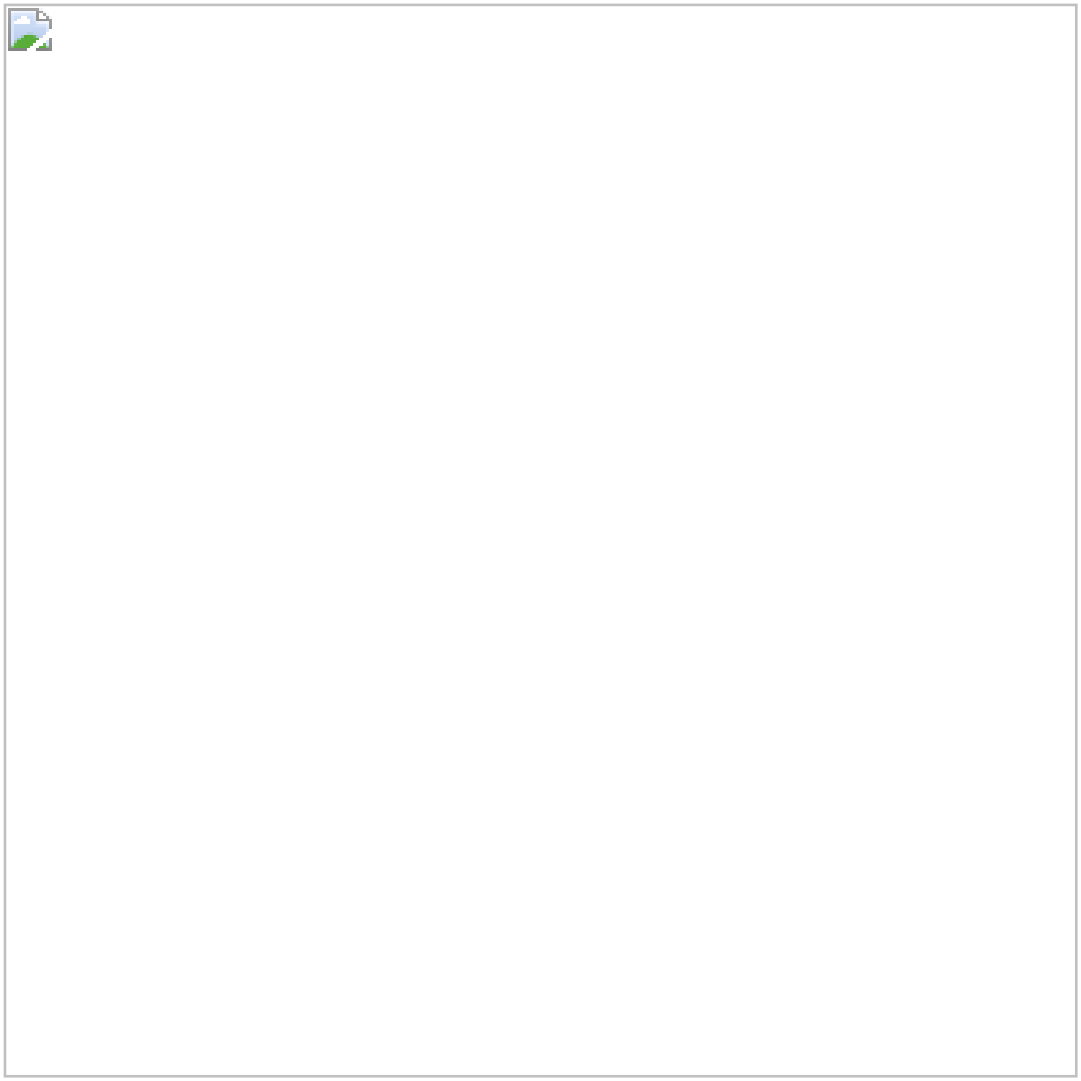

Evaluating the Financial Effectiveness of Funded Projects on Tiger Conservation in Bangladesh

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Review Article

Evaluating the Financial Effectiveness of Funded Projects on Tiger Conservation in Bangladesh

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Abstract

Background and Research Aims: The conservation of Bengal tigers is a global concern due to their exponential decline in population around the world. In 2010, all Tiger Range Countries (TRCs) committed to double their tiger population by 2022. As a member of the TRCs, Bangladesh has launched and conducted many tiger conservation projects with a heavy financial investment. However, the tiger population has not increased in the country. Therefore, there is an urgent need to investigate why those funded projects' outcomes were unsatisfactory compared to neighboring countries such as India and Nepal.

Methods: This review was conducted purely based on previous archival tiger conservation related documents. Six specific tiger conservation projects implemented in Bangladesh, India, and Nepal were selected to investigate the effectiveness of tiger conservation in Bangladesh. Allocated fund distributions were segmented into five groups: capacity building, planning policy and reports, infrastructural development, tiger–human conflict (THC) reduction, and in-field actions to increase the tiger population.

Results: The analysis showed that India and Nepal spent most of their budget on in-field activities and least on planning. A moderate amount was spent on THC reduction, capacity building, and infrastructural development. In contrast, Bangladesh spent the majority of its fund on planning. India and Nepal also developed a sustainable funding mechanism to reduce their dependency on donor agencies, which was absent in the case of Bangladesh.

Conclusion: It is recommended that future tiger conservation initiatives in Bangladesh should address more in-field action, such as patrolling to stop poaching and the illegal extraction of resources, sustainable long-term alternative income generation activities, and health issues such as identifying diseases, inbreeding effects, and captive breeding.

Implications for Conservation: Bangladesh needs to develop a sustainable long-term funding mechanism for in-field actions for tiger protection.

Keywords

tiger conservation, conservation finance, budget allocation, tiger population, Bengal tiger

Introduction

In the contemporary world of rapid urbanization, natural landscapes are massively affected. Hence, biodiversity and wildlife have declined, particularly over the last decade (United Nations, 2019). Wildlife and vegetation provide a country with economic, ecological, cultural, and scientific benefits. However, anthropogenic activities, for example in and around forests, often create complications such as habitat

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loss, hunting, and the over-extraction of natural resources. The biodiversity of Bangladesh is also plagued with such problems. Bangladesh is a biodiverse country, possessing 127 species of mammals that belong to fewer than 35 families (Reza and Mahabub, 2015) and amongst these the majestic Bengal tiger (*Panthera tigris*) is undeniably the country's most famous flagship species. Nevertheless, it is on the verge of extinction in the country despite the fact that the longest-running single species conservation project of Bangladesh is the one for the Bengal tiger. Of six sub-species of tigers, the Bengal tiger is the only sub-species present in Bangladesh and is considered globally endangered (Goodrich et al., 2022; IUCN). The Bengal tiger is mostly found in Bangladesh, Bhutan, India, Nepal, and Myanmar, and in Bangladesh its highest population is in Sundarbans (DNPWC, 2016). Indeed, the Sundarbans Forest, shared between Bangladesh and India, is the largest remaining Bengal tiger habitat in the world (Dinerstein et al., 2007; McGregor, 2010). Currently, there are approximately 210 tigers in the whole Sundarbans Forest, with 114 in the eastern part which belongs to Bangladesh (Aziz et al., 2019). The western part (India) has 96 (Bhattacharjee & Ganguly, 2021). Following the Sundarbans Forest, Nepal's Bardia National Park and adjoining forests is the second largest Bengal tiger reserve with 138 tigers and with 120 tigers. Chitwan National Park and adjoining forests is third (DNPWC, 2016). This study mostly focuses on the tiger population thriving in Sundarbans of Bangladesh.

The Global Tiger Recovery Program (GTRP) was committed to doubling the tiger population by 2022 in a summit held in 2010 to protect this iconic species. Bangladesh, India and Nepal also ratified their decision to participate in the commitment (Global Tiger Initiative Secretariat, 2012). Plans and projects were undertaken instantly to improve the growth of the tiger population as the countries recognized the need for constant monetary support required to reach the target. Bangladesh complied accordingly and started various projects to meet the goal, spending more than US$80 million on different conservation activities since 2010. These include projects such as the Bangladesh Tiger Action Plan (BTAP), the National Tiger Recovery Program (NTRP), and Project BAGH. Some of the projects are still in progress.

Similarly, India planned its own tiger conservation plan titled National Tiger Action Plan 2011-2022, following the initiation of the GTRP in 2010. The plan was to invest more than US$ 2.1 billion for 10 years to conserve the tigers in India. Most of the financial assistance was provided by the government (National Tiger Conservation Authority, 2010). Nepal approached the situation differently on two 4-year long action strategies. The Tiger Conservation Action Plan for Nepal (2008-2012) was the first initiative from 2008 to 2012 and had an investment of US$ 1.15 million. The second was from 2016-2020 and was called the Tiger Conservation Action Plan in Nepal (2016-2020) with a US$3.29 million investment. Both plans had good strategies to invest in activities and generate revenue within their collaborative bodies, which led to a sustainable financial method that resulted in better outcomes than both the countries in previous discussion.

All three countries drafted and executed their own national strategy to conserve their tiger population. India and Nepal have seen an improvement in their latest tiger count, with India having 2967 (Jhala et al., 2020) tigers and Nepal having 355 tigers (DNPWC & DFSC, 2022) after the implementation period. Unfortunately, Bangladesh could not fulfill its commitment to double the tiger population by 2022. In fact, since 2000, the tiger population has been declining, and this trend has not been reversed (Khan et al., 2018). One obstacle could be the lack of a constant flow of funding to maintain tiger protection activities in Bangladesh (Khan et al., 2018). Globally, this problem has been recognized by various international conservation bodies. One of the visions is that biodiversity and natural systems are essential to human survival and economic development (Deutz et al., 2020), but some political institutions have a propensity to favor instant economic advantages while endangering the bigger picture, which is that the upcoming generations will not be able to thrive on the natural resources in the ways that the current generation does. Therefore, the current financial model for development is focused more on economic gain that biodiversity conservation, which is creating lack of funding from public institutes for conservation purposes (Deutz et al., 2020). Bangladesh is one of the victim countries of such notions.

In the majority of the cases, Bangladesh depends on foreign donors for tiger conservation programs. Effective and proper use of these funds is crucial to achieving the GTRP's target. Key parameters such as law enforcement, efficient budget allocations, and strengthening the monitoring system are essential to ensure such projects' effectiveness. Hence, concerns arise regarding Bangladesh's strategy to enhance the tiger population when compared with the neighboring TRCs. Therefore, the aim of this critical review is to assess the investment made by the donor agencies together with the government official bodies between 2005 to 2022, and to compare fund distribution sectors with India and Nepal in order to tease out the loopholes in tiger conservation activities of Bangladesh. Additionally, comparison of the population trends of the tigers is an effective way of understanding the visual outcomes of these funding distributions. This study will help decision-makers and conservation practitioners to prepare better tiger conservation plans in the future. In addition to that, this review provides a simple method for systematically examining Tiger conservation projects' outcomes.

Review Approach

Data and Information Collection

Tiger Range Countries (TRC) are where tigers can roam freely. There are 13 TRCs currently, and they are engaged in

conserving tigers. India, Bangladesh, Bhutan, Cambodia, China, Indonesia, Malaysia, Myanmar, Nepal, Russia, Thailand, and Vietnam are included in this international collaboration. However, the World Wide Fund has reported that Bangladesh, India, Laos, and Nepal have many Bengal tigers (WWF 2022). According to WWF these countries have conducted their NTRPs under the GTRP project (Global Tiger Initiative Secretariat, 2012). Therefore, for this synthesis, we have considered Bangladesh, Nepal and India purposively since they are neighboring countries. This review was conducted purely based on previous archival tiger conservation related documents that included financial information and approximation of tiger population in the respected countries. A total of eight reports and action plans were considered for the financial distribution for this review (see Table 1) from seven specific tiger conservation projects in Bangladesh, India and Nepal. The documents were selected to investigate the effectiveness of tiger conservation in Bangladesh. These reports and action plans contain the major funding periods of these countries and all of the action plans are strategized by the governments of the respected countries. While there may be other initiatives and projects considered for tiger conservation during those periods, those we chose were conducted in a decentralized manner and on a smaller scale. All of the projects were initiated to meet the goals of GTRP; two were conducted in Nepal, one in India and the remaining three were from Bangladesh. The projects in Bangladesh were contrasted with the ones in Nepal and India to understand how their financial efficacy compares. Data on population trends were collected from the conservation reports and individual research, and from recorded statements provided by the government officials regarding the tigers. The purpose was to show a visual trend in the tiger population in these three countries, which is one of the indicators of this study. Note that the numbers of tigers represent only an approximate trend.

Content Analysis

The documents we used for our analysis included information on tiger conservation activities and the budgets allocated for such activities. The activities selected for all three countries have similar procedures and objectives. The activities were mostly concerned with improving capacity for tiger conservation, drafting regulations, planning strategies, monitoring and patrolling the population, improving co-management through local residents, building and renovating offices, reducing tiger–human conflicts through compensation, and implementing conservation strategies in the field. Fund distribution sectors' information was extracted from the reports and action plans mentioned in Table 1 and categorized into five major themes based on common activities that are generally conducted for mainstream conservation activities: i) capacity building (CB), ii) planning policy and reports (PR), iii) infrastructural development, iv) tiger-human conflict reduction (THC), and v) in-field actions or direct initiatives (DI). Nepal and India were selected for the comparison because these two countries are our neighbors and have a similar socio-cultural background. These countries also possess a significant number of tigers that contributes to the global tiger population.

Capacity Building

Capacity building motivates community members to engage in active conservation activities.It also means institutional developments, crime control mechanisms, and enhancing research activities. One of the significant challenges of tiger conservation in Bangladesh was the lack of capacity of the relevant stakeholders to initiate conservation activities (Ahmed et al., 2009). Therefore, fund allocation in the capacity-building sector was considered one of the major thematic areas.

Policy and Action Plan Formulation

Any conservation initiative needs a set of guidelines and measures to make it successful. Fund allocated to develop such policy and action plan was an essential aspect of assessing the effectiveness of the tiger conservation project. The BTAP was initially introduced in 2009 as a policy-level guideline for tiger conservation in Bangladesh.

Infrastructure Establishment

Most development project requires infrastructural establishments such as offices, accommodations, research facilities, and other relevant equipment. If every project allocates funds for such infrastructural development separately, it will be difficult to recognize the efficiency of the funds allocated for conservation. Researchers and conservation professionals can always use previous offices and facilities for upcoming projects. Therefore, the fund administered for infrastructure establishment was considered an effectiveness assessment criterion.

Tiger–Human Conflict Reduction

Tiger-human conflicts (THCs) have emerged as a significant factor contributing to the decline in the tiger population in the Sundarbans. The scarcity of natural food sources in the area forces tigers to venture into nearby villages in search of food, leading to encounters with humans. Unfortunately, these encounters often result in attacks on the tigers by villagers, leading to their death (Barlow, 2009). Therefore, it is crucial to involve local communities in order to mitigate THCs. To address this issue, BTAP (name of the program or organization) initially designed a comprehensive plan spanning eight years, focusing on reducing THCs and minimizing human casualties caused by tiger attacks. BTAP only focused

Table 1. Investigated Documents for the Review.

Project Name	Type of Document	Published Year	Funded by	Anecdotes
Bangladesh Tiger Action Plan (2009–2017)	Action Plan	2009	Bangladesh Forest Department	The Bangladesh Tiger Action Plan (BTAP) is an initiative aimed at ensuring the long-term conservation of tigers in Bangladesh. It serves as a policy statement outlining a holistic vision, goals, and objectives for tiger conservation in the country.
National Tiger Recovery Program of Bangladesh 2017–2022	Action Plan	2016	Government of Bangladesh, World Bank and Other donors.	As a participant in the Global Tiger Recovery Program (GTRP), Bangladesh developed the first edition of the National Tiger Recovery Program (NTRP) in 2010. In 2016, an updated version of the NTRP was released, encompassing the period from July 2017 to June 2022 and involving an estimated budget of approximately US$ 66 million. The revised program aimed to further support tiger conservation efforts in Bangladesh
Status of Tigers in Sundarbans 2018	Report	2019	Government of Bangladesh	An update on all the tiger conservation activities and tiger population abundance in Bangladesh
Bangladesh Tiger Action Plan (2018–2027)	Action Plan	2018	Government of Bangladesh, World Bank.	The BTAP starts a systematic effort to achieve long-term tiger conservation in Bangladesh with a budget of over US$ 14 million. The BTAP is a policy statement that lays forth a comprehensive tiger conservation strategy's vision, aims, and objectives.
Wildlife Without Borders - Rhinoceros and Tiger Conservation Fund	Report	2012	United States Fish and Wildlife Services	The USFWS granted 50 new grants totaling over US$ 2,600,000 from the Rhinoceros and Tiger Conservation Fund in 2012. In Bangladesh, project BAGH ran from 2014 to 2018 with around US$ 13 million. However, we could extract the allocation of 2014 for this project, where USFWS funded around US$ 212,000. However, we could extract financial allocation information for 2014 for this project, where USFWS funded around US$ 212,000.
Tiger Conservation Action Plan for Nepal	Action Plan	2008	Government of Nepal, Ministry of Forests and Soil Conservation, DNPWC.	Nepal implemented a tiger action plan for the period of 2008-2012, allocating an estimated budget of US$ 1.15 million. This initial action plan proved to be highly successful, leading to the development of another impactful action plan in 2016.
Tiger Action Plan in Nepal (2016–2020)	Action Plan	2016	DNPWC, DoF, WWF Nepal, National Trust for Conservation Nepal (NTNC), Zoological Society of London (ZSL)	Nepal's recent tiger action plan has resulted in a remarkable achievement, making it the first country to successfully double its tiger population. One of the notable strategies employed was the implementation of a sustainable financial model. Nepal's efforts, completed within a five-year plan, were accomplished with a modest budget of approximately US$ 3,290,000.

(continued)

Table 1. (continued)

Project Name	Type of Document	Published Year	Funded by	Anecdotes
National Tiger Action Plan India 2011–2022	Action Plan	2011	Government of India through Centrally Sponsored Scheme of Project Tiger, Other Donors.	India's tiger conservation efforts are rooted in robust national legislation known as The Wildlife Protection Act of 1972. Building upon this legislation, India developed a 10-year plan aligned with the vision of the Global Tiger Recovery Program (GTRP). The plan was formulated with a budget of approximately US$ 211,984,0000 to support the conservation endeavors.

on approaching the nearby communities to motivate and train them to assist in tiger conservation. In addition to BTAP, NTRP also took significant measures to mitigate THCs. They introduced Forest Tiger Response Teams (FTRT) and Village Tiger Response Teams (VTRT), which consist of community members trained by the Forest Department of Bangladesh (BFD). These teams monitor instances of tiger predation on livestock and make an urgent communication bridge between the villagers and the forest department through a hotline. Such scenarios are also the case for other Tiger Range Countries (TRCs). Consequently, the allocation of funds towards reducing human-tiger conflict has been identified as a key aspect for evaluating the effectiveness of conservation initiatives.

In-Field Actions to Enhance Tiger Population

This specific criterion focuses on the tangible measures taken to increase the tiger population. After developing a plan, a team of conservationists is deployed to address the ongoing challenges to provide better protection of the tigers. In-field actions include patrolling to stop poaching and illegal resources extraction, implementing sustainable long-term alternative income generation activities, monitoring the tiger population, addressing health issues such as disease identification, the effects of inbreeding, as well as measures to enhance captive breeding. Consequently, the allocation of funds towards these in-field actions serves as a crucial measure of effectiveness in tiger conservation efforts.

An Analysis of the Financial Costs of Tiger Conservation Actions in Bangladesh, India and Nepal

India had the highest estimated budget for tiger conservation, followed by Bangladesh and Nepal, as indicated in Table 2. The analysis revealed that India and Nepal spent most of their budget on in-field activities and less on planning purposes. For instance, approximately 48.84% of the total budget for India's National Tiger Action Plan 2011-2022 was dedicated to direct initiatives or in-field actions, while the Tiger Action Plan Nepal 2016-2020 allocated 46.20% for the same category. In India, a total of 48.01% of the budget was allocated to both tiger-human conflict and planning policy. In contrast, Nepal allocated 50% for capacity building and tiger-human conflict. On the other hand, Bangladesh allocated a significant proportion (around 40.08%) of its fund towards planning purposes, with only 19.81% allocated for in-field actions. This discrepancy in allocation could potentially explain why the projects in Bangladesh fell short of meeting expectations. Moreover, India and Nepal also developed a sustainable funding mechanism to reduce their dependency on donor agencies which was absent in the case of Bangladesh (Table 2).

The project National Tiger Recovery Program, implemented by Bangladesh from 2017-2022, aimed to protect the holistic ecosystem of the Sundarbans and conserve the tiger populations. The project spanned five years and encompassed various sectors, including infrastructure development, Spatial Monitoring and Reporting Tool (SMART) patrolling, and the reduction of Tiger-Human Conflict (THC) through the establishment of Village Tiger Response Teams (VTRT) and Forest Tiger Response Teams (FTRT). The project was specifically focused on in-field actions and capacity building, which used 27% and 38% of the total budget, respectively. Planning reports and tiger-human conflict reduction each consisted of approximately 16.70% of the total budget, and the rest of 7.58% was spent on infrastructure (Table 3).

The Bangladesh Tiger Action Plan 2018 - 2027 is undoubtedly the longest-running tiger conservation project in Bangladesh. This 10-year long-term initiative is estimated to cost US$ 14.9 million. Even though the previous version of this project could not bring much success in conservation (Khan et al., 2018), the project later made some adjustments. An analysis of the project's budget reveals that most of the allocation, approximately 40%, was allocated for planning reports (Table 3). Whereas only 20% was dedicated to direct initiatives, and 9% was allocated for tiger-human conflict reduction (Table 3).

The BAGH project, which began in 2013 and lasted for four years, received funding from USAID. USAID allocated 13 million US$ to improve the ongoing issues regarding tiger conservation. In addition to USAID, USFWS donated approximately US$ 212000 in 2014, equivalent to 18.17 million

Table 2. Comparison of Funding Allocation and Tiger Population Among India, Nepal, and Bangladesh.

Parameters	India (2011–2022)	Nepal (2008–2012) and (2016–2020)	Bangladesh (2018–2027)
Total Estimated Budget (USD)	2,119,840,000	318548100	14935,0004
Capacity Building (%)	1.99	27	31.12
Tiger-Human Conflict (%)	48.01[a]	23	8.95
Policy and Report Planning (%)		2	40.08
Direct Initiatives (%)	48.84	27	19.81
Infrastructure (%)	1.16	21	0.00
Current Estimated Tiger Population	2967	235	114

[a]n.b. National Tiger Action Plan, India 2011-2022 reports funding distribution for capacity building, infrastructure and direct initiatives. However, the report did not mention fund distribution for tiger-human conflict and policy and report planning purposes. Thats why we could not split these two parameter.

BDT, to conduct the necessary conservation activities. The focus of USFWS funding was primarily on the social aspects of tiger conservation and supporting the affected communities in the vicinity. Hence, approximately 52% of the funds were utilized for capacity building activities, while the remaining 48% was allocated towards THC reduction and direct initiatives (Table 3).

The focus of the National Tiger Action Plan India 2011-2022 was based on three crucial components providing support to local stakeholders and establishing necessary infrastructure, funding support, and technical guidance for the utmost success of the project (National Tiger Conservation Authority, 2010). This project also talks intensively about the in-field actions needed and taken for tiger conservation. Activities include sufficient staff recruitment to ensure monitoring, communication network development, water impounding structures such as ponds, anicuts (a type check dam to hold water) for tigers, voluntary village relocation, and veterinary facilities to enhance the tiger's conservation significantly. The project also discusses a detailed financial allocation made by the government and the associate foreign funding. Approximately 50% of the project funds were allocated for anti-poaching activities. The remaining funds were spent on community development through training (Table 2). On the other hand, only 2% of the total funds were used for staff capacity development (National Tiger Conservation Authority, 2010). The combined efforts supported by funding allocations resulted in a significant increase in India's tiger population. According to the prime minister of India in 2018, the tiger population sharply rose from 2,226 to 2,967 since 2014 (The Indian Express, 2019). This substantial growth serves as evidence of the effectiveness of tiger conservation measures facilitated by efficient funding distribution.

During a similar timeframe as Bangladesh, Nepal initiated its tiger action plan. In 2005, Nepal had an estimated tiger population ranging from 360 to 370. However, following the implementation of the first action plan titled "Tiger Conservation Action Plan for Nepal 2008-2012," the tiger population declined to 121 by 2010 due to various threats and challenges. Fortunately, within the next four years, the population rebounded significantly, reaching 198 tigers in 2014 (Figure 1), as reported by the GTRP report of 2010 (Figure 1). Nepal's government made notable progress by enhancing the budget plan and proposing a sustainable financing model for tiger conservation. The budget included a provision of 405 million Nepali Rupees (Nrs) or approximately US$ 3.3 million for five years (Figure 1) (DNPWC, 2016). The plan included a revenue generation model dedicated to tiger conservation as part of sustainable financing for the future. The plan involved leveraging the revenue generated by public parks and wildlife reserves, allocating a portion of their annual earnings towards tiger conservation in Nepal. After this sustainable funding mechanism and proper distribution of that fund (Table 2), Nepal managed to bring up its tiger population in 2018 to 235 tigers (Figure 2) (DNPWC, 2016). This achievement positioned Nepal as the first country to fulfill the commitment made at the St. Petersburg Summit to double the tiger population. It was primarily due to their committed action plan, conservation activities, and the successful implementation of a sustainable financial mechanism.

Tiger Population Trend and Budget Nexus

Since 1990-2002, tiger population for Bangladesh and India ranged between 350-450 (BFD, 1992) and 3000-3700 (Deutsche Welle, 2011), respectively. After 2002, tiger population of both countries started to decline sharply, which is still declining for Bangladesh. However, tiger population started to increase after 2008 (Jhala et al., 2020) and a total of approximately 3000 tigers is now available in India (Jhala et al., 2020). Whereas Bangladesh has about only 114 tigers (Aziz et al., 2019). The tiger population trend was completely different in the case of Nepal where there is always an increasing trend. At present Nepal has about 355 tigers (DNPWC & DFSC, 2022) (Figure 2). Considering the fact that the three countries have significantly different geographical territories, which will differ in the cumulative areas of tiger habitat these countries possess. India has a total of 50 tiger reserves with a total area of 71,027 km^2 (Jhala et al., 2020); Nepal has a total area of 9,653 km^2 (DNPWC & DFSC, 2022) with 5 tiger reserves; finally, Bangladesh has

Table 3. Individual Project Budget Breakdown Based on Selected Indicators.

Activity	Project Name	Year	Total Estimated Budget (US$ approx.)	Expenditure (US$ approx.)	Expected Outcome	Individual budget allocation (in %)
i) Capacity Building						
Institutional strengthening and capacity building	NTRP	2017–2022	$66,000,000	$8,000,000	Improving capacity building and institutional activities to enhance tiger conservation	12.12
Strengthening of Wildlife Crime Control Unit and Forensic lab				$5,000,000	Improving crime control unit and forensic lab facilities to experiment and test collected specimens for tiger conservation	7.58
Habitat controlling				$3,000,000	Managing habitat for the species	4.55
Wildlife Crime Intelligence Unit Development				$5,000,000	improving capacity building through founding wildlife crime experts' team	7.58
Total of the percentage of the estimated budget in Capacity Building for NTRP						31.82%
Build field-level capacity to deal with immediate tiger conservation needs	BTAP	2018–2027	$14,935,000	$116,000	Research team to undertake tiger, prey, and habitat monitoring programs developed	0.78
Build management capacity to plan, implement and monitor BTAP activities				$116,000	BTAP threats and challenges prioritized, and activities of BTAP implementation strategies developed	0.78
Build capacity for long-term tiger conservation (to last beyond the ten years of BTAP)				$930,000	Sustainable financing mechanism for tiger conservation developed, 'Tiger Conservation Fund' initiated; Wildlife conservation training programs for wildlife and forestry staff sustained	6.23
Improve tiger base and research and conservation knowledge learning facilities				$581,000	Platform established to facilitate sharing of information between national and international tiger conservation researchers	3.89
Minimizing tiger poaching				$1,162,000	Through determining intensity of poaching and policies.	7.78
Ensure awareness tiger conservation education to priority audience				$116,000	Improving awareness strategy	.78
Improve law enforcement capacity in the Sundarbans				$581,000	Forest protection strategy developed; staff living; Involvement of the SMART patrolling system.	3.89
Build capacity to implement awareness and education program				$116,000	Training to build national skills in conservation communication and social marketing organized	0.78
Build new generation of tiger conservation scientists				$930,000	Tiger scholarships were initiated for the aware participants.	6.23
Total percentage of the estimated budget in Capacity Building for BTAP						31.12%
Social reformation to reduce critical threats to tiger conservation	USAID's Bagh Project	2012	$211,000	$56,000	An education outreach program to improve the understanding of the importance of tiger conservation to the locals near Sundarbans	26.61
Social reformation to reduce critical threats to tiger conservation (for the second time)				$54,000	A public outreach program to improve the understanding of the importance of tiger conservation to the locals near Sundarbans	25.77
Total percentage of the estimated budget in Capacity Building for USAID's Bagh Project						52.13%

(continued)

Table 3. (continued)

Activity	Project Name	Year	Total Estimated Budget (US$ approx.)	Expenditure (US$ approx.)	Expected Outcome	Individual budget allocation (in %)
ii) Planning Policy and Reports						
Transboundary wildlife crime Control	NTRP	2017–2022	$66,000,000	$3,00,000.00	Plan policies and strategies with neighboring countries to mitigate transboundary animal poaching	4.55
Alternative income generation for the forest-dependent community				$8,000,000	Strategize community-based ecotourism and social forestry to ensure a healthy forest for sustainable development.	12.12
Total percentage of the estimated budget in Planning Policy and Reports for NTRP						16.67%
Incorporate tiger conservation into development plan	BTAP	2018–2027	$14,935,000	$581,000	An integrated approach for tiger and biodiversity conservation was adopted with sufficient help from the government and aware the mass people of the country	3.89
Assess other potential threats				$581,000	Control tourism to reduce pollution,	3.89
Ensure management needs to prioritize research				$58,000	Tiger's research agenda prioritized and documented	0.39
Assess Potential Threats				$291,000	Risk assessment of Canine Distemper and other diseases	1.95
Ensure a suitable tiger population in the Chittagong Hill Tracts				$1,162,000	Survey of tiger occupancy and abundance in CHT	7.78
				$116,000	Risk assessment to understand the mitigation activities for prey and the diseases identified.	0.78
Evaluating the habitat, abundance, and connectivity of the Prey population				$581,000	Understanding the Trends in prey occupancy, connectivity, and population size under various threat and management scenarios	3.89
Increase collaboration to increase available technical skills				$581,000	Gap assessment of conservation skills to determine national and international collaboration requirements completed	3.89
Minimize Prey Poaching				$697,000	Understanding and decreasing prey poaching through law enforcement and penalties. Also, to make targeted groups aware of the legal protection of tigers.	4.67
Reduce unsustainable forest resource use				$697,000	Reduce the human impact on forest resources, the level of illegal activities, and the spatial distribution of illegal activities monitored.	4.67
Engage neighboring countries to implement transboundary conservation initiatives				$581,000	Channel developed for joint activities with government and non-government organizations in neighboring countries	3.89
Collaborate with the international community to tackle the trade in tiger parts				$58,000	Platform established to curb cross-boundary illegal trade on tiger and tiger parts	0.39
Total percentage of the estimated budget in Planning Policy and Reports for BTAP						40.07%
iii) Infrastructural Development						
Building Infrastructure	NTRP	2017–2022	$66,000,000	$5,000,000	Building reporting stations and offices for the employees	7.58
Total percentage of the estimated budget for Infrastructural Development for NTRP						7.58%

(continued)

Table 3. (continued)

Activity	Project Name	Year	Total Estimated Budget (US$ approx.)	Expenditure (US$ approx.)	Expected Outcome	Individual budget allocation (in %)
iv) Tiger-Human Conflict Reduction						
Staffing, incentives and risk, insurance	NTRP	2017–2022	$66,000,000	$3,000,000	Ensure monetary assistance for the infield worker who confronts tigers and has life risks.	4.55
Tiger-human conflict mitigation				$3,000,000	Ensure monetary assistance for the affected locals who might confront tigers during daily activities.	4.55
Support for the FTRTs and VTRTs				$5,000,000	FTRTs and VTRTs will work for the local communities to ensure alternative incomes and other ways to reduce tiger-human conflict.	7.58
Total percentage of the estimated budget for THC Reduction for NTRP						16.67%
Facilitate the engagement and coordination of collaborators	BTAP	2018–2027	$14,935,000	$58,000	Collaborative Body Formed	0.39
Work with local communities to build joint solutions for tiger conservation				$291,000	The capacity of local community members in mangrove forests and tiger conservation developed	1.95
Minimize Tiger- Human Conflict				$407,000	Conflict minimizing protocol developed, Compensation to the victims,	2.72
Increase involvement and stake of local communities in tiger conservation				$581,000	Alternative livelihood options (mainly focusing on tiger victim families) facilitated	3.89
Total percentage of the estimated budget for THC Reduction for BTAP						8.95%
Improving VTRT handling of stray tiger incidents to reduce tiger-human conflict	USAID's Bagh Project	2012	$211,000	$48,000 $33,000	Empowering locals to play a vital role in communicating with the authorities regarding stray tiger attacks.	22.97
Community engagement to monitor tiger conflicts					The project will ensure the long-term conservation of the tigers by reducing THC by 70% by 2015.	15.77
Total percentage of the estimated budget in THC Reduction for USAID's Bagh Project						38.39%
v) On-field activities to Control Tiger Population						
Protection, controlling tiger and prey poaching, including logistic support (improved patrolling through SMART)	NTRP	2017–2022	$66,000,000	$10,000,000	Deploying a particular unit called SMART to monitor illegal activities on tiger protection strictly and assist logistically	15.15
Scientific monitoring, survey, and research (including a survey in the Chittagong Hill Tracts)	NTRP			$8,000,000	Surveying tigers and the people around CHT to evaluate and improve the monitoring system for the possible existence of tigers.	12.12
Total percentage of the estimated budget in Direct Initiatives to enhance Tiger Population for NTRP						27.27%
Engage other government bodies to increase BTAP implementation capacity	BTAP	2018–2027	$14,935,000	$58,000	High and mid-level officials become aware of tiger and Sundarbans conservation	0.39
Evaluate the current and desired state of tiger and prey habitat	BTAP			$581,000	Identify and particular monitor the elements of tiger and prey habitat	3.89
Continue to evaluate tiger population status, connectivity and occupancy	BTAP			$232,0000	Reporting and monitoring on tiger population	15.53
Total percentage of the estimated budget in Direct Initiatives to enhance Tiger Population for BTAP						19.83%
Developing the detection and prosecution of tiger and tiger prey criminals in Sundarbans	USAID's Bagh Project	2012	$211,000	$19,000	Strengthening critical components of the detection process and the prosecution system. This will be done by installing advanced technologies.	8.88
Total percentage of the estimated budget in Direct Initiatives to enhance Tiger Population for USAID's Bagh Project						9.00%

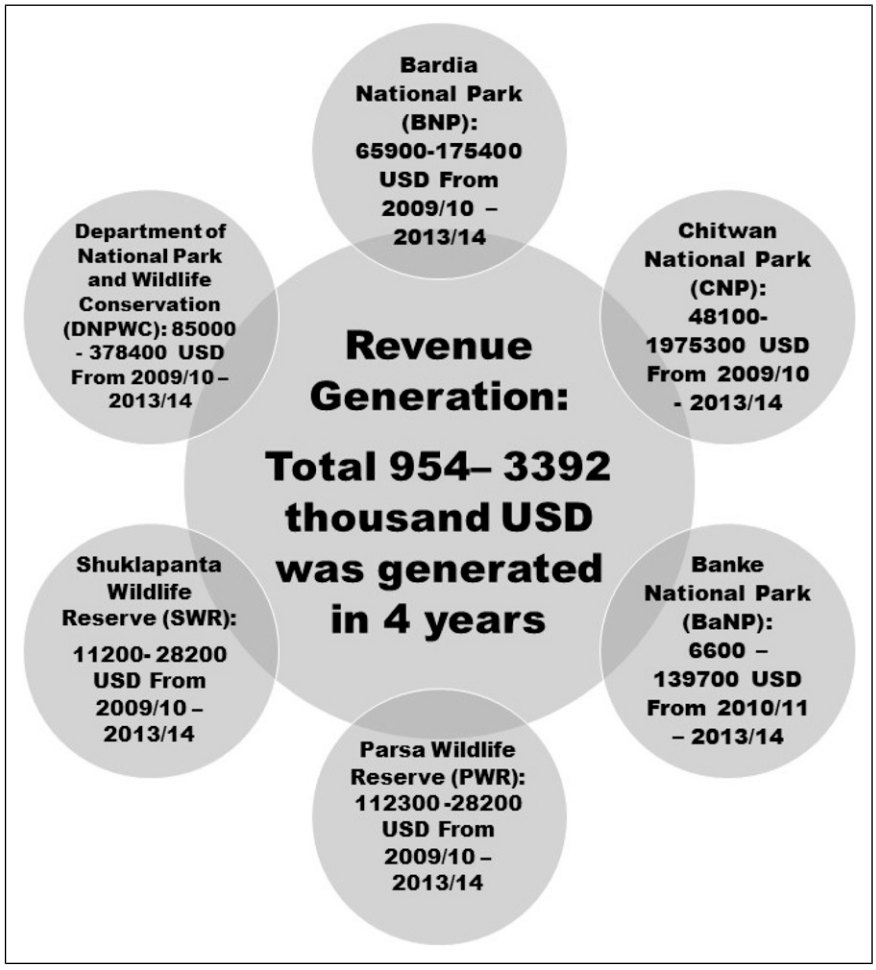

Figure 1. Revenue generation model for tiger conservation in Nepal. Source: Tiger Action Plan in Nepal (2016–2020).

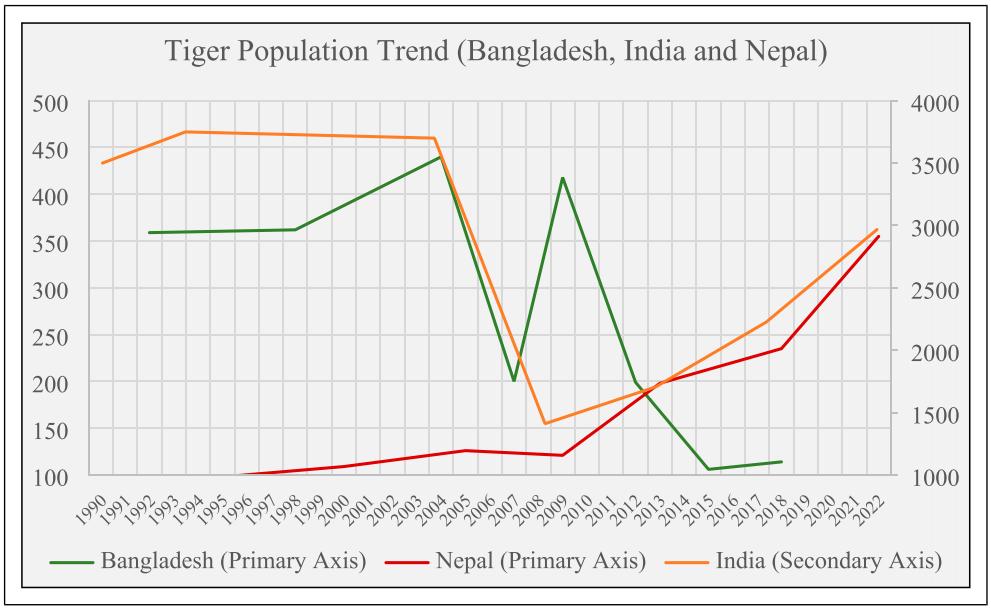

Figure 2. Tiger population trend of Bangladesh, India and Nepal from 1990–2022 Dhakal et al., (2020) and Seidensticker et al., (1999).

only three tiger reserves, all in Sundarbans with a total area of 6,107 km^2 (Aziz et al., 2019). Hence the total number of tigers does not indicate the effectiveness of the adapted projects. However, the change in the tiger population after the implementation of the projects is an indicator that shows the projects' effectiveness.

India has invested more than $2.1 billion in Bengal tiger conservation, averaging an annual expenditure of $82,640 per tiger. This investment has led to a 33% growth rate in the tiger population over a span of 10 years. In comparison, Nepal had a more than 50% growth rate in last 5 years, with an average annual expenditure of US$ 2966 per tiger (Supplementary Table 1).

The first BTAP launched in Bangladesh from 2009 to 2017 focused on identifying threats and challenges to tiger conservation. Activities during this period included census, awareness raising campaign, and developing co-management plan. However, one major drawback of BTAP was the lack of a future financial mechanism dedicated to tiger conservation. In contrast, both India and Nepal had developed financial strategies for tiger conservation since the early 2000s which proved to be efficient in increasing their tiger populations. On the other hand, Bangladesh faced an exponential decline of its tiger population where the tiger population dropped from 440 to 106 (Supplementary Figure 1). To address this issue, the Bangladesh government launched a new action plan in 2018 for four years to improve this situation. Most of the funds from this and other Tiger conservation projects were allocated towards planning reports, capacity building, and human-tiger conflict resolution. Only a few proportions of the budget were allocated for in-field actions. In contrast, India and Nepal prioritized in-field actions in their financial models, including co-management initiatives, practical research on habitat and prey-based management, combating tiger crimes, and creating undisturbed buffer zones for tigers. It is important to note that India allocated only 2% of its total budget to capacity building, while Nepal allocated almost 23% towards reducing tiger-human conflicts (Table 2).

Is Tiger Conservation in Bangladesh on the Right Track?

History of Tiger Conservation in the Sundarbans

Based on available temporal data, the management of the Sundarbans can be divided into four stages (Figure 3). These stages include the conversion of land for agriculture (1780-1875), timber production for revenue collection (1876-1951), inventory-based management (1952-1992), and integrated management and co-management (1993-current) (Mahmood et al., 2021). In the initial stage of 1781, the British Empire converted a significant amount of land for cultivation. However, due to the hostile environment and lower production capacity of the soil, the plan was not successful (Mahmood et al., 2021). As a result, they shifted their focus towards a more profitable approach, utilizing the Sundarbans for timber production, fuelwood, and revenue generation. To ensure sustainability, a taxing system was introduced to regulate the timber trade. This tax system was the first initiative to protect the forest resources of the Sundarbans. Even though there wasn't much scientific research on tigers during this period, the abundance of tigers can be sensed from historical scenarios. During 1860s, the death tolls from wild beast attacks in India were quite high. It is also known that some of the attack was from tigers too. Hence, in 1862, the Bengal government announced reward of 50 Euros to kill one specific tiger in Mysore, which killed more than 200 people (Murdoch, 1863). Another instance occurred in Eastern Bengal (currently Bangladesh) where several schools remained closed for a year in the due to an increasing number of tiger attacks on students (Murdoch, 1863). As a result of frequent tiger attacks, the government often appointed hunters to kill off tigers in return of rewards. This can be portrayed as one of the major reasons for the sharp decline of Bengal tigers in the Sundarbans (Mahmood et al., 2021). In the second stage, the first-ever forest policy was approved in 1894 with an aim of increasing revenue through agricultural activities and timber production. . The first decentralized management plan for the Sundarbans was established in 1889 by establishing The Sundarbans Forest Division (SFD) in Khulna. The SFD implemented the first formal "Working Plan" to protect timber species such as *Heritiera fomes, Xylocarpus mekongensis, Sonneratia apetala, and Aglaia cucullate.* However, the primary focus remained on increasing the production of wood species from the Sundarbans, with little emphasis on wildlife conservation. During this period, shooting tigers was a popular sport among European and local hunters in a large portion of Bengal, the North-West Provinces of India and Central India The local hunters used to build platforms on trees (also known as machans) to shoot tigers from that platform without being noticed or chased (Lydekker & Sclater, 1893). Despite the local superstition of considering tigers sacred, the killing of tigers by others did not bother them. Rather they used the bones, teeth and whiskers of the deceased tigers to make charms and preserve them (Lydekker & Sclater, 1893). Such practices, both by locals and Europeans, contributed to a further decline in the tiger population in the Bengal region, with a total of 1,259 tiger deaths identified in a recent study (Barlow, 2009). After 1947, the management of the Sundarbans came under the control of East Pakistan. Due to massive timber extraction until 1960, the authority planned a detailed 20 years management plan till 1980 for Sundarbans. The plan was developed for the exploitable timber species based on Diameter at Breast Height (DBH) classes. According to IUCN, in 1969 it was recognized that the number of tigers decreased exponentially, leading to the establishment of sanctuaries in various areas, including the Sundarbans in West Bengal. The government also prohibited hunting of all herbivores which served as food for the tigers in the

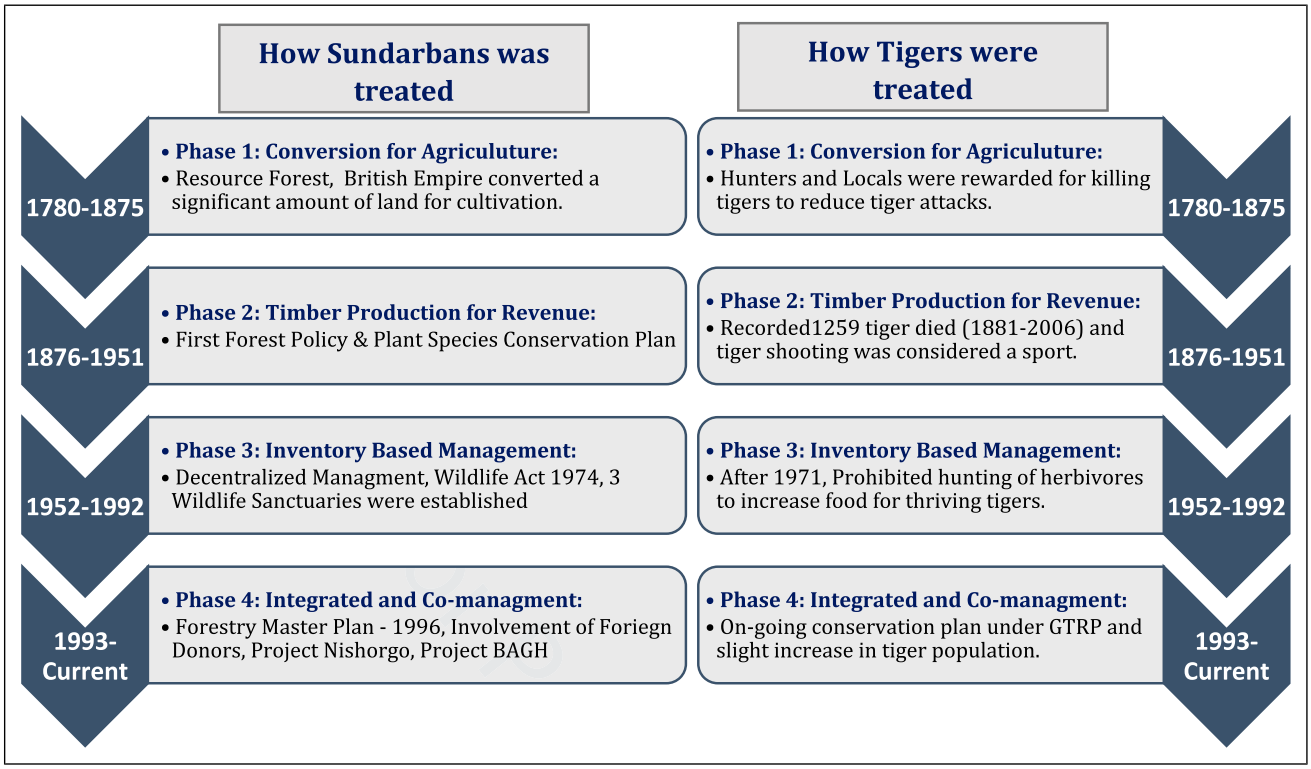

Figure 3. Phases of wildlife management in the Sundarbans (Source: adopted from Mahmood et al. 2021).

West Bengal reserved forests (IUCN & UNESCO, 1970). Notably, there were observable efforts towards wildlife conservation from both East and West Pakistan during this time.

In the early 1970s, the World Wildlife Fund (WWF) started a joint collaboration with the government of the countries where tigers were still thriving. Bangladesh was one of the countries who immediately banned the export of tiger skins, which were in high demand for fashion purposes in western countries (Mountfort, 1974). Following the independence of Bangladesh, the country took its first significant step towards wildlife conservation by adopting The Wildlife Conservation Act in 1974. This was followed by the establishment of three wildlife sanctuaries in 1977 (Mahmood et al., 2021). During this time, the tiger population in the Sundarbans was estimated to be around 100, partly due to the presence of excessive human settlers near the Sundarbans and the vulnerability of the swamps to tidal flooding (Mountfort, 1974).

The first-ever wildlife management plan was officially established in 1984 by the SFD. Recognizing a massive depletion trend of the forest resources in 1989, Bangladesh Government banned harvesting timber from the Sundarbans. Subsequently, the country implemented the first-ever Forestry Master Plan in 1996 and the Forest Policy in 1994(Mahmood et al., 2021). During that period of time according to the government of Bangladesh more than 350 tigers where thriving in the Sundarbans (BFD, 1992). The involvement of international bodies also catalyzed forest conservation initiatives. In recent years, under the Nishorgo Support Project, the conservation management plan was established for the three wildlife sanctuaries (1997-98 to 2002-03). However, a management paradigm shift from commercial forestry to a conservation approach could not increase tiger abundance in the Sundarbans no comprehensive survey was conducted to determine the exact number of remaining tigers. Different researchers and organizations employed various methods to approximate the tiger population in the Sundarbans from 1990 to 2010 (Figure 1). Currently, the official tiger population estimated by the authorities is 114 (Aziz et al., 2019) (Figure 2 and Supplementary Figure 1).

Implications for Conservation

The conservation activities for Bengal tigers in the Sundarbans Forest are undoubtedly Bangladesh's most significant conservation projects. The Bangladesh Forest Department has brought together some of the best conservationists to save this national treasure. Government and the non-governmental agencies have made a great effort through research and development projects to conserve the current tiger population of Bangladesh. Despite some success in reducing tiger–human conflict and increasing patrolling in the forests, the tiger population has not raised significantly in the last 10 years. Hence, the main purpose of this study was to try and explore whether the financial distribution of the budgets of different conservation projects has been appropriate for Bangladesh, in comparison to India and Nepal.

We found that the conservation efforts in Bangladesh are not even close to being efficient in terms of financial allocation. This inefficiency is affecting tiger conservation both now and in the long run. Most of the funds have been allocated for capacity building and institutional strengthening, while little has been devoted to physically safeguarding the tigers. Therefore, financial remodeling is essential if tiger conservation is to be improved in Bangladesh (Box-1).

Box 1: Possible recommendations to improve Bengal tiger conservation projects in Bangladesh

Recommendations

- Bangladesh should establish a sustainable funding mechanism to support on-the-ground initiatives aimed at protecting tigers.
- Enhanced co-management strategies need to be implemented to mitigate the conflicts between tigers and humans in the Sundarbans region.
- Increased manpower should be dedicated to monitoring and patrolling efforts in order to combat illegal poaching and trafficking of tigers.
- There should be a greater emphasis on addressing tiger health concerns, including the identification of diseases, the impacts of inbreeding, and the promotion of captive breeding programs.

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Author Contributions

I.A.M. and M.S.I.S. conceptualized and designed the review. I.A.M. collected required data and information. I.A.M. analyzed the data, information and wrote the initial draft paper, which is subsequently edited by I.A.M., M.S.I.S. and M.S.

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Supplemental Material

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