

Balancing conservation and development in Nandhaur Wildlife Sanctuary, Uttarakhand, India

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The Terai Arc Landscape in the foothills of the Himalaya is a critical tiger conservation unit straddling India and Nepal. The Nandhaur Wildlife Sanctuary (NWS) located in the eastern part of this landscape, is an important corridor for the movement of large mammalian species. This landscape is under tremendous pressure due to increased human population and demands for forest resources. The present study (1) assesses the dependence of the local communities on forest resources, (2) identifies concerns and interests of major stakeholders, and (3) assesses the major issues challenging conservation in the NWS. Household surveys and focus group discussions were carried out in 13 fringe villages around the NWS, and key stakeholders were identified and consulted. Risk assessment was done to identify the major issues in the area and their underlying causes. The local communities are dependent on forest for fuel wood (25–40 kg/household/day) and fodder (20–25 kg/household/day). Low-income groups, displaced groups and the gujjar community emerged as the most dependent stakeholders. Diverse interests arose from the communities having different livelihood patterns. Habitat loss and degradation due to excessive extraction of forest resources, riverbed mining and lack of support of local communities emerged as the major threats hampering conservation in the area. Involvement of local communities in forest conservation along with provision of alternative livelihood is needed. It is critical to develop a consultative framework with the local communities and other stakeholders to explore alternative strategies that meet conservation and development goals.

Keywords: Anthropogenic pressure, community-based conservation, dependent stakeholders, forest corridor, habitat degradation.

RAPIDLY expanding human population, poverty and lack of opportunities often tend to increase dependence of people on forest resources. The declaration of protected areas (PAs) restricts the accessibility of local communities to forest resources, resulting in shift of dependence from PA to adjoining corridors¹, leading to concentrated

exploitation of the resources and subsequently fragmentation and degradation of forests. Conservation and management practices, however, hamper human development goals. Hence, most of the developing countries face a dilemma in finding the appropriate balance among the divergent uses of its natural resources, conservation and development².

The Terai Arc Landscape (TAL) situated in the foothills of the Himalaya and proximate plains, is one such landscape where rapid population growth and development have led to its present fragmented and degraded state³. In human-dominated landscapes, conservation becomes multifaceted, particularly where perceived conflicts with large carnivores exist which hamper economic development and local livelihoods⁴.

TAL was among the most productive ecosystems in Asia, capable of rapid regeneration and supporting high densities of ungulates and tigers⁵. It extends over Uttarakhand, Uttar Pradesh and Bihar in India, and accounts for nearly 22% of the tiger population in the country⁶. The suite of pressures on tigers such as habitat loss, prey predation and poaching continue to take a toll on their populations in the TAL, a critical tiger conservation unit straddling the Indo-Nepal border⁷.

High productive soil and suitable conditions for agriculture and eradication of malaria in the early 1960s have made the Terai safer, prompting many to migrate and settle in the area. As a result, today the habitat is mostly cleared and few small remnant patches of natural forests and grasslands lay scattered⁵. The wildlife, therefore, are restricted to PAs⁸, and despite the current protection in these refuges, they face an uncertain future because many of these patches are too small to support populations large enough to withstand the consequences of inbreeding⁵.

The Nandhaur Wildlife Sanctuary (NWS) is one crucial area in the eastern part of TAL, which stretches from Himachal Pradesh in India to Nepal. It is a vital connecting link for the movement of tigers, elephants and other large-bodied animals between India and Nepal. In 2012 the NWS was notified as a crucial move to save the connectivity of TAL which was being threatened by severe anthropogenic pressures such as overexploitation of forest resources and unsustainable riverbed mining⁹.

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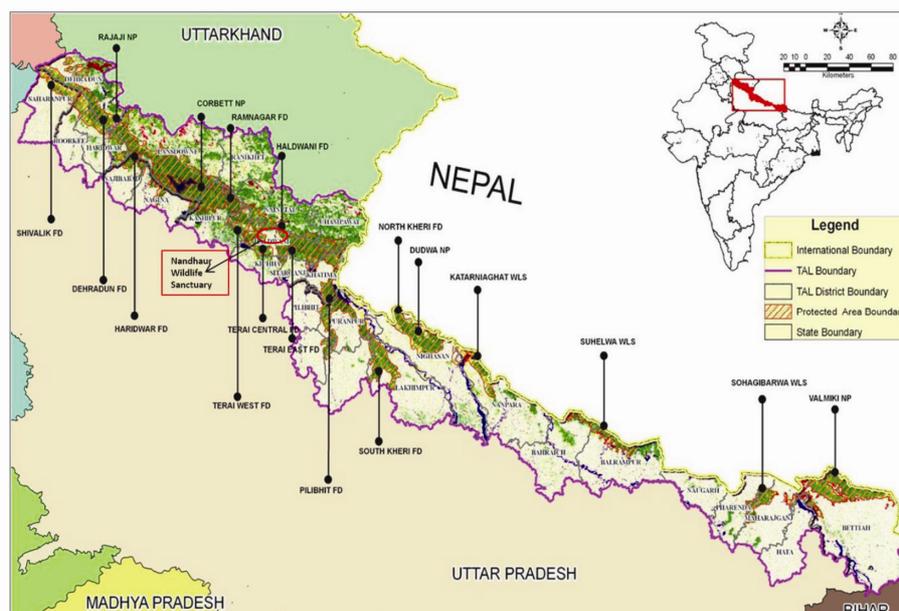


Figure 1. Map of Terai Arc Landscape (modified from ref. 3).

Extreme poverty, lack of opportunities and basic facilities, high dependence on forest resources and high social conflicts are some of the major issues in the area leading to rapid degradation of the forests³. Despite faster rate of degradation, conservation initiatives are far from those desired in this landscape, perhaps due to inadequate information, lack of coordinated efforts⁷, and also due to the ensuing negative human–wildlife interactions.

In view of the above, the present study was conducted to (1) assess the dependence of the local communities on forest resources, (2) identify concerns and interests of major stakeholders, and (3) assess the major issues challenging conservation in the NWS.

This study is important for understanding the various issues in the area, interplay of the factors responsible for these issues, to pin-point the knowledge gaps, and how best to protect and conserve this critical corridor in the wake of increasing population and subsequent urbanization of areas near it.

Study area

The NWS (29°02'00"N, 79°48'00"E) is in Uttarakhand, India. Before its notification as a PA in 2012, most of the Nandhaur landscape was a reserve forest. It served as an important habitat corridor for the movement of large mammals between Nepal and India⁹. The NWS is flanked by the River Gola in the west and River Sharda in the east. It is also intersected by the River Nandhaur which flows east to west in the northern area and then turns south to cut the landscape into two before disappearing in the Terai area. The NWS is the only link between the Brahmadevand Sukhlaphata Wildlife Reserve of Nepal,

and the Terai Central and Ramnagar forest divisions of India (Figure 1). The area is also a part of the Shivalik Elephant Reserve declared in 2002 (ref. 3).

The NWS is surrounded by villages along its northern and southern fringes. The northern hill villages are sparsely located, while the southern villages are located in the plains. The southern villages are better connected to urban areas, while the northern villages lack connectivity to these areas. The southern villages are composed of various social groups, significant among them are the Thakurs, Brahmins, Tharus, Harijans, Nepali migrants, Muslims, Sikhs and Christians, while the northern villages include the Gonias and the Thakurs.

Methods

Extensive literature review was done prior to the field survey in order to understand the existing scenario, availability and gaps in the information. Data were collected in three stages using rapid rural appraisal (RRA) approach^{10,11} and narrative analysis^{12,13}. In the first stage, a reconnaissance survey was done in order to understand the area. Villages were selected taking into account their proximity to the forest, demographic characteristics and accessibility¹⁴. In the second stage, household interviews were done in randomly selected households using semi-structured questionnaire¹⁵. One hundred and fifty-six households in 13 villages were surveyed for the study, 12 villages along the southern fringes of the NWS and one village to the north.

During household survey, the head of the household or any elderly person (either men or women) was interviewed using a semi-structured questionnaire. The first

part of the questionnaire dealt with socio-economic structure, including demography, livelihood pattern, landholding, agricultural pattern and livestock holding. The second part dealt with determining dependence on forests for fuelwood, fodder and other NTFPs. Questions were framed on fodder and fuelwood collection pattern, number of visits made to the forest for collection, average head-load size, frequency of visit/month, and the main and lax seasons. The information from these interviews was validated through personal observations. In the third stage, focus group discussions (FGDs) were carried out in all the selected villages. This was conducted at a common place in the villages and representation of all community groups was ensured. Frontline staff from the Forest Department acted as moderators in this exercise and later also participated in the FGDs as stakeholders. The FGD framework was unstructured and prepared keeping in view a number of key points mainly related to the socio-ecological issues in the area.

Stakeholder groups were identified using the 'reputational approach', which involved consulting knowledgeable individuals for their suggestions to enumerate stakeholders; the 'focal approach', which involved consulting key stakeholders of the NWS to prepare a list of stakeholder groups¹⁶, and the 'snow ball technique'¹⁷, which involved consulting each stakeholder to list other potential stakeholders until no new stakeholder groups could be identified. These stakeholders were then assessed for their knowledge, position, power, interests and relationship with the forest resources^{18,19}. For our study, the following stakeholder characteristics were used, as outlined by Schmeer²⁰.

Knowledge of policy or mandate of NWS

Knowledge is defined as awareness about management activities, policy mandates, government schemes and various conservation initiatives and the role of individuals in these activities. Stakeholders were then classified into three knowledge categories: high, medium and low.

Position or level of support for conservation of the NWS

Position is determined by whether the stakeholder supports, opposes, or is neutral about the conservation issues, which is key in establishing whether or not the stakeholder will support or retaliate against conservation initiatives and the role of individuals in these activities.

Power

This is the ability of a stakeholder to make decisions, express his/her views, take part in public meetings and

his/her ability as an individual or member of any local institution to support or oppose the conservation activities as well as other stakeholders and their actions.

Interest

This includes the stakeholder's interest in the activities, or the advantages and disadvantages those activities may bring to the stakeholder or his/her organization. Determining the stakeholder's vested interests helps policy makers and managers better understand his/her position and address his/her concerns.

Risk assessment was carried out through FGDs and personal interviews using a structured questionnaire. In the household personal interviews, individuals or groups of individuals were asked to list down the various issues which they considered critical for the area and its conservation. These issues were noted during the interviews and discussions. These along with other issues observed by the authors were organized using a logical framework approach²¹. From this exercise major issues were selected and listed. After this, in the FGDs, individuals were asked to rate the issues listed on the basis of the given scale of 1–10 (10 being the highest and 1 the lowest). Risk assessment of the identified sets of issues or risks was also been carried out for their ecological, economic and social impacts^{22–24}.

Results

Household surveys and FGDs conducted in 13 villages on the fringes of the NWS yielded significant results regarding the dependence pattern of the local communities on forest resources, identification and assessment of the main players or stakeholders in the area, and identification and assessment of the major social and ecological threats faced by this PA its communities.

The southern villages were dominated by the Thakurs (16.6%) and Harijans (14.7%). Majority (40%) of the local people in the southern villages were daily-wage labours (agricultural and mining). River-bed mining (10%), agriculture (35%), livestock rearing (5%), Government service (2%), private jobs (4%), business (2%) and pension (2%) were the other sources of livelihood. Goniara a fringe village, in the northern part of the NWS consisted of scattered households, not linked by proper roads. This village was dominated by the Gonia community (83.7%). People from the northern villages have migrated into the southern villages in search of livelihood. The males are engaged in daily-wage labour for which they travel to southern villages, while the females and aged males are involved in subsistence agriculture. Villages in the southern part of the NWS were observed to be economically better off compared to the northern villages.

The forest resources that the local people use are fuelwood and fodder, and extractions of these are frequent, except in the monsoon season. People extract of 25–40 kg fuelwood/household/day (12–15 days/month) at a time. The collection of fodder is comparatively less than that of fuelwood (20–25 kg/household/day; 10–12 days/month) as most of the local communities (80% of respondents) grow fodder trees and grasses on their agricultural lands. The people who extract fodder are from the low-income groups with no land holdings to grow fodder plants. Secondary source of energy includes: LPG (53.8%), biogas (46.2%) and kerosene (3.8%). Daily-wage labours, displaced groups, landless Harijans (2% of the respondents), Gujjars and other low-income groups are those with highest dependence on these resources as they lack the capacity to avail alternatives such as LPG and kerosene.

In the FGDs, 346 individuals participated, including frontline staff of the Uttarakhand Forest Department and representatives from 13 selected villages. Five main stakeholder groups were identified with different extents of dependence and interest (Table 1). The villagers were sub-divided into mining and non-mining communities. The non-mining communities were further divided as high-income and low-income groups. The Gujjars and displaced groups were stakeholder groups with highest dependence on the forest resources, having moderate to less knowledge and power (Tables 1 and 2). The Gram Panchayats and Forest Department were found to be involved in the management of forest resources and had more knowledge and power (Tables 1 and 2).

For highly dependent groups such the Gujjars, displaced groups and other low-income groups, interests included availability of alternative livelihood options, accessibility to developmental schemes and basic facilities. However, diverse interests emerged from the mining and non-mining communities. The non-mining communities demanded for a halt in the mining activities leading to better conservation; however, the mining community's only interest was that conservation activities should not hamper mining (Table 2).

Major socio-ecological issues in NWS

The major socio-ecological issues identified in the NWS are threat to wildlife connectivity and well-being of the local communities. This is further aggravated by the lack of opportunities or alternatives to forest resources among the local communities leading to lack of support towards conservation initiatives. These raise the following issues:

Multiple stakeholders with multiple interests

The key stakeholders were the highly dependent local communities: low-income villagers, Gujjars, displaced groups and those involved in daily-wage labour (low-

income groups). Stakeholders with opposing views and interests arose.

Habitat fragmentation

Conversion of forest land into agricultural land, deforestation, unregulated mining activities and human settlements inside the forests have severely degraded and fragmented the forest ecosystem.

Poverty and lack of opportunities/alternatives

The lack of livelihood opportunities and inability to procure alternative resources have increased the dependence of the local communities on the forests. This dependence is more pronounced among the vulnerable communities, such as those engaged as daily-wage labour.

River-bed mining

River-bed mining serves as an easy and continuous source of income. Majority of the local communities involved in mining were not willing to take up any alternate source of income.

Lack of support from local communities

The lack of support from the local communities for conservation of wildlife was mainly due to the persistent negative human–wildlife interactions (both crop depredation and livestock predation). However, the local people involved in mining were also against conservation of forests and its wildlife.

Risk assessment

Habitat fragmentation had the highest ecological and economic impact. While it had a negative ecological impact on the forest ecosystem due to the extensive damage caused, it improved the economic conditions of the local communities. It had both positive and negative social impacts, as habitat fragmentation led to reduced resource availability and increased human–wildlife interactions on the one hand, while also contributing to the development of the area as a whole. Human–wildlife interactions accounted for the negative attitude of the local people towards the conservation of wildlife and hence have a high social impact (Table 3). Riverbed mining had a high ecological impact due to the extensive damage caused by the activity to the riverine ecosystem and to the adjoining forests. However, due to its contribution to the livelihoods of significant percentage of the local communities, it had a positive economic impact. The other

Table 1. Type and extent of forest resource dependence by different stakeholder groups of the Nandhaur Wildlife Sanctuary (SWS), Uttarakhand, India

Stakeholders (N = 346)	Cultural/historic relationship to the natural resources	Current rights to land (formal/customary/legal/non-legal)	Degree of dependence on these resources for livelihood	Relationship between current human use and conservation objectives	Extent of positive or negative impacts on resource sustainability
Villagers					
Mining community (n = 80)	This group shifts from one river to another after the exhaustion of the former and has a destructive relationship with the natural resources	Customary, non-legal	High	Negative	Negative
Non-mining community (n = 183)	This group is further divided into high- and low-income groups. The high-income group is less dependent on the natural resources due to ability to avail alternatives. The low-income group has a high dependence on the natural resources	Customary, non-legal	Moderate for high-income group. Very high for low-income group	Positive for high-income group Negative for low-income group	Positive for high-income group Negative for low-income group
Gujjars (forest-dwellers) (n = 49)	This group has a long and culturally significant relationship with the natural resources and high dependence	Customary, non-legal	Very high	Negative	Negative
Displaced group (n = 20)	This group has high dependence on the natural resources	Customary, non-legal	Very high	Negative	Negative
Gram Panchayats (n = 10)	This group has moderate dependence on the natural resources	Customary, legal	Moderate	Positive	Positive
Forest Department (n = 4)	This group has no direct dependence on natural resource, however key management body	Legal	Low	Positive	Positive

Table 2. Importance of stakeholders of the NWS based on power, leadership and knowledge levels, and their interests and expectations

Stakeholders	Knowledge	Power	Interests/expectations from the conservation activities	Potential positive or negative impacts on their livelihood by conservation activities	Potential positive or negative influence of the stakeholders on conservation activities
Villagers	Low	High	Mining activities to continue and not to be hampered by conservation activities.	Cease in mining activities leading to loss of livelihood.	Cease in mining activities leading to conservation of the environment. However, this group may become antagonistic to the project.
Non-mining community	Moderate	Low	Mining to be stopped and infrastructural development and conservation of protected areas (PAs) to take place.	Developmental activities initiated and cease in mining activities leading to deflection of potential social and political conflicts.	Conservation and proper management of PAs and wildlife through collaboration with management authorities. However, if they are not taken on-board, unsustainable extraction of forest resources will continue.
Gujjars (forest-dwellers)	Low	Low	Access to basic facilities, developmental schemes and conservation of traditional values.	Developmental schemes in place.	Conservation and proper management of PAs and wildlife through collaboration with management authorities.
Displaced group	Moderate	Low	Alternative livelihood options.	Alternative livelihood options in place.	Conservation and proper management of PAs and wildlife through collaboration with management authorities.
Gram Panchayats	Moderate	High	Alternative livelihood options, access to basic facilities, developmental schemes, etc.	Alternative livelihood options and developmental schemes in place.	Conservation and proper management of PAs and wildlife through collaboration with management authorities.
Forest Department	High	High	Habitat fragmentation and degradation to be regulated, conservation of PAs, increased tiger numbers, adequate staff and equipments for proper protection of the PAs.	Proper management of the PAs and coordination among various line agencies.	Conservation and proper management of PAs and wildlife through collaboration with various line agencies and local communities.

Table 3. Major issues in the NWS and their ecological, economic and social impacts

Major issues in the area	Ecological	Economic	Social
Habitat fragmentation and degradation	10 (-ve) Negative due to extensive damage to forests and surrounding areas	8 (+ve) Positive due to linear and other developments which occur after deforestation	5 (both +ve and -ve) Both because the communities are benefiting from it as well as accruing losses due to it.
River-bed mining	9 (-ve) Negative due to extensive damage to the ecosystem and resulting pollution of the surroundings	7 (+ve) Positive due to economic benefits accrued from mining activities	7 (both +ve and -ve) Both as a portion of the communities is benefiting from it, while the remaining are suffering from its consequences
Poverty and lack of livelihood opportunities/alternatives	8 (-ve) Negative due to extensive damage to forests due to overexploitation	6 (+ve) Positive due to economic benefits from forest resource extraction	5 (both +ve and -ve) Both because the communities are benefiting from it as well as accruing losses due to it
Increasing human-wildlife interactions	5 (-ve) Negative because these interactions generate negative attitude of the local communities, thus hindering conservation	8 (-ve) Negative because these interactions obstruct economic growth of the local communities through crop depredation and livestock predation	8 (-ve) Negative because these interactions generate negative attitude of the local communities
Multiple stakeholders with multiple interests	4 (-ve) Negative due to the diverse interests of different groups.	4 (-ve) Negative due to the diverse expectations of different groups	7 (-ve) Negative because of the various social conflicts arising due to it.

*On a scale of 1–10, 1 being the lowest and 10th the highest.

Table 4. Risk assessment: impacts, risk level and control measures

Major issues of the area	Harmful potential effects	Risk level	Affected zone	Control measures
Habitat fragmentation and degradation	Loss of important habitats and corridors for the conservation of tigers and other wildlife; loss of important species of flora and fauna	High	Forest area	Improve protection of PAs, regulate mining activities, relocation of forest-dwellers, alternate sources of fodder to reduce pressure on forest resources
River-bed mining	Loss of riverine ecosystem	High	Rivers and surrounding areas	Awareness programmes for the mining community about the negative implications of unsustainable mining, and availability of alternative livelihoods.
Poverty and lack of livelihood opportunities/alternatives	Increased exploitation of forest resources due to the inability to procure alternatives	Medium	Villages	Livelihood intervention and involvement of villagers in conservation practices
Increasing human-wildlife interactions	Increased enmity of the local communities towards conservation and wildlife-livestock kill and crop depredation, and in extreme cases, loss of human life	Medium	Villages/agricultural fields	Establishment of alternative livelihood measures to reduce dependency and hence wildlife encounters
Multiple stakeholders with multiple interests	Excessive pressure on the forest and its resources	Medium	Forests and surrounding villages	Active frequent dialogues

factors posing risk for the ecological and social sustainability of the area were poverty and lack of livelihood opportunities, and human–wildlife interactions. Table 4 lists the affected zones and possible control measures.

Discussion

In TAL poverty and lack of livelihood opportunities are responsible for the high dependence of the local communities on the forest resources. Although the PA boundaries and management regulations are understood by the local communities, extreme poverty and lack of alternatives combined with the lack of awareness and support of the local communities has led to high extraction and dependence on the easily available forest resources.

The dependence of the local communities on fuelwood was higher than that of the fodder, as agricultural residue and fodder species planted in agricultural field provided an alternative to forest fodder. Therefore, dependence on fodder from forest was higher for households without agricultural landholding. The southern plain villages were better connected to nearby towns and industrial areas compared to the northern hill villages and therefore, had access to alternative livelihood opportunities resulting in enhanced ability to avail alternatives to forest resources. The difference in the ability to avail alternatives and freedom of choice leads to a diverse set of interests and priorities in the stakeholder groups. The difference in the interests shown by the different stakeholder groups poses a management challenge.

Local governance system (Panchayati Raj institutions) and concerned forest departments need to be properly equipped in order to reasonably address these issues keeping in mind the dual goals of poverty reduction and conservation of the forests.

In the NWS, habitat fragmentation and degradation caused by excessive extraction of forest resources and agriculture extension, poverty and lack of livelihood opportunities, negative interactions between human and wildlife, and unregulated and unsustainable riverbed mining are the main issues which need to be addressed taking into consideration their social, ecological and economic impacts.

The persistent human–wildlife interactions in the area have heightened the degree of poverty and dependence of these communities. Although no detailed studies have been conducted on the extent of loss due to human–wildlife conflict, in the neighbouring areas of Corbett in the same landscape, the indirect costs in terms of crop and livestock depredation by wild animals ranged from US\$ 2408 to 37,958 per village over a five-year period²⁵. This loss of livelihood has consequently resulted in the lack of support from the local communities towards the conservation of wildlife.

The inadequate compensation measures for these losses were identified as another cause for the lack of local support. This is in line with the recommendations made by the participants at the World Parks Congress²⁶ in Durban, which states that ‘one way to engender local support of conservation objectives has been to directly compensate members of communities affected by PAs for economic losses caused by protected wildlife’. When implemented under ideal conditions, i.e. in a timely, transparent and equitable manner economic compensation can go far in promoting positive people–park relationships, and support increased levels of tolerance towards ‘offending’ wildlife²⁷.

Another cause for the lack of support from the local communities is the absence of development schemes, lack of a proper platform for the development of tourism and other livelihood-enhancing options. The exclusion of the local communities from park management was also identified as a cause for the lack of support^{2,18,25,28–31}. The antagonism among local communities towards PAs is largely fuelled when traditional livelihoods are curtailed and new opportunities are created in which they cannot partake. This social antagonism may eventually fuel political action against PAs³², and is the source of numerous management issues².

Riverbed mining has become a good industry in the area, providing employment to a majority of the local population. By providing employment opportunities, the mining community has acquired a mass base. However, the ecological and potential social conflicts imposed by it cannot be ignored. People not involved in the mining activities have reported that they lack the resources and power to take on the powerful mining lobby and therefore bear the ill-effects of mining. Therefore, any attempt to curtail mining activity in the area may have political implications and may face resistance from these powerful people.

If alternatives are not developed and participation of the local communities not secured in park management, it may increase additional conflicts. Ensuring livelihood security for local stakeholders, therefore, is critical in forest conservation; hence, the creation of alternative income sources to shift stakeholders’ dependency away from the forests through the formation of community-based forest conservation programmes is the need of the hour³³. According to Larson and Ribot³⁴, the commercial and subsistence value of forests was drawing increased attention to their potential role in poverty alleviation; however, there may also be trade-offs between forest conservation and poverty alleviation.

Local, social, economic, political and ecological realities in PAs play an important role in perceptions about benefits and losses, and may be particularly important for managing trans-boundary landscapes. Top-down management efforts which assume that the same factors are relevant across all PAs are likely to be less successful

than management efforts tailored to individual places. Extending PA benefits to smaller landholders, highly resource-dependent households, and households subjected to higher income losses due to human–wildlife interactions are particularly promising to balance costs and losses from living in and around PAs³⁵.

Conclusion

Nandhaur is the last link which connects two major ecologically important landscapes, and harbours high floral and faunal biodiversity. The social and political issues in the area have caused a bottleneck for both conservation and development. Until the area overcomes the social, political and environmental conflicts caused by inadequate management and the mining lobby, and ensures participation of the local communities and other stakeholders in the conservation of the PA, any effort by conservationists will be futile.

It is thus critical to develop a consultative framework with the local communities to explore alternative strategies that meet conservation and human development goals. If the management provides for good conservation strategies, restores corridors and connectivity, develops ecotourism in the area and ensures participation of local communities, alternative livelihood options will be available to these communities. This will lead to a more sustained ecosystem wherein the local communities are actively supporting the conservation of the PA, its tigers and other wildlife.

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