources', measured with a four-point scale consisting of 1 = not at all, 2 = a little, 3 = a lot and 4 = don't know. This was constructed because the establishment of PAs and BZ laws prevented people from entering PAs to collect resources such as firewood. The second statement was 'BZ laws have been an obstacle to the development and growth of my village', measured by responses 1 = disagree, 2 = neutral, 3 = agree and 4 = don't know. This variable was added to the model because development activities are regulated in BZs compared to other parts of the country due to their close proximity to PAs. Each item was added as a separate variable as 'complication to resource utilization and development obstacles'.

Knowledge of BZ fund purpose

Knowledge of BZ fund purpose was examined with the statement 'Based on your understanding of BZ funds, do you believe this fund is providing compensation to the households impacted by wildlife?' A dummy variable was created as knowledge was given a value of 1 if the respondents believed that the BZ funds would be used to compensate households for wildlife-related damage and was 0 otherwise. This variable was added because even though the BZ funds by law are not intended for compensation and are not primarily used for this, our preliminary work indicated that some residents believed otherwise. This misunderstanding or lack of accurate knowledge regarding the purpose of BZ funds could impact their attitudes towards a park and the perception of PA–people relationships.

Institutional coordination

Respondents were asked to indicate their level of agreement with the statement 'Satisfactory coordination between the PA and local government about BZ law enforcement'. Responses ranged from 1 = disagree to 3 = agree and 4 = don't know, and they were represented by 'institutional coordination' as the variable name. It was expected that the respondents who expressed satisfaction with PA–government coordination would be more likely to have a perception of an improving PA–people relationship.

Damage history

Respondents were asked about their experiences of loss due to wildlife damage in the previous 2 years. Based on their responses, a dummy variable was created: damage was given a value of 1 if they experienced damage and was 0 otherwise. Since recent damage history could have an impact on their attitudes towards the PA (Wang et al. 2006) and perception of the PA–people relationship, this variable was included as a control variable in the model.

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Table 1. Number of households (HHs) in the study areas.

Protected area	Number of HHs (year)	Number of surveyed HHs	Physiographical region	Annual tourism income
Sagarmatha National Park	1619 (2016)	303	Mountain	High
Langtang National Park	14 963 (2018)	308	Mountain	Moderate
Rara National Park	2548 (2021)	297	Mountain	Low
Chitwan National Park	54 155 (2022)	395	Terai	High
Bardiya National Park	26 117 (2022)	419	Terai	Moderate
Koshi Tappu Wildlife Reserve	14 865 (2018)	399	Terai	Low

Data source: Individual reports and management plans of each protected area.

Geographical region

The PA–people relationship can vary between geographical regions given the size of BZ funds shared with local communities, activities conducted by external conservation partners or the extent of human–wildlife conflict involved. We created a dummy variable (terai) to control for those differences. This variable was coded 1 if the respondent was from one of the three PAs in the terai (lowland) region or 0 if they were from one of the three PAs in the mountains. PAs in the terai and the mountains of Nepal are different because of accessibility, the wild animals involved in conflicts and urban development pressure.

Education

The level of respondent education was used as a control variable because education could impact how people perceive the value of PAs and affect perceptions of the relationship between people and PAs (Shahi et al. 2023). This variable was measured using six levels of education (1 = no education at all, 2 = literate, 3 = some schooling, 4 = high school education, 5 = some college-level education, 6 = a college degree).

Given that this is the first study to assess the contribution of the BZP to the PA–people relationship, existing measures of constructs were limited. However, our selection of these indicators was inspired by a past assessment of stakeholder perceptions of the revenue-sharing mechanism (MacKenzie 2012) and other studies that independently assessed residents' attitudes towards PAs (Allendorf 2022), institutional coordination in park benefit-sharing (Tumusiime & Vedeld 2012) and perceptions of the impacts of revenue-sharing (Munanura et al. 2016).

Model estimation

The ordered logit regression was an appropriate estimator because the dependent variables in Equation 1 included ordinal data measured on a five-point Likert scale (Vaske 2019). However, since the two measures of dependent variables were related, a Wald test of independence was conducted to determine whether these variables could be modelled independently. The test rejected the null hypothesis that these equations are independent, and therefore a generalized bivariate ordinal logit regression (GBLR) analysis was performed. This estimation decision is informed by the notion that two strongly related items (e.g., the attitudes and feelings of local people towards PA staff) with implications for understanding the underlying theoretical concept (e.g., the PA–people relationship) can be jointly modelled in a set of two equations (Equations 2 & 3; Hernández-Alava & Pudney 2016). Notably, in the GBLR, only one model involving two equations was estimated. The advantage of using a GBLR is that the biased coefficient estimates due to unobserved error terms of the two equations being stochastically dependent and non-normal can be avoided. The 'bicop' package of Hernández-Alva and Pudney (2016) allowed for non-normality in residual distribution and accounted for complex forms of dependence in the generalized model as:

$$Y_{i1}{}^{*} = X_{i1}\beta_1 + U_i \quad (2)$$

$$Y_{i2}{}^{*} = X_{i2}\beta_2 + V_i \quad (3)$$

where Y_{i1}* and Y_{i2}* are two dependent variables, X_{i1} and X_{i2} are the same set of independent variables, β_1 and β_2 are conformable column vectors of the coefficients and U_i and V_i are unobserved residuals that may be stochastically dependent and non-normal. The variables are described and the expected relationship with the dependent variable is presented in Table 2.

Results

Respondents' characteristics

Of the 2122 respondents, 57% were from the PAs in the terai (i.e., lowland) region (419 from Bardia National Park, 395 from Chitwan National Park, 399 from Koshi Tappu Wildlife Reserve) and the other 43% were from the PAs in the mountain region (308 from Langtang National Park, 297 from Rara National Park, 303 from Sagarmatha National Park). Slightly more than half (54%) were male, and 90% were native to the region (i.e., born in the region). The average age was 44 years. Some 32% self-identified as from the minority community or socially marginalized groups, including *Dalits* and indigenous groups (*Bote*, *Mushaahar*, *Tharu*). The remaining 68% included *Brahmins*, *Chhetri* and *Janajati*, which are often considered in the majority in Nepal's society. Nearly half (47%) of respondents had some formal educational training (i.e., some years of school, high school, some college, college degree), 36% were illiterate (i.e., no education at all) and the remaining 17% were literate (i.e., able to read and write). The most important source of household income was farming, being mentioned by 44% of respondents. Other income sources included daily wage employment (22%), jobs in private agencies (20%), foreign employment (7%), jobs in government offices (4%) and pensions and allowances (4%). Approximately 72% indicated that they had suffered damage from wildlife within the past 2 years.

Perception of change in the PA–people relationship

Most respondents (75%) perceived a slight or great increase in the positive attitudes of local communities towards PA staff over the 10 years, and only 6% perceived a slight or great decrease. Similarly, most respondents (80%) indicated a slight or great decrease in the number of neighbours upset with the PA staff, and only 5%

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Table 2. Description of variables used in regression model explaining the perceived change in park–people relationship.

Variable		Description	Expected relationship with dependent variables: Change in number of upset neighbours	Expected relationship with dependent variables: Change in positive attitudes towards park	Mean (standard deviation)
Benefits	Personal benefit	Reported agreement with 'I or my family members have benefitted from the BZ funds/programme'	–	+	1.598 (0.870)
	Community benefit	Reported agreement with 'BZ funds have benefitted my community'	–	+	2.003 (0.894)
Burdens	Development obstacles	Reported agreement with 'BZ laws have been an obstacle to the development and growth of my village'	+	–	1.807 (0.872)
	Complication to resource utilization	Perceived impact of BZ programmes in 'Adding complication to the utilization of natural resources in the BZ'	+	–	1.838 (0.689)
Knowledge of BZ funds' purpose		Respondent understanding of the purpose of BZ funds (1 = if they believe it is given for providing compensation to wildlife victims, 0 otherwise)	+	–	0.590 (0.492)
Institutional coordination		Perceived satisfaction of coordination among BZ and other local institutions about BZ law enforcement	–	+	2.363 (0.823)
Damage		A dummy variable indicating whether they had experienced a loss due to wildlife damage or attack in the past 2 years	+	–	0.727 (0.445)
Geographical region (terai)		A dummy variable indicating whether the respondent was from a PA in the terai (lowland) region	+/–	+/–	0.572 (0.495)
Education		An ordinal variable representing the level of education	–	+	2.553 (1.458)

BZ = buffer zone; PA = protected area.

Table 3. Results from generalized bivariate ordered logit regression explaining the buffer zone residents' perceived changes in the protected area (PA)–people relationship.

Variable		Dependent variable: perceived increase in number of neighbours upset with the park authority: Coefficient	Dependent variable: perceived increase in number of neighbours upset with the park authority: Standard error	Dependent variable: perceived increase in positive attitudes of local people towards park staff: Coefficient	Dependent variable: perceived increase in positive attitudes of local people towards park staff: Standard error
Benefits	Personal benefits	0.072	0.047	0.129**	0.054
	Community benefits	–0.088*	0.047	0.106**	0.051
Burdens	Obstacle to development	0.265***	0.043	–0.247***	0.044
	Complication to resource utilization	–0.095	0.061	0.171***	0.064
PA region		0.131*	0.078	–0.238***	0.084
Damage history		0.375***	0.087	–0.404***	0.092
Knowledge of funds' purpose		0.007	0.075	–0.604***	0.079
Institutional coordination		–0.1344***	0.049	0.259***	0.047
Higher education		–0.0236	0.025	0.0481*	0.026
Wald χ^2 (df = 9) statistic					244.31***
VIF					1.20

Significant at: *p < 0.10; **p < 0.05; ***p < 0.01.
VIF = variance inflation factor.

indicated a slight or great increase. Collectively, these patterns indicate an improved perception of the PA–people relationship over time.

Perception of BZ benefits and burdens

Some 26% of respondents agreed that they were personally benefitting from the BZ funds, whereas 66% disagreed with this statement. For community benefits, equal percentages of respondents agreed (40%) and disagreed (40%) that their communities were receiving benefits from BZ funds. For burdens, 50% of respondents disagreed with the statement about BZ laws being an obstacle to their villages' growth and development, and 67% of respondents believed that the BZP had introduced complications to natural resources use.

Estimates from the regression model

The sample size used in the regression model (Table 3) was 1038 because the 'don't know' response to some questions led to the removal of many observations. The Wald tests of equality of independence indicated that the equations used should not be jointly estimated and therefore justified using the generalized bivariate logit model over two separate binomial logit models. The mean value of the variance inflation factor was well below the critical threshold of 5.0 (Vaske 2019) and indicates that multicollinearity is not an issue in the

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model. Following the tradition in social science research for determining relationships (Vaske 2019), the significance of variables was denoted at 1%, 5% or 10%, which is reasonable considering the modest size of the sample used in the regression.

Amongst the perceived benefit variables, the personal benefits to the respondent or their family item was positively and significantly ($\beta = 0.13$, $p < 0.05$) related to the perception of an increased positive attitude towards PA staff but not to the perception of an increase in the number of neighbours upset with the PA authority. The second benefit variable representing the perception of community benefits was positively and significantly ($\beta = 0.11$, $p < 0.05$) related to the perceived increase in the positive attitudes of local people towards the PA staff. In contrast, the second benefit variable was negatively and significantly ($\beta = -0.08$, $p < 0.05$) related to a perceived increase in the number of neighbours upset with the PA authority.

Amongst the variables capturing burdens, the first variable representing BZP obstacles to the development and growth of their village was negatively and significantly ($\beta = -0.25$, $p < 0.05$) related to the respondents' perceptions of an increase in the positive attitudes of local people towards PA staff. On the other hand, this variable was positively and significantly ($\beta = 0.26$, $p < 0.01$) related to the perceived increase in the number of neighbours upset with the PA authority. However, the second indicator of perceived burden, which represented complications to resource utilization within the BZ, had a positive ($\beta = 0.17$, $p < 0.01$) sign in the model, explaining an increase in the positive attitudes towards PA staff.

A few variables other than benefits and burdens were significant. The knowledge of fund purpose (or the possible misbeliefs about fund purpose) was negatively and significantly ($\beta = -0.60$, $p < 0.01$) related to the increase in positive attitudes of local people towards PA staff but was not significantly related to the perceived increase in the number of neighbours upset with the PA authority. In other words, the respondents who incorrectly believed that the BZ funds were provided for compensation to victims indicated a decline in the positive attitudes of local people towards the PA staff.

The coefficient for the variable institutional coordination, which characterizes respondents' satisfaction with the coordination amongst the BZ institutions, was significantly related to both measures of the dependent variables ($p < 0.01$). It was negatively related to a perceived increase in the number of neighbours upset with the PA authority ($\beta = -0.13$) and positively related to an increase in the positive attitudes of local people towards PA staff ($\beta = 0.26$). Not surprisingly, the damage history variable was significantly ($\beta = -0.40$, $p < 0.01$) negatively related to the positive attitudes of local people towards PA staff and significantly ($\beta = 0.37$, $p < 0.01$) positively related to the perceived increase in the number of neighbours upset with the PA authority.

Moreover, the dummy variable denoting whether respondents belonged to one of the PAs in the terai (lowland) region was positively ($\beta = 0.13$, $p < 0.10$) related to their perception of increase in number of neighbours upset with the PA authority. The same variable was negatively ($\beta = -0.24$, $p < 0.01$) related to a perceived increase in the positive attitudes of local people towards PA staff. The education variable was significantly positively ($\beta = 0.05$, $p < 0.10$) related only to the perceived increase in the positive attitudes of local people towards PA staff (Table 3).

Discussion

Our results support the notion that the relationship between PAs and the local people in Nepal has improved over the last decade. Past studies conducted in Nepal's PAs have also concluded that local attitudes towards PAs have improved, especially in areas where local residents have directly or indirectly benefitted from the programmes conducted by a PA or the tourism that depends on it (Spiteri & Nepal 2008, Shahi et al. 2023). Although the benefits generated from the PA itself are limited in order to substantially benefit a broader population, the BZP was intended to provide more benefits to local residents. Despite a low proportion of residents perceiving the personal and community-level benefits from the BZP, the proportion believing that public attitudes towards the PA are improving remains very high. In addition, the perception of benefits received and satisfaction with coordination among BZ institutions has contributed to improving the PA–people relationship.

The current study implied that the perceived personal or community benefits that the residents received from the BZP were correlated with their positive attitudes towards the PA authority and a decrease in the number of residents who were upset with the PA, both of which are indicators of local people's improved relationship with the PA. This might arise because receiving personal benefits alone does not directly impact the number of other community members upset with the PA authority. This corroborates other studies that concluded that residents' attitudes towards PAs vary according to the extent to which they receive benefits and see the burdens of living near PAs (Spiteri & Nepal 2008, Bennett 2016, Abukari & Mwalyosi 2020, Allendorf 2020, Holland et al. 2022, Shahi et al. 2023, Snyman et al. 2023). In particular, residents have usually had a favourable attitude towards PAs, but the residents who directly or indirectly benefitted from the PA were more likely to have favourable views of PAs than those who had had negative experiences (e.g., damage or attack from wildlife, regulatory burdens). In the context of Nepal's BZP, it is possible to connect these perceived benefits and improved attitudes of local people with the programmes implemented by not only the BZ institutions that receive BZ funds for community development but also the external funds brought into BZ communities by various conservation organizations such as the National Trust for Nature Conservation, WWF Nepal, CARE Nepal and the Zoological Society of London. As Onyango and Ipara (2015) point out, a positive attitude towards PA authorities implies strong local cooperation in PA management; therefore, prioritization of fund allocation and designing BZ activities should focus on benefitting local people (Lamichhane et al. 2019). Since BZ funds are usually too small to produce meaningful and substantial benefits for every resident household, funding projects in the community's interest (i.e., that generate benefit to the entire community) might still help local people to benefit from a PA and improve the PA–people relationship (MacKenzie 2012, Tumusiime & Vedeld 2012, Lamichhane et al. 2019, Snyman & Bricker 2019). Notably, 83% of our survey respondents indicated that BZ funds are too little to generate meaningful benefits for local people, and 74% of the knowledgeable respondents agreed that, regardless of the benefits to their households, BZ funds positively contributed to conservation and sustainable development in their region. Taken together, the evidence suggests that, despite acknowledging the rather small amount of BZ funds given to their community, local people perceive the benefits of BZ funds and programmes, and that perception contributes positively to shaping their positive relationship with the PA.

The results also indicated that local people perceive certain aspects of the BZP as burdens, which had a negative impact on the PA–people relationship. Perceived burdens, specifically for BZ-related regulations limiting their community's development and

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growth, could eventually reduce local support for PA management. However, local people often lack an accurate understanding of government policy and programmes, which creates misunderstanding about the scope of regulatory impacts. A barrier in perception is considered a major issue in community acceptance of PAs (Job et al. 2021). For example, we found that many local residents misunderstood BZ funds' primary purpose for their community and expressed a decreased positive attitude towards the PA. This implies that more outreach and education programmes may be necessary to educate local communities on the benefits provided by a BZ and to demonstrate how the benefits outweigh the potential burdens in the long term. A comparative study in Ghana and Tanzania showed that when local residents accurately understand PA rules and regulations, they tend to recognize the benefits to their livelihoods (Abukari & Mwalyosi 2020), form more positive attitudes towards PA staff and show support for PA management (Htun et al. 2012, MacKenzie 2012). If local people continue to believe that the legal provision for BZ funds is to provide relief for wildlife damage and fail to see that happening, the PA–people relationship could be jeopardized. For instance, in Dhorpatan Hunting Reserve in Nepal, public outrage over misconceptions and unclear messages about the extent of regulatory oversight on private land use within a BZ has been a major hurdle in securing local support for establishing the BZP (Chalise 2023). Nonetheless, since BZ programmes impose restrictions on major development projects, transportation of wood and wood-based productions and the operation of the forest-based industry within the BZ area, programmes such as these might see higher public acceptance if they support local livelihoods whilst also aligning with conservation objectives (Sene-Harper et al. 2019).

Contrary to our expectations, the other measure of perceived burden (i.e., additional complications to resource use) was positively related to the perceived increase in the positive attitudes of local people towards the PA staff. One possible explanation for this is that the resources – debris wood, sand and gravel collected from rivers and streams within the BZ – are often illegally collected by smugglers or over-extracted by licensed contractors. As a result, local people believe that the BZP has allowed the PA authority to protect these resources (Shova & Hubacek 2011, Joshi et al. 2021). Many people see the protection of rivers and streams from the haphazard and uncontrolled quarrying as a benefit (rather than a burden) because this can prevent over-extraction or smuggling of public goods and also reduce the dangers of floods, landslides and the like (Allendorf 2022). In this sense, our characterization of this variable as a burden of the BZP might not be accurate.

Respondents' perceptions of the coordination between the PA and local government in enforcing BZ laws seem to be correlated with their perceptions of the improved PA–people relationship. Those satisfied with the coordination between these institutions perceived an improved relationship between the PA and people over the years. These observations corroborate earlier findings that institutional trust can lead to enhanced public support for conservation and successful project outcomes (Baral 2012, Watkins et al. 2021). Because PAs and local government units have contrasting mandates (conservation versus development), levels of government (federal versus local) and leadership structures (elected leaders versus bureaucrats; Pokharel 2022), inter-institutional coordination is essential for effective law enforcement and BZ fund use. The perceived importance of coordination between these institutions is also evident in that recently adopted federalism (i.e., a decentralized three-tier structure of government, including local, provincial and federal government) has created confusion and conflicts in the governance of natural resources within BZs. This development has led to lawsuits and has been a hurdle in programme implementation in some PAs (Thakali et al. 2018). The Local Government Operation Act of 2017 authorized local government units to regulate the extraction of natural resources within BZs and collect revenue from contracting and permitting, which was already governed by the PA authority under the existing regulation regarding BZ management (Thakali et al. 2018). As maintaining effective coordination amongst different stakeholders at the local level is key to successful conservation (Mannigel 2008), resolving the discrepancy between old and recently enacted laws and clarifying the jurisdictional differences between these institutions becomes a necessary step.

Experiencing damage from wildlife in the recent past was related to a perceived increase in the number of neighbours upset with the PA authority and a decrease in the positive attitudes of local people towards PA staff. Although loss or damage of crops or property due to wildlife alone could be sufficient for their negative perception, lack of fair compensation for the loss or the slow and inefficient compensation process might also contribute to negative attitudes towards a PA (Mir et al. 2015), even if the compensation is not provided through BZ funds. In a related question, more than two-thirds of the respondents who experienced damage indicated dissatisfaction with the compensation or relief received. Studies in Nepal and elsewhere have reported that slow, inefficient and complicated compensation processes have negatively impacted local attitudes towards PAs (Xu et al. 2006, Anthony 2007, Spiteri & Nepal 2008, Ravenelle & Nyhus 2017, Lamichhane et al. 2019). As reducing PA–people conflict, which is mostly caused by damage from wildlife, is one of the primary goals of sharing BZ funds, adopting a straightforward and efficient process and allocating some funds for compensation might be necessary (Lamichhane et al. 2019). Unless this issue is addressed, the PA–people relationship might not be improved, regardless of how many BZ grants are given to communities for development projects.

Our results also showed a regional difference in residents' perceptions of PA–people relations over the years. Compared with their counterparts in mountain PAs, respondents in the terai-region PAs were more likely to report that the number of neighbours upset with the PA authority had increased and positive attitudes towards the PA staff had decreased over the years of the BZP's implementation. This might be explained by the fact that most terai-region PAs are the homes of wild animals such as tigers and one-horned rhinoceroses. These animals are often involved in significant conflicts with humans, such as killing humans, damaging houses/sheds and destroying crops, and they are thus more threatening to humans than smaller wild animals such as porcupines, monkeys and red pandas, which are commonly present in the Himalayan region.

Finally, as expected, the respondents with higher education reported perceiving an increase in positive attitudes of local people towards the PA staff. Various studies have shown that respondents with higher levels of education perceived more benefits of PAs than their less educated counterparts (Xu et al. 2006, Htun et al. 2012). People with higher education may be more aware of the value added by BZ funds and other programmes conducted within their community, and they may be better able to recognize the improved communication between the PA and people since the BZP was implemented. In addition, some with appropriate skills might even have received job opportunities generated through the investment of BZ funds or other external funds (Xu et al. 2006).

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A few limitations of this study should be noted. First, several of the constructs used in this study were measured using a single item indicator. This may be considered an imperfect measure of the underlying construct. Because of limited research on this topic, several of the items developed in this study had not been previously tested. Second, because of the challenges (e.g., low literacy of rural communities, unreliable postal service) associated with the mail survey, interviews were administered by trained enumerators, and social desirability bias in some responses cannot be ruled out. Third, cases of 'don't know' were removed from the regression analysis because including data from uninformed respondents could mislead the policy assessment, but it is possible that some of those responses were non-responses rather than true 'don't know' responses. However, removing these observations is justified in this study because analysing the impact of a public policy such as BZP requires utilizing responses from those individual who are actually informed and knowledgeable. In attitudinal survey research in public health and environmental economics, the deletion of 'don't know' responses is a commonly used approach (Wang 1997, Mirzaei et al. 2022). Finally, although this study provides a general context of the revenue-sharing policy of Nepal, the results might not necessarily be generalizable to all PAs around the world because of their different contexts.

Future research could build upon this study to analyse how the benefits that are not BZ funds (e.g., external grants, aids, training, scholarship) brought into BZ communities by conservation partners help promote sustainable conservation and development. Qualitative in-depth assessment of how the existing BZ regulations could be revised to alleviate their negative effects on the utilization of natural resources, to educate misinformed residents on the real purpose of the BZ funds and to increase the coordination amongst BZ institutions (i.e., BZUGs, BZUCs and BZMCs) could inform policy processes and increase the effectiveness of the BZP.

Conclusion

Our findings have several implications for understanding the value of BZ and PRS programmes in enhancing PA governance and improving PA–people relationships. First, local residents around PAs recognized the improvement in PA–people relationships since the BZP's implementation. Second, although not all residents were fully aware of the benefits and burdens of the BZP, those who were knowledgeable appreciated the benefits of the PA to their community and recognized the burdens associated with it. Third, the perception of benefits from BZ funds at the personal and community levels contributed to improving the PA–people relationship, whereas the perceived burden (in terms of limit in growth and development) and misbeliefs about the BZ funds' purpose negatively impacted this relationship. Taken together, this suggests that managers might reap benefits when they educate local people regarding the BZ funds' purpose, highlighting their benefits and relaxing laws/regulations that limit development. Fourth, because wildlife damage experience negatively impacts residents' attitudes towards the PA, and because providing relief is not the focus of current BZ fund guidelines, improving the PA–people relationship might require revising the PRS approach to allocate funds for providing relief to wildlife victims. Finally, in considering the importance of coordination between the PA and other institutions, the effectiveness of programmes such as BZs can be increased by fostering local-level coordination between PA staff and other institutions (BZ institutions and local government) to enforce laws and implement programmes through BZ funding. Doing so could help garner local community support for effective PA management in Nepal and inform similar strategies to improve the PA–people relationship in PAs worldwide.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/S0376892924000018.

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