Nature-Based Tourism and Mangrove Forest Conservation in the Sundarbans, Bangladesh: A Pathways–Pressures–Governance Framework

Partho Biswas*

[a]**Bangladesh Bondhu Foundation (Bondhu), Dhaka, Bangladesh**

[b]**Department of International Tourism Management, Cardiff Metropolitan University, UK**

***Corresponding Author**

DOI: https://doi.org/10.51584/IJRIAS.2026.11SP140019

Received: 25 October 2026; Accepted: 30 October 2026; Published: 12 November 2026

ABSTRACT

Nature-based tourism is widely promoted as a tool for conserving tropical forests, yet evidence that it protects forests is thin and context-dependent. This study examines when nature-based tourism contributes to conserving the Bangladesh Sundarbans, the world's largest contiguous mangrove forest. Research on Sundarbans tourism has emphasised potential rather than forest outcomes, the relevant evidence has been analysed in separate silos, and the post-2022 surge in visitors and forest-edge resorts has not been examined. We combined an integrative review of peer-reviewed, official and news sources from 2000 to 2026, including Bangla-language reports, with secondary-data and geospatial analysis, organised through a pathways–pressures–governance framework, and stress-tested the framework against the Indian Sundarbans. Reported visitors rose by 69% between FY2015–16 and FY2022–23, to 216,143, although official series conflict. Tourism receipts of about Tk 182 per visitor equal roughly 1–4% of package prices and less than 1% of tourism's estimated economic contribution. Forest extent has remained broadly stable while dense canopy has thinned, and no study attributes these changes to tourism. All three conservation pathways (revenue, livelihood substitution and stewardship) are weakly evidenced. Three of the seven core visitor sites lie inside wildlife sanctuaries, and published daily visitor limits are several times higher than average demand, so they constrain only peak days. In the Indian Sundarbans, a rule entitling fringe communities to 25% of tourism receipts has not stopped benefits from bypassing the poorest households, which supports the framework and extends its benefit-sharing condition to the ownership of tourism capital. Tourism is likely to conserve the Sundarbans only when five governance conditions hold: earmarked revenue, benefits reaching resource-dependent households, binding spatial and seasonal limits, outcome monitoring, and control of edge development. Five testable propositions are set out to guide primary data collection.

Keywords: Nature-based tourism, Mangrove conservation, Protected-area governance, Co-management, Sundarbans

INTRODUCTION

Mangrove forests are among the most threatened and least understood forest ecosystems [30]. The Sundarbans, in the delta of the Ganges, Brahmaputra and Meghna rivers, is the largest single block of halophytic mangrove forest in the world. It covers about 6,017 km² in Bangladesh and about 4,000 km² in India, was designated a Ramsar site in 1992 and was inscribed as a UNESCO World Heritage Site in 1997 [31]. Historical over-exploitation, upstream dams, shrimp and salt farming and recurrent oil spills have depleted its tree stock [31]. The forest also supports a large rural economy. About 3.5 million people live around the Bangladesh Sundarbans and about 600,000 depend directly on it for fish, crabs, honey and nipa palm (*golpata*) [26]. Poorer households derive a larger share of their income from mangrove resources than better-off households [1].

Nature-based tourism is often promoted as a way to reconcile conservation with these livelihood demands. In principle, it can raise revenue for protected-area management, create jobs that replace extraction and build public support for protection [36]. In practice the evidence is mixed. Kiss [20] argued that community-based ecotourism usually generates modest income for few people and is only weakly linked to conservation behaviour. A global systematic review found only 17 empirical studies of ecotourism impacts on forests. It concluded that ecotourism, as typically practised, leads to deforestation, but that it can protect forests when explicit conservation mechanisms are in place, such as protected areas, payments for ecosystem services, and monitoring and enforcement [5]. A counterfactual study of 15 Himalayan ecotourism hubs found that effects depended on context. Forest loss was lower in ecotourism hubs where background deforestation pressure was high, but higher where it was low [6]. A 30-year review of ecotourism research also found that ecotourism is often conflated with general outdoor recreation, which blurs what is being evaluated [36].

Tourism in the Bangladesh Sundarbans has grown quickly. Bangladesh Forest Department (BFD) records show visitor numbers rising from 128,175 in fiscal year (FY) 2015–16 to 216,143 in FY2022–23 [26]. The Padma Bridge, opened in June 2022, cut travel time from Dhaka to the gateway city of Khulna, and operators report a 45% rise in domestic visitors since then [26]. Demand has driven a boom in eco-resorts and cottages along the forest edge [26]. In October 2026 the Department of Environment ordered 24 of these resorts, in Khulna, Bagerhat and Satkhira districts, to close for operating in the Ecologically Critical Area without the required permission [40]. Meanwhile, the BFD, with support from USAID and Solimar International, has prepared a 20-year Sundarbans Ecotourism Master Plan (2025–2045). The plan calls for regulated visitor flows, community-based tourism and the dispersal of visitors across more sites [3, 26]. Whether this growth helps or harms the forest is therefore a live policy question.

Research gap

Three gaps limit the evidence available to answer that question.

1. **Potential rather than outcomes.** Research on Sundarbans tourism has been largely prospective. Early work proposed GIS-based planning to minimise visitor impacts [28]. Later studies assessed whether community-based tourism could facilitate conservation [16] and how adaptive co-management could improve tourism governance in Bangladesh's protected areas [17, 18]. These studies describe potential and process; none measures tourism's effect on the condition of the forest.

2. **Evidence in separate silos.** Remote-sensing studies track forest extent and canopy density [7, 11, 19]. Livelihood studies quantify dependence on forest resources [1], and governance studies evaluate co-management [21, 33]. These literatures have not been brought together to ask whether tourism changes the drivers of forest loss and degradation.

3. **An unexamined new phase.** The period since 2022 brought record visitor numbers [26], a resort boom at the forest edge [26, 40], an annual three-month closure of the forest [23], a new master plan [3] and a 2026 decision of the UNESCO World Heritage Committee on the property [44]. None of these has been examined in the peer-reviewed literature. Globally, Brandt and Buckley [5] call for research on how, when and where ecotourism protects forests. To our knowledge, mangrove systems, where tourism is boat-based and forest-dependent populations are large, are rarely the subject of such studies.

Aim and research questions

This study asks when nature-based tourism conserves forests in the Bangladesh Sundarbans. It addresses three research questions (RQs):

- **RQ1.** Through which pathways can nature-based tourism contribute to conserving the Sundarbans, and how strong is the evidence for each?

- **RQ2.** What pressures does tourism place on the forest, and where are they concentrated?

- **RQ3.** Which governance conditions determine whether the net effect of tourism on the forest is positive?

Contributions

The study makes four contributions. First, it develops a pathways–pressures–governance framework for assessing tourism–forest outcomes in mangrove protected areas and stress-tests it against a second mangrove case, the Indian Sundarbans. Second, it compiles and cross-checks official visitor and revenue statistics for FY2015–16 to FY2023–24, using Bangla-language reports of divisional accounts to reconcile part of the series, and derives indicators of how much visitor spending reaches forest management. Third, it maps the core visitor sites against sanctuary boundaries and compares published visitor limits with demand. Fourth, it identifies five governance conditions and five testable propositions that can guide implementation of the Ecotourism Master Plan and the draft 2025–2035 Integrated Resource Management Plan. The remaining sections present the conceptual framework, methodology, results, discussion and conclusions.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Conservation pathways

The literature identifies three ways in which nature-based tourism can conserve forests. The **finance pathway** operates when entry fees and concession charges pay for patrols, monitoring and restoration [20, 36]. The **livelihood-substitution pathway** operates when tourism jobs and enterprises replace income from extraction, so that households harvest less [20, 36]. The **stewardship pathway** operates when tourism raises awareness, builds political support for protection and places guides and visitors in the forest, making illegal activity more visible [36]. Each pathway depends on a link that is often missing: revenue must reach management, benefits must reach the people who extract resources, and awareness must change behaviour [20]. In the Indian Sundarbans, Ghosh and Ghosh [10] found that ecotourism benefits were unevenly distributed and accrued disproportionately to remotely located capital invested in tourism facilities, which weakens the substitution pathway.

Tourism pressures

Tourism also creates pressures on forests. **Direct pressures** include vessel traffic, fuel and oil discharge, noise, solid waste, disturbance of wildlife and the clearing of vegetation for jetties, walkways and watchtowers. **Indirect pressures** arise because tourism stimulates wider development, including better transport links, market integration and new settlement, which are themselves associated with forest loss [5, 6]. Brandt et al. [6] showed that the balance between these forces depends on background deforestation pressure: where that pressure is low, development driven by tourism can add to forest loss.

Governance as the moderator

Whether the pathways outweigh the pressures depends on governance. Brandt and Buckley [5] found that ecotourism protected forests only where explicit conservation mechanisms and clear spatial boundaries were in place. Ostrom's social-ecological systems framework [25] locates such outcomes in the interaction of the resource system, its users and the governance system, and emphasises monitoring, graduated sanctions and the role of users in making rules. Co-management of protected areas has operated in the Sundarbans since 2008 [21], so the quality of co-management is a likely moderator of tourism outcomes there.

The pathways–pressures–governance framework

Figure 1 combines these elements. Tourism activity feeds three conservation pathways (P1–P3) and two classes of pressure (direct and indirect). Five governance conditions moderate both: **G1**, revenue earmarked for forest management; **G2**, benefits that reach resource-dependent households; **G3**, enforced spatial and seasonal limits on use; **G4**, credible monitoring of visitors and impacts; and **G5**, control of development at the forest edge. The outcome for the forest is the net of strengthened pathways and contained pressures.

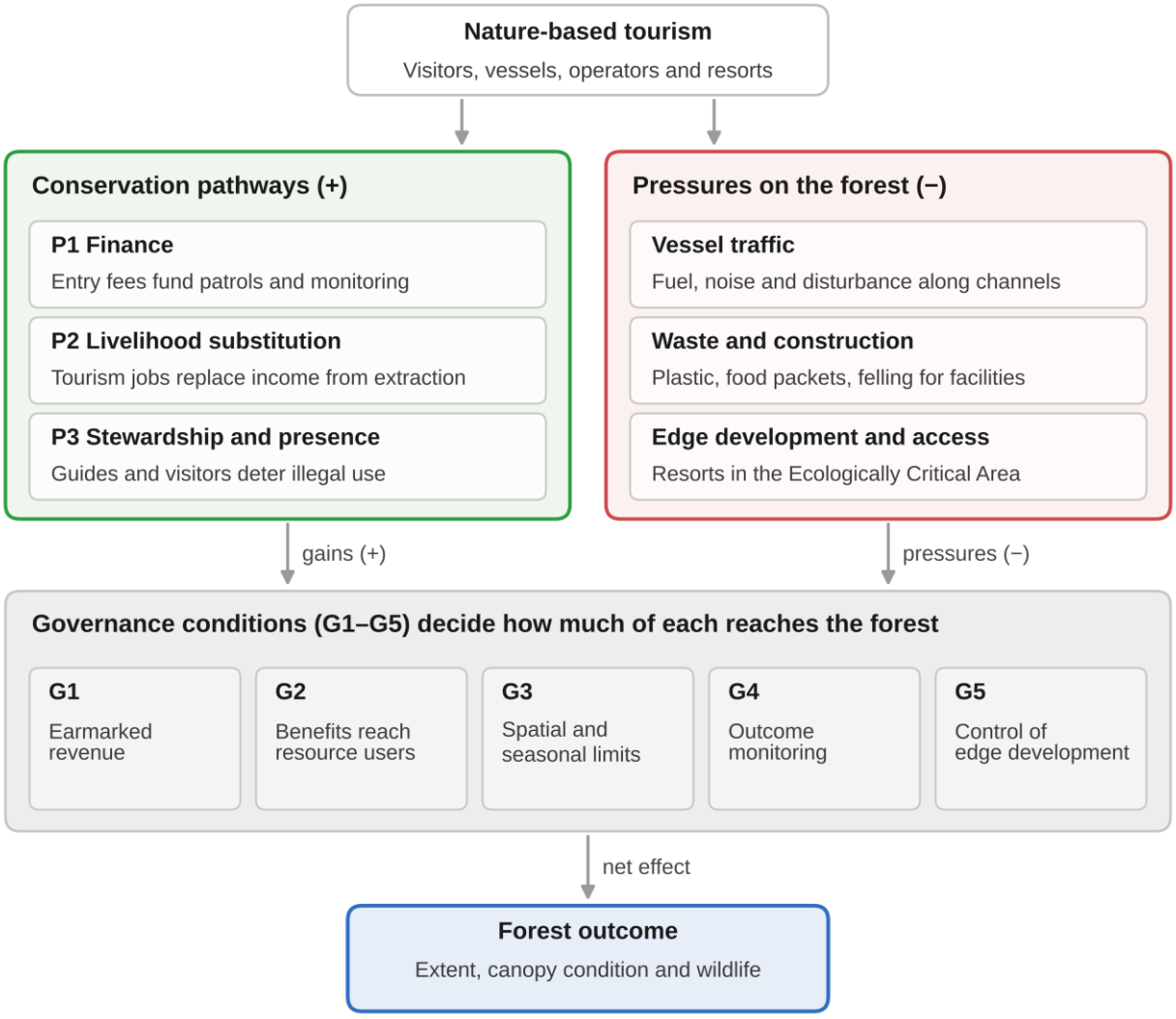

Figure 1: The pathways–pressures–governance framework. Nature-based tourism generates conservation gains through three pathways (P1–P3) and pressures through direct channels (vessel traffic, waste and construction) and indirect channels (edge development and access). Five governance conditions (G1–G5) determine how much of each reaches the forest, and the forest outcome is the net effect. Source: author, drawing on [5, 20, 25, 36].

METHODOLOGY

Study area

The Sundarbans Reserve Forest (SRF) covers 6,017 km² in south-western Bangladesh, across Khulna, Bagerhat and Satkhira districts (Figure 2). About 1,874 km² (31%) of the reserve is water, in some 450 rivers and canals [37]. The BFD manages the reserve through the Sundarbans East and West forest divisions [38]. Three wildlife sanctuaries declared in 1996 covered 139,699 ha, about 23% of the reserve; in 2017 they were expanded to 317,950 ha, more than half of the reserve, and all extraction of wild resources is banned inside them [45]. The World Heritage property (No. 798) consists of the three 1996 sanctuaries [38].

Visitors reach the forest by boat from gateway towns including Khulna, Mongla, Munshiganj and Sharankhola [3, 26]. Seven core visitor sites (Karamjal, Harbaria, Katka, Kochikhali, Dublar Char, Hiron Point and Kalagachhia) receive most visitors. Four new sites (Alibandha, Andharmanik, Shekhertek and Kailashganj) have been added to ease pressure on them [26]. The tourism season runs from October to March [37]. Since 2022 the forest has been closed to all entry, including tourists and resource users, from 1 June to 31 August each year to protect breeding fish and wildlife [23].

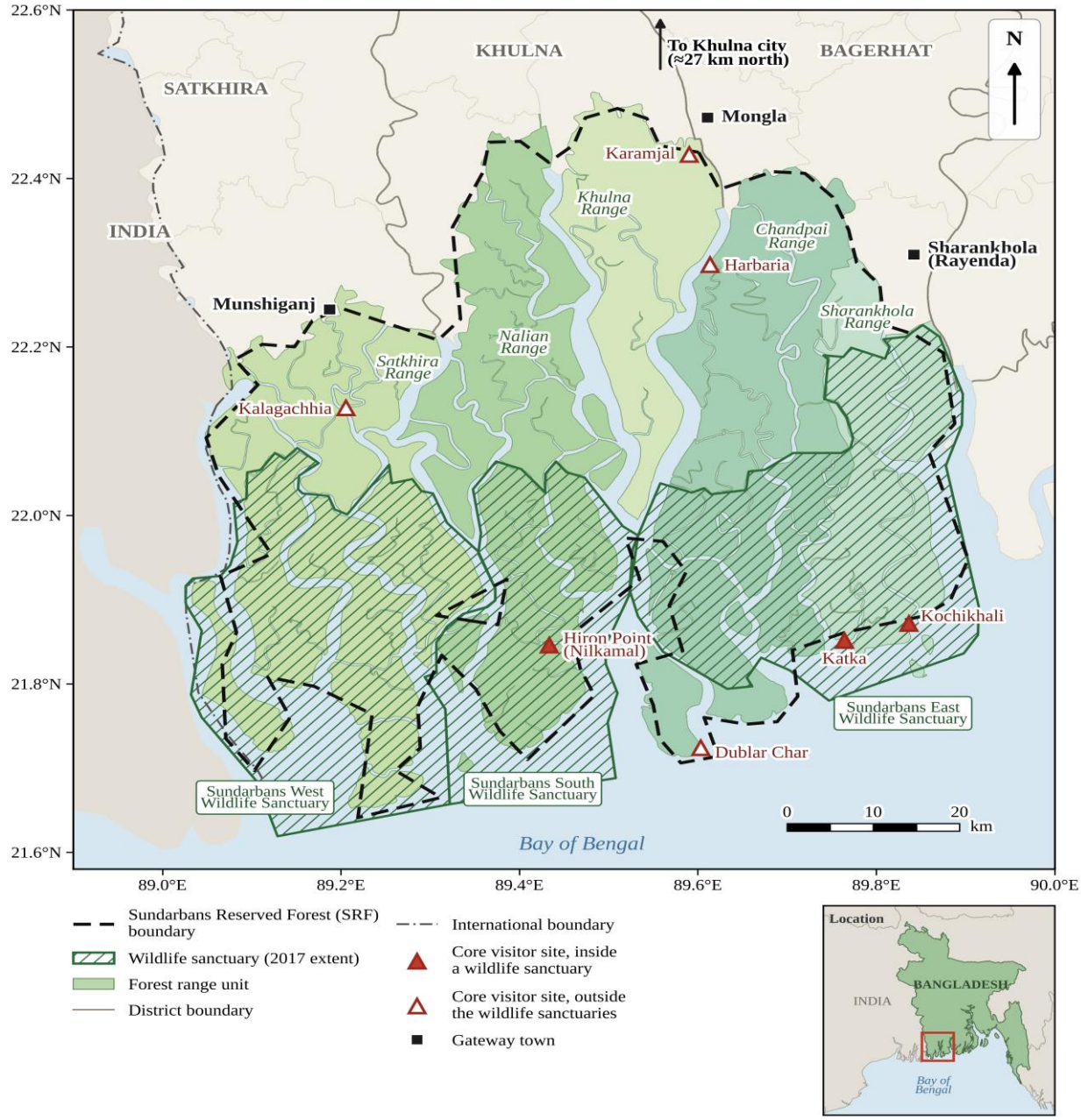

Figure 2: Study area: the Bangladesh Sundarbans, showing the boundary of the Sundarbans Reserved Forest (SRF), the three wildlife sanctuaries (2017 extent), forest range units, the seven core visitor sites (filled symbols: inside a wildlife sanctuary) and the main gateway towns. Data sources: protected-area boundaries from the World Database on Protected Areas [43]; forest range units and administrative boundaries from geoBoundaries [27]; site and town locations from GeoNames [9], with Karamjal positioned approximately; base map from Natural Earth.

Research design

The study combines an integrative literature review with a synthesis of secondary data, a geospatial analysis of visitor sites and a comparative stress-test of the framework. An integrative review draws together empirical, theoretical and grey sources to build a framework and synthesise evidence on a topic that spans disciplines [34]. The design suits the question for two reasons. The relevant evidence is spread across the remote-sensing, livelihood, governance and policy literatures, and no single dataset links tourism activity to forest outcomes in the Sundarbans. The spatial analysis and the comparative test were added to examine the framework against data that were not used to build it.

Data sources and selection

Peer-reviewed literature was identified through Google Scholar and publisher and institutional repositories. Searches combined "Sundarbans" with "tourism", "ecotourism", "forest cover", "land cover", "mangrove change", "livelihood", "dependence", "co-management" and "governance". Global searches combined "ecotourism" and "mangrove tourism" with "forest", "deforestation" and "conservation outcomes". Reference lists of included studies were followed backwards. Grey literature comprised UNESCO World Heritage Committee decisions, BFD and project documents, working papers, and national newspaper reports that quote BFD officials and records. Because much reporting on the Sundarbans appears only in Bangla, the online archives of national Bangla-language dailies were also searched, using the Bangla terms for "Sundarbans" combined with those for "tourism", "tourist", "revenue" and "permit". The BFD does not publish a continuous series of tourism statistics, so annual visitor and revenue figures were compiled from official statements reported in national newspapers and cross-checked across outlets and languages.

Sources were eligible if they (a) addressed the Bangladesh Sundarbans, the Indian Sundarbans for comparison, or global evidence on ecotourism, mangrove tourism and forest outcomes; (b) reported evidence on tourism activity, forest condition, livelihood dependence or governance; (c) were peer-reviewed, official, or attributable to an official source; and (d) were published in English or Bangla between 2000 and October 2026. Seminal theoretical and methodological works outside this window were also admitted. Opinion pieces without data and promotional travel content were excluded. The final evidence base comprised 44 sources: 25 peer-reviewed publications, including two used for theory and method, and 19 official, project, working-paper and news sources, two of them in Bangla (Table 1). Three geospatial datasets were used for the spatial analysis [9, 27, 43].

Spatial and capacity analysis

The seven core visitor sites were located from the GeoNames gazetteer [9]. Karamjal, which has no gazetteer entry, was positioned approximately (22.428°N, 89.590°E) from its reported location on the Pasur River south of Mongla. The sites were overlaid on the boundaries of the SRF and the three wildlife sanctuaries from the World Database on Protected Areas [43], and on forest range units and administrative boundaries from geoBoundaries [27], using GeoPandas in Python, and each site was classified as inside or outside a sanctuary. Published daily visitor limits for each site [2] were then compared with mean daily demand, calculated as annual visitors divided by the number of days the forest was open.

Comparative stress-test

To test whether the framework explains outcomes beyond the case from which it was built, it was applied to the Indian Sundarbans. The Indian side was chosen because it shares the ecosystem, the boat-based form of tourism and a large forest-dependent population with the Bangladesh side, but differs in tourism governance, notably through a formal rule that shares tourism receipts with forest-fringe communities. For each framework element, the outcome expected if the framework holds was stated in advance and compared with published evidence from the Indian side. Each prediction was recorded as supported, contradicted or not testable with the available evidence, and contradictions or qualifications were used to refine the framework.

Analysis

Sources were coded deductively against the framework (pathways, pressures and governance conditions) and inductively for additional themes. For each pathway and pressure, the strength of Sundarbans-specific evidence was rated on a four-point scale:

- **Strong:** quantitative, outcome-level data replicated across independent studies.
- **Moderate:** empirical data from at least one systematic study, or an official regulatory action.
- **Weak:** perceptions, single cases, official statements or programme outputs.

- **Absent:** no Sundarbans-specific evidence found.

Five indicators were derived from the compiled statistics. **Revenue per visitor** is reported tourism revenue divided by the number of visitors. The **public capture ratio** is revenue per visitor as a share of typical package prices, and indicates how much visitor spending reaches forest management; it was cross-checked against a published travel-cost estimate of tourism's economic contribution [24]. **Tourism's share of forest revenue** compares tourism receipts with total revenue from the Sundarbans. The **capacity–demand ratio** compares published daily visitor limits with mean daily visitor numbers. The **sanctuary share** is the proportion of core visitor sites that lie inside wildlife sanctuaries. Where sources disagreed, both values are reported rather than reconciled.

RESULTS

Evidence base

Finding 1: The evidence base is broad but disconnected. No source links tourism activity to measured forest outcomes in the Sundarbans. Table 1 summarises the eight evidence streams, what each shows and its main limitation for answering the research questions.

Table 1: Evidence streams used in the synthesis

Evidence stream	Sources	What it shows	Main limitation
Global ecotourism–forest studies	[5, 6, 20, 36]	Forest outcomes depend on conservation mechanisms and background deforestation pressure	Few counterfactual studies; no mangrove case found
Sundarbans tourism and tourism governance	[16–18, 28]	Community-based tourism has conservation potential; adaptive co-management aids learning	Prospective or process-focused; no forest outcomes
Forest change: remote sensing, plots and wildlife surveys	[7, 11, 19, 22, 29–32]	Stable forest extent; thinning canopy; homogenising species composition; recovering tiger numbers	Changes not attributed to tourism; 30 m imagery misses site-scale effects
Livelihoods and economic valuation	[1, 24, 42]	Poorer households depend most on the forest; tourism was about 5% of forest revenue in 2001–2010; tourism's annual economic contribution estimated at USD 53 million	Pre-dates the post-2022 tourism boom
Co-management governance	[4, 15, 21, 33]	Moderate governance quality; gap between policy and practice; limited local voice	Not specific to tourism
Comparative mangrove evidence	[10, 12, 14, 19, 35]	Formal revenue-sharing but skewed benefits in the Indian Sundarbans; mangrove tourism worldwide is mainly boat-based	Few studies; perception surveys; dated household data
Official statistics, regulation and policy	[2, 3, 8, 13, 23, 26, 37–41, 44–47]	Visitor and revenue trends, including divisional accounts reported in Bangla; closures; resort regulation; permit practices; master plan; UNESCO decisions	Mostly reported through newspapers; inconsistent series
Geospatial data	[2, 9, 27, 43]	Location of core sites relative to sanctuaries; published daily visitor limits	Generalised boundaries; one site positioned approximately

Tourism trends and fiscal flows

Finding 2: Visitor numbers grew by 69% between FY2015–16 and FY2022–23, but the official series is inconsistent and only a small share of visitor spending reaches forest management.

Table 2: Reported visitors and tourism revenue, Bangladesh Sundarbans, FY2015–16 to FY2023–24 (1 crore = 10 million)

Fiscal year	Visitors	Foreign visitors	Tourism revenue (Tk crore)	Revenue per visitor (Tk)	Source
2015–16	128,175	–	–	–	[26]
2016–17	183,890	–	–	–	[38]
2017–18	221,969	–	2.00	90	[38]
2018–19	189,570	2,261	1.51	80	[46]
2019–20	172,979	2,317	1.87	108	[46]
2020–21	146,211	320	1.57	107	[46]
2020–21, sum of divisions	–	–	1.17	–	[8]
2021–22	155,477	1,103	2.24	144	[46]
2021–22, sum of divisions	150,037	–	1.65	110	[8, 37]
2022–23	216,143	2,143	3.94	182	[37, 46]
2023–24	211,057	–	3.60	171	[26]

Note: Revenue per visitor was calculated by the author. – = not reported. Rows marked "sum of divisions" add figures reported separately for the West and East forest divisions. For FY2021–22, the West Division recorded 73,613 visitors and Tk 0.76 crore [8]; the East Division figures (76,424 visitors, including 864 foreign visitors, and Tk 0.89 crore) are those that bdnews24.com attributed to "the Sundarbans division" [8, 37].

Visitor numbers fell to 146,211 in FY2020–21, a year that coincided with COVID-19 restrictions. They then rose by 39% between FY2021–22 and FY2022–23, the first season after the Padma Bridge opened. Foreign visitors made up about 1% of the total. Revenue per visitor more than doubled, from Tk 80 in FY2018–19 to Tk 182 in FY2022–23.

The series contains three inconsistencies. First, the FY2017–18 figure of 221,969 visitors [38] exceeds the FY2022–23 figure of 216,143 that later reports present as the high point of a rising trend [26, 46]. Second, the divisional accounts reported in Bangla [8] show that a FY2021–22 figure previously reported for "the Sundarbans division" [37] refers to the East Division alone. Summed across both divisions, visitor numbers (150,037) agree with the national figure (155,477) to within 4%, but revenue (Tk 1.65 crore) is about a quarter lower than the Tk 2.24 crore reported nationally, and the gap is similar for FY2020–21 (Tk 1.17 crore against Tk 1.57 crore) (Table 2). Third, FY2023–24 revenue was described as a 30% fall from FY2022–23, although the reported values (Tk 3.94 crore to about Tk 3.6 crore) imply a fall of about 8% [26, 46]. No single, published visitor series therefore exists.

Tour packages cost Tk 4,500–7,500 per person for budget trawler trips, Tk 7,500–10,000 for mainstream three-day trips and Tk 14,500–22,000 on air-conditioned or luxury vessels [26]. At Tk 182 per visitor, forest-management receipts equal roughly 0.8–4% of the trip price. This public capture ratio is indicative, because package prices are for 2025 and revenue for FY2022–23, but an independent estimate points the same way. A zonal travel-cost study of 421 visitors put the annual economic contribution of Sundarbans tourism at USD 53 million [24], whereas BFD tourism receipts of Tk 1.5–3.9 crore a year between FY2018–19 and FY2023–24 amount to roughly USD 0.2–0.4 million at contemporary exchange rates, less than 1% of that value. Most visitor spending therefore accrues to operators, vessel owners and businesses in the gateway towns.

Tourism has nevertheless become fiscally important. From FY2001–02 to FY2009–10, tourism contributed an average of USD 42,000 a year to BFD revenue from the Sundarbans, about 5% of the USD 786,000 earned from provisioning and cultural services together [42]. Divisional accounts put tourism at 12% of the Tk 9.47 crore collected by the two forest divisions in FY2020–21 and 13% of Tk 12.38 crore in FY2021–22 [8]. Totals reported for later years are lower, at Tk 7.57 crore in FY2024–25 and Tk 6.76 crore in FY2025–26 [47], while tourism receipts reached Tk 3.6–3.9 crore in FY2022–23 and FY2023–24 (Table 2). The years differ and the later totals may not be comparable with the divisional accounts, but on either basis tourism's share of forest revenue has risen as extraction has been restricted [45].

Forest outcomes

Finding 3: Forest extent has been stable for five decades, while canopy density and species composition have changed. No study attributes these changes to tourism.

Table 3: Studies of forest and wildlife change in the Bangladesh Sundarbans

Study	Period	Data and method	Main finding
Giri et al. [11]	1973–2000	Landsat MSS, TM and ETM+; Bangladesh and India	Net change in mangrove area of about 1.2%, within classification error; turnover from erosion and accretion exceeded net change; stability credited to government protection
Mondal and Debnath [22]	1973–2010	Landsat with NDVI	No major change in total SRF area; vegetated land −4.01%, mudflats +19.69%, barren land +14.81%
Chowdhury and Hafsa [7]	1980–2020	Landsat, supervised classification (kappa 0.88–0.93)	Forest area unchanged except for river-bank and coastal erosion; shrimp ponds replaced land outside the forest
Kanan and Pirotti [19]	1975–2020	Landsat, five density classes	Dense forest in the Bangladesh part fell by 1.20% a year, while moderate (+3.62% a year) and sparse (+8.36% a year) forest expanded
Sarker et al. [29, 31]	1986–2014	110 permanent sample plots; habitat and diversity models	Rising compositional homogeneity; density hotspots of threatened species fall outside the protected-area network; historical harvesting depressed threatened species
BFD camera-trap surveys, reported in [32]	2015–2024	1,210 cameras at 605 locations in the latest survey	Tiger population of 106 (2015), 114 (2018) and at least 125 (2023–24)

Across studies, the forest's extent has been broadly stable for five decades while its canopy has thinned and its species composition has become more uniform. The drivers named are erosion and accretion, rising salinity, historical harvesting and land conversion outside the reserve. Giri et al. [11] credit the forest's stability to protection under reserve, sanctuary and international designations. No study tests for or reports an effect of tourism. Tourism's footprint is confined to a few sites and waterways and is unlikely to be detectable at the 30 m resolution of Landsat imagery, so the absence of a tourism signal is an evidence gap rather than evidence of no effect. The rise in visitors after 2015 coincided with a recovering tiger population [32]. This suggests that tourism, at current levels, has not offset the gains from stronger protection; it does not show that tourism contributed to them.

Evidence for the conservation pathways

Finding 4: All three conservation pathways are weakly evidenced in the Sundarbans. Revenue is not demonstrably linked to management, and benefits do not clearly reach the households that extract forest resources.

Table 4: Conservation pathways: Sundarbans evidence and its strength

Pathway	Expected mechanism	Sundarbans evidence	Strength
P1 Finance	Visitor fees fund patrols, monitoring and restoration	Receipts reached Tk 3.94 crore in FY2022–23 (Table 2), less than 1% of tourism's estimated economic contribution [24]; a national rule returns 50% of protected-area entry fees to co-management committees, but Sundarbans sites are absent from the published allocation table [15]	Weak
P2 Livelihood substitution	Tourism income replaces extraction income	Resort owners report jobs for hundreds of families, and one former collector reports fewer forest trips since taking a resort job [26]; conservation potential of community-based tourism argued [16]; benefits skewed to outside capital in India [10]	Weak
P3 Stewardship and presence	Guides and visitors raise awareness and deter illegal use	More than 200 eco-guides trained [3, 26]; operator clean-ups removed 12 sacks of plastic in May 2026 and 15 sacks from five visitor sites in September 2026 [13]	Weak (outputs, not outcomes)

Finance (P1). Bangladesh's protected-area co-management system includes a grant-financing arrangement, approved in March 2009, under which 50% of revenue from entry fees, parking, picnic spots, dormitories and tourist shops is returned to co-management committees [15]. The Sundarbans sanctuaries appear among the co-managed protected areas, but not in the published table of grant allocations for FY2009–10 to FY2013–14 [15]. We found no public record of how Sundarbans tourism receipts are used. Siddique et al. [33] identify weak accounting and transparency as continuing problems in Sundarbans co-management. Bangla-language reporting shows how such weaknesses can undercut revenue at the point of collection. In 2024, fishers and crab collectors renewing 4,044 forest-entry permits at six forest stations reported paying Tk 600–1,200 each against official fees of about Tk 15–50, so that informal payments (about Tk 38 lakh) were roughly 19 times the official revenue (about Tk 2 lakh) [41]. The report concerns extraction permits rather than tourism, but it indicates that publishing receipts is a precondition for the finance pathway.

Livelihood substitution (P2). The evidence consists of anecdotes and feasibility studies. Resort owners describe tourism as an alternative to illegal extraction, and a woman who once collected nipa palm and honey reports going into the forest less often since a nearby eco-cottage hired her [26]. Islam et al. [16] argued that community-based tourism has the potential to support conservation. However, the households most dependent on the forest are the poorest [1], while tourism operators and resorts are concentrated in gateway towns and along a few stretches of the forest edge [26]. The annual closure also halts tourism and extraction at the same time [23, 47], so tourism jobs cannot cushion extraction households during the months they lose forest income.

Stewardship and presence (P3). Programme outputs exist, including more than 200 trained eco-guides [3, 26] and clean-ups by the Tour Operators Association of Sundarbans [13]. No study measures whether these change visitor behaviour, waste levels or illegal activity.

Evidence on tourism pressures

Finding 5: Tourism pressures are local, water-borne and concentrated at a few core sites and along the forest edge. They are smaller than non-tourism pressures but are growing.

Table 5: Tourism pressures: evidence, location and strength

Pressure	Evidence	Where concentrated	Strength
Vessel traffic and fuel	About 65 registered launches, plus 5–7 boats outside the operators' association, operate from Khulna; smaller operators run day trips from Mongla [26]	River routes to core sites	Weak (activity data only)
Solid waste and noise	Plastic bottles, food packets and disposable plates in the forest and waterways; loud music on boats [39]; much plastic also arrives on tides from coastal settlements and fishing boats [13]	Core visitor sites	Weak

Facility construction	Trees cut or damaged while new ecotourism centres, walkways, watchtowers and ticket counters were built [8, 39]	New visitor sites	Weak
Visitor concentration	200,000–250,000 visitors a year at seven core sites [39], three of them inside wildlife sanctuaries (Table 6)	Seven core sites	Moderate (official counts)
Forest-edge development	At least 23 eco-resorts documented and about 120 claimed locally [26]; 24 ordered to close for operating in the Ecologically Critical Area without permission [40]	Forest edge in Khulna, Bagerhat and Satkhira districts	Moderate (regulatory action)
Improved access	Domestic visitors up about 45% after the Padma Bridge opened [26]	Whole destination	Weak

The pressures documented for tourism are aquatic and disturbance-related rather than clearance of forest. Their main concentration, outside the core visitor sites, is the forest edge, where resort construction outpaced regulation until the Department of Environment's 2026 closure order [40]. Forest officials themselves describe visitor numbers as a threat to biodiversity and have placed the new sites near the outer edge of the forest to draw visitors away from the interior [8]. Larger pressures come from outside tourism. The 2026 UNESCO decision focuses on industrial development in the south-west region, power generation near the property, oil and chemical spill contingency planning and the eco-hydrology of the shared delta [44]. Illegal fishing with poison and illegal entry during the closure are also reported [37, 39]. Tourism is therefore a secondary driver of pressure on the forest overall, but the leading human presence at the sites visitors use.

Spatial exposure and visitor capacity

Finding 6: Three of the seven core visitor sites lie inside wildlife sanctuaries, and published daily visitor limits are set well above average demand, so they constrain only peak days.

Overlaying the seven core sites on the sanctuary boundaries (Figure 2, Table 6) shows that Katka and Kochikhali lie in the Sundarbans East Wildlife Sanctuary and Hiron Point in the Sundarbans South Wildlife Sanctuary, within the 1996 sanctuaries that form the World Heritage property [38], where all extraction is banned [45]. At these three sites, visitors, guides and forest staff rather than resource users are the main human presence, so the quality of visitor regulation, more than livelihood substitution, decides whether tourism helps or harms the most protected parts of the forest. The other four core sites (Karamjal, Harbaria, Kalagachhia and Dublar Char) lie outside the sanctuaries, in zones where permit-based extraction continues and where livelihood substitution could matter.

Table 6: Core visitor sites: location relative to the wildlife sanctuaries and published daily visitor limits

Site	Inside a wildlife sanctuary?	Published daily limit (visitors)
Karamjal	No	Not published
Harbaria	No	1,600
Katka	Yes (Sundarbans East)	1,600
Kochikhali	Yes (Sundarbans East)	1,600
Hiron Point (Nilkamal)	Yes (Sundarbans South)	Not published
Dublar Char	No	1,600
Kalagachhia	No	1,500
Total, five core sites with a published limit	–	7,900
Total, all nine sites with a published limit, including Alibandha, Kalabogi, Dobeki and Shekhertek	–	20,900

Note: Sanctuary status was determined by overlaying site locations on protected-area boundaries [43] (Figure 2). Daily limits are from the BFD ecotourism portal [2].

The BFD publishes daily visitor limits for nine sites, ranging from 500 to 10,000 visitors a day and totalling 20,900 [2]. No limit is published for Karamjal or Hiron Point, and the basis of the limits is not stated. In FY2023–24, 211,057 visitors [26] entered the forest over about 273 open days, given the three-month closure [23], an average of about 770 a day. Even under conservative assumptions, that every visitor arrived during the six-month main season and called at four core sites, average daily site visits (about 4,640) would remain below the combined limit for the five core sites that have one (7,900). The limits can therefore bind only on peak days. As set, they do not cap visitor pressure, which strengthens the case for capping vessels rather than visitors alone (Propositions 3 and 5).

Status of the governance conditions

Finding 7: Of the five governance conditions, only spatial and seasonal limits (G3) are largely in place. Edge control (G5) and benefit-sharing (G2) are partial, and earmarked revenue (G1) and outcome monitoring (G4) are not documented.

Table 7: Status of the five governance conditions in the Bangladesh Sundarbans

Condition	Current status	Main gap	Assessment
G1 Earmarked revenue	BFD collects entry fees; a national rule returns 50% of protected-area entry fees to co-management committees [15]	No public record that the rule applies to Sundarbans tourism receipts; informal payments for forest-entry permits far exceed official revenue in one range [41]	Not documented
G2 Benefits to resource-dependent households	Co-management since 2008, with governance rated moderate and a wide gap between policy and practice [21]; limited local voice and weak accounting [33]; unequal participation and corruption reported [4]; closure food aid reached 8,324 of 23,928 registered fishers in Shyamnagar [23]	Tourism benefits are not targeted at resource users	Partial
G3 Spatial and seasonal limits	More than half of the SRF lies in sanctuaries [45]; annual three-month closure [23]; master plan proposes boat limits and dispersal of visitors [26]	Daily visitor limits (500–10,000 a site) are well above average demand and their basis is not published (Table 6) [2]; vessels are not capped	Largely in place
G4 Monitoring	Tiger surveys [32]; annual visitor statistics	No published monitoring of tourism impacts; inconsistent visitor series (Table 2)	Not documented
G5 Edge control	Ecologically Critical Area rules; 2026 closure order for 24 resorts [40]; a Strategic Environmental Management Plan informs industrial decisions in the south-west [44]	Resorts were built before enforcement; cumulative edge effects are unassessed	Partial

G3 is rated as largely in place because of the sanctuaries and the seasonal closure, not because of the visitor limits, which the capacity analysis shows to be non-binding on most days. The weakest conditions, G1 and G4, are those that would link tourism revenue to management and show whether tourism harms the sites it uses.

Comparative stress-test: the Indian Sundarbans

Finding 8: The Indian Sundarbans, which has a formal rule for sharing tourism receipts that Bangladesh lacks, supports the framework's central prediction: a benefit-sharing rule on paper did not by itself make tourism conservation-positive, because tourism income was seasonal and benefits were captured by outside capital.

The Indian Sundarbans is managed as the Sundarban Tiger Reserve (2,585 km², declared in 1973) within the Sundarban Biosphere Reserve (1989), and its national park core was inscribed as a World Heritage Site in 1987 [14]. Between 1993 and 1998, 51 Forest Protection Committees and 14 Eco-Development Committees were formed in 46 forest-fringe villages, and the Eco-Development Committees in villages adjoining the sanctuaries are entitled to 25% of tourism receipts [14]. On paper, therefore, the Indian side meets the revenue and benefit-sharing conditions (G1 and G2) that are undocumented or partial in Bangladesh (Table 7). Table 8 compares what the framework predicts with what the evidence shows.

Table 8: Stress-test of the pathways–pressures–governance framework against the Indian Sundarbans

Framework element	Prediction if the framework holds	Evidence from the Indian Sundarbans	Result
Benefit-sharing rule (G1, G2)	A formal share of receipts strengthens the finance and substitution pathways only if benefits reach resource-dependent households	Eco-Development Committees are entitled to 25% of tourism receipts [14]; only about 36% of interviewees reported any benefit from ecotourism, the poorest received none, and returns flowed mainly to remotely located capital [10]	Supported
Livelihood substitution (P2)	Substitution occurs only where tourism income is regular enough to replace extraction	Forest dependence was significantly lower among households working in tourism, but no household lived on tourism alone because the work is seasonal, and little income spilled over to other households [12]	Supported, with seasonality confirmed as a condition
Direct pressures	Boat-based tourism produces pollution and disturbance rather than forest clearance	Local residents and conservation agencies both regarded tourists as increasing pollution and harming the ecosystem [10]	Supported (perception evidence)
Forest outcome	If protection and physical processes, not tourism governance, drive landscape-scale change, forest trends should be similar on both sides	Dense forest declined by 1.60% a year in India and 1.20% a year in Bangladesh between 1975 and 2020, while moderate forest expanded on both sides [19]	Consistent; tourism effect not separable
Ownership of tourism capital	Not specified in the original framework	Benefits accrue to outside investors in India [10] and to operators and resort owners in Bangladesh [26]	Refinement: G2 should include local ownership of tourism enterprises

Two results matter for the framework. First, the Indian case separates the existence of a benefit-sharing rule from its effect. G2 must therefore be judged by who receives benefits, not by whether a rule exists, and the ownership of tourism capital is part of that condition. Second, forest trends on the two sides are broadly parallel despite different tourism governance [19], which is consistent with Finding 3 that tourism is not a detectable driver of landscape-scale forest change. The test is qualitative and rests on few studies, so it stress-tests the framework rather than validating it.

DISCUSSION

When does tourism conserve the Sundarbans?

The synthesis answers the study's question in three parts. At present, nature-based tourism is a minor and largely neutral influence on the extent of the Sundarbans, a growing source of local pressure, and a large but unlinked source of revenue. The forest's stability reflects legal protection rather than tourism. Tourism would become positive for conservation only if its revenue and benefits were tied to the forest and its pressures were capped.

These results fit the global evidence. Brandt and Buckley [5] found that ecotourism leads to deforestation where no conservation mechanisms exist and protects forests where protected areas, payments or enforcement are in place. The Sundarbans has strong mechanisms of the second kind: long-standing reserve status, sanctuaries

covering more than half the reserve, a seasonal closure and World Heritage oversight [23, 44, 45]. This explains why tourism has not been associated with clearance inside the reserve. What the Sundarbans lacks are the finance and benefit links that would make tourism actively conservation-positive (Table 7). Brandt et al. [6] found that where background deforestation pressure is low, tourism-driven development can increase forest loss. Inside the SRF, legal protection keeps clearance pressure low, so the main risk from tourism-driven development lies at the edge of the forest. The resort boom and the 2026 closure order [26, 40] are consistent with this prediction. The pattern of small receipts that are weakly linked to conservation matches Kiss's [20] critique of community-based ecotourism. The Indian Sundarbans adds a sharper lesson: a formal revenue-sharing rule has not prevented the same skew of benefits toward outside capital (Finding 8), so creating such a rule in Bangladesh would be necessary but not sufficient.

Why mangroves differ

Three features of a mangrove destination shape how tourism affects it. First, tourism is boat-based. Its pressures are fuel, noise, waste carried by tides and disturbance of wildlife along channels, rather than clearing of land, and they are poorly captured by the land-cover methods used to judge forest outcomes [7, 11, 19]. Second, the benefits of boat-based tourism accrue mainly to operators and vessel owners in gateway towns such as Khulna and Mongla [26], while many resource-dependent households live in villages along the forest margin [1]. We propose that this spatial mismatch limits livelihood substitution, and the Indian evidence on seasonal, outside-owned tourism income is consistent with it [10, 12]. Third, the annual closure removes tourism and extraction income in the same months [23], so tourism cannot serve as a buffer for extraction households unless its revenue is deliberately redistributed.

Does the framework transfer to other mangrove destinations?

These features are not peculiar to the Sundarbans. A global inventory identified 3,945 mangrove attractions in 93 countries and territories; boating was recorded at 82% of English-language attractions and boardwalks at 12%, and mangrove visitation appeared to have minimal negative impact compared with coral-reef tourism [35]. The framework's emphasis on water-borne pressures, vessel caps and the capture of boat-tour revenue by gateway operators should therefore apply to most mangrove destinations. Its weakest point for transfer is the assumption of a large forest-dependent population. Where few people extract resources, the substitution pathway (P2) and benefit targeting (G2) matter less, and revenue earmarking (G1) and spatial limits (G3) matter more. Applying the framework with primary data to a mangrove destination outside South Asia would test this expectation.

Testable propositions

Because the framework has so far been applied and stress-tested rather than validated, its main causal claims are restated here as five testable propositions. Each links a governance condition to an observable outcome and names the data that would test it, so that later studies can confirm or reject the framework rather than simply apply it:

1. **Earmarking (G1, P1).** Where a fixed share of tourism receipts is earmarked for management and publicly reported, enforcement effort per unit area will rise relative to periods or ranges without earmarking. *Test:* range-level patrol and budget records before and after earmarking.

2. **Substitution (G2, P2).** Households with a member employed in tourism will report fewer days of forest entry than matched households without one, but only where tourism income is year-round or compensates for the closure months. *Test:* a household survey in forest-fringe unions, matching households on permit holding and assets.

3. **Site pressure (G3).** Indicators of waste, noise and wildlife disturbance at visitor sites will scale with vessel numbers more closely than with visitor numbers. *Test:* repeated litter transects, noise readings and vessel counts at the seven core sites on peak and off-peak days.

4. **Edge development (G5).** Resort density will be associated with land-cover change in the Ecologically Critical Area but not inside the reserve. *Test:* high-resolution imagery around mapped resorts, compared with matched control locations.

5. **Dispersal (G3, G4).** Spreading visitors to new sites will reduce pressure at core sites only if total vessel numbers are capped. *Test:* before–after–control–impact monitoring at core and new sites.

Policy implications

The findings point to five measures for implementing the Ecotourism Master Plan [3] and the 2025–2035 Integrated Resource Management Plan [44]:

1. **Earmark and publish revenue (G1).** Apply the existing 50% grant-financing principle [15] to Sundarbans tourism receipts, publish annual accounts by forest range and visitor site, and collect ticket and permit payments through traceable digital channels to limit informal payments [41].

2. **Target benefits at resource users (G2).** Reserve a share of guiding, boat-crew and homestay roles for households holding boat licence certificates for resource collection [37], support locally owned tourism enterprises, and use tourism revenue to support these households during the closure months.

3. **Cap vessels, not only visitors (G3).** Daily visitor limits already exist for most sites [2] but are set well above average demand (Table 6); add channel- and site-level vessel limits with fuel, noise and waste standards, and require operators to carry waste back to port.

4. **Monitor outcomes (G4).** Publish a consistent monthly visitor and revenue series by site and forest division, and use before–after–control–impact monitoring of waste, disturbance and vegetation at new sites before they open fully.

5. **Enforce the Ecologically Critical Area (G5).** Complete the review of forest-edge resorts, require environmental clearance for new tourism facilities, and assess cumulative edge effects within the south-west Strategic Environmental Management Plan [44].

Limitations

The study has four limitations. First, it still relies on secondary data. Visitor and revenue figures come from official statements reported in newspapers; Bangla-language reports of divisional accounts reconcile part of the series (Table 2) but do not resolve it. Second, the design cannot identify causal effects. The absence of a tourism signal in forest-change studies reflects the scale of those studies, not proof of no effect, and the spatial and capacity analysis describes exposure rather than impact. Third, the Bangla-language search covered national newspapers but not Bangla-language academic journals, theses or unpublished BFD records, which may hold further evidence. Fourth, the comparative stress-test draws on few studies of the Indian Sundarbans and is qualitative. No primary data were collected; the field measurements and household survey specified in the propositions would test the framework directly.

CONCLUSION

Nature-based tourism in the Bangladesh Sundarbans has not yet been a demonstrable force for conservation. It has become a significant source of public revenue and a growing local pressure, while the forest's stability continues to rest on legal protection. The reason lies in the links that would turn visitor spending into conservation: most are missing, and the Indian Sundarbans shows that a revenue-sharing rule alone does not supply them. The pathways–pressures–governance framework, stress-tested against that case and refined to include the ownership of tourism capital, gives other mangrove destinations a structure for asking the same question. In Bangladesh, the Ecotourism Master Plan and the draft 2025–2035 Integrated Resource Management

Plan are the natural vehicles for putting the missing conditions in place. For research, the priority is to move from synthesis to measurement by collecting the site-level and household data that the five propositions require.

Declarations

Ethical approval: This study used only published literature and publicly available secondary data. It involved no human participants or animals, so ethical approval was not required.

Conflict of interest: The author declares no conflict of interest.

Data availability: All data used in this study are available from the public sources cited in the reference list. The compiled visitor and revenue figures are reported in Table 2, and the site locations and code used to produce Figure 2 and Table 6 are available from the author on request.

Author contributions: Partho Biswas is the sole author and was responsible for conceptualisation, methodology, data curation, formal analysis, and writing (original draft, review and editing).

REFERENCES

1. Abdullah, A. N. M., Stacey, N., Garnett, S. T., & Myers, B. (2016). Economic dependence on mangrove forest resources for livelihoods in the Sundarbans, Bangladesh. Forest Policy and Economics, 64, 15–24. https://doi.org/10.1016/j.forpol.2015.12.009
2. Bangladesh Forest Department. (n.d.). Eco-tourism in Sundarbans [Website]. Retrieved November 1, 2026, from https://sundarbantourism.bforest.gov.bd/en
3. Bangladesh Sangbad Sangstha. (2025, October 12). Master plan formulated to boost foreign tourism in Sundarbans. The Financial Express. https://thefinancialexpress.com.bd/environment/master-plan-formulated-to-boost-foreign-tourism-in-sundarbans
4. Begum, F., Lobry de Bruyn, L., Kristiansen, P., & Islam, M. A. (2021). Institutionalising co-management activities for conservation of forest resources: Evidence from the Sundarban mangrove forest management of Bangladesh. Journal of Environmental Management, 298, Article 113504. https://doi.org/10.1016/j.jenvman.2021.113504
5. Brandt, J. S., & Buckley, R. C. (2018). A global systematic review of empirical evidence of ecotourism impacts on forests in biodiversity hotspots. Current Opinion in Environmental Sustainability, 32, 112–118. https://doi.org/10.1016/j.cosust.2018.04.004
6. Brandt, J. S., Radeloff, V., Allendorf, T., Butsic, V., & Roopsind, A. (2019). Effects of ecotourism on forest loss in the Himalayan biodiversity hotspot based on counterfactual analyses. Conservation Biology, 33(6), 1318–1328. https://doi.org/10.1111/cobi.13341
7. Chowdhury, M. S., & Hafsa, B. (2022). Multi-decadal land cover change analysis over Sundarbans Mangrove Forest of Bangladesh: A GIS and remote sensing based approach. Global Ecology and Conservation, 37, Article e02151. https://doi.org/10.1016/j.gecco.2022.e02151
8. Ehsan, S. A. (2023, March 21). Sundarban theke rajosso ahoron barchhe, porjotoner chape humkite poribesh [Revenue collection from the Sundarbans is rising, while tourism pressure threatens the environment]. Prothom Alo. https://www.prothomalo.com/bangladesh/district/tipg63flo4
9. GeoNames. (2026). GeoNames geographical database [Data set]. Retrieved October 26, 2026, from https://www.geonames.org
10. Ghosh, P., & Ghosh, A. (2019). Is ecotourism a panacea? Political ecology perspectives from the Sundarban Biosphere Reserve, India. GeoJournal, 84(2), 345–366. https://doi.org/10.1007/s10708-018-9862-7
11. Giri, C., Pengra, B., Zhu, Z., Singh, A., & Tieszen, L. L. (2007). Monitoring mangrove forest dynamics of the Sundarbans in Bangladesh and India using multi-temporal satellite data from 1973 to 2000. Estuarine, Coastal and Shelf Science, 73(1–2), 91–100. https://doi.org/10.1016/j.ecss.2006.12.019
12. Guha, I., & Ghosh, S. (2007). Does tourism contribute to local livelihoods? A case study of tourism, poverty and conservation in the Indian Sundarbans (SANDEE Working Paper No. 26-07). South Asian

Network for Development and Environmental Economics. https://idl-bnc-idrc.dspacedirect.org/items/1807f1fd-097f-4ac1-a123-d2592ffc37de

13. Hossain, H. (2026, September 12). Plastic waste threatens Sundarbans as tides carry coastal pollution into forest. Dhaka Tribune. https://www.dhakatribune.com/bangladesh/nation/419699/plastic-waste-threatens-sundarbans-as-tides-carry
14. International Water Association. (2019). Landscape narrative of the Sundarban: Towards collaborative management by Bangladesh and India [Draft report submitted to the World Bank]. World Bank. https://documents1.worldbank.org/curated/en/539771546853079693/pdf/Sundarban-Joint-Landscape-Narrative.pdf
15. Islam, M. T. (n.d.). [Co-management and grant financing of protected areas in Bangladesh] [Conference presentation]. Asia Parks Congress, Working Group 4. https://www.env.go.jp/nature/asia-parks/pdf/wg3/APC_WG4-26_Md.%20Tariqul%20Islam.pdf
16. Islam, M. W., Rahman, M. M., Iftekhar, M. S., & Rakkibu, M. G. (2013). Can community-based tourism facilitate conservation of the Bangladesh Sundarbans? Journal of Ecotourism, 12(2), 119–129. https://doi.org/10.1080/14724049.2013.820309
17. Islam, M. W., Ruhanen, L., & Ritchie, B. W. (2018a). Adaptive co-management: A novel approach to tourism destination governance? Journal of Hospitality and Tourism Management, 37, 97–106. https://doi.org/10.1016/j.jhtm.2017.10.009
18. Islam, M. W., Ruhanen, L., & Ritchie, B. W. (2018b). Tourism governance in protected areas: Investigating the application of the adaptive co-management approach. Journal of Sustainable Tourism, 26(11), 1890–1908. https://doi.org/10.1080/09669582.2018.1526291
19. Kanan, A. H., & Pirotti, F. (2022). A comparative assessment of land use–land cover dynamics between Bangladesh and Indian Sundarbans from 1975–2020: A geospatial and statistical-based approach. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XLIII-B3-2022, 625–632. https://doi.org/10.5194/isprs-archives-XLIII-B3-2022-625-2022
20. Kiss, A. (2004). Is community-based ecotourism a good use of biodiversity conservation funds? Trends in Ecology & Evolution, 19(5), 232–237. https://doi.org/10.1016/j.tree.2004.03.010
21. Mollick, A. S., Roy, M., Khan, M. N. I., Islam, M. W., Sadath, M. N., & Nath, T. K. (2022). Assessing good governance in protected areas (PA) co-management: A case study of the Sundarbans mangrove forests of Bangladesh. Journal of Sustainable Forestry, 41(3–5), 277–301. https://doi.org/10.1080/10549811.2021.1923531
22. Mondal, S. H., & Debnath, P. (2017). Spatial and temporal changes of Sundarbans Reserve Forest in Bangladesh. Environment and Natural Resources Journal, 15(1), 51–61. https://doi.org/10.14456/ennrj.2017.5
23. Nature's timeout: Sundarbans closed to all for three months for wildlife revival. (2025, June 1). The Business Standard. https://www.tbsnews.net/bangladesh/natures-timeout-sundarbans-closed-all-three-months-wildlife-revival-1156896
24. Nobi, M. N., Sarker, A. H. M. R., Nath, B., Røskaft, E., Suza, M., & Kvinta, P. (2021). Economic valuation of tourism of the Sundarban Mangroves, Bangladesh. Journal of Ecology and the Natural Environment, 13(4), 100–109. https://doi.org/10.5897/JENE2021.0910
25. Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. Science, 325(5939), 419–422. https://doi.org/10.1126/science.1172133
26. Roy, D. (2025, October 31). Sundarbans faces a new test as eco-tourism surges. The Daily Star. https://www.thedailystar.net/business/news/sundarbans-faces-new-test-eco-tourism-surges-4023966
27. Runfola, D., Anderson, A., Baier, H., Crittenden, M., Dowker, E., Fuhrig, S., Goodman, S., Grimsley, G., Layko, R., Melville, G., Mulder, M., Oberman, R., Panganiban, J., Peck, A., Seitz, L., Shea, S., Slevin, H., Youngerman, R., & Hobbs, L. (2020). geoBoundaries: A global database of political administrative boundaries. PLOS ONE, 15(4), Article e0231866. https://doi.org/10.1371/journal.pone.0231866
28. Salam, M. A., Ross, L. G., & Beveridge, M. C. M. (2000). Eco-tourism to protect the reserve mangrove forest the Sundarbans and its flora and fauna. Anatolia, 11(1), 56–66. https://doi.org/10.1080/13032917.2000.9686983

29. Sarker, S. K., Matthiopoulos, J., Mitchell, S. N., Ahmed, Z. U., Al Mamun, M. B., & Reeve, R. (2019). 1980s–2010s: The world's largest mangrove ecosystem is becoming homogenous. Biological Conservation, 236, 79–91. https://doi.org/10.1016/j.biocon.2019.05.011
30. Sarker, S. K., Reeve, R., Paul, N. K., & Matthiopoulos, J. (2019). Modelling spatial biodiversity in the world's largest mangrove ecosystem—The Bangladesh Sundarbans: A baseline for conservation. Diversity and Distributions, 25(5), 729–742. https://doi.org/10.1111/ddi.12887
31. Sarker, S. K., Reeve, R., Thompson, J., Paul, N. K., & Matthiopoulos, J. (2016). Are we failing to protect threatened mangroves in the Sundarbans world heritage ecosystem? Scientific Reports, 6, Article 21234. https://doi.org/10.1038/srep21234
32. Siddique, A. (2024, October 17). Tiger population census in Bangladesh shows a hopeful upward trend in the Sundarbans. Mongabay. https://news.mongabay.com/2024/10/tiger-population-census-in-bangladesh-shows-a-hopeful-upward-trend-in-the-sundarbans/
33. Siddique, M. R. H., Hossain, M., Rashid, A. Z. M. M., Khan, N. A., Shuvo, S. N., & Hassan, M. Z. (2024). Evaluating co-management in the Sundarbans mangrove forest of Bangladesh: Success and limitations from local forest users' perspectives. Ecology and Society, 29(2), Article 8. https://doi.org/10.5751/ES-14905-290208
34. Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. Journal of Business Research, 104, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039
35. Spalding, M., & Parrett, C. L. (2019). Global patterns in mangrove recreation and tourism. Marine Policy, 110, Article 103540. https://doi.org/10.1016/j.marpol.2019.103540
36. Stronza, A. L., Hunt, C. A., & Fitzgerald, L. A. (2019). Ecotourism for conservation? Annual Review of Environment and Resources, 44, 229–253. https://doi.org/10.1146/annurev-environ-101718-033046
37. Sundarbans reopening to foresters and tourists from Sunday. (2024, August 30). bdnews24.com. https://bdnews24.com/bangladesh/5465ef603400
38. Sundarbans to get 4 eco-tourism centres. (2019, January 2). The Daily Star. https://www.thedailystar.net/country/news/sundarbans-get-4-eco-tourism-centres-1682143
39. Sundarbans under siege (Part II): Can tourism be grown without losing natural heritage? (2026, June 7). The Daily Observer. https://observerbd.com/news/578524
40. 24 resorts built near Sundarbans ordered to shut down. (2026, October 7). The Business Standard. https://www.tbsnews.net/bangladesh/24-resorts-built-near-sundarbans-ordered-shut-down-1565146
41. Uddin, I. (2024, September 8). Sundarbane probesher onumotipotro nobayone rajosher cheye 40 gun ghush aday [Bribes 40 times the revenue collected for renewing Sundarbans entry permits]. Prothom Alo. https://www.prothomalo.com/bangladesh/district/o7lzlas5nf
42. Uddin, M. S., de Ruyter van Steveninck, E., Stuip, M., & Shah, M. A. R. (2013). Economic valuation of provisioning and cultural services of a protected mangrove ecosystem: A case study on Sundarbans Reserve Forest, Bangladesh. Ecosystem Services, 5, 88–93. https://doi.org/10.1016/j.ecoser.2013.07.002
43. UNEP-WCMC & IUCN. (2026). Protected Planet: The World Database on Protected Areas (WDPA) [Data set]. Retrieved October 26, 2026, from https://www.protectedplanet.net
44. UNESCO World Heritage Committee. (2026). Decision 48 COM 7B.70: The Sundarbans (Bangladesh). UNESCO World Heritage Centre. https://whc.unesco.org/en/decisions/9109
45. United News of Bangladesh. (2017, September 16). More than half of Sundarbans now designated as 'sanctuary'. Dhaka Tribune. https://www.dhakatribune.com/bangladesh/125732/more-than-half-of-sundarbans-now-designated-as
46. United News of Bangladesh. (2024, February 14). Sundarbans Day: World's largest mangrove forest draws growing number of tourists. The Business Standard. https://www.tbsnews.net/bangladesh/sundarbans-day-worlds-largest-mangrove-forest-draws-growing-number-tourists-792746
47. United News of Bangladesh. (2026, September 1). Sundarbans reopens after three-month fishing, tourism ban. The Business Standard. https://www.tbsnews.net/bangladesh/sundarbans-reopens-after-three-month-fishing-tourism-ban-1530031