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PROMOTION OF BIODIVERSITY CONSERVATION AND LOCAL LIVELIHOODS IN BUXA TIGER RESERVE: CHALLENGES AND OPPORTUNITIES

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Abstract

The present paper attempts to outline the emerging twin challenges of biodiversity conservation and the promotion of local livelihood opportunities for local people residing in and around the Buxa Tiger Reserve (BTR) in the Indian State of West Bengal. The study is based on a comprehensive review of the existing literature, secondary data collected from various government reports, and interaction with local forest dwellers in and around the nature park. The study finds that although the Buxa Tiger Reserve houses some of the critically threatened species, both flora and fauna, it is under severe pressure from both natural and anthropogenic factors. The natural factors that are threatening the nature park include climate change-induced water scarcity, frequent droughts and erratic rainfall. This has also brought about livelihood insecurity among local inhabitants, which has resulted in human-wildlife conflicts, illegal and rampant wildlife poaching, fragmented landscapes due to encroachment, deforestation, forest fire, the conflict between the forest department and local people, and others. Hence, sustainable use and management of park resources require both effective conservation measures and local livelihood strategies. Efforts should be made for adopting participatory biodiversity conservation strategies in which both park authority and local people work collectively towards achieving desired conservation and livelihood outcomes.

Keywords: Biodiversity, Livelihood, Institutions, Buxa Tiger Reserve, West Bengal.

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Introduction

The variety of life (terrestrial, marine and other aquatic organisms) and their ecological habitat, in which they reside, collectively form biodiversity. The role of biodiversity is undeniable in the delivery of multiple ecosystem services (provisioning services, regulating services, supporting services and cultural services) from time immemorial. Biodiversity provides direct benefits, such as a resource base for essential products and indirect benefits such as recreation, aesthetic values and cultural values (Stocking et al., 1995; Roux et al., 2020). But biodiversity loss has emerged to be one of the greatest threats to the world (Bergseng & Vatn, 2009), because of climate change, global warming, expansion of agricultural land, deforestation and human-wildlife conflicts. Overall, about 83 per cent of the Earth's surface is directly affected by human activities (Sanderson et al., 2002). Species are estimated to be disappearing from the lap of nature at an alarming rate which is more than a thousand times faster than is known historically (Pimm et al., 1995). The loss of biodiversity has not been stopped despite it being the source of goods and services to humankind (Mora & Sale, 2011). In order to address this situation, countries across the world have adopted the concept of protected area (hereafter PA) to preserve biodiversity by imposing different types of protection rules.

PA has been created as core 'units' of in-situ conservation of threatened flora and fauna (Chape et al., 2005). In 1872, the first modern PA Yellowstone National Park was created (Chape et al., 2005; Becken & Job, 2014). Subsequently, the number of PAs has been increasing rapidly to control biodiversity loss across the world (Mora & Sale, 2011). At present, the world has a network of more than 200000 PAs covering nearly 15 per cent of the Earth's surface (Protected Planet, n. d.). The benefits associated with the establishment of PAs are manifold, ranging from environmental, and socio-economic to cultural (Amoah & Wiafe, 2012). Despite the potential benefits of the creation of PAs, there exist countless conflicts and problems (ibid). The restrictions on access to forest resources are imposed on local communities who live in and around the PAs, leading to economic loss (Bergseng & Vatn, 2009; Amoah & Wiafe, 2012). Human development and livelihood are the major impediments to the expansion of PAs and biodiversity conservation (Mora & Sale, 2011). Social problems such as conflicts among local people, communities, and different stakeholders may arise due to the creation of PAs (ibid), which many a time can be country-specific. In developed countries, the main drivers of conflicts are social aspects such as the recreational, emotional, and cultural values of people attached to the PAs. In contrast, in developing countries, livelihood aspects drive conflicts (Soliku & Schraml, 2018).

As of 2019, India holds 903 PAs in total, which comprise 101 National Parks, 553 Wildlife Sanctuaries, 86 Conservation Reserves and 163 Community Reserves occupying 5.02 per cent of the entire geographical area of the country (ECoWPA, 2020). India faces multiple problems in the case of biodiversity conservation due to the high population density in and around biodiversity hotspots. A significant number of the population of the world live in India, and the majority of rural people are reliant upon natural resources for their livelihoods which imposes enormous pressure on PAs. The existence of the human population is visible in 18 (56 per cent) national parks and 100 (72 per cent) sanctuaries out of the 32 national parks and 138 sanctuaries, respectively, within their boundaries (Kothari et al.,1989). Consequently, excessive use of forest resources, habitat loss or fragmentation, increasing human-wildlife conflicts, poaching and illegal trade of wild animals, and boundaries between the forest department (henceforth FD) and local people are the common scenario in almost every PA in India (Ghosh-Harihar et al., 2019).

Besides these common problems and challenges, there are some site-specific problems and challenges associated with PA management. These site-specific challenges should be identified for the better management of the PA through a

localised model. The existing studies in Buxa Tiger Reserve (BTR) have mostly focused on the analysis of different species and biodiversity richness and local livelihood's dependency on the forest. Complex and interlinked challenges in conservation management were not properly studied. The study hypothesised that sustainable management of BTR can promote both local livelihood and biodiversity conservation. Therefore, the present study attempts to understand the emerging twin challenges of biodiversity conservation and promotion of livelihood opportunities for local people residing in and around the BTR and outline potential opportunities available for sustainable use and management of the park. The present study will address specifically the following research questions:

a) What are the challenges faced by BTR?

b) What are the current management issues prevailing in BTR?

c) What are the potential opportunities in BTR for livelihood promotion and biodiversity conservation?

Location, Management Approach and Importance of BTR

BTR is situated in Alipurduar district extending from latitudes 26o30′ and 26o55′ N and longitudes 89o20′ and 89 o55′ E covering 760 square kilometres with 390.58 square kilometres core area or critical Tiger habitat and 370.28 square kilometres buffer zone. Buxa was declared a Tiger Reserve in 1983. Then, the Government of West Bengal constituted a national park taking approximately 117 square kilometres in 1997. BTR is divided into two divisions – West and East, and each division is administered by seven territorial ranges and 24 beats.

The annual temperature and rainfall range from 15oC to 39 o C and 3570 mm to 5600 mm, respectively. Huge altitudinal difference (125 metres to 1750 metres) makes this biodiversity-rich park a habitat for different types of flora and fauna. Several rivers, such as Jayanti, Raidak, Sankosh, Phashkhawa, Turturi, Churnia, Nonani and Dima flow across this PA and provide an extra picturesque beauty. BTR is the Eden for bird watchers, and animal and flower lovers. Hitherto, 73 species of mammals, 390 species of birds, 76 species of snakes, and 5 species of amphibians have been recognised. High rainfall tropical rainforest and savannah forest are abundant here. The floral diversity comprises 400 species of herbs, 250 species of shrubs, 100 species of grasses, 150 species of orchids, 9 species of canes, 10 species of bamboos and more than 300 species of trees, and 130 species of aquatic flora (Wildlife Wing, 2021). Dolomite mining in this PA has severely affected biodiversity conservation.

There are 37 forest villages inside the reserve forest, and the core area contains eight forest villages. BTR has 44 revenue villages and 25 tea gardens (Sarkar & Das, 2012). BTR is inhabited by diverse ethnic groups such as Rava, Santhal, Oraon, Garo, Mechia, Nepali, Bhutia, Rajbanshi, Bengalis, etc.

Materials and Methodology

The present paper has been composed by reviewing the existing literature, collecting secondary data from the annual report published by the FD of West Bengal and authors' interactions with local people during recent field visits to BTR. The secondary data has been collected from various forest departments (Office of Field Director, Deputy Field Director, BTR). Besides, several field surveys were carried out from August 2020 to January 2021 to match the secondary information and extract new and in-depth information regarding the prevailing challenges and opportunities in the reserve. During the field visit, multiple focus group discussions (n= 4) and personal key informants' interviews (n=12) were conducted to elicit the relevant information required for the study. In each focus group discussion, 10-15 people participated.

Participation in focus group discussions was voluntary, and participants were free to speak. In addition, several informal interviews were taken. In focus group discussions, persons from different social strata participated, while the Gram Panchayat secretary, elders, and members of joint forest management were chosen for key informants' interviews. Further, the transect walk method was chosen to explore the livelihood conditions of local communities and the conditions of the forest ecosystem in the BTR. The statements given by villagers in Bengali and Hindi were translated into English for better understanding. The geographical map showing infrastructure development in and around BTR has been prepared with the help of remote sensing data in Arc GIS software. The high-resolution data from Google Earth Pro was utilised to show the road, infrastructure facilities, places and boundary line.

Key Challenges Prevailed in BTR

Climate Change Vulnerability and Flood Disaster*:* The Himalayan foothills of West Bengal are vulnerable to continually changing climatic conditions. The study area has many rivers originating from Bhutan Himalayas. Moreover, flash flood incidents commonly occur owing to the incessant rain in the Bhutan Himalayas. Therefore, villages in the vicinity of rivers are more prone to climate change-induced floods (Ghosh & Ghosal, 2020). The researchers show that climate change-induced floods and other factors like poor physical infrastructure, low work opportunities and food insecurity are the prime causes of their overall socio-economic vulnerability to climate change. Flood, livestock death, and household loss are the biggest fear in the study areas. However, forest villages confront more vulnerability than agricultural villages owing to livelihood insecurity at a large scale and poor livelihood adaptive strategies (Ghosh & Ghosal, 2020). In another study, Sam and Chakma (2018) observed that 61 per cent area of Bengal Duars is vulnerable to climate change. BTR East, Baikunthapur, Jalpaiguri, Wildlife-II, Wildlife-III and their surrounding landscape are the most vulnerable areas with more climatic variation. The predominant hindrances to the resilience of adaptation of communities to climate change are poverty and backwardness (Sam & Chakma, 2018).

Another triggering factor of flood disasters in BTR is several restrictions imposed within PA, which lead to excessive boulders and debris accumulating in the riverbeds. The subsequent increasing level of riverbeds causes frequent flood events forthwith the loss of agricultural land, wildlife habitat and plantations (Das, 2009). Devastating floods were reported in 1950, 1952, 1954, 1968 and 1993, which caused heavy damage to the habitat of the reserve (Das, 2009), and finally displaced the settlement. For instance, in June 1998, the Gholani River, a main tributary of the Sankoshriver, shifted its course westwards, immensely damaging all cultivable and homestead land of Bangdoba forest village. The entire village was washed away, and agricultural land was covered with sand and silt; consequently, the villagers were compelled to move to other places[1] (Das, 2009). The study also revealed that forced displacement by natural disasters has had harmful consequences such as landlessness, homelessness, joblessness, etc.

Higher Dependency and Livelihoods Insecurity: The local inhabitants belonging to marginal sections of society and poor socio-economic conditions are largely dependent on forests for fuelwood, non-timber forest products and grazing at a large scale.

Table 1 reports about 19,623 persons residing in forest villages and fixed demand holding villages, i.e. around 26 persons are living per square kilometre in BTR. Adding the population of surroundings revenue villages and tea gardens, the figure stands at 3,24,874, which is a big concern for the management of the park. Along with the human population, the cattle population is also large, which kindles pressure on grazing practices in the forest. The BTR west division alone has a cattle population of 8360, including forest villages and fixed-demand holding villages. The data shows that more than 20 cattle are brought up per square kilometre.

Table 1

Population (Human & Cattle) in and around BTR

Type of Village	BTR (West)		BTR (East)	
	Total population	Total cattle	Total population	Total cattle
Forest village	10919	7946	5483	
Revenue village	80416	30315	51269	23277
Tea garden	130188	29923	43378	16384
Forest Department Holding	1468	414	1753	
Total	**222991**	**68598**	**101883**	

Source: Offices of Deputy Field Director, BTR

N.B.: Data as on 2008 for BTR (West) & 2011 for BTR (East) for total population.

Around 87 plant species have been used by inhabitants of BTR - 60 are utilised for commercial purposes and the rest of 27 for subsistence purposes. Approximately 35 are collected very often for commercial purposes and income generation, while the rest are collected very rarely. Recently, the collection of NTFPs for commercial purposes has decreased due to the emergence of alternative sources of income (Sarkar & Das, 2012), but Das (2005) cherished an opposite opinion regarding the same. But still, the use of forest resources for domestic uses is found to be very high. The villagers go to the forest for fuelwood collection and amass it in their houses, often against their will. In the words of villagers, "If we do not collect fuelwood and sell it, what will we eat? We have no job." The degree of dependency and its importance in their livelihood can be imagined from the statement of a villager, "We want nothing; we just want to extract the forest resources like past time." The imposition of strict rules by the BTR authority for extracting forest resources badly affects the household income and livelihoods and forces illegitimate entry into the forest for survival. A senior villager also pragmatically said, "What will people do if they have no work?" The question is vital to understand the root problems of the park.

The high price for refuelling of LPG cylinder provided by FD often discourages them from using it. Despite the implementation of ecotourism, it has failed to empower the local people and eradicate poverty effectively. Outsiders are running several homestays on lease. Villagers said, "We don't get anything from ecotourism, and there are few people who benefit from it." Consequently, people of local villages continue to extract the forest resource in heavy quantities for commercial purposes as well as for their daily livelihoods. Unregulated grazing practice inside the park affects the forest ecosystem. People used to unyoke cattle throughout the year in most of the villages. The day -long grazing practice haply causes damage to new saplings inside the forest.

Infelicitous Ecotourism: Ecotourism has been implemented with the aim to develop the tourism industry in and around the natural environment without disturbing the reserve. Nowadays, many tourists travel irresponsibly to natural areas in BTR. The construction of hotels, restaurants and resorts and the influx of tourists in huge numbers in an unscrupulous manner are extremely hampering the biodiversity surrounding the BTR. During the study, it was found that the main motive of ecotourism has gone astray, and ecotourism has emerged to be a nuisance in BTR due to inefficiency and lack of goodwill of management authorities and tourists.

Human-Wildlife Conflicts: Instances of crop raiding, human beings sustaining injuries and

succumbing to death, and livestock loss are common in this area. Human-animal encounters happen frequently as people go to the forest to collect forest resources. Sometimes, wild animals come to fringe villages in search of food. Tea estates which are in the vicinity of forest areas are the hotspots of conflicts. Consequently, most local people nursed fear and hatred for wildlife. The smell of local-made rice alcohol (local name is Hadiya or Hariya) attracts elephants and it enhances the probability of elephant attack. Another interesting fact is that when a cow begets a calf, leopards can sense the smell of newborn, which leads to a possibile attack. However, many forest dwellers consider themselves responsible for the acceleration of HWCs. According to their opinion, "We have fed them (elephants) salt. Therefore, they intrude on our home to taste it". People are afraid to get out of their houses after the evening due to the fear of ferocious and unwary attacks from wild animals. On the contrary, wildlife deaths due to retaliatory killing reduce the diversity of wildlife more quickly.

In order to prevent and mitigate the conflicts with wild animals, the FD and households have adopted different prevention and mitigation strategies such as electric fencing, trenches, acoustic deterrents like drumming, lighting, etc. Some households have installed electric fencing around the households. However, most villagers evaluated these prevention strategies as less effective in reducing the intrusion of wild animals into human habitations and conflicts with humans. In mitigation strategies, a compensation mechanism has been implemented by the FD. Compensation has been given to the affected households based on the cost of damage caused by wild animals. However, the researchers' interaction with villagers revealed that non-transparency, delay, insufficient amount and complex processes make the nonchalance victims apply for compensation for damage by wild animals, eventually reducing the tolerance level of local people towards wild animals. However, we observed a positive attitude of inhabitants towards HWCs. They have started to believe that resource scarcity is the main driver of HWCs. Most of the villagers do not pay any attention provided the number of wildlife increases inside the forest. In fact, they want an increase in the deer population inside the forest so that leopards do not attack their livestock.

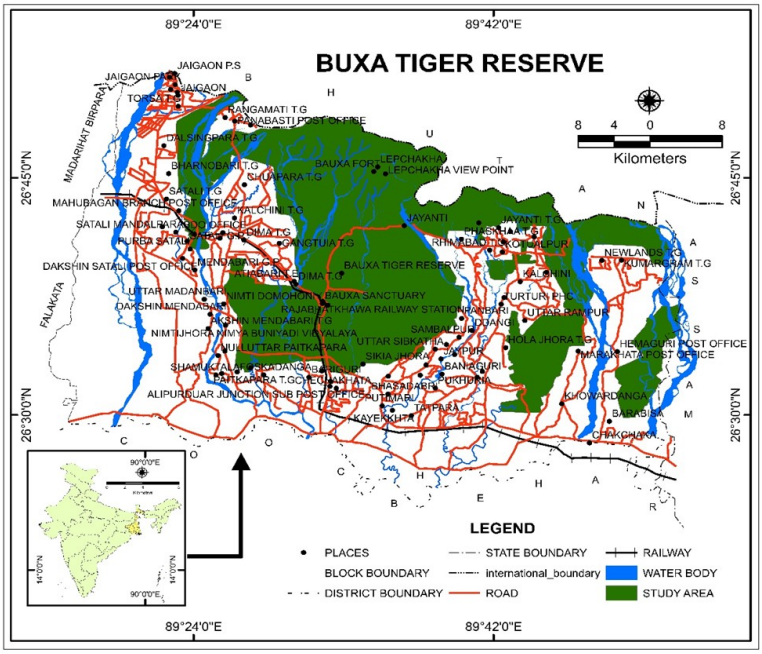
Infrastructure Development, Fragmented Landscape and Habitat Loss: Expansion of human settlement and rapid infrastructure development, such as the construction of roads, hotels, and resorts for tourism development in and around BTR, leads to fragmented landscapes, thus, habitat loss of wildlife.

Different types of roads, such as National Highway, concrete, Black Top Motorable (BTM), Earthen (ERN), and Non-Motorable Foot Tracks (NMFT) spread like a spider web over the areas. This, clubbed with reckless speed of the vehicle, has resulted in frequent fatal accidents involving wild animals.

Railway-Wildlife Interactions: The railway line passing through the forest landscape caused damage to the forest ecosystem and has resulted in trains hitting wild animals. A vivid example of such a scenario is the 161 km long Siliguri–Alipurduar track in the northern part of West Bengal, which witnesses train–elephant collisions in a frequent manner (Roy & Sukumar, 2017). Most of the accidents are nocturnal. Crop raiding and train-elephant accidents seem to have a reciprocal relationship, possibly due to the increase in elephant movement near railway tracks during cultivation season. Male elephants are more inclined to accidents, probably due to the behavioural traits that impel them to cross railway tracks more frequently (Roy & Sukumar, 2017). Frequent railway-elephant accidents have made Northern West Bengal emerge as a hotspot in the map of train–elephant collisions. The total number of such accidents from February 1974 to November 2013 was 84. The number of causalities has risen from an average of one per annum to more than five per annum after the conversion of railway metre gauge to broad gauge. However, larger forest cover, distance to the nearest stream or

Figure 1

Map Showing Infrastructure Development in and around BTR



river, distance to the nearest station, and closer distances to the nearest curve on the railway line are associated with a higher probability of casualty (Dasgupta & Ghosh, 2015).

Poaching and Other Illegal Activities: Poaching is a serious issue in BTR due to the presence of many commercially valuable and rare species. Besides, the reserve shares an international border with Bhutan in the North and a State border with Assam in the East. According to villagers, miscreants mainly come from outside to poach wild animals and steal forest wood. Even people from revenue villages around the park enter the forest frequently and steal forest wood. Villagers opine that during the lockdown, Illegal felling of trees had increased due to loss of jobs. One villager unreservedly said that they steal timer as the forest department denies them permission. Other illegal activities, such as illicit tree felling, unauthorised grazing, wildlife offences, etc., seriously hamper biodiversity conservation. However, FD also acts strongly to seize the timber. During encounters, there were instances of offenders assaulting the staff. While dealing with offenders and the public, two staff were assaulted in BTR in 2016-17. On the other hand, 62 persons have been arrested in BTR, however, none has been convicted in court (Department of Forests, 2018).

Deforestation and Reduction in Animal Species: Nad et al. (2022) found that the area of dense forest has decreased in adjoining areas of BTR, while Sam (2022) indicates that distinct natural and anthropogenic adversities predominantly caused the deterioration of forest health in most of the places. During the field visit, a villager made a rhetorical mention that earlier sun rays did not percolate the canopy of the forest, but now the situation is different. He rued that there would not be any tree in Buxa after 20 years. According to villagers, Sal and Segun are not eco-friendly. “From the perspective of ecology, the plantations of sal and segun are like deserts. The groundwater level in the plantations depletes, and hence there is no chance to grow any other tree or grass near Sal and Segun,” they said. Villagers claimed that they were engaged in plantation work earlier, which

helped them to improve their livelihoods, but now it is not taking place at the speed at which the deforestation is taking place.

Forest villagers also asserted that the number of various wild animals has decreased at a large scale. The annual report 2013-14 of Wildlife Wing indicates a continuous decrease in flagship species, i.e. tiger population in BTR. Though forest officials claimed an increase in number of most of the wild animals like elephants, bison, deer and leopard, etc., for several years, many villagers denied the claim by arguing that wild animals are seen more in number for less dense forests compared to the past.

Conflict and Clash between Forest Department and Local People: The unlawful activities on behalf of villagers generate conflict and clash between FD and local people (FP), which is adversely affecting conservation efforts and inhabitants' livelihoods. Local peoples' involvement in illegal activities often leads to arrests and encounters. For instance, in May 1997, a man from the Rabha community was shot dead by the forest guards patrolling the BTR. Rabha villagers claimed that the man had gone to the forest to fetch a log which had been left by some others. But the forest guard mistook him for an illicit tree-cutter to be detained anyhow (Karlsson, 1999). However, a clear-cut difference in opinion between common villagers and villagers who worked in FD has been observed. Generally, villagers occupying multifarious posts provided by FD have taken the side of the latter.

Forest Fire: Both divisions of BTR are vulnerable to forest fires. During the year 2015-16, the maximum number of incidents has been reported from BTR (W) division in the State along with the Baikunthapur division. In 2015-16, a total number of 66 incidents of forest fire took place in the BTR west division, which affected 36,389 ha of forest area (Department of Forests, 2018).

Lack of Irrigation: Most of the villagers in BTR cultivate paddy once a year solely depending on monsoon rainfall. As a consequence, income from agriculture is very low, which compels villagers to depend on the forest for meeting their daily livelihood needs. However, recently, to provide irrigation facilities, FD has started constructing and/ or repairing the 'Jampoi' system[2]. For reviving the Jampoi system, Khutimari forest village has witnessed an rise in crop production. However, most villages in and around the BTR are having problems with access to irrigation facilities.

Current Management Issues in BTR

Threat of Relocation: A total of 1229 families from eight villages are facing the threat of relocation as per the annual report 2013-14 published by Wildlife Wing. But most of the families are not willing to relocate, which creates multiple problems for sustainable management planning in BTR. In recent times, some households from Bhutiabasti have been relocated, but some households are found even now in the new area. The recent sighting of the Royal Bengal tiger inside the Buxa has accelerated the planning of relocation.

During our interaction with villagers, it was reported that they have been offered two options - either Rs.10 lakh per household (now Rs.15 lakh) or a house in another place to be built by the FD. In the case of Bhutri village located in the core area, they have been asked to relocate to Patkapara, which is located far outside the park. Most of the villagers are not willing to relocate; they either receive the prescribed amount or shift to remote areas like Patkapara. They want a better place for relocation. One man said, "What will we do after receiving such less amount? On the other hand, if we relocate to Patkapara, what will we do there? Bhutri is far better than Patkapara."

Local Institutional Dynamics: Different local institutions, such as the Eco-development Committee (EDCs) and Forest Protection Committee (now redesigned as JFMC) have been set up for the improvement of PA management with the involvement of local inhabitants and their welfare.As per the annual administrative report

2016-17 published by the Department of Forest, a total of 44 JFMCs have been formed in BTR as of 31st March 2017, and a total of 8428 people were engaged in JFMCs, including 7660 males, and 768 females; of this, 6583 belonged to SC/ST category. The data depicts that participation of marginal groups (more than 75 per cent) is more significant in local institutions than women's participation (below 10 per cent). Women's participation in biodiversity conservation is often stressed for sustainable and effective management (Agarwal, 2009). However, the participation of marginal groups (SC and ST) is a positive indication of a conservation programme. The creation of self-help groups (SHGs) among the members of JFMC has accelerated the improvement of their livelihoods. However, according to villagers, forest density has been enhanced after participatory management. The effectiveness of local institutions has been relatively reduced. At the outset, members of local institutions would do plantation and joint patrolling with FD, but now the activities under local institutions are limited only to distributing assets such as LPG cylinders and searchlights, as reported by villagers. They claimed that these local institutions could act more effectively if FD shows interest in afforestation. The villagers said though they prefer planting, the FD is not showing any interest. However, informal institutions in the form of religious beliefs and taboos concerning forests and wild animals play a major role in conservation here.

Incomplete Implementation of FRA (2006): After a long time, forest dwellers have been given rights to forests through The Schedule Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, which is popularly known as The Forest Rights Act (FRA), 2006. Along with other protected areas, the FRA Act has been implemented in Buxa. However, the transformation of rights has not been fully granted till now.

Table 2

Status Report of the Implementation of FRA Act (2006) in BTR (West Division) as per 2019-20

Total Rights Claimed (Individual)	Total Rights Claimed (Community)	Forest Rights settled (Individual)	Land allotted Acres
2647	790	754	684.221

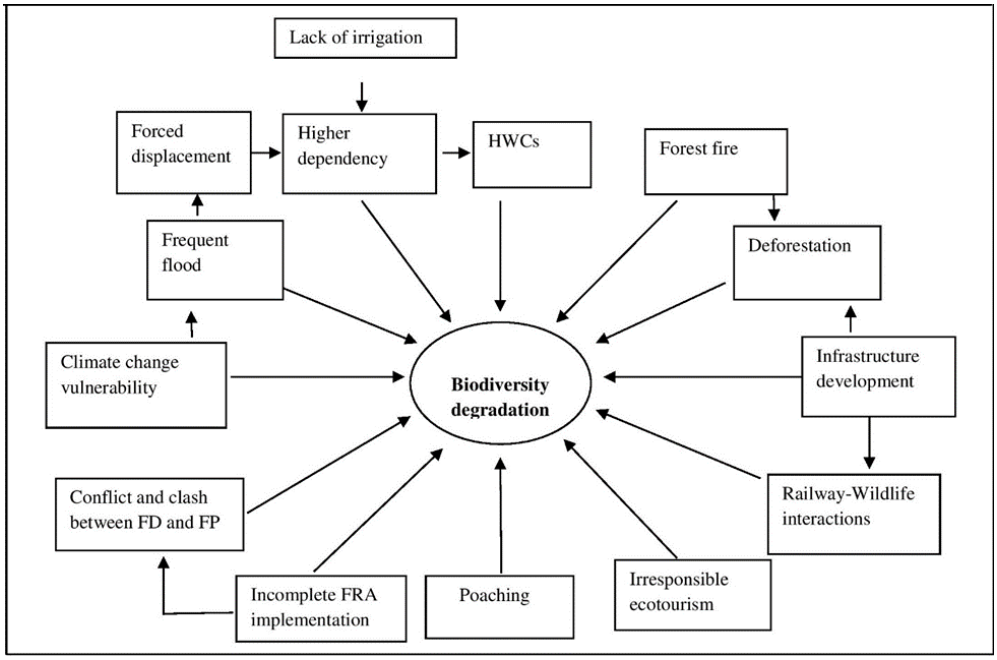
Source: Office of Deputy Field Director, BTR (W).

Table 2 shows that less than 30 per cent of claimed individual rights have been given, and a total of 684.221 acres has been allotted in the west division of BTR. No community right has yet been granted in the west division of BTR. Consequently, there is dissatisfaction among the villagers regarding the incomplete implementation of the FRA Act. One villager said "According to the FRA Act, the Forest Right committee (FRC) should be set up instead of JFMC and right on forest should be transferred to us from the Forest Department. Under JFMC, all rights are entrusted to the Forest Department, which is not logical according to the FRA Act. Our ancestors lived here, and we have had a relationship with the forest from time immemorial. We want to govern forest ourselves at the community level."

Inadequacy of Staff: At present, a total of 354 staff are working to manage the park which spreads over nearly 760 square kilometres (WBFD, 2021). This indicates that, on average, each staff has to manage more than 2 square kilometres. Therefore, the inadequacy of staff reduces the probability of smooth functioning of the day-to-day management work of BTR.

Figure 2

Complex and Interconnected Challenges to Biodiversity Degradation in BTR



Potential Opportunities in BTR

Sustainable Ecotourism: Ecotourism, which may promote local livelihoods and conservation simultaneously, is a viable option in BTR for generating handsome revenue from both native and foreign tourists. As per the annual report 2013-14 of Wildlife Wing, 51,086 native and 35 foreign tourists visited during 2013-14. From tourism, BTR earned a total revenue of Rs. 18,46,058, out of which BTR East and West divisions, respectively, contributed Rs. 4,49920 and Rs. 13,96,138. Given this, ecotourism can be used as an economic and livelihood solution for the inhabitants with proper guidelines and also as a tool for sustainable management of the park.

Proper Utilisation of Local Institutions: Existing local institutions such as JFMC can be utilised for better management of the park and effective livelihood opportunities, which may enormously help in the sustainable management of the park in various ways (see Figure 3). Therefore, appropriate steps should be taken to incorporate more villagers into the umbrella of JFMC. Better forest management planning can be achieved through the active participation of all villagers by building awareness among the users.

Multiple Cropping: Farmers can opt for multiple cropping patterns if irrigation facility is provided. Most of the farmers have low adaptation capacity to climate change due to their backward socio-economic conditions. Irrigation facilities at the community level should be set up as most of them cannot bear the cost of modern irrigation.

Developmental Schemes: Different schemes and programmes such as Rashtriya Krishi Vikas Yojana (RKVY), National Afforestation Programme (NAP), Green India Mission (GIM), ecotourism projects, etc., have been adopted to regenerate the forest, and improve livelihoods and village infrastructure. Infrastructure development schemes like construction of roads, culvert, drinking water supply and electricity supply have been started. Vocational training sessions on motor driving, computer course, beautification, and tourist guide have been given to JFMC members. Besides, the distribution of solar lanterns, searchlights, sewing machines

Figure 3

A Schematic Framework on Impacts of JFMC on Sustainable Forest Management

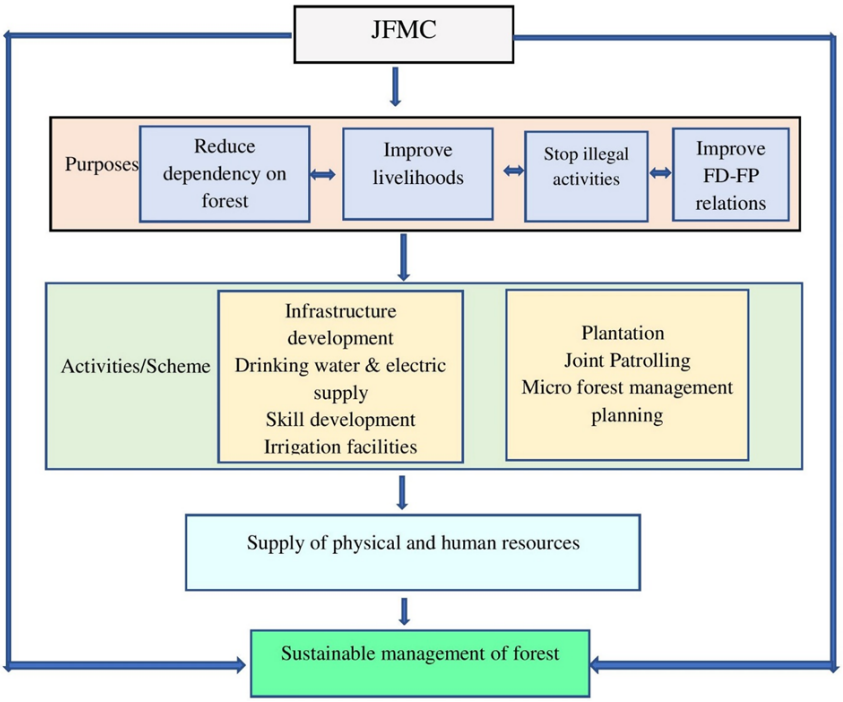
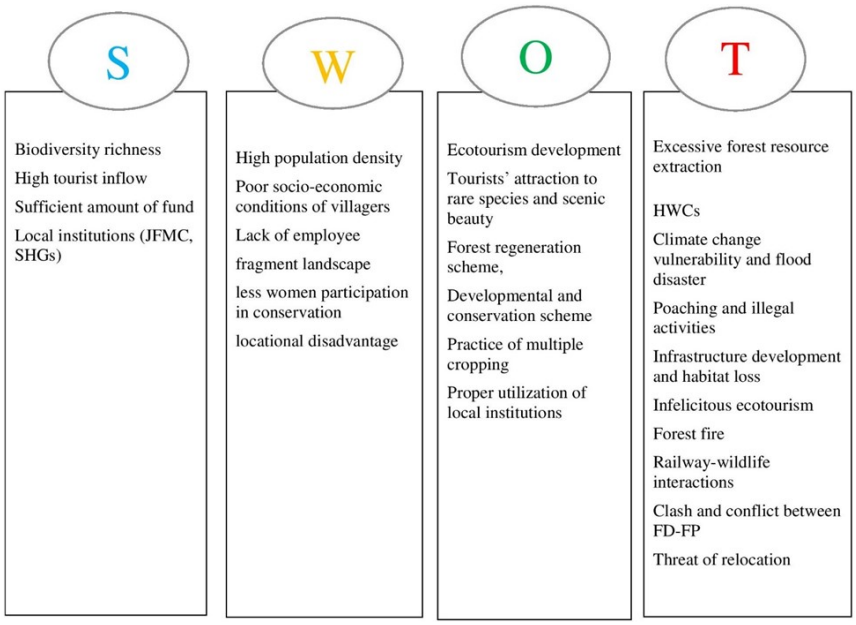


Figure 4

SWOT Analysis to Understand the Strengths, Weaknesses, Opportunities and Threats of BTR



and tube well to members, and computers to JFMC schools, has been initiated. These schemes and programmes may be utilised in this area more pragmatically.

Conclusion

The present study finds that biodiversity and its ecosystem services are facing both natural and anthropogenic challenges, such as climate change, deforestation, forest fire, poaching and other illegal activities, fragmented landscape, and higher dependency on forest resources. In addition, the promotion of local livelihoods is constrained by flood vulnerability, frequent human-wildlife conflicts, and clashes with FD. Currently, relocation, implementation of FRA, and proper utilisation of local institutions are major management issues. Therefore, effective and sustainable measures and policies should be taken to rejuvenate the ecosystem services of forests. Prompt response from FD, transparency, easy process, payment of compensation without delay, and modern technology to tackle HWCs are necessary. Promotion of ecotourism, low-cost refuelling of LPG, and enhancing local livelihoods should be prioritised. More importantly, collective action of forest officials and local people should be strengthened through participatory forest management for better biodiversity conservation and livelihood outcomes.

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End Notes:

1. After displacement, forest villagers of Bangdoba encroached and settled in the plantation areas of Ghoramara beat under the east division of BTR (Das, 2009).
2. Irrigation canals from streams for paddy cultivation, which are popular in this region.

Author's Contribution:

Uttam Das: Conceptualisation, Methodology, Data collections, Writings – original draft, Reviewing & Editing.

Bhagirath Behera: Conceptualisation, Reviewing & Editing, Supervision.

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