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Full Length Review Article

Ecotourism Potential and Sustainable Development in the Sundarbans: An Analytical Study of Conservation-Based Tourism, Community Participation, and Local Livelihoods

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Abstract

Background: *The Sundarbans boasts remarkable ecotourism resources, including mangrove ecosystems, tiger habitats, crocodiles, avian species, river excursions, indigenous culture, and international conservation status; however, tourism may exacerbate waste generation, maritime congestion, noise pollution, wildlife disruption, inequitable profit distribution, and vulnerability to cyclones. Sustainability is contingent upon governance and distribution, rather than only on tourist expansion. Methods: This secondary-data analysis included reserve visitation and revenue documentation; a historical series from 2003-04 to 2014-15 and a baseline for FY2024-25; five years of benefit-sharing from the Joint Forest Management Committee; an 80-participant livelihood survey in Bali-Satjelia; and contemporary directives. It used descriptive statistics, compound annual growth rate, Pearson correlation, percentage analysis, and a clear 0-5 evidential maturity rating. Data pertaining to business, employment, waste, maritime traffic, and carrying capacity were not interpolated. Outcomes: Historical visitors surged from 59,861 to 174,256, reflecting a compound annual growth rate of 10.20%, whilst reported income escalated from ₹15.08 lakh to ₹182.88 lakh, representing a 25.47% annual rise. Visitor counts and income exhibited a robust correlation across 12 data points (r=0.937, p=0.000007), however the relationship remains exploratory. In the fiscal year 2024-25, the reserve documented 365,583 domestic visitors and 3,023 international guests, culminating in a total of 368,606, with revenue amounting to ₹56.32 million. International tourists constituted 0.82%. The committee's financial allocation rose from ₹12.04 million in 2020-21 to ₹17.31 million in 2024-25, exhibiting yearly fluctuations. Evidence maturity was 60.0% with equal weighting and 57.1% when environmental protections and outcome assessments were prioritised. Conclusion: The Sundarbans have significant ecotourism potential but exhibits intermediate levels of demonstrated sustainable maturity. The priorities include adaptable carrying capacity, safer registered boats, trash and noise management, community-owned companies, transparent conservation financing, women-led value chains, cyclone-resilient activities, and yearly assessment of ecological and distributional results.*

Keywords: *Sundarbans; ecotourism; community participation; local livelihoods; conservation finance; carrying capacity; sustainable development*

1. Introduction

Ecotourism in the Sundarbans is appealing due of the interconnection of the travel, scenery, fauna, and indigenous culture. Tourists navigate the river through a vibrant mangrove delta instead of visiting a solitary confined venue. The experience may include observation towers, streams, avian fauna, alligators, marshlands, community lodgings, cuisine, artisanal products, and insights into tiger ecosystems. This generates prospects for guides, boat crews, homestays, resorts, transportation services, chefs, artisans, cultural entertainers, and conservation initiatives. Tourism also imposes environmental challenges as almost every visit relies on boats, fuel, waste management, landing locations, water, and conduct near delicate ecosystems.

The expansion of tourism does not inherently equate to ecotourism. A journey is deemed conservation-oriented only when its framework minimises environmental harm, generates dependable local advantages, fosters understanding and guardianship, and funds administration in a transparent manner. Elevated visitor counts with concentrated ownership, unregulated plastic waste, high noise levels, hazardous vessels, or animal congestion might boost income but jeopardise the same resources that sustain tourism. In contrast, a small-scale community business may provide significant

advantages to households and educate visitors, however it may be economically vulnerable if access to permits, digital marketing, funding, and transportation is inequitable (Ministry of Tourism, 2022a; Global Sustainable Tourism Council, 2019).

The Indian Sundarbans is a notably challenging sustainability challenge. Communities confront cyclones, saline inundation, erosion, restricted freshwater access, seasonal joblessness, and reliance on fishing, crab harvesting, agricultural, and forestry-related jobs. Tourism has the potential to diversify revenue streams away from hazardous extractive activities; yet, it is subject to seasonality and susceptible to storms, extreme temperatures, wildlife laws, transportation interruptions, and national or international travel disruptions. Businesses could furthermore get labour, food, fuel, and ownership from other sources, therefore diminishing local multipliers. Sustainable development assessment must therefore enquire about ownership, labour, environmental cost bearers, and the longevity of revenue beyond peak periods (De & Das, 2021; Jamal et al., 2022). The vulnerability of low-lying delta communities is underscored by climate adaptation and migration evaluations (Intergovernmental Panel on Climate Change, 2022; United Nations Environment Programme, 2023; World Bank, 2021) as well as by five successive national environmental annual reports (Ministry of Environment, Forest and Climate Change, 2021, 2022, 2023, 2024, 2025).

This study assesses recorded tourist patterns and organisations while distinguishing anticipated potential from actual results. It examines a historical series of visitors and income for the Sundarban Tiger Reserve, the official benchmark for FY2024-25, the benefit-sharing of the Joint Forest Management Committee, involvement of self-help groups, and a livelihood assessment conducted in two villages. It does not fabricate figures about boats, lodges, guides, employment, waste, or guest contentment in the absence of current public records. The objective is to determine what the evidence substantiates, ascertain the data required for carrying-capacity and benefit-distribution evaluation, and provide a destination-management framework that harmonises conservation, community involvement, and sustainable livelihoods.

2. Context of the Study and Issue Identification

The Sundarbans is concurrently a World Heritage site, a biosphere reserve, a Ramsar wetland, a tiger habitat, a populated delta, and a coastal area susceptible to disasters. These titles enhance its international tourist allure while necessitating a responsibility of stewardship. Wildlife observation and river navigation take place in areas already impacted by erosion, salinity, cyclonic activity, and deterioration of plant health. Tourism strain may be geographically focused at watchtowers, jetties, constricted waterways, picnic or accommodation groups, and village entry points, despite overall visitor statistics for the reserve seeming sustainable (UNESCO World Heritage Centre, 2025; UNESCO Man and the Biosphere Programme, 2025; Ramsar Sites Information Service, 2025; Samanta et al., 2021). The tourist resource is thus intertwined with the state of mangroves as recorded by the Forest Survey of India (2021, 2024), the Food and Agriculture Organization of the United Nations (2020), the Global Mangrove Alliance (2024), Sievers et al. (2020), and Lovelock (2024).

A secondary issue pertains to dissemination. Community engagement may include employment, ownership, supply agreements, consultation, or the acquisition of a shared benefit; these aspects are not synonymous. A seasonal worker earning little salary has less autonomy than a cooperative that owns a vessel, lodging, or processing business. In a similar vein, a total income amount does not disclose the allocation for conservation, safety, upkeep, private earnings, local salaries, or communal resources. A sustainable tourism account need to map the value derived from tourist spending to business ownership, labour earnings, local sourcing, taxation and levies, conservation efforts, and economic leakage beyond the destination.

3. Survey of Literature

National policies define ecotourism as conscientious travel to natural environments that promotes conservation and enhances local welfare. The 2022 Indian initiatives prioritise destination planning, community engagement, interpretation, standards, skill development, and oversight. Global directives also define sustainability in terms of ecological preservation, economical advantages, cultural authenticity, and governance of destinations (Ministry of Tourism, 2022a, 2022b; World Tourism Organization, 2021; Global Sustainable Tourism Council, 2019). These concepts are particularly pertinent to protected mangrove locations, where access and appropriate conduct need more regulation compared to traditional mass tourist.

The tourist literature of the Sundarbans indicates both expansion and susceptibility. Bhattacharyya et al. (2017) aggregated yearly visitation and income data for the Sundarban Tiger Reserve spanning from 2003-04 to 2014-15. The series chronicles significant expansion but occurs before to the COVID-19 upheaval and current disclosures. It continues to serve as a historical reference point as the 2024-25 annual report establishes a new official standard, but without the intervening yearly data in a unified table. The comparison should illustrate the disparity instead of suggesting an uninterrupted path.

Evidence about livelihoods indicates that tourism exists, but not as a predominant force. Jamal et al. (2022) conducted a study with 40 participants in Bali and 40 in Satjelia in 2019. Ten percent of the aggregated occupational profile was associated with tourist endeavours, in contrast to 45% for fishing and 8% for crab harvesting. In Bali, the primary challenges mentioned were animal hazards, climate change, and restricted job opportunities; conversely, in Satjelia, the predominant issue was restricted employment. The sample is restricted and intentional, however it demonstrates the potential: tourism may broaden revenue sources, but current involvement is insufficient to replace primary livelihood sectors. Comparative data from Shymnagar in the Bangladesh Sundarbans also indicates ongoing reliance on forest and aquatic resources, however its percentages are distinguished from the Indian sample (Azad et al., 2021).

Investigations into ecotourism and conservation indicate that convergence is contingent. Samal and Dash (2023) contend that tourism may bolster conservation and enhance livelihoods when institutional alignment exists; nevertheless, disparities arise when ecological expenses, inequitable advantages, or commercialisation prevail. The economic assessment of the Bangladesh Sundarbans reveals both tourist and ecosystem-service value; however, these figures are not applicable to the Indian reserve due to variations in pricing, governance, accessibility, and sampling methodology (Nobi et al., 2021). The instructional takeaway is to cultivate local metrics instead of relying on imported benefit coefficients.

Community organisations provide a pre-existing framework. The reserve report for 2024-25 delineates 26 Joint Forest Management Committees including 38 revenue villages and 26,474 hectares, with female representation in each executive body. The quantity of self-help groups linked to the system rose from 143 in 2020-21 to 173 by 2022-23 and sustained that figure until 2024-25. The allocation of funds to JFMCs fluctuated annually, however was more in 2024-25 compared to 2020-21. These metrics illustrate organisational and financial dynamics, although they fail to delineate the segment primarily linked to tourism or its allocation among households.

Environmental sustainability must consider the aggregate stress and potential for catastrophe. The sounds and velocity of boats may disrupt wildlife and lead to bank erosion; fuel and trash may compromise water quality; high visitor density can result in litter and overcrowding; lodges need freshwater, energy, sewage, and solid waste management; and frequent animal encounters can alter behaviour. Cyclones have the potential to impair tourist infrastructure and leave guests or employees isolated. Destination planning must consequently incorporate biodiversity surveillance, waste management, vessel regulations, emergency communication systems, shelters, and climate-adaptive design, rather than considering tourism in isolation from protected area and disaster management (IPCC, 2022; NDRF, 2021; India Meteorological Department, 2020).

4. Research Deficiency, Purpose, Goals, and Enquiries

The research deficiency is a contemporary, comprehensive overview linking visitor numbers, income, business proprietorship, job creation, profit distribution, ecological strain, capacity limits, and conservation results. Current references elucidate segments of this continuum but use varying years and measurements. The lack of a standardised visitor series from 2015-16 to 2023-24 hinders continuous trend analysis, and the unavailability of current enterprise and waste registrations obstructs a credible economic multiplier or ecological carrying-capacity assessment.

The research sought to: (1) analyse recorded tourism expansion and the 2024-25 standard; (2) evaluate existing evidence of livelihoods and community involvement; (3) pinpoint environmental and social challenges; (4) assess the development level of documented sustainability frameworks; and (5) recommend a community-focused destination approach. The research enquiries examined if revenue increased in correlation with past visitation, how the current demographic of visitors contrasts with the previous historical data, what community organisations and financial transactions are recorded, which aspects of sustainability are inadequately quantified, and what information is necessary prior to expansion.

5. Methods and Materials

The research used a hybrid secondary-data methodology. Distinct extraction sheets were created for historical visitors, historical income, the official benchmark for FY2024-25, JFMC share funds, self-help group totals, current community-institution metrics, and published livelihood survey statistics. Qualitative extraction included tourist assets, ecological stresses, engagement frameworks, governance protections, and suggested oversight. The main geographical entity was the Sundarban Tiger Reserve together with the neighbouring tourist villages of the Indian Sundarbans; the data from Bangladesh was contextual and not aggregated.

Investigated government reports from 2020 to 2025, records on protected areas, international tourist guidelines, and scholarly articles. Search keywords included Sundarbans ecotourism, visitors to the Sundarban Tiger Reserve, tourist income, homestays, boats, guides, livelihoods, self-help groups, community engagement, carrying capacity, waste management, plastic pollution, noise

pollution, wildlife disruption, sustainable tourism practices, and conservation financing. The 2017 historical compilation was preserved since it replicates a multi-year official reserve data not found in a current consolidated source.

Historical visitor figures were determined by summing Indian and international tourists and verified against the published numbers. The compound annual growth was determined during the period of 2003-04 to 2014-15 over 11 intervals. The revenue was preserved in lakh rupees. The Pearson correlation examined the relationship between total visits and reported income across 12 observations. Due to the temporal trends of both variables and the sequential arrangement of records, the p-value is indicative rather than conclusive, failing to establish that an increase in visits directly resulted in proportionate revenue enhancement.

The FY2024-25 benchmark had 365,583 Indian tourists, 3,023 international visitors, and documented revenues of ₹56,316,945.70. The derived metrics were total visits, foreign participation, and average revenue per documented visitor. The present total and collection were evaluated against the benchmarks of 2014-15, rather than as endpoints of an ongoing trend. No yearly rate was computed for the omitted years, and no modifications were implemented for inflation or potential changes in the fee framework.

The financial data of JFMC shares was examined over the period from 2020-21 to 2024-25 using yearly figures, total variation, and four-period compound growth. The expansion of the self-help group was assessed from 143 to 173. These indicators pertain to community-institution metrics rather than a direct series of tourist revenue: the yearly report does not confirm that each rupee of shared funds originated from tourism or illustrate the allocation at the household level. The differentiation is preserved in each table and analysis.

A sustainability evidence-maturity score was developed for 10 aspects with a clear ordinal rubric: 0, no public evidence; 1, only recognised; 2, partial or pilot arrangement; 3, consistent implementation; 4, measured implementation; and 5, result validated. The dimensions included conservation assets, community institutions, visitor and revenue statistics, benefit sharing, engagement of local enterprises, participation of women and self-help groups, waste and boat safety measures, carrying capacity utilisation, training and certification, and result assessment. Equal weights were documented, followed by a sensitivity score that allocated double weight to conservation assets, environmental protections, carrying capacity, and result assessment. The assessment measures recorded managerial maturity rather than environmental efficacy.

6. Study-Area Overview

The research examines the tourism environment of the Indian Sundarbans linked to the Sundarban Tiger Reserve, safeguarded mangrove channels, observation towers and educational sites, entry points like the Sagar-Gosaba area, and neighbouring villages that provide boats, labour, lodging, cuisine, handicrafts, and cultural activities. Tourism is mostly reliant on rivers and is influenced periodically by the risks associated with monsoons and cyclones. The examination employs official visitor and income statistics at the reserve level, together with published livelihood evidence at the village level, without considering either as indicative of the whole transboundary Sundarbans.

7. Results

Table 1. Major ecotourism resources, values, and management requirements

Resource/attraction	Visitor value	Conservation/community value	Management requirement
Mangrove river landscape	Distinctive boat-based experience	Coastal protection, carbon and nursery habitat	Route limits, speed/noise control and interpretation
Tiger habitat and watchtowers	High symbolic and viewing interest	Flagship conservation finance and awareness	No chasing/feeding; crowd and expectation management
Birds and seasonal assemblages	Photography, education and repeat visits	Monitoring and habitat protection	Quiet zones, seasonal sensitivity and trained guides
Crocodiles, terrapins and aquatic fauna	Wildlife diversity beyond tiger	Support for threatened-species programmes	Safe viewing distance and no disturbance
Village culture, food and crafts	Authentic local experience	Income, identity and women's enterprise	Consent, fair payment and local ownership

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Resource/attraction	Visitor value	Conservation/community value	Management requirement
World Heritage, biosphere and Ramsar status	International recognition	Governance legitimacy and conservation obligation	Accurate interpretation and impact monitoring

Sources: UNESCO (2025), Ramsar (2025), STR (2025), SOIB (2023), and IUCN (2024).

Table 1 identifies the resource base. The principal attractions are not independent products: mangrove scenery, tiger habitat, birds, crocodiles, river travel, village culture, and global designations form one destination system. This interdependence means that environmental degradation at creeks, jetties, or high-use wildlife sites can reduce the quality and legitimacy of the whole tourism offer. Interpretation and local cultural participation are therefore part of conservation management, not optional additions.

Table 2. Reported visitor and revenue observations for Sundarban Tiger Reserve

Financial year	Indian visitors	Foreign visitors	Total visitors	Reported collection/revenue (₹ lakh)
2003-04	59,225	636	59,861	15.08
2004-05	51,032	1,063	52,095	17.65
2005-06	63,158	749	63,907	24.33
2006-07	86,908	1,665	88,573	29.79
2007-08	84,714	2,081	86,795	33.50
2008-09	117,724	2,771	120,495	41.39
2009-10	86,973	2,867	89,840	34.33
2010-11	91,581	3,001	94,582	38.14
2011-12	124,146	3,418	127,564	83.61
2012-13	139,532	3,461	142,993	117.72
2013-14	154,119	3,638	157,757	140.76
2014-15	170,471	3,785	174,256	182.88
2024-25	365,583	3,023	368,606	563.17

Sources: Bhattacharyya et al. (2017) for 2003-04 to 2014-15; STR (2025) for 2024-25. The gap is not interpolated. Historical visitor CAGR=10.20%; revenue CAGR=25.47%.

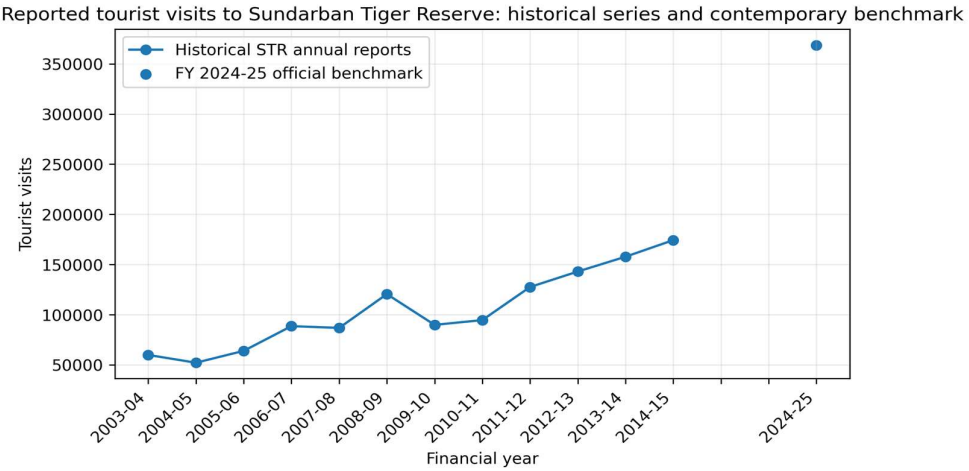


Figure 1. Reported tourist visits to Sundarban Tiger Reserve: historical series and contemporary benchmark

Source: Author chart from Bhattacharyya et al. (2017) and STR (2025). The visible gap denotes unavailable harmonised annual observations.

The historical series in Table 2 increased from 59,861 visitors in 2003-04 to 174,256 in 2014-15, an absolute increase of 114,395 and CAGR of 10.20% per year. Reported revenue rose from ₹15.08 lakh to ₹182.88 lakh, a CAGR of 25.47% per year. The FY2024-25 total of 368,606 was 111.5% above the 2014-15 benchmark, but the ten-year reporting gap prevents a continuous growth estimate.

Historical visitors and reported revenue were strongly associated (Pearson r=0.937, n=12, p=0.000007). The common upward trend and serial ordering violate a strict independence interpretation, so the coefficient is descriptive. It establishes that high-visitor years tended to be high-revenue years in the recorded series; it does not estimate spending per additional visitor or the causal effect of tourism on local income.

In FY2024-25, Indian visitors numbered 365,583 and foreign visitors 3,023. Foreign visitors formed 0.82% of the total, compared with 2.17% in 2014-15. Collections were ₹56,316,945.70, equivalent to ₹152.78 per recorded visitor. This ratio is not total tourist expenditure because accommodation, transport, food, guiding, and private enterprise revenue are not included in the same official value.

Table 3. Current tourism and community-institution indicators

Indicator	Value	Period	Interpretation
Total recorded visitors	368,606	FY 2024-25	Reserve administrative total
Foreign share	0.82%	FY 2024-25	Small visitor segment; not a value measure
Recorded collections	₹56.32 million	FY 2024-25	Not total destination expenditure
Average collection per recorded visitor	₹152.78	FY 2024-25	Administrative ratio
JFMCs / revenue villages	26 / 38	FY 2024-25	Existing community-governance platform
Area associated with JFMCs	26,474 ha	FY 2024-25	Institutional coverage, not tourism area
Women represented in JFMC executives	26 of 26	FY 2024-25	Representation; decision power/income need separate measurement
Self-help groups	173	FY 2024-25	Stable since 2022-23

Source: STR (2025); author calculations. Values do not establish household-level benefit distribution.

Table 4. JFMC share-money series and selected livelihood indicators

Indicator/year	Value	Comparison or share
2020-21	₹12.040 million	+0.0%
2021-22	₹8.904 million	-26.0%
2022-23	₹13.692 million	+13.7%
2023-24	₹18.418 million	+53.0%
2024-25	₹17.314 million	+43.8%
Fishing occupational share	45%	Bali-Satjelia survey, n=80
Tourism activities	10%	Bali-Satjelia survey, n=80
Crab collection	8%	Bali-Satjelia survey, n=80
Honey / woodcutting / boat work	6% each	Bali-Satjelia survey, n=80

Sources: STR (2025) and Jamal et al. (2022). JFMC share-money CAGR=9.51% over 2020-21 to 2024-25; funding source is not assumed to be entirely tourism.

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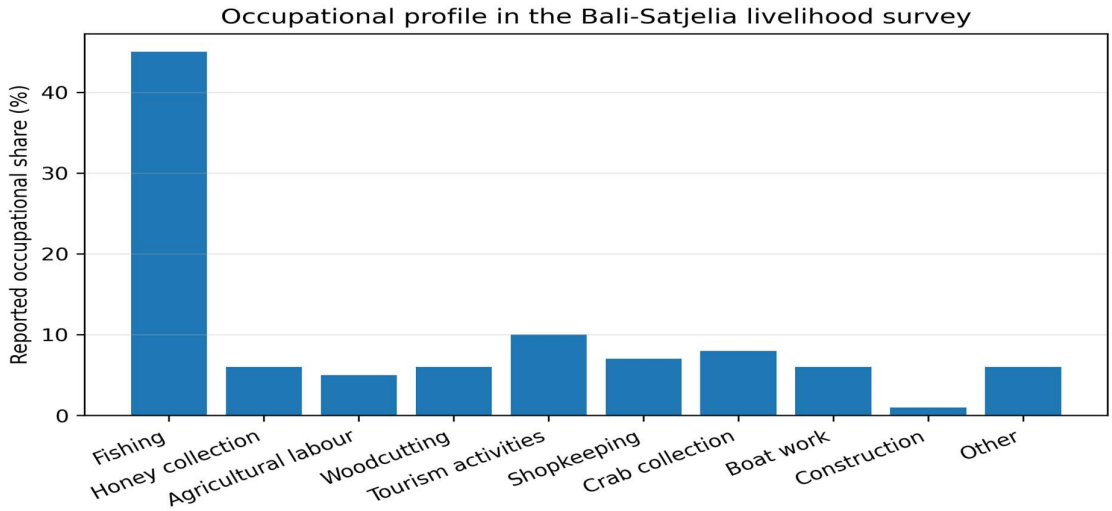


Figure 2. Occupational profile in the Bali-Satjelia livelihood survey

Source: Author chart from Jamal et al. (2022), n=80. Percentages describe the sample, not the entire Sundarbans population.

Community institutional indicators in Table 3 show 26 JFMCs serving 38 revenue villages and 26,474 hectares, with women in all 26 executive committees. Self-help groups increased from 143 to 173, or 21.0%, between 2020-21 and 2022-23 and remained at 173 through 2024-25. JFMC share money rose from ₹12.04 million to ₹17.31 million over four intervals, a compound change of 9.51% per year, but the annual series was non-monotonic.

The livelihood table shows that fishing represented 45% of the 80-person Bali-Satjelia occupational sample, while tourism activities represented 10%. Crab collection accounted for 8%, and honey collection, woodcutting, and boat work each 6%. The distribution demonstrates an existing tourism foothold but also confirms that most sampled livelihoods remained tied to aquatic, forest, agricultural, or local service activities. Tourism benefits should therefore be evaluated as diversification rather than replacement.

Table 5. Community participation and benefit-sharing mechanisms

Mechanism	Documented evidence	Potential benefit	Required verification
JFMC participation	26 committees; 38 villages; women in all executives	Collective governance and revenue sharing	Meeting influence, household reach and equity
Self-help groups	173 groups reported	Women-led food, crafts, services and savings	Active membership, profit and market access
Share money	Five annual values reported	Collective conservation-linked finance	Source, formula, timing and household use
Tourism employment	10% in two-village occupational sample	Diversification from hazardous resource work	Jobs, wages, seasonality and worker origin
Community enterprise	Supported by strategy and case literature	Ownership, local procurement and multiplier	Registered enterprises, turnover and leakage
Interpretation and guiding	Policy-supported opportunity	Visitor learning and skilled local work	Certification, quality and income

Sources: STR (2025), Jamal et al. (2022), Ministry of Tourism (2022a, 2022b) and Equator Initiative (2024).

Table 6. Environmental pressures, sustainability maturity, and evidence status

Dimension	Score (0-5)	Observed evidence or pressure	Priority data
Conservation asset	5	Global designations and active reserve management	Habitat/site condition linked to visits

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Dimension	Score (0-5)	Observed evidence or pressure	Priority data
Community institutions	4	26 JFMCs and 173 SHGs	Ownership and household benefit
Visitor/revenue data	4	Current total and collection plus historical series	Monthly route/site distribution
Benefit sharing	4	Annual JFMC share-money data	Allocation formula and use
Local enterprise inclusion	2	Tourism is 10% in one published occupational sample	Enterprise count, wages and leakage
Women/SHG inclusion	4	Women in every JFMC executive	Income and decision influence
Waste/boat safeguards	2	Pressure recognised; no consolidated waste/boat series	Waste, noise, speed and trips
Carrying-capacity use	1	No published destination-level numerical limit located	Ecological, social and infrastructure thresholds
Training/certification	2	Policy emphasis; limited public operator register	Certified boats/guides/lodges
Outcome monitoring	2	Wildlife and visitor outcomes not linked in one dashboard	Disturbance, safety, satisfaction and resident attitudes

Source: Author evidence-maturity audit using a published 0-5 rubric. Equal-weight score=60.0%; environmental-weight sensitivity score=57.1%. Scores assess documentation, not destination performance.

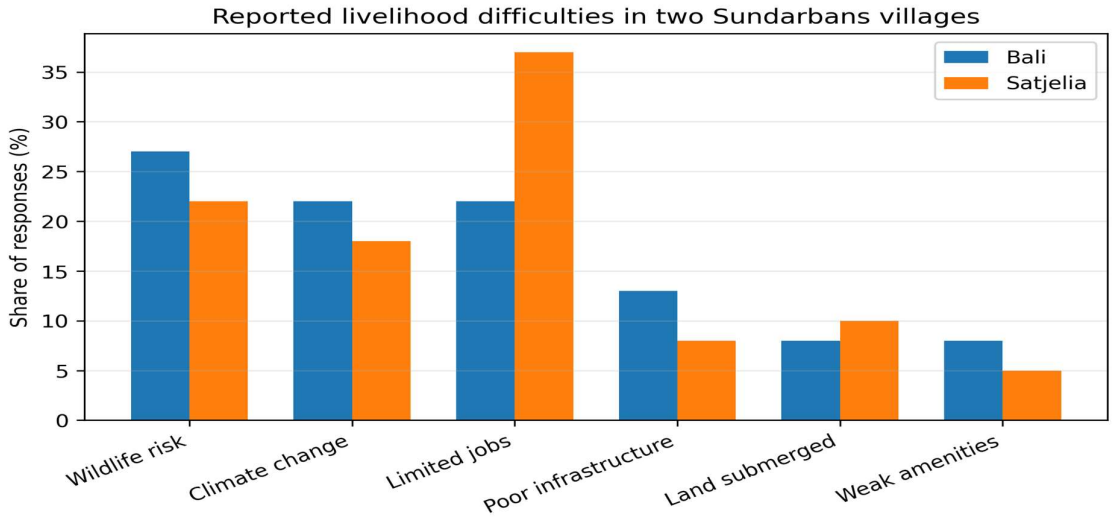


Figure 3. Reported livelihood difficulties in two Sundarbans villages

Source: Author chart from Jamal et al. (2022), 40 respondents per village.

Village concerns in Figure 3 reveal constraints on sustainable development. In Bali, wildlife risk accounted for 27% of reported difficulties, while climate change and limited employment each accounted for 22%. In Satjelia, limited employment was 37%, wildlife risk 22%, and climate change 18%. Tourism may address the employment constraint, but it remains exposed to the same climate and wildlife conditions and can create new environmental pressure if unmanaged.

The ten-dimension evidence-maturity score was 60.0% with equal weights. Scores were highest for conservation asset, community institutions, visitor and revenue data, benefit

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sharing, and women/SHG inclusion. Local-enterprise inclusion, waste and boat safeguards, training, carrying-capacity use, and outcome monitoring were weaker. When conservation, safeguards, carrying capacity, and outcome monitoring received double weight, the score declined to 57.1%, confirming sensitivity to environmental-governance gaps.

Table 6 distinguishes observed strengths, observed constraints, plausible opportunities, and risks. Global recognition and demand are documented strengths; data discontinuity and weak operational monitoring are documented constraints. Community-owned enterprises and conservation finance are opportunities contingent on implementation. Ecological crowding, leakage, elite capture, and cyclone disruption are risks rather than measured outcomes unless future monitoring quantifies them.

Table 7. Recommended sustainable-ecotourism development strategy

Strategic pillar	Immediate action	Measurable indicator	Intended outcome
Destination observatory	Monthly trip, route, enterprise and impact database	Completeness and annual public report	Evidence-based decisions
Adaptive carrying capacity	Route/site/season limits and review	Crowding, disturbance, safety and resident thresholds	Use within ecological and social limits
Low-impact vessels	Licensing, speed/noise, safety and waste rules	Compliance, incidents, fuel spills and wildlife approaches	Safer, quieter river tourism
Community ownership	Cooperatives, permits, homestays, procurement and booking access	Local ownership, wages, profit and procurement share	Higher local retention and inclusion
Conservation finance	Ring-fenced and disclosed allocation	Share to habitat, waste, community and safety	Visible tourism-conservation linkage
Skills and interpretation	Accredited guides and operator training	Certification and visitor-learning scores	Quality employment and responsible behaviour
Climate resilience	Warning, manifests, shelters and resilient utilities	Closure compliance, evacuation and recovery time	Reduced disaster loss

Source: Author synthesis aligned with Ministry of Tourism (2022a, 2022b), GSTC (2019), STR (2025), CBD (2022), and IPCC (2022).

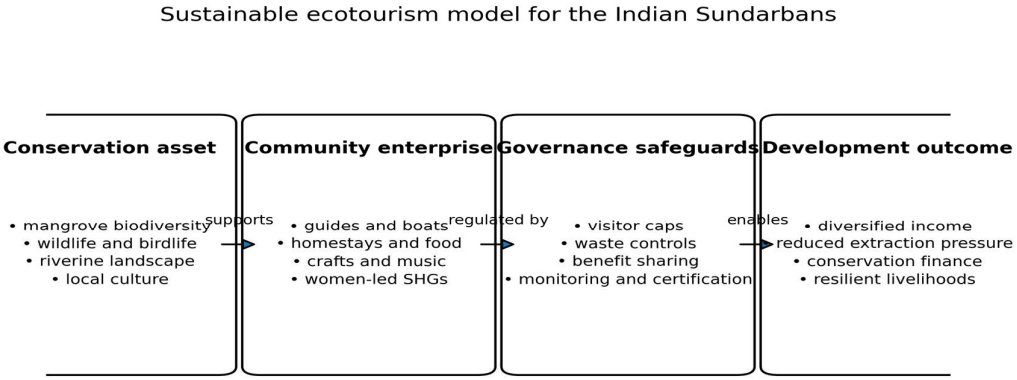


Figure 4. Sustainable ecotourism model for the Indian Sundarbans

Source: Author-developed conceptual synthesis.

The approach shown in Table 7 and Figure 4 connects conservation resources to community ventures via governance protections. The model forecasts sustainable-development advantages just when tourist restrictions, waste and vessel management, benefit distribution, certification, and oversight influence the connection. In the absence of this governing framework, the expansion of tourism may concurrently elevate income and ecological

strain, resulting in visible immediate achievements but eventual deterioration of the destination.

8. Discourse

The historical and contemporary data indicate robust tourist demand; yet, they do not confirm a consistently upward trajectory. The number of visits more than quadrupled from the previous historical observation to FY2024-25, while the intervening timeframe included significant storms, the COVID-19 pandemic, potential fee alterations, infrastructure enhancements, and variations in reporting. Displaying the two segments with an apparent interval is more convincing than using a single growth model. For strategic planning, the total for 2024-25 serves as a capacity standard that must now be broken down by month, route, watchtower, vessel, and community.

Historical income increased at a rate beyond that of visitor numbers, exhibiting a strong link. Various factors may elucidate this: escalated fees, alterations in service composition, enhanced revenue collection, extended durations of stay, or augmented visitor expenditures. The series is unable to differentiate between them. The average current collection per visitor serves administrative purposes but does not represent overall tourist spending or local economic worth. An appropriate tourist satellite account for the site need to quantify lodging, dining, maritime services, transportation, tour guides, handicrafts, salaries, local sourcing, taxes, fees, and economic leakage.

The little foreign ownership warrants careful analysis. It might signify market composition, accessibility, regulatory frameworks, travel resurgence, tourist inclinations, or classification systems. Sustainable growth does not need the optimisation of international tourists; local visitors may foster consistent demand and cultural ties. Nevertheless, the enhancement of product development, quality of interpretation, safety regulations, multilingual communication, and global marketing might elevate higher-value niches without raising overall pressure, provided that capacity is well controlled. The objective need to be on value and local retention relative to each unit of ecological effect, rather than only on tourist numbers.

Community organisations represent a relative advantage. Twenty-six JFMCs, with female representation on each executive committee, 173 self-help groups, and recorded yearly share contributions provide avenues for engagement and communal financing. Nonetheless, the existence of institutions does not equate to fair ownership in tourism. Subsequent reports need to delineate the quantity of boats, homestays, guiding services, eating establishments, and craft companies that are community-owned; the distribution of contracts; the salaries and earnings generated; and the involvement of women, younger residents, and families heavily reliant on forests.

The livelihood assessment reveals both potential and prudence. Tourism represented 10% of the analysed occupational profile, much less than fishing. This indicates that tourism could reduce dangerous exposure for some families, although it cannot be regarded as a universal substitute for fishing, crab harvesting, or agriculture. Tourism is characterised by seasonality and vulnerability to disruptions. Diversification must integrate tourism with enhancements in aquaculture, food processing, artisanal crafts, restoration jobs, and social safety nets to prevent a single vulnerability from cyclones or declines in tourist numbers.

The maturity ratings reveal a disparity in governance. Conservation assets, visitor documentation, community organisations, benefit distribution, and women's involvement are recorded more robustly than practices related to carrying capacity, environmental protections, training/certification, and result assessment. Applying double-weighting to the latter lowers the total score. This sensitivity has significant importance: a location may seem institutionally prosperous while environmental strain goes unassessed. Sustainable growth must be contingent upon addressing these monitoring and protection deficiencies.

Ecotourism must thus be administered at both destination and route levels. An aggregate yearly figure for the reserve may obscure congestion at some observation towers or constricted waterways. Capacity is influenced by seasonal variations and other factors: the sensitivity of animals, tidal and meteorological conditions, vessel safety, infrastructure at landing sites, availability of freshwater, waste disposal, community acceptance, and emergency evacuation protocols are all significant. Adaptive thresholds may vary by location and time of year and need to be adjusted via monitoring, rather than being shown as a single, unchanging maximum figure.

9. Implications for Management and Policy

Destination governance ought to consolidate the forest department, tourist officials, local administrations, disaster management entities, transportation and pollution agencies, researchers, Joint Forest Management Committees, self-help organisations, boating associations, guides, lodging providers, and community representatives. The organization need to provide a yearly sustainability report including visitor demographics, fees, local sourcing, employment statistics, business ownership, benefit distribution, trash management, vessel adherence, wildlife disruption, incidents, grievances, and conservation spending.

A license and certification framework need to define vessel capacity, safety apparatus, crew

training, speed and noise regulations, waste retention protocols, fuel spill prevention measures, route authorisations, guide proficiency, interpretation criteria, and emergency communication requirements. Digital travel records may document routes, passengers, departures, and returns, all while safeguarding personal information. Regulatory measures must be accompanied with accessible compliance assistance to prevent the displacement of small local enterprises by capital-heavy corporations.

Community advantage need to be enhanced by ownership and procurement, rather than only via communal transfers. Designated or endorsed permits, collaborative vessels, enhancement of homestay standards, companies managed by women in food and crafts, certification for local guides, access to digital reservations, and clear supplier listings help sustain spending. Public disclosures need to delineate total income, administrative expenses, conservation funding, JFMC allocations, salaries, and regional sourcing to ensure the transparency of benefit distribution.

Environmental protections need to include visitor limitations tailored to particular routes, restricted access during critical wildlife or climatic conditions, designated speed zones, regulations for silent observation, restrictions on single-use plastics, mandates for trash return, standards for sewage and freshwater at lodges, and consistent monitoring of banks and animals. Tourism infrastructure should be robust to cyclones, linked to alerts and shelters, and constructed to ensure that post-disaster reconstruction does not infringe upon mangroves or exacerbate erosion.

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