Master Plan of Saint Martin's Island

September 2025

Department of Environment
Ministry of Environment, Forest and Climate Change

Master Plan
of Saint Martin's Island

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Abbreviations and Acronyms

°C	Degree *Celsius*
AIGAs	Alternative Income Generating Activities
BBS	Bangladesh Bureau of Statistics
BDP 2100	Bangladesh Delta Plan 2100
BDT	Bangladesh Taka
BFD	Bangladesh Forest Department
BFDC	Bangladesh Fisheries Development Corporation
BGB	Boarder Guard of Bangladesh
BIMRAD	Bangladesh Institute of Maritime Research and Development
BIWTA	Bangladesh Inland Water Transport Authority
BMU	Bangladesh Maritime University
BOBLME	Bay of Bengal Large Marine Ecosystem
BORI	Bangladesh Oceanographic Research Institute
BPC	Bangladesh Parjatan Corporation
BSCIC	Bangladesh Small and Cottage Industries Corporation
BWDB	Bangladesh Water Development Board
CASE	Clean Air and Sustainable Environment
CBA-ECA	Community Based Adaptation- Ecologically Critical Area
CBD	Convention of Biological Diversity
CBT	Community Based Tourism
CC	Climate Change
CEGIS	Centre for Geographical Information and Services
CFU	Colony-Forming Unit
CMP	Conservation Management Plan
COE	Cost of Electricity
COP	Conference of the Parties
CPUE	Catch Per Unit Effort
CSV	Comma-Separated Values
CWBMP	Coastal and Wetland Biodiversity Management Project
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DDM	Department of Disaster Management
DFR	Development Results Framework
DG	Director General
DoE	Department of Environment

DoF	Department of Fisheries
DoSS	Department of Social Services
DoZ	Department of Zoology
DPE	Directorate of Primary Education
DPHE	Department of Public Health Engineering
DPP	Development Project Proforma/Proposal
DRM	Disaster Risk Management
EC	Electric Conductivity
ECA	Ecologically Critical Area
ECAMU	ECA Management Unit
ECC	Environmental Clearance Certificate
ECR	Environmental Conservation Rules
EIA	Environmental Impact Assessment
EM	Environmental Measures
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
FAO	Food and Agriculture Organization
FC	Faecal Coliform
FGD	Focus Group Discussion
FS	Feasibility Study
GBF	Global Biodiversity Framework
GEF	Global Environment Facility
GHG	Green House Gas
gm/m^2	Grams per square meter
GoB	Government of Bangladesh
H.S.C.	Higher Secondary School Certificate
ha	Hectare
HBRI	Housing and Building Research Institute
iBAS++	Integrated Budget and Accounting System
IEE	Initial Environmental Examination
IGA	Income Generation Activities
IPM	Integrated Pest Management
IUCN	International Union for Conservation of Nature
KII	Key Informant Interview
kW	Kilowatt
LGD	Local Government Division
LGED	Local Government Engineering Department

LGI	Local Government Institutions
LULC	Land use/Land cover
M&E	Monitoring & Evaluation
m^2	Square meter
MEAL	Monitoring, Evaluation, Accountability & Learning
mg/L	Milligrams Per Liter
MIS	Management Information System
MIS-MP	Management Information System-Master Plan
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forest
MoEFCC	Ministry of Environment, Forest and Climate Change
MoFL	Ministry of Fisheries and Livestock
MOSMT-MIS	Saint Martin's Tourism Monitoring Information System
MOU	Memorandum of Understanding
SMP	Strategic Master Plan
MP	Master Plan
MPA	Marine Protected Area
MRF	Material Recovery Facility
MRV	Monitoring, Reporting, and Verification
NACOM	Nature Conservation Management
NAP	National Adaptation Plan
NBSAP	National Biodiversity Strategy and Action Plan
NCS	National Conservation Strategy
NEC	National Environment Committee
NGO	Non-government Organization
NHA	National Housing Authority
NPC	Net Present Cost
NPI	National Provider Identifier
NRM	Natural Resource Management
O&M	Operation & Maintenance
ODK	Open Data Kit
PA	Protected Area
PA	Protected Area
PCM	Public Consultation Meeting
PCP	Project Co-ordination Platform
PD	Project Director
PDF	Portable Document Format
PES	Payment-For-Ecosystem Services

PES	Payment-For-Ecosystem Services
Ph.D.	Doctor of Philosophy
PIA	Program Implementing Agency
PMU	Project Management Unit
PSC	Program Steering Committee
QA	Quality Assurance
S.S.C.	Secondary School Certificate
SDG	Sustainable Development Goal
SLR	Sea Level Rise
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SMBCEDP	St. Martin's Island Biodiversity Conservation and Eco-Tourism Development Project
SMI	Saint Martin’s Island
SMTD	Saint Martin’s Tourism Dashboard
SoNG	Swatch-of-No-Ground
SOPs	Standard Operating Procedures
St.	Saint
STP	Sewage Treatment Plant
STW	Shallow tube wells
SWMR	Solid Waste Management Rules
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TALC	Tourism Area Life Cycle
TCC	Tourism/Tourist carrying capacity
TEDs	Turtle Excluder Devices
UNDP	United Nations Development Programme
UNO	Upazilla Nirbahi Officer
UP	Union Parishad
UP Chairman	Union Parishad Chairman
USD	United States Dollar
UZP	Upazila Parishad
VCG	Village Conservation Group
VGS	Vertical greening systems
WI	Winrock International
ZP	Zila Parishad

Executive Summary

Saint Martin's Island is recognized for its remarkable ecological diversity, including several coral species that are exclusive to this region of Bangladesh. The island sustains a broad spectrum of invertebrates, algae, and coral communities, serving as a critical nesting area for endangered marine turtles and an important wintering habitat for migratory birds. Nevertheless, over the past two decades, the biodiversity of Saint Martin's Island has experienced a marked decline.

The island is home to 269 plant species distributed across diverse habitats, such as mangroves, bushlands, homesteads, and dunes. Both mangrove areas and wild bushlands are ecologically sensitive and play a critical role in maintaining coastal biodiversity. The wildlife population encompasses 194 species, representing significant avian, mammalian, reptilian, and marine groups, including endangered marine turtles. SMI features approximately 66 coral species—both hard and soft varieties—positioning it as Bangladesh's unique hotspot for coral diversity. Seaweed is plentiful and contributes substantially to ecosystem energy dynamics. Fisheries boast over 475 fish species alongside a wide range of invertebrates, underpinning local livelihoods.

Tourism serves as a primary attraction for Saint Martin's Island, especially during the peak season from September to April, when daily visitor numbers range between 3,000 and 7,000. However, the island's limited area of 590 hectares is insufficient to accommodate such high tourist volume in a sustainable manner. This excessive influx has exceeded the island's carrying capacity, resulting in development that surpasses sustainable thresholds. The associated environmental challenges including increased waste and sewage production, inadequate drainage systems, unregulated growth of resorts and restaurants, habitat degradation, coral extraction, persistent poverty, limited alternative employment opportunities, unplanned infrastructure, and constraints in energy and eco-friendly transportation facilities have collectively placed significant pressure on both local ecosystems and the socio-economic stability of the resident community.

Between 2005 and 2023, developed land on SMI nearly doubled from 45.26 Ha to 86.13 Ha, with significant declines in agricultural and vegetated areas due to unregulated tourism and construction. Mangrove and waterbody areas remained relatively stable. These land cover changes contribute to habitat loss, erosion, and ecosystem instability.

In response to these challenges, a comprehensive development strategy is imperative. The Department of Environment (DoE) has initiated the "Ecosystem-Based Development, Management, and Conservation of the Saint Martin Project," which seeks to formulate a master plan for the sustainable protection, development, and management of the island's natural resources.

This study articulates a clear vision and well-defined objectives for the Master Plan (MP), which is intended to guide the island's development over the next decade, prioritizing ecosystem preservation and optimal resource management. A thorough review of relevant policies, strategies, and existing frameworks was conducted to set realistic targets aligned with the MP's overarching aims. The plan utilizes holistic methodology, establishing key priorities such as ecosystem protection, environmental stewardship, responsible resource use, and the advancement of socio-economic welfare for the island's residents.

The MP recommends limiting tourism to approximately 500–900 visitors per day within designated areas to prevent ecological degradation. It restricts tourism activities to 4.1 km of beach in the General Use Zone to maintain conservation priorities.

The development of the Saint Martin's Master Plan entails the formulation of a framework that articulates the island's overarching vision, physical configuration, principal growth components,

business rationale, delivery strategies, and guidelines for execution. Integral to this process has been public engagement through consultations and Focus Group Discussions (FGDs), ensuring that stakeholder perspectives and community preferences inform and guide the creation of sustainable solutions.

The strategy outlined in the plan encompasses both tangible and intangible interventions, placing equal importance on socio-economic progress and sustainable natural resource management. Following an assessment of primary community concerns and development priorities, nine sectors have been identified for the MP, which comprises 26 focused programs across the nine sectors designed for efficient implementation by relevant agencies.

The sectors that have been identified for the development of the program are: Sustainable Tourism Management; Conservation of Fish Resources and Benthic Communities; Protection of Coral Resources and Associated Flora and Fauna; Conservation of Turtles and Nesting Sites; Terrestrial Flora and Fauna Development and Preservation; Waste Management; Groundwater Management; Enhancement of Internal Road Communication and Green Infrastructure; and Livelihood Improvement Initiatives.

Implementation is organized into short-term (1–3 years), medium-term (1–5 years), and long-term (1–10 years) actions. The total estimated investment amounts to 547.9 million BDT, allocated across 12 high-priority programs (194.5 million BDT), 3 top-priority initiatives (115.0 million BDT), 8 medium-level undertakings (138.4 million BDT), and 3 low-priority actions (100.0 million BDT).

The Saint Martin's Island investment plan integrates comprehensive desk reviews, field studies, and stakeholder consultations to evaluate ecosystem requirements and establish intervention priorities. With a total allocation of 547.9 million BDT, the Ministry of Environment, Forest and Climate Change receive the principal share of funding. Implementation encompasses public sector projects, subject to government endorsement and ADP funding, in addition to private sector involvement in areas such as biodiversity conservation, waste management, sustainable tourism, and coral reef protection. This multi-faceted approach fosters coordinated and sustainable development of the island's ecosystem.

Oversight of the Saint Martin's Island Master Plan will be undertaken by the Department of Environment (DoE), operating in conjunction with the Ministry of Environment, Forest and Climate Change. Progress on the Plan's 26 initiatives, spanning six thematic domains, will be systematically tracked through an indicator-based Management Information System (MIS), ensuring consistent alignment with national objectives. Governance structures, including a Permanent Steering Committee, relevant technical committees, and a Project Coordination Platform, will promote interagency collaboration and active engagement of development partners. These mechanisms are designed to provide rigorous monitoring of ecological, physical, and financial outcomes throughout the Plan's implementation. The MP establishes mechanisms for ongoing monitoring, evaluation, and adaptive management using an indicator-based Management Information System. Maintenance plans cover preventive, periodic, and emergency activities to ensure infrastructure and ecological health. Capacity building and training programs are integral to effective implementation.

The Master Plan is designed to enhance Saint Martin's Island as a leading tourist destination, improve residents' quality of life, and protect the island's natural resources through coordinated efforts across multiple sectors. Achieving these objectives relies on robust collaboration among governmental entities, local communities, tourism stakeholders, and environmental organizations to ensure sustainable results and support progress toward the Sustainable Development Goals (SDGs).

1. Introduction

1.1 Context

The Master Plan (MP) for Saint Martin's Island (SMI) establishes a comprehensive, long-term framework to guide biodiversity conservation, sustainable tourism management, and resilient community livelihoods. This plan serves as a roadmap intended to balance ecological integrity with socio-economic objectives, ensuring protection of the island's unique natural assets while encouraging environmentally responsible development. By integrating conservation measures with local community needs and aligning with national development strategies, the MP seeks to safeguard ecosystems of global significance and deliver sustainable benefits to present and future generations.

Saint Martin's Island represents Bangladesh's only coral-bearing ecosystem, supporting diverse communities of invertebrates, algae, and fish that are of considerable ecological, cultural, and economic importance. The island's resources are fundamental to local livelihoods, particularly through fisheries and tourism. However, escalating threats such as unregulated tourism, extraction of corals and shells, unsustainable fishing practices, and susceptibility to climate change and extreme weather have accelerated environmental degradation. These challenges place significant stress on coral habitats, threaten biodiversity, and compromise essential ecosystem services including shoreline protection, food security, and tourism-derived income.

In recognition of these vulnerabilities, the Department of Environment (DoE), has designated SMI as an Ecologically Critical Area (ECA), prioritizing its conservation. Despite previous conservation initiatives, progress has been limited by disjointed efforts, data deficiencies, limited enforcement capabilities, and the lack of an integrated planning approach. To address these issues, the DoE launched the "Ecosystem-Based Development, Management, and Conservation of the Saint Martin Project," promoting a holistic strategy that synchronizes ecological preservation with socio-economic development.

As part of this study, extensive Natural Resource Surveys and related activities have been conducted to establish baseline data concerning coral communities and associated marine biodiversity, including fish, molluscs, echinoderms, cnidarians, crabs, lobsters, as well as algae and seaweeds. These findings underpin scientific conservation planning, monitoring protocols, and adaptive management practices. Leveraging this foundation, the Master Plan will implement an integrated approach encompassing ecosystem stewardship, climate adaptation, sustainable tourism regulation, and collaborative community management, thereby ensuring the enduring ecological health and socio-economic resilience of Saint Martin's Island.

1.2 Guiding Principles

The Master Plan for Saint Martin's Island is underpinned by an integrated framework that prioritizes ecosystem and biodiversity conservation, while simultaneously advancing sustainable development and enhancing resilience to disasters and climate change. The guiding principles outlined below form the basis for all proposed directions:

i. Ecosystem and Biodiversity Conservation

- The island's distinctive coral reef ecosystems, seaweed beds, mangrove areas, screw-pine thickets, marine turtles, and associated biodiversity are regarded as its principal assets.

- Conservation of critical habitats, restoration of degraded ecosystems, and the establishment of protected zones, including no-take and buffer areas are designated as key priorities.
- Biodiversity-friendly management policies will be implemented to safeguard ecological integrity and ensure long-term sustainability.

ii. Sustainable Development in Harmony with Nature

- All development activities, encompassing tourism, fisheries, and infrastructure expansion, are required to adhere to the island's ecological carrying capacity and incorporate environmentally responsible land use practices.
- The advancement of eco-tourism, renewable energy projects, and green infrastructure is intended to alleviate pressure on natural systems, while also supporting local livelihoods.
- Efforts will focus on achieving equilibrium between economic growth and the preservation of fragile ecosystems.

iii. Climate Change Adaptation and Disaster Risk Reduction

- Given the island's significant vulnerability to sea-level rise, cyclones, and storm surges, climate-resilient planning is imperative.
- Natural defenses, such as mangroves, screw-pines, and coral reefs, will be restored and managed as core components of ecosystem-based disaster risk reduction strategies.
- Furthermore, disaster preparedness initiatives, early warning mechanisms, and resilient community infrastructure will be systematically incorporated into development planning.

iv. Participatory and Inclusive Management

- Active engagement of local communities, traditional resource users, women, and youth will be facilitated in all phases of planning and decision-making processes.
- Co-management models will be encouraged to foster shared ownership and accountability for conservation and resource utilization.

v. Policy Integration and Alignment with Global Commitments

This Master Plan is aligned with national policy documents including the Bangladesh Climate Change Strategy and Action Plan, Coastal Zone Policy, and National Biodiversity Strategy and Action Plan as well as key international frameworks such as the Convention on Biological Diversity (CBD), Ramsar Convention, Sustainable Development Goals (SDGs), and the Sendai Framework for Disaster Risk Reduction.

1.3 Vision, Goal and Objectives

1.3.1 Vision

The Master Plan (MP) for Saint Martin's Island aims to protect the island's distinctive ecosystems and biodiversity, while promoting sustainable practices in land use, tourism, fisheries, groundwater management, and livelihood development. The plan articulates a vision of an island where ecological integrity and human well-being are harmoniously balanced, underpinned by principles of long-term resilience and sustainability.

1.3.2 Goal

The purpose of the master plan is to systematically define the optimal development within the planning authority's jurisdiction. Although objectives may differ, the master plan establishes clear policy statements, land use guidelines, and conservation principles. These are substantiated by maps and data, thereby providing legal legitimacy for actions taken by the planning authority.

1.3.3 Objectives

The Master Plan for Saint Martin's Island has been meticulously developed to prioritize the conservation of the island's distinctive ecosystems and biodiversity, while also facilitating the sustainable utilization of its natural resources. This plan establishes a robust framework that balances ecological preservation with livelihood enhancement, tourism governance, and active community involvement. The principal objectives of the plan include:

- **Conservation of Ecosystems and Species:** Safeguard and rehabilitate critical habitats including coral reefs, mangroves, seagrass beds, and endemic species to promote ecological resilience.
- **Sustainable Resource Management:** Advocate for the responsible management of fisheries, forests, freshwater resources, and other natural assets, ensuring these activities without compromising ecosystem integrity.
- **Climate and Disaster Resilience:** Augment coastal protection measures, disaster preparedness, and climate adaptation strategies to protect both natural habitats and local communities.
- **Regulated Land Use and Development:** Define designated zones for conservation, residential settlements, eco-tourism, and economic activities, ensuring all development aligns with biodiversity conservation objectives.
- **Community Engagement and Empowerment:** Involve local communities as key custodians of biodiversity by fostering their engagement in decision-making, monitoring, and equitable benefit-sharing processes.
- **Eco-Tourism and Green Economy:** Encourage low-impact tourism and the growth of green businesses that contribute economically while upholding conservation priorities.
- **Research, Education, and Awareness:** Advance ecological research initiatives, ongoing monitoring, and public education programs to reinforce biodiversity protection efforts.
- **Policy and Governance Support:** Implement comprehensive legal, institutional, and financial mechanisms to secure effective, long-term management and regulatory compliance.

2. Environmental Setting

2.1 Administrative Locations

Saint Martin's Island, also referred to locally as Narikel Jinjira, is a small coral island situated in the southernmost region of Bangladesh within the Bay of Bengal. The island is administered as part of Saint Martin's Union (No. 6), under Teknaf Upazila in the Cox's Bazar District of the Chattogram Division. Positioned approximately 13 km south of the tip of the Teknaf Peninsula and around 9.5 kms west of Myanmar's northwest coast, it is notable for being the only coral-bearing island in Bangladesh. Administrative functions are conducted through the local Union Parishad under the oversight of the Teknaf Upazila Parishad. Due to its strategic proximity to the maritime boundary, law enforcement and coastal security are managed by both district and national authorities.

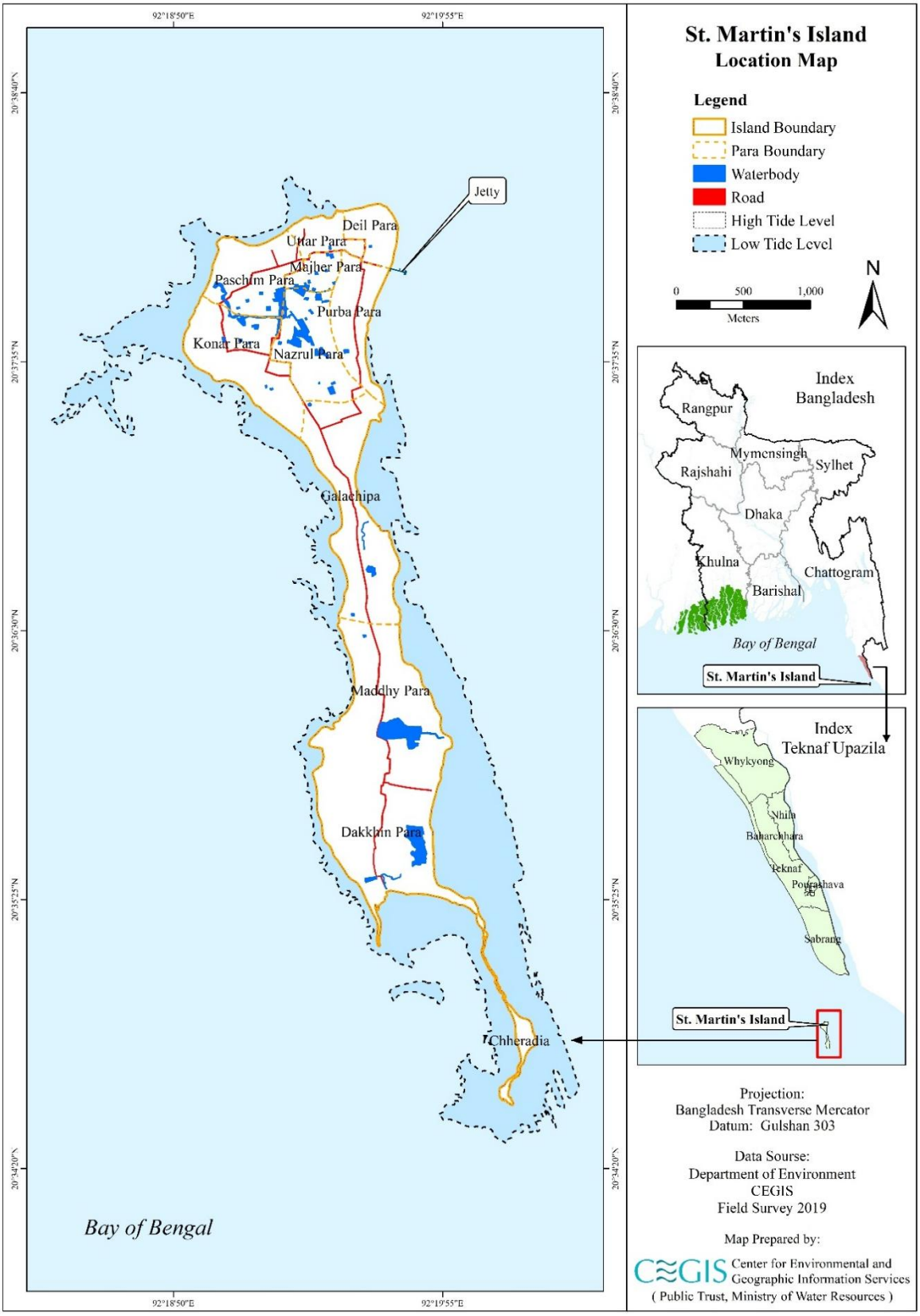


Figure 2.1: Base Map of SMI

2.2 Physical Settings

2.2.1 Geology and Topography

The geology of Saint Martin's Island is principally characterized by the St. Martin Limestone Formation, which comprises two predominant types of molluscan coquina (shelly limestone) that function as the chief sources of freshwater, along with coralline limestone formed by coral aggregations. The island represents a sedimentary continental landmass and is likely associated with the Chittagong-Yama–Arakan folded system. Its foundational layer consists of Girujan Clay Shale (Pliocene), interspersed with sandstone and overlain by the St. Martin Limestone (Pleistocene), distinguished by coarse-grained, partially consolidated strata and cream-hued coral accumulations.

In terms of topography, the island can be divided into three principal landforms: high land, back slope, and valley, as detailed in Table 2.1 below.

Table 2.1: Topography of St. Martin Island

Land Type	Land Use
High Land	Settlement, agriculture, market, mosque, school, hotel
Back Slope	Beach, drying fish, shop, vegetation
Valley	Water body, coral formation, fishing

2.2.2 Drainage Network

Saint Martin's Island lacks a formal drainage system and relies exclusively on natural drainage shaped by tidal patterns and topography (Muhibbullah and Sarwar, 2017). The absence of a structured drainage plan has led to localized waterlogging and associated issues across the island.

Multiple challenges affect Saint Martin's Island's drainage network due to its unplanned development. Data indicates that drainage congestion is the most prominent issue, impacting 41% of the area, while waterlogging affects 27%. Additional concerns include salinity intrusion (12%), overflow (7%), and minor impacts on agriculture (9%) and other sectors (4%). These findings underscore the need for comprehensive drainage planning to safeguard the island's ecosystems and support local livelihoods.

2.3 Natural Resources

2.3.1 Soil and Land Use

This island has been entirely developed atop coral beach sand. The soil remains relatively young and is predominantly in its initial formation stages, resulting in a sandy texture throughout. Drainage and moisture levels within the soil are assessed as moderate and medium, respectively.

Current land use on St. Martin's Island is primarily characterized by intertidal or rocky areas (34.1%), followed by intertidal zones (18.6%), agricultural land (18.4%), hotels and resorts (5.5%), settlements (5.4%), and beach or sand areas (5.1%). Detailed information regarding existing land use can be found in Table 2.2 and Figure 2.2.

Table 2.2: Existing Land Uses in St. Martin's Island

Land Use Class Name	Area 2023 (acres)	Percentage
Inter Tidal Area/Rocky	576.4	34.1
Inter Tidal Area	314.2	18.6
Agricultural Land	311.3	18.4

Land Use Class Name	Area 2023 (acres)	Percentage
Hotel and Resort	92.1	5.5
Settlement	90.6	5.4
Beach/Sand	85.8	5.1
Cultivated Trees	65.1	3.9
Wild Bushland	46.6	2.8
Lagoon	24	1.4
Keya	23.8	1.4
Current Fallow Land	16.3	1.0
Road	10.7	0.6
Administrative area	9.4	0.6
Mangrove	8	0.5
Khal	4.9	0.3
Pond	4.1	0.2
Marine Park	2.9	0.2
Restaurant and Bazar	2.5	0.1
Total	**1688.7**	**100.0**

Source: CEGIS, 2023

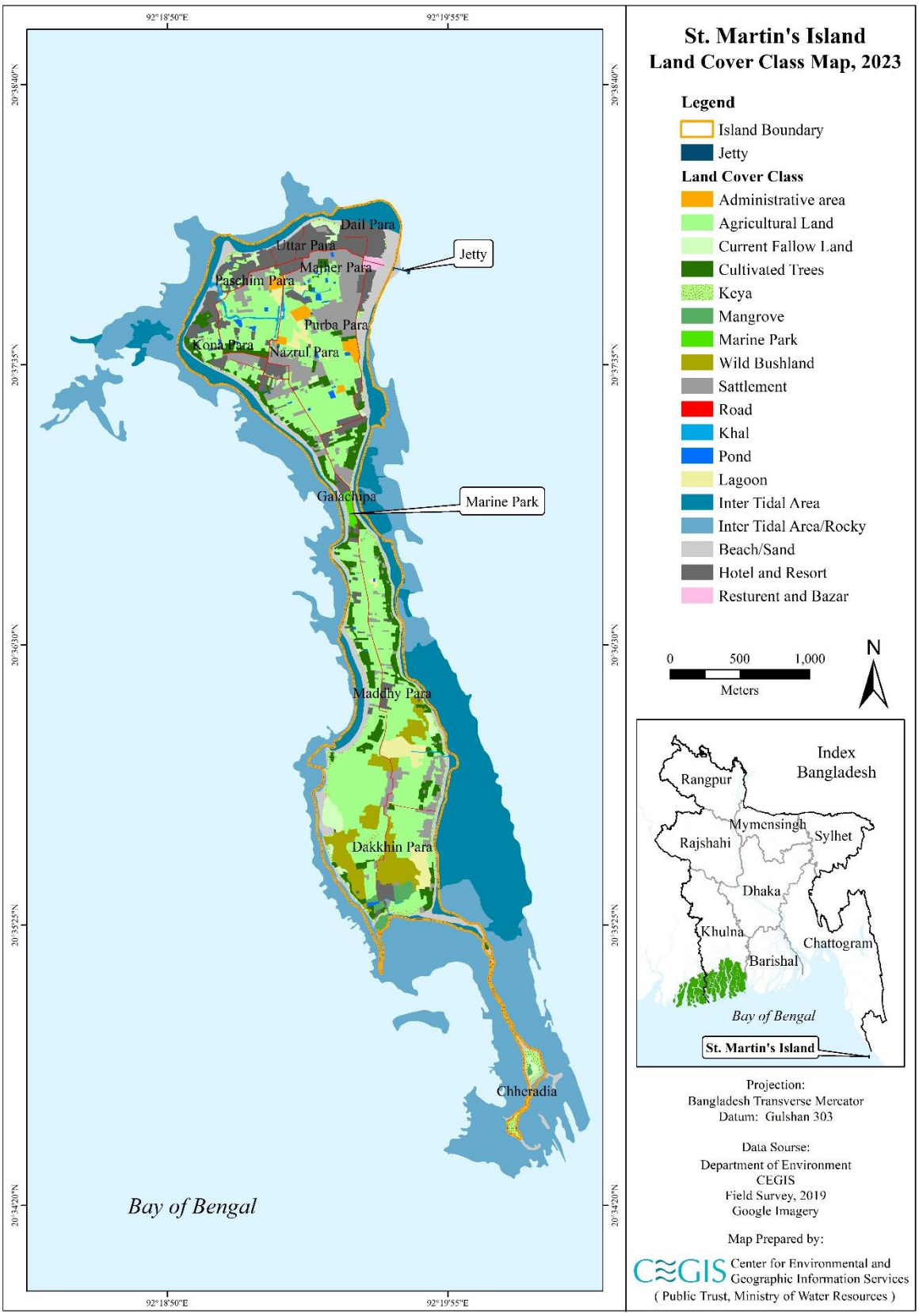


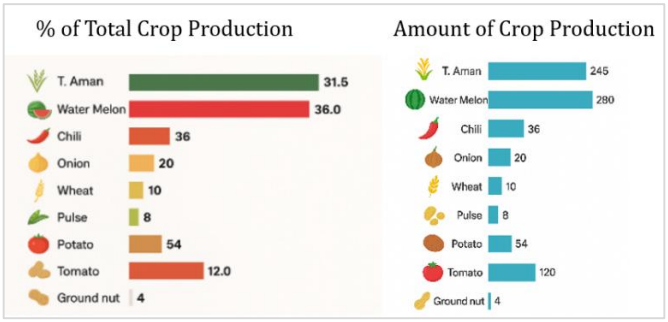
Figure 2.2: Land Use of St. Martin's Island

2.3.2 Agriculture

Agricultural practices on Saint Martin's Island are limited in scope yet remain essential to local livelihoods. The community primarily engages in the cultivation of rice and vegetables for domestic use, supplemented by modest production of watermelon, wheat, and ground nuts. Predominant cropping patterns include fallow–Aman and fallow–Aman–vegetable rotations, which correspond to a cropping intensity of 133%. Single-crop systems account for more than 60% of the cultivated land area. Comprehensive information regarding cropping patterns and yield statistics can be found in Tables 2.3 and Figure 2.2.

Table 2.3: Cropping Scenario of St. Martin's Island

SL. No.	Cropping Pattern	Area (ha)
1	Fallow-Aman-Water melon	4
2	Fallow-Aman-Chili	3
3	Fallow-Aman-Onion	5
4	Fallow-Fallow-Aman	44
5	Fallow-Aman-Vegetables	14
6	Fallow-Fallow-Ground Nut	1
7	Fallow-Fallow-Wheat	1
8	Fallow-Fallow-Pulse	3
9	Fallow-Fallow-Potato	3
	Total Area	**78**



Source: Upazila Agriculture Office (Teknaf), 2020

Groundwater irrigation plays a critical role in sustaining agriculture within the region, enabling consistent crop production throughout the year. Although T. Aman rice cultivation initially depends on rainfall, supplemental irrigation is applied in later growth stages to improve yields. Crops grown during the Rabi season rely exclusively on groundwater, which is primarily extracted using shallow tube wells (STWs). According to CEGIS, approximately 2,000 million cubic meters of groundwater are utilized annually for irrigation purposes with notable efficiency.

2.3.3 Floral Diversity and Distribution

Saint Martin's Island (SMI) supports a notably rich and diverse flora, with 269 plant species documented across 76 families. This assemblage comprises 113 herbs, 54 shrubs, 71 trees, and 31 climbers. Among the most prevalent trees are Narikel (*Cocos nucifera*), Kathbadam (*Terminalia catappa*), Supari (*Areca catechu*), Jhaw (*Casuarina equisetifolia*), Sheora (*Streblus asper*), and Poresh pipal (*Thespesia populnea*). The shrub stratum is primarily dominated by Keya (*Pandanus foetidus* and *Pandanus odoratissimus*), Bhola (*Hibiscus tiliaceus*), Nishinda (*Vitex negundo*), Hargoza (*Acanthus ilicifolius*), Akanda (*Calotropis gigantea*), and Bhenna (*Ricinus communis*). Common herbaceous species include Fulkori (*Ageratum conyzoides*), Batuashak (*Chenopodium album*), Durba grass (*Cynodon dactylon*), Tukma (*Hyptis suaveolens*), Bhat *(Clerodendrum viscosum*), Brammi (*Bacopa monnieri*), and Kanchira (*Commelina diffusa*). Noteworthy climbing plants include Sagor lota (*Ipomea pes-caprae*), Nata (*Caesalpinia bonduc*), and Nekungruibi (*Tetrastigma angustifolia*). The island's flora encompasses both indigenous and 21 introduced species; certain taxa such as Bain (*Avicennia marina*) and Gewa (*Excoecaria agallocha*) are experiencing declines and may be at risk locally.

Distinct habitat-wise vegetation patterns are evident on SMI. Homestead zones contain 128 species, including economically important timber and fruit trees such as Narikel and Kathbadam. Wild bush areas support 110 species, predominantly herbs and shrubs with applications in fodder and traditional medicine. Roadside environments host 65 hardy species, mainly herbs and shrubs like Akanda and Durba grass. Agricultural fields comprise 66 taxa, including vegetable crops such as Batuashak and watermelon (*Citrullus lanatus*). Dune systems are characterized by Keya and associated shrubs, whereas mangrove habitats house 24 species—including Bain, Goran (*Ceriops decandra*), and Gewa—which play a crucial role in coastal stabilization. Wetlands and lagoons support 14 primarily herbaceous species, such as Sij (*Phyllanthus distichus*) and Chanchi (*Alternanthera sessilis*). Local communities utilize 35 fruit species, 33 ornamental taxa, 35 vegetable species, 32 timber resources, 22 medicinal plants, and 27 fodder species. These habitat-specific vegetation assemblages underscore the ecological and socio-economic value of Saint Martin's Island's plant diversity, highlighting the imperative for its effective conservation and sustainable management.

Table 2.4: Summary Information of Plant Species Recorded from SMI

Category		Local Status		Uses		Habitat Types	
Types	**No.**	**Status**	**No.**	**Category**	**No.**	**Habitat**	**No.**
Herb	113	Very Common	11	Vegetables	35	Agriculture Land	66
Shrub	54	Common	18	Fruit	36	Homestead	128
Tree	71	Fairly Common	69	Medicinal	22	Mangrove	24
Climber	31	Less Common	113	Ornamental	33	Roadside	65
-	-	Rare	58	Timber	32	Sand Dune	14
-	-	-	-	Fodder	27	Wetland	14
-	-	-	-	Unknown use	84	Wild Bush	110
Total	**269**	**-**	**269**	**-**	**269**	**-**	**-**

Figure 2.3: Wetlands and Lagoons of Saint Martin's Island

2.3.4 Mangrove and Bushlands

Mangrove vegetation patches are situated along the southern side of Dakkhinpara and encompass 24 mangrove and mangrove-associated plant species, including 9 herbs, 7 shrubs, 5 trees, and 3 climbers. Prominent mangrove species in this area are Hargoza (*Acanthus ilicifolius*), Bhola (*Hibiscus tiliaceus*), Bain (*Avicennia marina*), Goran (*Ceriops decandra*), and Gewa (*Excoecaria agallocha*) (NCSIP-1, 1997a; DoE, 2020a). Furthermore, the wild bush habitats distributed across Dakkhinpara support 77 plant

species and provide critical shelter and foraging opportunities for a diverse array of marine and terrestrial fauna, such as birds, reptiles, and crabs.

Both mangrove and bushland ecosystems are ecologically sensitive and play an essential role in sustaining coastal biodiversity. Nevertheless, these habitats face increasing threats from anthropogenic pressures, including tourism activities, fuelwood and thatch harvesting, agricultural land expansion, and ongoing coastal erosion. Ensuring the conservation and sustainable management of these areas is imperative to maintain their ecological integrity and to support the myriad species dependent on them.

Figure 2.4: Mangroves and Bushlands of Saint Martin's Island

2.3.5 Other Vegetation

The vegetation of Saint Martin's Island (SMI) encompasses homestead gardens, cultivated crop fields, and roadside greenery. Surveys identified 65 plant species along the island's roadsides, including 29 herbs, 8 shrubs, 23 trees, and 5 climbers. Homestead areas exhibit greater botanical diversity, supporting 128 plant species, while agricultural lands are home to 66 species. Despite their ecological and economic significance, these managed habitats are subject to considerable pressure due to local demand for fuelwood and thatching materials, which are harvested not only from homestead vegetation but also from adjacent mangroves and bushland.

Figures 2.3 and 2.4 above illustrate the various floral habitats present on SMI.

2.3.6 Wildlife Diversity

Saint Martin's Island hosts a significant diversity of wildlife, encompassing marine and coastal species as well as terrestrial fauna such as birds, reptiles, amphibians, mammals, and a variety of invertebrates that flourish within its distinct island habitats. To date, 194 wildlife species have been documented on Saint Martin's Island; however, ongoing year-round research may reveal additional species. The composition and abundance of these species are presented in Figure 2.5.

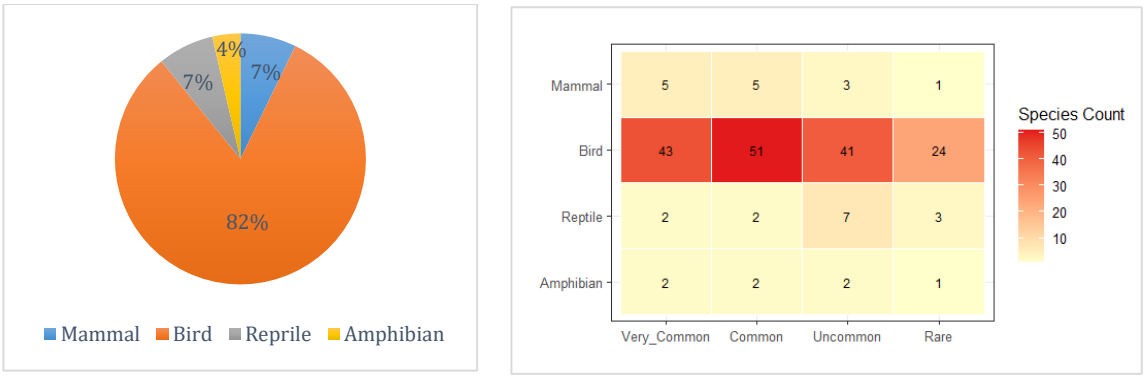


Figure 2.5: Wildlife Composition (Left) and Their Abundance (Right) Found at SMI

A total of fourteen mammalian species were identified, including the Small Indian Mongoose, Asian House Shrew, various Rat species, Indian Flying Fox, Pipistrelle, and Greater Asiatic Yellow Bat. Local accounts indicate that Golden Jackals (*Canis aureus*) were present approximately two decades ago; however, none have been observed in recent years. The survey recorded 159 avian species: 94 residents, 58 winter visitors, three summer visitors, one passage migrant, and three vagrants (DoE, 2020b). Fourteen reptile species were noted, such as the Garden Lizard, Bengal Monitor, and several snakes including the Checkered Keelback, Rat Snake, and Cobra. Additionally, two sea turtle species—Olive Ridley and Green Turtle, and two freshwater turtle species were documented on the island (DoE, 2020b).

Figure 2.6: Some Wildlife of Saint Martin's Island

2.3.7 Lagoons and Wetlands

Saint Martin's Island contains three lagoons. The lagoons located at Uttarpara and Daskhinpara, encompassing approximately 24 acres, have largely become muddy swamps with shallow water, maintaining connectivity to the sea exclusively during high tide through shallow creeks. Geologically, the northern lagoons are older and possess a more extended evolutionary history, while the southern lagoon is relatively younger and continues to be actively shaped by marine processes (Kabir, 2006). Since the 1960s, there has been ongoing reclamation of the northern lagoon for paddy cultivation and infrastructure development.

The lagoons on Saint Martin's Island offer significant potential as sources of freshwater, irrigation, salinity moderation for groundwater, fish culture, and provision of drinking water for avifauna. Additionally, two lagoons support a diverse range of flora and fauna. With appropriate planning and management, these ecological and resource values can be further enhanced. Consequently, integrating lagoon management into the Island's future master plan is essential.

2.3.8 Capture Fisheries

St. Martin's Island is notable for its extensive and varied aquatic biodiversity. Research in the region has identified a total of 475 fish species. Focused assessments—such as Direct Catch Assessments and

Market Surveys conducted by CEGIS from 2018 to 2020—documented approximately 63 fish species spanning 37 families across 12 orders. According to local fishermen, daily catches typically include over 100 species, covering bony and cartilaginous fishes, cephalopods, echinoderms, and shrimp. These findings underscore the island's ecological importance as a habitat supporting a broad spectrum of marine life.

Figure 2.7: Some of the Fish Species of SMI

2.3.9 Invertebrates

A total of nine echinoderm species were identified, comprising sea urchins, a sea star, nudibranchs, and a sea cucumber. The subtidal and intertidal zones of SMI are inhabited by 187 mollusk species, including 44 gastropods, with the remainder being bivalves. Crustacean diversity encompasses 12 crab species and 26 prawn species (NCSI-1, 1997b; MoEF, 2001b; BOBLME, 2015). A comprehensive inventory of invertebrates is presented in the study report DoE, 2020b.

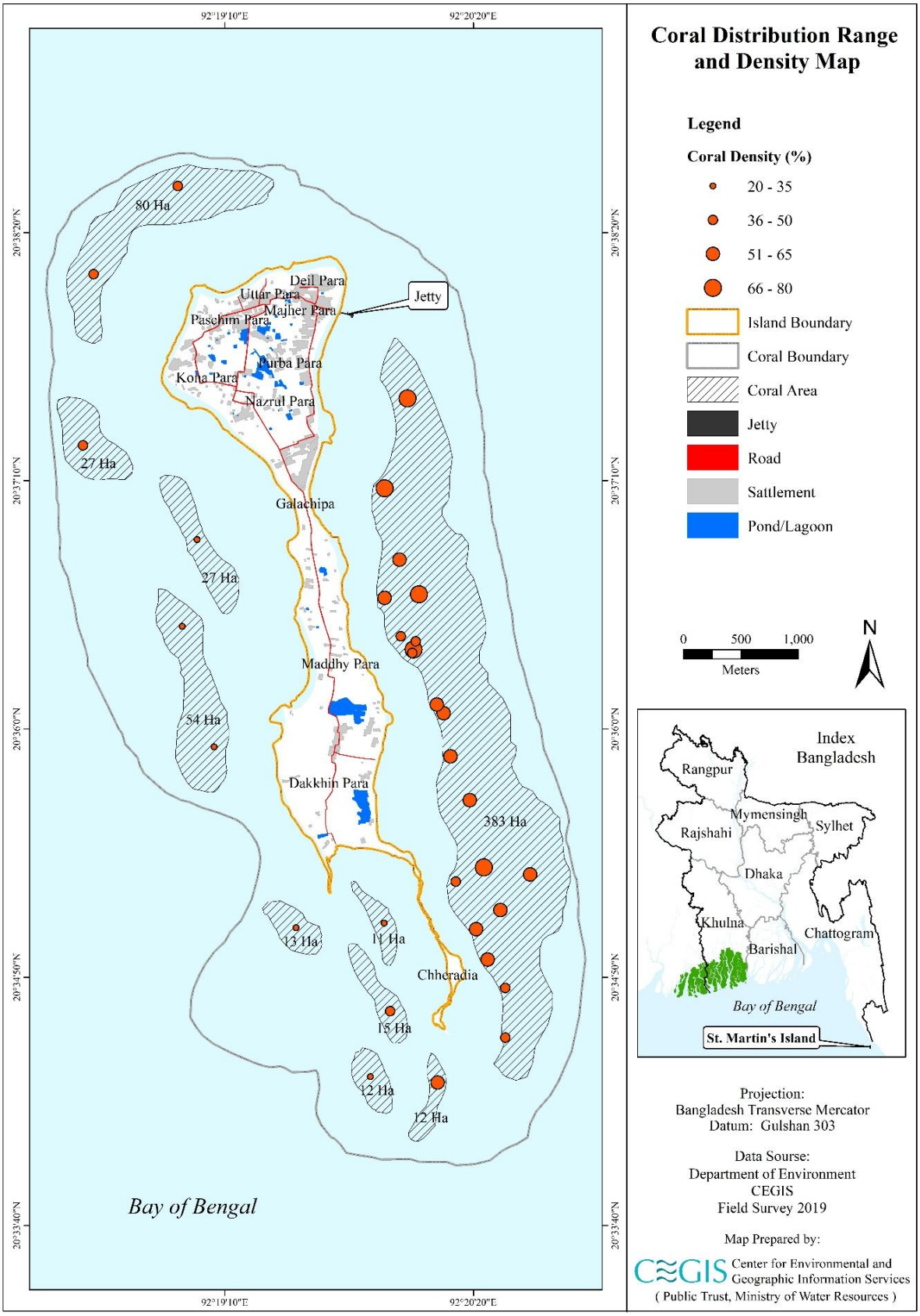
2.3.10 Corals

Saint Martin's Island supports an exceptional assemblage of coral species, especially within its rocky subtidal zones that extend up to 1,000 m offshore. According to historical records (Tomasick, 1997), the island is home to approximately 66 coral species: 36 living hard corals, 11 soft corals, and 19 fossil corals, underscoring significant paleontological and ecological value. More recent assessments (DoE, 2020c) corroborate this diversity, identifying 25 hard coral species from 13 families and 15 soft coral species from 10 families, with hard corals comprising the majority. Coral distribution encircles the island, though densities are highest in certain regions and more limited in the northern and northwestern areas. The genus Porites represents the m*ost prev*alent among hard corals, alongside

Favites, Goniopora, Cyphastrea, and Goniastrea, which are particularly abundant on deeper rocky slopes. Feather duster corals are regularly encountered, while Acropora species exhibit a broad presence in deeper offshore waters, emphasizing the island's status as Bangladesh's sole hotspot for coral diversity. Further information is available in the DoE, 2020c research report.

A comprehensive monitoring plan for corals and associated flora and fauna is provided in **Appendix A**.

Figure 2.8: Images Showing Different Species of Hard and Soft Corals found at SMI

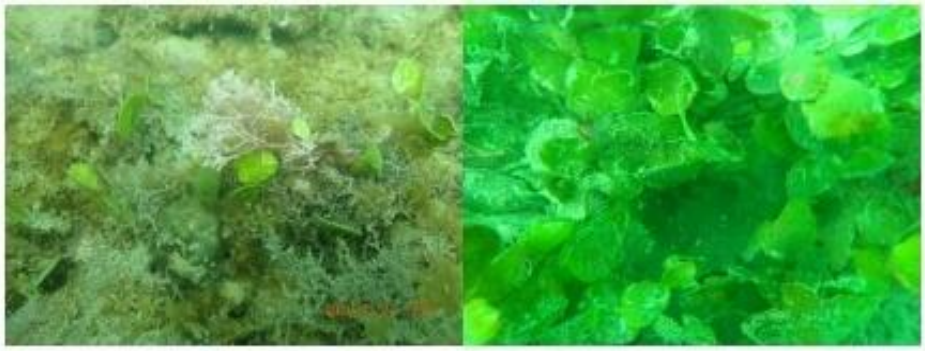


Source: DoE, 2020c

Figure 2.9: Coral Distribution and Density Map of Saint Martin's Island

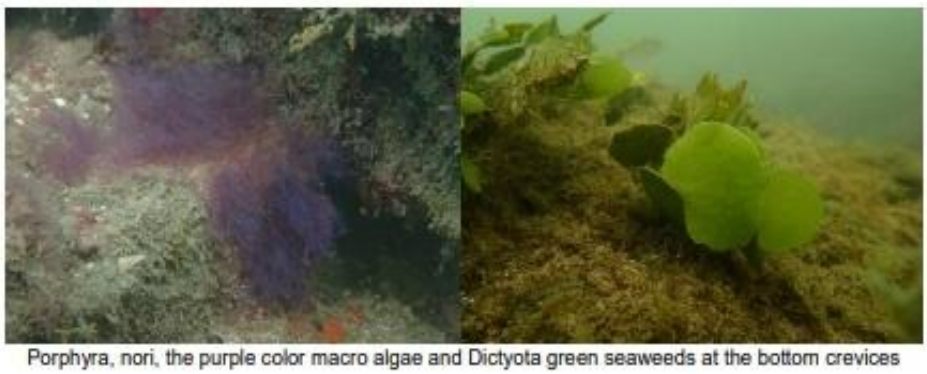
2.3.11 Sea Weeds

Seaweed plays a crucial role in the energy dynamics of marine, coastal, and island ecosystems. On Saint Martin's Island, 34 species of seaweed have been recorded, including 7 Chlorophyta, 17 Rhodophyta, and 10 Phaeophyta species. Eleven of these species are prevalent across all ecological zones, with eight being particularly dominant. The greatest species richness and diversity occur in the upper subtidal zone, whereas the intertidal zon*e exhibits* the lowest values. Ac*cording to DoE* (2020c), seaweed proliferates extensively around the island, predominantly from December to April, with the most concentrated growth found along the southeast coast. The island supports a range of distinctive morphologies, such as circular and brown thalli anchored to sandy substrates, represented by genera including Padina, Ulva (Sea Lettuce), Cladophora, and additional forms such as Prickly Pear, Bubble, Feathery, Pea, Cat Tail, and Vagabond Cladophora. Red seaweed, such as Chondracanthus, flourishes in the clear waters surrounding the island and is notably abundant. Figures 2.10 and 2.11 illustrate the diversity and spatial distribution of seaweed species along the island's shoreline, highlighting the unique ecological characteristics of Saint Martin's Island. Further information is available in the DoE, 2020c research report.



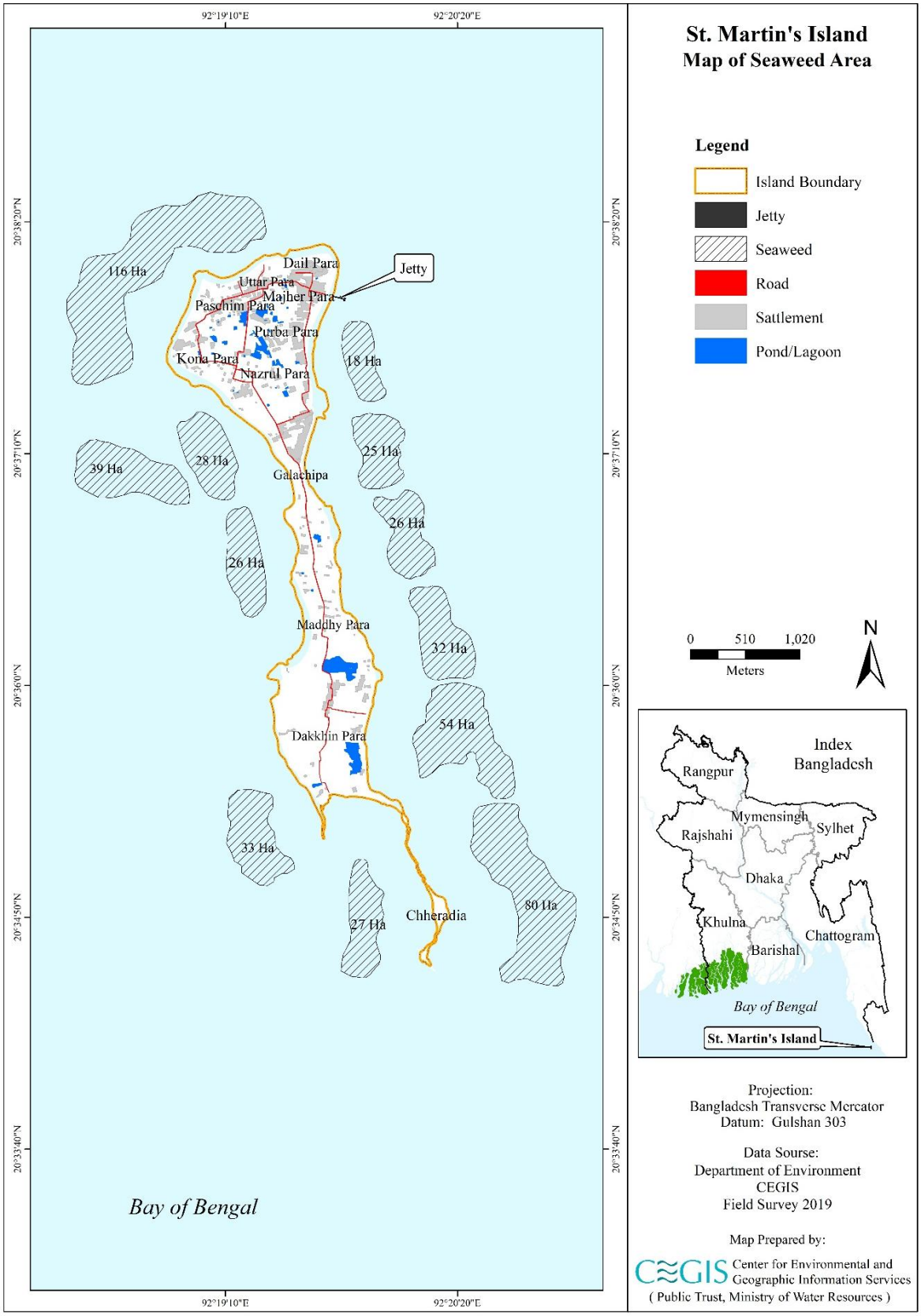
Green algae associated with soft coral at subtidal habitat

Brown algae at sandy bottom of sea floor and on the encrusted coral communities



Porphyra, nori, the purple color macro algae and Dictyota green seaweeds at the bottom crevices

Figure 2.10: Seaweeds Diversity at Saint Martin's Island



Source: DoE, 2020c

Figure 2.11: Seaweeds Distribution Map

2.4 Socio-economic Landscape

Saint Martin's Island, the nation's only coral island, is inhabited by approximately 9,885 individuals across 1,445 households. The average household size of 6.84 significantly exceeds the national average, reflecting the highly cohesive nature of family life within the community. The demographic profile indicates a predominance of youth; 42 percent are under 18, and another 44 percent are between 19 and 45 years old, while only 14 percent are above this age range. Although these figures suggest potential for a "demographic dividend," its realization is contingent upon improvements in educational opportunities, employment prospects, and skill development, areas where the island currently faces considerable challenges.

The economy is primarily driven by fishing and tourism, albeit with varying degrees of benefit among residents. Survey data indicates that approximately 61 percent of income is derived from sea fishing, while 31 percent is associated with small businesses, predominantly linked to tourism. The mean monthly household income stands at BDT 6,448, which is low compared to national standards and fluctuates notably based on seasonal variations in fishing and tourism. For instance, income temporarily rises from June to August during the Hilsa fishing season, and again from November to March when increased ferry traffic supports tourism-related employment. Conversely, extended off-seasons present financial hardships for many households.

Infrastructure on the island exhibits disparities and vulnerabilities. Educational facilities are limited, with only one school providing instruction up to Grade 11, and 36 percent of residents have never attended school. Less than 1 percent have completed higher secondary education. Healthcare provision is inadequate: although there is a hospital building, it lacks regular medical staff, compelling residents to rely on local pharmacies or undertaking hazardous journeys to Cox's Bazar for serious medical needs. Pregnant women and children face elevated risks due to these deficiencies, and several families report loss of life attributable to delayed access to care.

Essential services are similarly strained. Water is supplied by 727 hand tube wells, but quality and reliability remain inconsistent. Approximately one-third of households lack toilet facilities, and the island does not possess a sewage system. Recent improvements in electricity, brought about by solar grids, now provide continuous power to 45 percent of businesses and a minority of households; however, high costs and perceived predatory pricing inhibit broader access.

Transportation and communication challenges underscore the island's isolation. Access through ferries from Teknaf is feasible during winter yet becomes unpredictable and hazardous during monsoon months. On the island, residents chiefly travel on foot, on the rickshaw van, or rented bicycle. Mobile phone services are available but suffer from instability, frequent call drops, and slow internet speeds, adversely affecting both commercial activity and education.

Tourism has expanded rapidly, with a marked increase in resorts and hotels, yet ownership remains disproportionate. Approximately 51 percent of establishments are operated by non-residents, and nearly all large resorts are owned externally. While local involvement exists through van-pulling, eateries, and souvenir sales, major profits accrue elsewhere. This dynamic creates persistent tensions, as tourism generates income but does not secure sustainable economic benefits for year-round residents.

The master plan addresses these concerns through recommended programs aimed at improving livelihoods and fostering new business opportunities utilizing local resources. Integrating these initiatives with current technological capacities may facilitate inclusive participation by both men and women. The expansion of secondary and vocational education is identified as fundamental to harnessing the island's youthful population. Enhancements in healthcare should focus not only on infrastructure but also on staffing and emergency response capabilities. Energy regulation may be

necessary to ensure solar power remains accessible and affordable. The urgency of scaling sanitation and waste management infrastructure is highlighted to mitigate environmental risks posed by further tourism growth. Economic recommendations advocate for greater inclusion of local entrepreneurs in tourism revenues and diversification beyond fishing and seasonal trades.

2.4.1 Economic Resources

Main Productive Area

The primary economic sectors of Saint Martin's Island are tourism, fisheries, and agriculture. **Tourism** has seen considerable growth over the past decade, with up to twelve vessels operating during the peak season from October to March to accommodate visitor transport. Consequently, tourism has become an important source of seasonal income for local residents, significantly contributing to the growth of resort and hotel businesses. Presently, there are more than 109 resorts and hotels established on the island. This sector generates various employment opportunities, both directly and indirectly, as locals participate through ventures such as temporary tea stalls, coconut sales, and fish fry stands along the beach.

Saint Martin's **fisheries** sector is notable for its rich marine biodiversity, encompassing coral formations, sandy substrates, and perennial lagoon-like environments. The fishing industry is substantial, employing approximately 600 professional fishers and operating 170 boats, mainly active between September and April. The daily average catch is reported at around 11 metric tons (MOEF, 2001b). Fishing techniques include drift nets, fixed and plain gill nets, and seine nets, targeting species both offshore and near coral reefs. A**dditional**ly, nearly half of all household heads engage in resource exploitation activities, such as shrimp fry collection (Islam, 2001). There are four dry fish processing enterprises in the study area, collectively overseeing about 70 of the approximately 1,000 operational fishing boats. A detailed account of fish habitats and production distribution can be found in Table 2.5.

Table 2.5: Fish Habitat and Production Assessment of the SMI and Its Surroundings

Sl. No	Habitat Type	Habitat Area (ha)	Fish Production (MT)
1	Open Marine	9,091	297,683
2	Inter Tidal Area	133	15
3	Inter Tidal Coral Associated Area	229	25
4	Khal	2	0
5	Lagoon	10	15
	Total	**9,465**	**297,738**

Source: Land use satellite image, 2019

Coral Associated Habitat

Open Marine Habitat

Sandy Bottom Habitat

Lagoon-like Fish Habitat

Source: CEGIS Field Observation, 2018

Figure 2.12: Major Fish Habitat in Saint Martin Island

With respect to **agricultural** production on St. Martin Island, watermelon stands out as the leading crop in terms of both economic significance and volume. Recognized as the island's primary cash crop, watermelons generate an estimated annual market value of nearly two crore taka, according to data from UAO Teknaf. Farmers typically retain approximately half of this amount after accounting for production costs. Other crops, including rice, are largely produced for local consumption and do not contribute substantially to the island's overall market revenue.

Other Relevant Service Area

The principal service sectors on the island encompass sanitation systems, education, health, road transport, housing, and settlement. Sanitation remains a critical issue: roughly 30% of businesses utilize flush toilets, 18% employ pit latrines, and 11% rely on water-sealed safety tanks (Islam & Sultana, 2019). Conversely, about 35% of businesses lack any form of sanitation facilities, and the island lacks a centralized sanitation or sewerage infrastructure.

The education system is characterized by limited resources and planning. The island hosts one secondary school/college offering education up to Grade 11 (since 2015), in addition to one government and two non-government primary schools, and fifteen madrasas (*mokhtobs*) dedicated to religious instruction. Literacy rates stand at 36% for males and 22% for females (Islam & Sultana, 2019).

Healthcare services are inadequate, with only one hospital, which is understaffed in terms of doctors and nurses, resulting in constrained operations. There are six operating pharmacies on the island (Islam & Sultana), but their capacity to supply medicines consistently is limited. Consequently, residents frequently undertake the risk of traveling to Cox's Bazar for treatment of serious medical conditions.

Saint Martin's Island is served by two major roads that connect Uttarpara and Paschimpara, beginning at Jetty Ghat and passing through the main bazaar. The predominant mode of transportation is the van (three-wheeler), with over 150 vans transporting tourists and residents, especially during ship arrivals and departures. Secondary modes include bicycles and motorbikes.

According to the Bangladesh Population and Housing Census 2011 (BBS, 2012), there are approximately 1,161 households on the island. Most dwellings are classified as Kutcha (68.0%), followed by Jhupri (17.4%), Semi Pucka (13.7%), and Pucka (0.9%).

2.5 Public and Private Infrastructure and Facilities

The infrastructure of the island appears to have been developed primarily to serve tourists rather than local residents. Access to Saint Martin's Island is exclusively through ferry from Teknaf. During the winter months (November to April), when sea conditions are favorable, several ferries operate between the mainland and the island, accommodating the influx of visitors. Once the peak tourism season concludes, the island becomes relatively isolated, particularly during the monsoon period when travel is challenging. Trawlers remain operational despite adverse conditions, facilitating the transport of goods and, on occasion, passengers between the island and Teknaf.

Transportation within the island is limited to rickshaw vans, with walking being the most common means of getting around. Some individuals use rented bicycles for local travel. For excursions to Cheradia Island and Daruchini Dwip, tourists typically utilize speed boats, trawlers, and other watercraft.

Historically, electricity was supplied by diesel generators with restricted service hours. Recently, the introduction of a solar power grid has enabled continuous, 24-hour electricity provision for most residents and businesses. However, the cost of solar power remains high, with rates that can be considered unreasonably expensive.

I. Government offices present in the island

Several government offices operate on the island, as outlined below:

- Border Guard of Bangladesh (BGB)
- Bangladesh Naval Forces
- Bangladesh Coast Guard
- Bangladesh Police
- Hospital
- Department of Environment
- Weather Department
- Lighthouse
- Post Office

II. Environmental groups and committees

Numerous environmental groups and committees operate on Saint Martin's Island, as outlined below:

- Village Conservation Groups (VCGs), each led by a designated village representative; there are six VCGs across the villages of Saint Martin's Island.
- The Union ECA Coordination Committee, chaired by the respective Union Chairperson of Saint Martin's Island.
- The Upazilla ECA Coordination Committee, supervised by the Upazilla Nirbahi Officer (UNO) in Teknaf.
- The District ECA Coordination Committee, led by the Deputy Commissioner (DC) of Cox's Bazar.
- The Central ECA Coordination Committee within the Ministry of Environment and Forests, overseen by the Minister.

Each committee serves an essential function in advancing conservation efforts and coordinating environmental initiatives within its respective jurisdiction.

III. Associations

Several associations operate on the island, each representing the interests of various groups engaged in fisheries-related occupations.

- Trawler Services Association: Oversees mechanized boats and trawlers transporting passengers between Teknaf (the mainland) and the island.
- Fishermen Association: Focuses on advancing the welfare of the island's fishermen.
- Fish Traders Association: Facilitates transactions by purchasing fish from local fishermen.
- Hotel Malik Samity
- Bazar Dokan Malik Samity
- Rickshaw & Van Chalok Samobay Samity
- Life Boat, Speed Boat Malik Somobay Samity
- Boat Malik Samity and Gun Boat Malik Samity

Table 2.6 below provides a summary of the public and private infrastructure and facilities available on the island.

Table 2.6: Public, Private, and Community Infrastructure and Facilities Available on Saint Martin's Island

Name of facilities	Number	Name of facilities	Number
Primary Schools Gov.	1	Agent banks/ ATM Booth (Dutch Bangla-2, Bikash	3
Primary School Non-Govt	2	Solar Station	1
Secondary Schools	1	Union Office	1
Saint Martin B. School and College Open University	1	NGOs (BRAC, Shulshilon, Eklab, Nari Khomotayan, Marine Life.	5
Madrasha Noorani (Class-4)	13	Hospital	1
Madrasha Hafizia	4	Weather station	1

Name of facilities	Number	Name of facilities	Number
Mosques	14	Post office	1
Graveyards	3	Cyclone shelter	2
Eid-Gagh	2	Environment Dept. Office	3
Health clinics/ Surjer Hashi	1	Govt Guest house	1
Road's concrete	6 km	Police station	1
Bazar	1	Naval base	1
Broadband	4	Coast Guard	1
Associations	7	BGB	1

Source: DoE, 2020f

3. Major Problems and Challenges

3.1 Problem Identification

Saint Martin's Island is recognized for its distinctive natural environment, including extensive seaweed beds and vibrant coral reefs that flourish under favorable ecological conditions (Islam and Thompson, 2010). The island's picturesque scenery and varied tourist attractions have led to sustained high visitor numbers. Nevertheless, unmanaged tourism poses significant risks to the sensitive ecosystem, threatening local biodiversity and undermining long-term sustainability. Furthermore, the island's natural features create developmental challenges that necessitate thoughtful management and the resolution of several complex issues.

Major problems and cross-cutting issues, as illustrated in **Figure 3.1**, significantly affect multiple sectors and have been duly incorporated into the Master Plan.

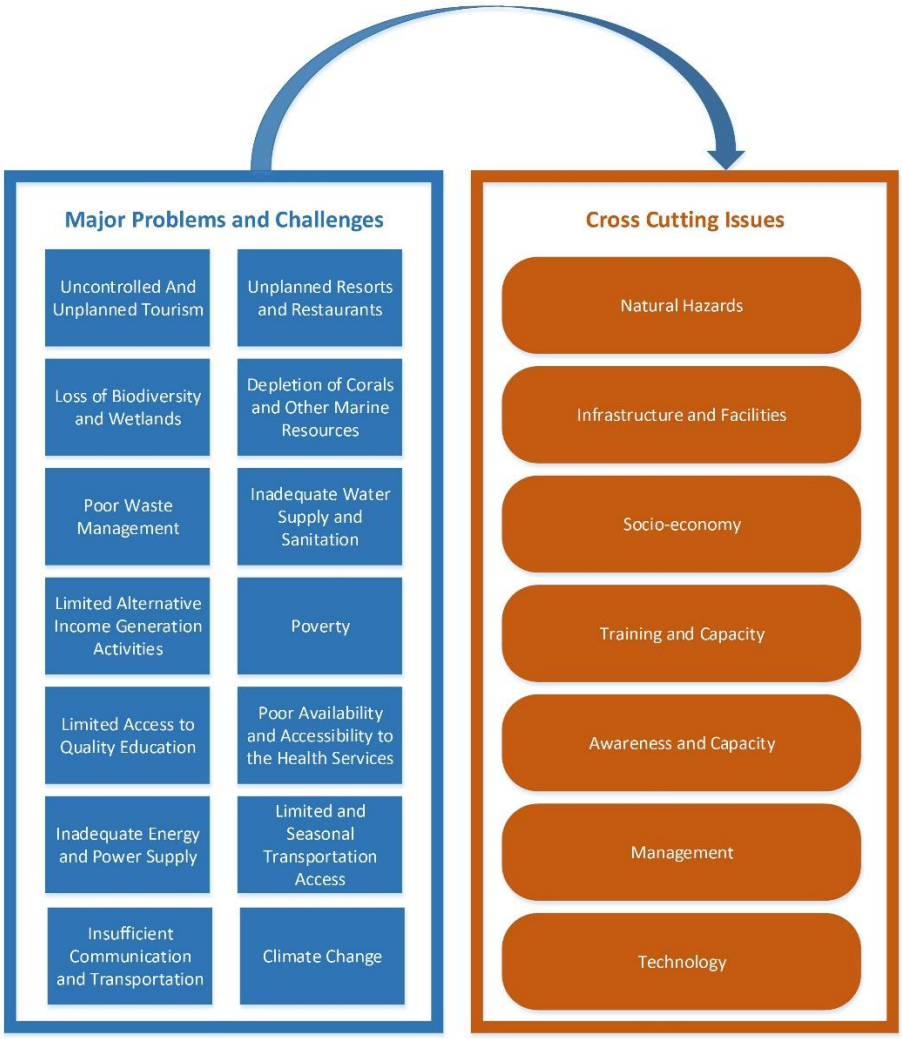


Figure 3.1: Cross Cutting Issues

The primary identified issues are as follows:

- Uncontrolled and unsustainable tourism
- Unplanned development of resorts and restaurants
- Loss of biodiversity and wetlands
- Depletion of coral reefs and other marine resources
- Poor waste management practices
- Inadequate water supply and sanitation facilities
- Limited alternative income-generating opportunities
- Prevalence of poverty
- Insufficient communication and transportation infrastructure
- Limited availability and accessibility of health services
- Restricted access to quality education
- Inadequate energy and power supply
- Limited and seasonal transportation options

Major challenges include:

- Climate change
- Cross-cutting issues

3.2 Major Problems

3.2.1 Uncontrolled and Unsustainable Tourism

A significant influx of tourists arrives at this island annually. Transportation is provided through ships and engine boats departing from Teknaf. Table 3.1 details the tourist ships and engine boats along with their designated carrying capacities and actual daily capacities during the peak season. According to the data, these vessels transport 7,193 tourists per day during peak season, compared to the intended capacity of 4,155. This indicates that the daily number of visitors is nearly double the official capacity of the available transportation.

Table 3.1: List of Ships and Boats with Actual Tourist Carrying Capacity and Actual Daily Tourists Carried during Peak Season

Name of Ships and Engine Boats	Actual Capacity	Actual Daily Carried During Peak Season (Minimum Increase to 150%)
MV The Atlantic Cruise (C-180)	300	450
MV Keari Cruise and Dine (C-1619)	310	465
MV Keari Sindbad (C-1510)	346	519
MV Kajole	700	1050
MV Bay Cruiser (C-1787)	251	377
MV Greenline-1 (C-1878)	120	180
MV Farhan (M-7020)	540	810
MV Parijat (M-01-1121)	346	519

Name of Ships and Engine Boats	Actual Capacity	Actual Daily Carried During Peak Season (Minimum Increase to 150%)
MV Doelpakhi (M-01-1669)	440	660
S T Vhasa Shaheed Salam (C-1731)	220	330
MV Karnaphuli Express (C-2053)	582	873
Tourists by Mechanized Boat (3 boats with 80 tourists each)		960
Total	**4,155**	**7,193**

Source: Field Survey, 2018-2019 and DoE 2020e

Based on data from the CEGIS Field Survey and BIWTA (2018–2019), **Table 3.2** presents the daily number of tourists visiting St. Martin's Island during the tourist season in relation to actual capacity. The data indicate that in December, January, and February, the influx of visitors consistently exceeded the total capacity of all vessels operating on the route.

Table 3.2: Number of Tourists Visiting St. Martin's Island Per Day during the Tourists Season

Months	Capacity	Tourism Season					
		Oct	Nov	Dec	Jan	Feb	Mar
Total Tourists Carried by All Ships	4,155	3,038	3,453	7,193	7,193	7,193	3038
~Total Tourists (Round Figure)	4155	3,000	3,000	7,000	7,000	7,000	3000

Source: CEGIS Field Survey and BIWTA Data, 2018-2019; DoE 2020e

Tourist visitation frequently surpasses the island's sustainable limits, resulting in environmental degradation. Unsustainable practices such as littering, the collection of coral and shells, and the discharge of oil and waste from vessels contribute to the pollution of marine and coastal ecosystems. Additionally, activities like walking and bathing on rocky areas adversely affect coral and seaweed habitats, progressively diminishing the island's ecological health and marine biodiversity (Nafi and Ahmed, 2017; Feeroz, 2009).

The assessment of the physical carrying capacity, real carrying capacity, and effective carrying capacity utilizes visitor-per-day metrics, with individual standards of 6 m^2 and 10 m^2 per person, as outlined in Table 3.3. Notably, the effective carrying capacity under both spatial standards is significantly lower than the corresponding physical and real carrying capacities.

Table 3.3: Tourism Carrying Capacity of Saint Martin's Island

Standards	Physical Carrying Capacity (visitors/day)	Real Carrying Capacity (visitors/day)	Effective Carrying Capacity (visitors/day)
6 m^2	45,500	4,631	926
10 m^2	27,300	2,779	556

Source: Estimated by CEGIS, 2019

To promote sustainable management of natural resources and improve livelihoods on Saint Martin's Island, tourism activities should be carefully regulated with consideration for the local ecosystem and biodiversity. Protecting the island's environment requires the implementation of eco-friendly tourism practices.

Figure 3.2: Tourists Flux in St. Martin's Island

3.2.2 Unplanned Resorts and Restaurants

Saint Martin's Island features a considerable number of resorts and restaurants, offering accommodation for up to 4,466 tourists across approximately 109 establishments. Despite the significant visitor numbers during peak seasons, challenges persist regarding elevated costs and limited availability of high-quality lodging. The unregulated expansion of resorts has resulted in complications for both the tourism sector and local socio-economic dynamics, while environmental pollution has increased due to inadequate solid and liquid waste management systems. Table 3.4 presents detailed information on room numbers, accommodation capacity, and resort quality for each establishment.

Table 3.4: Resort-Wise Room Number and Capacity of Accommodation with Resort Quality

Resort Quality	Resort No.	Room Number	Tourist Capacity (P)
Good	27	279	1,134
Medium	44	365	1,388
Bad	38	487	1,944
Grand Total	**109**	**1,131**	**4,466**

Source: Field Survey, 2018-2019; DoE 2020e

3.2.3 Loss of Biodiversity and Wetlands

Over recent decades, the biodiversity of St. Martin's Island has encountered a range of threats stemming from various activities:

- Oil and heavy metal pollution from marine vessels and fishing boats creates anaerobic conditions detrimental to aquatic life.
- Coastal erosion and wave action have led to the decline of screw pine and mangrove populations.
- The removal of algae and sea grass by tourists and fishermen has resulted in habitat loss and food scarcity for marine fish along the foreshore.
- Mangroves and sand dunes are being destroyed due to fuel wood collection and the development of hotels and resorts.
- Marine turtles experience disturbances from nighttime noise pollution generated by power equipment and unregulated tourist activities.

- Overfishing and destructive practices, such as the use of cyanide and dynamite, further threaten local ecosystems.
- Construction, agriculture, and deforestation contribute to increased sedimentation on sand dunes and shoreline areas.
- Accumulated waste, particularly plastics discarded into the sea, obstructs sunlight required by coral reefs and poses fatal risks to turtles and other marine species.
- Wetlands and low-lying areas are being filled to accommodate new buildings and hotel developments.

These concerns highlight the necessity for strengthened conservation initiatives to safeguard the island's distinctive ecosystems.

3.2.4 Depletion of Corals and Marine Resources

Coral reefs are highly sensitive to water quality and disturbances arising from various anthropogenic activities. The coral reefs and associated marine resources on St. Martins Island currently face several significant challenges:

- Increased tourist activity in coral-dominated areas has resulted in physical damage to reef structures.
- Extraction of corals for the souvenir trade and the collection of building materials continue to threaten their existence.
- Sewage discharge and chemical pollution, particularly from fertilizer runoff, have contributed to coral degradation. Presently, the majority of hotel wastewater is directed into the sea.
- Incursions by foreign fishing trawlers and the incidental capture or harm of marine turtles due to fishing practices and equipment further jeopardizes local biodiversity.
- Offshore sediment deposition is burying coral reefs, thereby obstructing sunlight required for algal photosynthesis.
- Abandoned fishing nets become entangled with the reefs, impeding the movement of numerous marine species.
- Boat anchoring leads to the displacement and destruction of coral colonies.
- Erosion at the base of coral communities undermines structural stability.
- Overfishing within coral habitats, often utilizing destructive fishing gear, exacerbates ecosystem decline.
- Excessive deployment of fishing nets over coral areas persists.
- Illegal collection (poaching) of living corals diminishes population resilience.
- Disposal of waste directly onto coral beds along the shoreline remains an ongoing issue.
- Walking on exposed coral beds during low tides inflicts additional physical stress on these fragile systems.
- Coral bleaching events and the prevalence of diseases such as white band and black band disease represent further critical threats.

Taken together, these challenges compromise the health and long-term viability of coral reef ecosystems on St. Martins Island, highlighting the need for effective conservation and management measures.

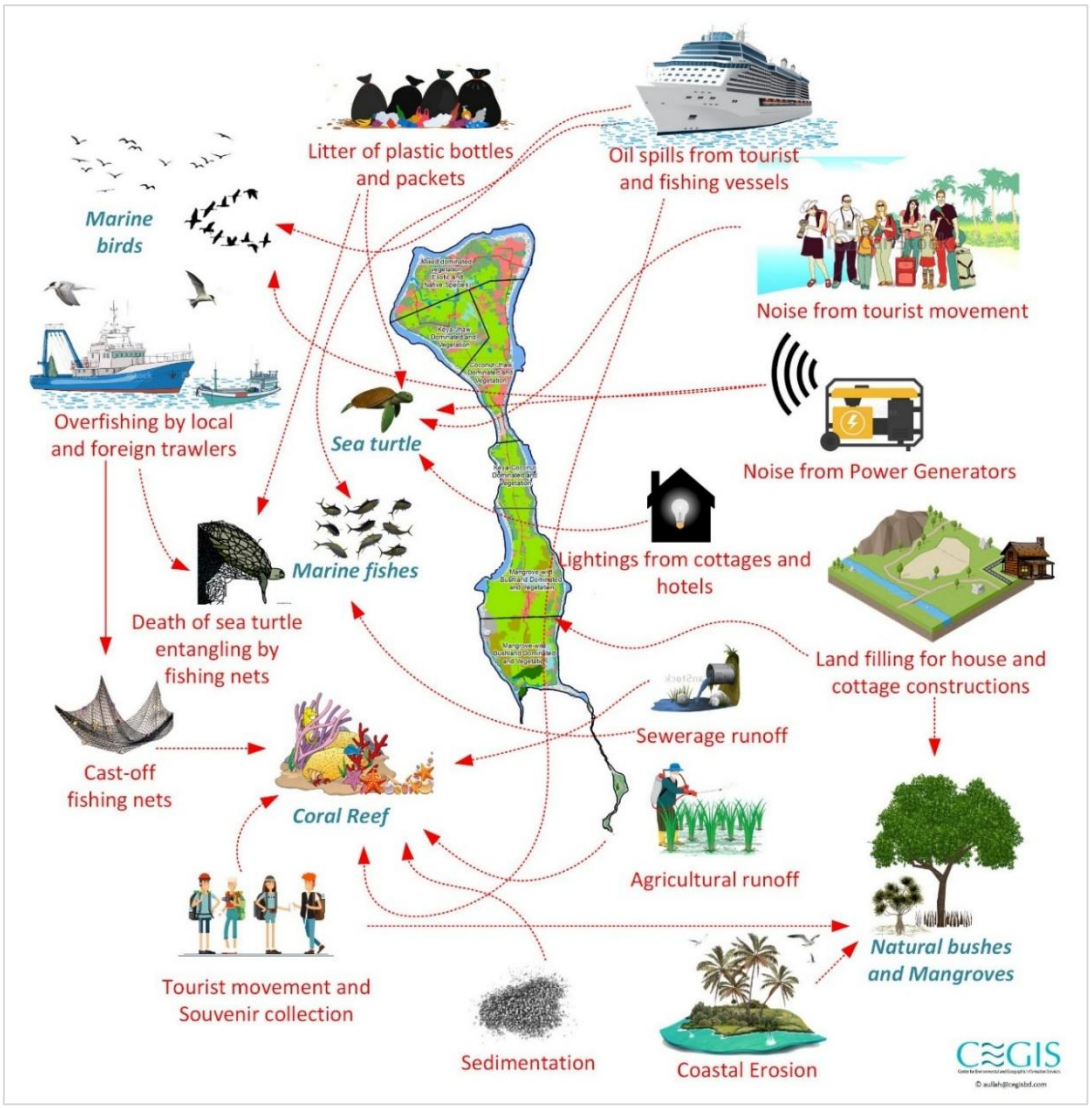


Figure 3.3: Major Threats and Problems Regarding Biodiversity and Coral Reefs of St. Martin's Island

3.2.5 Poor Waste Management

Saint Martin's Island is currently facing considerable challenges related to increased waste generation, attributable to population growth and a rise in tourism activities. There is a marked lack of an organized waste management system on the island (Muhibbullah and Sarwar, 2017). Although Saint Martin is well-suited for sustainable and responsible eco-tourism, the recent influx of mass tourism has significantly escalated the burden of sewage and waste disposal. Alarmingly, it has been observed that sewerage lines from tourist accommodations are directly discharged into the sea, leading to surface water pollution and presenting serious risks to the island's aquatic ecosystem and biodiversity. Additionally, improper disposal of plastic materials—such as polybags and plastic bottles—by tourists in the vicinity of the island poses threats to coral health (see Figure 3.4).

Due to insufficient management practices, the island's natural resources are experiencing gradual degradation. Furthermore, suboptimal land use patterns have contributed to ineffective and unsustainable waste management practices.

Figure 3.4: Wastes in Saint Martin's Island

On the island, several waste-related challenges have been identified:

- Solid waste accumulation in lagoons is deteriorating water quality and causing persistent odors.
- Plastic debris is entering the marine environment, negatively impacting coral reefs and other benthic habitats.
- Liquid waste is contributing to the degradation of both the marine environment and lagoon, as evidenced by increased levels of fecal coliforms and other pathogens.

According to the study, only 16% of properties are equipped with septic tanks; the remainder lack adequate wastewater disposal solutions. Furthermore, more than 60% of establishments do not have a solid waste management system in place, resulting in waste accumulation at certain locations (DoE, 2020f). Table 3.5 below details the current status of wastewater and solid waste management on the island.

Table 3.5: Location-wise Common Sewerage System in Saint Martin's

Type	Number of Locations	Percentage
Discharged directly to land	254	64.47%
None	74	18.78%
Other	2	0.51%
Septic Tank	64	16.24%
Total	**394**	**100.00%**

Table 3.6: Locarion-wise Solid Waste Disposal Systemin Saint Martin's

Type	Number of Locations	Percentage (%)
Burning	50	12.69
Disposed irregularly	25	6.35
Disposed to a predefined landfill	58	14.72
Disposed to a wild disposal area	223	56.60
Disposed to the sea	0	0.00
None	38	9.64
Total	**394**	**100.00**

3.2.6 Inadequate Water Supply and Sanitation

Water supply

The predominant source of water supply is hand tube-wells, utilized by 35% of business establishments. Electric water pumps account for 33%, primarily serving larger resorts, hotels, and restaurants. Approximately 30% of business houses lack any formal water supply sources (DoE, 2020f). For drinking and cooking, 82.8% of households rely on deep tube-well (DTW) water. The use of water taps is rare, with only 0.2% prevalence on the island. The remainder of water needs are met by ponds and other natural water bodies.

Sanitation

Sanitation represents a significant challenge on the island. About 30% of households have access to flush toilets, 18% utilize pit latrines, and 11% have water-sealed safety tanks. Notably, around 35% of households do not possess any sanitation facilities, potentially reflecting a lack of requirement or access (DoE, 2020f). Saint Martin's Island lacks a formal drainage system and instead depends entirely on natural drainage due to its geographic location, tidal influences, and related factors. Consequently, issues such as waste congestion within the natural drainage system have been observed, as documented through questionnaire surveys and direct observation (Muhibbullah & Sarwar, 2017).

3.2.7 Employment and Income

On the island, household incomes tend to be lower, particularly during periods of reduced tourism and seasonal fluctuations in sea and coastal fishing (Islam & Sultana, 2019). Levels of economic activity reflect these variations, with increased activity typically observed during peak fishing and tourism seasons. Most households rely primarily on tourism or sea fishing as their main sources of income. Additionally, a notable proportion of household earnings and employment is derived from home-based enterprises or businesses operated from residential premises, including temporary and mobile mini stalls (Islam & Sultana, 2019).

3.2.8 Lack of Income Generation Activities

Tourism is a critical driver of employment and income generation on Saint Martin's Island. However, a considerable portion of tourist facilities are owned and managed by non-local or external entities, thereby limiting the direct economic benefits to local residents (Islam & Sultana, 2019). Employment opportunities in tourism are predominantly seasonal, restricting consistent work for Islanders outside peak periods, except for intermittent engagement in agriculture and fishing. Local residents are primarily involved in sectors such as souvenir shops, seafood restaurants, van transportation, and small retail businesses. In the absence of alternative income-generating activities (IGA), tourism

remains the principal source of livelihood, intensifying reliance on this sector and placing increasing pressure on the island's resources.

3.2.9 Poverty

Coastal regions frequently experience significant challenges due to increasing population density and elevated poverty rates among residents. According to BOBLME (2015), approximately 70% of the island's inhabitants live below the poverty line. Poverty is pervasive throughout the population, with income generation identified as a fundamental need. Unemployment remains a critical concern, exacerbated by the limited availability of alternative livelihood options. As a result, dependence on natural resources for income persists; however, local communities also demonstrate a strong commitment to resource conservation. Given these socio-economic conditions, effective strategies are needed to address poverty. The adoption of alternative income-generating activities may offer enhanced opportunities for individuals to improve their economic circumstances and reduce poverty levels.

3.2.10 Insufficient Communication and Transportation

St. Martin's Island faces significant transportation challenges, particularly in the absence of all-weather roads. These difficulties are exacerbated by adverse sea conditions, which impede access to healthcare services and make it extremely difficult for residents to travel to Cox's Bazar and Teknaf for important examinations such as the Secondary School Certificate (S.S.C.) and Higher Secondary Certificate (H.S.C.). The island's infrastructure appears to prioritize tourist convenience rather than addressing the needs of local residents, resulting in persistent issues related to inadequate transportation and facilities throughout the year.

Access to St. Martin's Island is limited to ferry services operating from Teknaf. During the winter months, calmer seas allow seven ferries to operate regularly, primarily catering to day-tripping tourists and facilitating increased connectivity with the mainland. In contrast, the rainy season renders the island largely inaccessible, isolating residents due to rough seas and limited transport options. Currently, only bicycles, rickshaw vans, and walking are feasible means of movement on the island, as there are no roads suitable for vehicular traffic.

3.2.11 Poor Availability and Accessibility to the Health Services

A well-equipped hospital, staffed with enough qualified doctors and nurses, is necessary to provide comprehensive health services for the residents of Saint Martin Island. Furthermore, it is crucial to establish robust infrastructure that enables access to appropriate medical care, including treatment and diagnosis. Pregnant women, particularly in critical conditions, face significant challenges in obtaining adequate healthcare. The shortage of medical professionals and limited access to health services remain key issues affecting the population of the island.

3.2.12 Limited Access to Quality Education

The pressing demand for adequate school facilities and standardized examination centers (S.S.C. and H.S.C.) is apparent, as insufficient infrastructure negatively impacts student motivation towards education. Although students are permitted to travel to Cox's Bazar or Teknaf for academic purposes, these journeys pose increased risks, particularly under adverse weather conditions. Such circumstances have resulted in comparatively lower educational attainment within this region. St. Martin's Island notably lacks facilities for S.S.C. or H.S.C. examinations, thus making student participation in these exams challenging (Islam & Sultana, 2019). As a result, continuing education beyond the primary level is especially onerous on this remote island, with female students facing significant barriers that often render further study nearly unattainable. The necessity to travel to Cox's

Bazar or Teknaf for examinations not only disrupts educational aspirations but also contributes to student attrition and waning interest in pursuing education.

3.2.13 Inadequate Energy and Power Supply

The power and energy sector in this region remain relatively underdeveloped. Geographic isolation and natural features contribute to its economic and geographical obscurity, presenting significant challenges to expanding grid infrastructure across sea areas[1].

Environmental Point of View

Analysis indicates that nearly 55 generators of varying capacities are used daily to meet the island's electricity demands, with each generator consuming approximately 5 liters of diesel per day. This results in a total daily consumption of about 275 liters of diesel, leading to an estimated 737 kg of greenhouse gas (GHG) emissions each day and approximately 110 tons over a five-month peak tourism season. Furthermore, the operation of these generators generates substantial noise and vibration, particularly within the bazaar area, which could adversely impact local ecology and biodiversity in the future[2].

Economical Point of View

The current diesel-powered generator incurs significantly higher electricity costs due to substantial capacity-related and operational expenses. For intermittent off-grid demand in Saint Martin, coupled with transportation costs, the electricity price typically ranges from BDT 35 to BDT 50 per unit. Furthermore, given the irregular nature of the load, the per-unit cost of electricity generated by diesel may exceed the aforementioned price[2].

Furthermore, there is limited public awareness regarding the application of renewable energy. The absence of appropriate equipment, insufficient training facilities, and inadequate financial resources have been identified as significant challenges associated with this matter.

3.2.14 Limited Seasonal Transportation Access

St. Martin's Island is accessible exclusively by water transportation, primarily through boats and ships utilized by tourists arriving from Cox's Bazar and Teknaf. On the island, internal transport is limited to non-motorized vans (refer to Figure 3.5) and rickshaws. The road infrastructure is comprised of concrete surfaces that are generally well-maintained, although transportation costs within the island tend to be somewhat higher than average. All hotels operate generators until 11:00 p.m., after which they transition to solar power, which serves as a widely adopted energy solution across the island.

[1]Islam, AKM Sadrul, et al. "Hybrid energy system for St. Martin Island, Bangladesh: an optimized model." Procedia Engineering 49 (2012): 179-188.

[2]ESIA of 250 kWp Solar Mini Grid Power Plant project at St. Martin's Island, Cox's Bazar; September 2018

Figure 3.5: Internal Transportation Vehicles in Saint Martin's Island

All-weather road infrastructure is absent on this island, resulting in significant transportation challenges, particularly during adverse sea conditions. Access to healthcare services and opportunities to participate in S.S.C. or H.S.C. examinations in Cox's Bazar and Teknaf become notably limited during such periods. The development of infrastructure has predominantly prioritized the comfort of tourists rather than addressing the needs of the island's residents. Consequently, local inhabitants experience ongoing difficulties due to insufficient infrastructure and transportation options. St. Martin's Island is accessible solely by ferry from Teknaf. During the winter season, when sea conditions are favorable, traffic between the mainland and the island increases considerably, with seven ferries accommodating day-trip tourists. However, in the rainy season, the island is effectively cut off from the mainland. Transportation within the island is restricted to bicycles, rickshaw vans, and pedestrian movement, as there are no roads suitable for vehicular travel.

3.3 Major Challenges

3.3.1 Climate Change

Climate Change Impact on Saint Martin's Island

Climate change remains one of the most widely analyzed subjects in relation to recent global environmental transformations. Bangladesh, especially its coastal regions, is among the nations considered most vulnerable to climate change impacts. Extensive research has established intricate links between climate change and natural disasters, resulting in detrimental social and economic consequences for affected populations. Saint Martin's Island experiences up to eight significant storms annually, predominantly during the summer or rainy season. Observable indicators of climate change-related disasters include intense winds and persistently cloudy skies. Salinization now affects approximately one-third of the island, primarily due to sea level rise attributed to global warming. Environmental changes observed on Saint Martin's Island include climatic displacement, increased bank erosion, altered agricultural practices, excessive rainfall, and an increase in disease prevalence.

Cyclones are the predominant natural disaster affecting Saint Martin's Island, accompanied by other events such as bay bank erosion, storm surges, salinization, and sea level rise. The area typically faces up to eight major storms each year, concentrated in the warmer months. Common signs of climate-

related disasters include strong wind activity and cloud cover. Salinity impacts a third of the island, largely as a consequence of rising sea levels caused by global warming. Environmental shifts encompass population displacement, accelerated bank erosion, evolving farming methods, heavy seasonal rainfall, and greater incidence of diseases.

Impact on Biodiversity

The biodiversity of Saint Martin's coral reefs is increasingly threatened by global climate change. Significant risks to coral reefs arise from elevated sedimentation, cyclonic events, storm surges, and beach erosion. Global warming has emerged as a principal concern for coral reefs worldwide, including those surrounding the island. A key impact of elevated sea temperatures is coral bleaching, which diminishes both the aesthetic and ecological value of the reefs. Incident rates of coral mortality due to thermal stress have risen substantially. Coral ecosystems rely on symbiotic algae for nutritional needs by photosynthesis; when water temperatures exceed 28°C, corals expel these algae, leading to nutritional deficiency.

Environmental contamination exacerbates these risks. Crude oil and non-biodegradable waste from ferry and engine boat operations are discharged into local seawater. Additionally, market and domestic waste, often untreated, including sewage (with 68 percent of the population having access to adequate facilities) further diminish coastal water quality. Both residents and tourists contribute to this degradation. Rapid infrastructure development, such as the construction of concrete buildings, hotels, motels, and jetties, also poses a threat to the sensitive island ecosystem.

Coconut trees exhibit heightened sensitivity to temperature extremes and water stress, leading to impaired reproductive development. Fruit production is negatively affected, principally due to decreased pollen viability, manifesting as fewer, empty, or elongated nuts.

Sea level rise constitutes a serious threat to mangrove ecosystems by promoting sediment erosion, inundation stress, and increased landward salinity. Mangroves face challenges migrating inland due to 'coastal squeeze.' Excessive rainfall and silt deposits further constrain mangrove health.

Elevated salinity levels result in high mortality of Pandanus trees, whose removal accelerates beach and dune erosion. Ozone layer depletion exposes seaweed to harmful ultraviolet radiation, reducing both photosynthetic efficiency and productivity.

Seaweed populations may decline by up to 40% by century's end due to climate change. Sea level rise reduces turtle nesting grounds, while higher sand temperatures alter sex ratios and coral bleaching disrupts feeding sources. Torrential rainfall can flood turtle nests by increasing groundwater tables.

Ocean acidification decreases mollusk abundance, while the breeding habitats of crabs and shrimp are at risk from rising seas. Coral bleaching and mangrove loss will reduce habitats for sea fish. High sea surface temperatures impact seabirds' foraging ability, growth, and reproduction. Consequently, coral bleaching and increased temperatures are expected to lower seabird breeding success and population numbers.

Life

Residents of Saint Martin's Island are significantly affected by bay bank erosion and cyclones, with the most substantial losses involving homes and personal property. Salinity presents a major challenge, limiting access to fresh drinking water. Population surveys report consistent losses due to sea level rise, including land, homes, and vegetation. Home and land losses due to erosion remain critical concerns. Droughts cause health problems, such as summer illnesses and acute shortages of both potable and irrigation water. Common diseases related to elevated temperatures include fever,

diarrhoea, and skin conditions, with waterborne infections like diarrhoea and skin disease frequently reported.

On average, only fifteen percent of residents attempt to mitigate anticipated losses attributable to climate change. Local inhabitants rely heavily on government assistance and increased labor efforts following disasters such as tsunamis. Agricultural adaptations include improved farming techniques and use of advanced fertilizers to offset production shortfalls. Defensive measures such as constructing embankments or soil barriers around homes are commonly adopted to prevent water intrusion.

Impacts of Sea Level Rise

Salinity Intrusion: Rising sea levels reduce freshwater availability due to increased salinity. Both water and soil salinity along the coast escalate with rising seas, altering the fundamental characteristics of coastal resources.

Fisheries and Aquaculture Impacts: Sea level rise alters river estuary locations, affecting fish habitats and breeding grounds. Penaeid prawns, for example, thrive in brackish environments where saltwater meets freshwater. As sea levels rise, this interface moves inland, modifying prawn habitats. The region supports 60 shrimp hatcheries and 124 processing plants, many of which are located near coastlines and thus threatened by inundation. Twenty-one government fisheries service centers operate in the area, providing essential services but are similarly at risk.

Agriculture Impacts: Increased salinity impedes crop production through reduced access to fresh water and declining soil quality. Salinity suppresses germination in certain plant species. Coastal agricultural lands are particularly susceptible to soil degradation and flooding, threatening food security in Bangladesh.

Landmass and Settlement Impacts: Sea level rise affects land availability, resulting in agricultural land loss, destruction of homes, damage to infrastructure, and diminished biodiversity. Erosion is a leading cause of land loss and displacement, with many poor residents rendered homeless and akin to internal refugees when their homes are destroyed.

Salt Industry Impacts: Salt production relies on seawater collected from local canals or rivers, processed over several days based on evaporation rates affected by climate conditions. Inundation of salt fields by sea level rise will lead to significant unemployment as displaced workers struggle to find alternative livelihoods.

Tourism Impacts: Cox's Bazar, acclaimed as the world's longest uninterrupted sandy beach, draws both domestic and international visitors. Tourist infrastructure situated close to the shoreline is at direct risk from sea level rise and associated phenomena like floods and storm surges. The tourism sector in Cox's Bazar is notably vulnerable to such climate-related disasters.

Health Impacts: Higher sea levels may increase the prevalence of health hazards such as diarrhoea and cholera. Cholera, a common infectious disease in Bangladesh's coastal areas, is caused by *Vibrio cholerae*, which thrives in saline waters due to sodium ions essential for growth. The average salinity of seawater (3.5%) provides an ideal environment for such pathogens, making coastal regions breeding grounds for cholera.

3.3.2 Cross-Cutting Issues

Certain sectors exert substantial positive or negative influences on others. Sectoral interdependencies can foster beneficial growth; however, disparities in resource allocation across sectors may lead to unplanned development and inefficient use of limited resources. The intricate interaction between governance, infrastructure, socio-economic conditions, public awareness, technological advancement,

and vulnerability to natural hazards has resulted in a context where challenges within one sector frequently propagate to others.

Natural Hazards: Events such as cyclones, rising sea levels, and extreme weather functions as threat multipliers. These hazards inflict damage on coastal communities, degrade wetlands and coral reefs, and destroy essential infrastructure including roads, utilities, and tourism facilities—thereby adversely affecting livelihoods and economic stability.

Infrastructure and Facilities: Deficiencies in infrastructure and essential services are pervasive contributors to a majority of identified problems. Inadequate solid waste management, unreliable water supply and sanitation, limited energy access, and insufficient transportation and communication networks collectively intensify many of the island's challenges. These shortcomings impede progress in health, education, and economic sectors, while also increasing stress on vulnerable ecosystems.

Socio-Economy: Persistent poverty and a lack of sustainable livelihood options present enduring socio-economic difficulties. Such economic insecurity often results in over-exploitation of natural resources, including coral and fisheries, due to limited alternatives for local communities. While tourism provides some economic benefit, it is frequently unregulated and does not consistently yield equitable or sustainable advantages for the broader population.

Awareness and Capacity: Limited public awareness and institutional capacity are significant factors in ongoing environmental degradation. A lack of understanding regarding ecosystem fragility contributes to detrimental practices such as destructive fishing and improper waste disposal. Moreover, insufficient training in sustainable tourism, resource management, and alternative income-generation restricts the adoption of resilient strategies by communities and local institutions.

Weak Institutional Management and Governance: Ineffective policy frameworks, insufficient enforcement, and a lack of coordinated planning have facilitated uncontrolled tourism developments and unsustainable land use. This, in turn, has accelerated coral depletion, biodiversity loss, and overall deterioration of natural resources, emphasizing the critical role of governance in shaping both environmental and socio-economic outcomes.

Technology: Limited adaptation of modern technology amplifies the island's existing challenges. Continued reliance on conventional energy sources, such as diesel generators, is exacerbated by inadequate investment in renewable technologies. Similarly, advancements in recycling, waste-to-energy, and water treatment could greatly alleviate persistent issues in waste management and sanitation if appropriately implemented.

4. Analysis of Land Cover Change

Saint Martin's Island, which historically encompassed 1,688 acres of primarily natural coral terrain, was characterized by native vegetation such as coastal shrubs, coconut palms, and limited agricultural and open spaces. The local economy centered on small-scale fishing and ecotourism, with land cover in 2005 indicative of a predominantly natural environment and minimal urban development, suggesting a sustainable balance between human activities and ecological preservation.

Analysis through transition matrices demonstrates substantial continuity in developed land, while conversions from natural vegetation and agricultural areas have incrementally increased urban expansion. Quantitative assessments show that the extent of developed land rose from 45.26 Ha in 2005 to 86.13 Ha in 2023, accompanied by notable declines in both agricultural (7.77% decrease) and vegetative areas (23.8% decrease), both converted into built-up regions. Waterbodies and mangrove habitats remained largely unchanged, evidencing minimal encroachment. These results highlight that anthropogenic factors, especially unregulated tourism and construction are principal drivers of considerable land cover change, intensifying environmental challenges such as habitat degradation, soil erosion, and diminished ecosystem stability. Land cover changes observed over nearly two decades, documented at six-year intervals, are detailed below:

4.1 Land Cover Categorization

The detailed land cover classes derived from satellite imagery were consolidated into six principal categories to ensure consistency and comparability over time. The Developed Area category encompasses all anthropogenic features, such as settlements, roads, jetties, and tourism infrastructure, signifying permanent conversion of land to built-up uses. Waterbodies include both natural and artificial aquatic surfaces rivers, lagoons, ponds, and the open sea—which are spectrally distinguishable in classification processes. Mangrove remains a distinct category due to its ecological sensitivity and unique spectral characteristics. The Vegetation Area groups together non-agricultural vegetated surfaces, including cultivated tree stands, bushland, Keya, and marine park vegetation, collectively representing natural or semi-natural cover. Agricultural Land is designated for actively cultivated cropland, while Open Area comprises transitional or unvegetated surfaces such as beaches, fallow land, intertidal zones, and rocky areas. This hierarchical framework supports both quantitative change analysis and nuanced ecological interpretation of land transitions.

Table 4.1: Land Cover Classes

Detailed Classes	Broad Category
Administrative Area, Hotel and Resort, Jetty, Restaurant and Bazar, Road, Settlement, Settlement with Homestead Vegetation	Developed Area
Khal, Lagoon, Pond, Sea	Waterbodies
Mangrove	Mangrove
Cultivated Trees, Keya, Marine Park', Wild Bushland	Vegetation Area
Agricultural Land	Agricultural
Beach/Sand, Current Fallow Land, Fallow Land, Inter Tidal Area, Inter Tidal Area/ Rocky	Open Area

4.2 Land Cover Change

The spatial distribution and temporal dynamics of major land use/land cover (LULC) categories for 2005, 2011, 2018, and 2023 are detailed in the accompanying table, which presents both absolute (Ha) and relative (%) changes with reference to the 2005 baseline. Developed Area exhibited a notable increase, with a net gain of 86.13 Ha by 2023, indicative of urban expansion and new infrastructure development. Waterbodies remained largely stable throughout the study period, with marginal reductions (<0.05%), suggesting minimal loss of aquatic habitats. Mangrove cover experienced a modest decline (~3%), likely because of localized coastal development and environmental stressors. Vegetation Area initially expanded between 2005 and 2011, potentially due to natural regeneration or afforestation initiatives; however, by 2023, a reduction of 23.8% was observed, underscoring the vulnerability of non-agricultural vegetated land to land conversion. Agricultural Land saw a consistent decrease (−13.09 Ha, −7.8%), attributable to conversion to developed areas or shifts in land management practices. Open Area displayed relative stability, reflecting the ongoing persistence of intertidal zones, beaches, and fallow lands.

Table 4.2: Change in Land Cover from 2005 to 2023

Broad Category	Area in 2005 (Ha)	Change from 2005 to 2011		Change from 2005 to 2018		Change from 2005 to 2023	
		(Ha)	(%)	(Ha)	(%)	(Ha)	(%)
Developed Area	45.26	4.01	8.85	14.07	31.08	38.98	86.13
Waterbodies	10453.36	-2.98	-0.03	-2.76	-0.03	-3.94	-0.04
Mangrove	4.57	-0.05	-1.05	-0.14	-3.12	-0.14	-3.12
Vegetation Area	84.54	8.17	9.66	4.74	5.61	-20.12	-23.80
Agricultural	168.46	-9.88	-5.86	-11.66	-6.92	-13.09	-7.77
Open Area	460.42	0.73	0.16	-1.87	-0.41	0.68	0.15

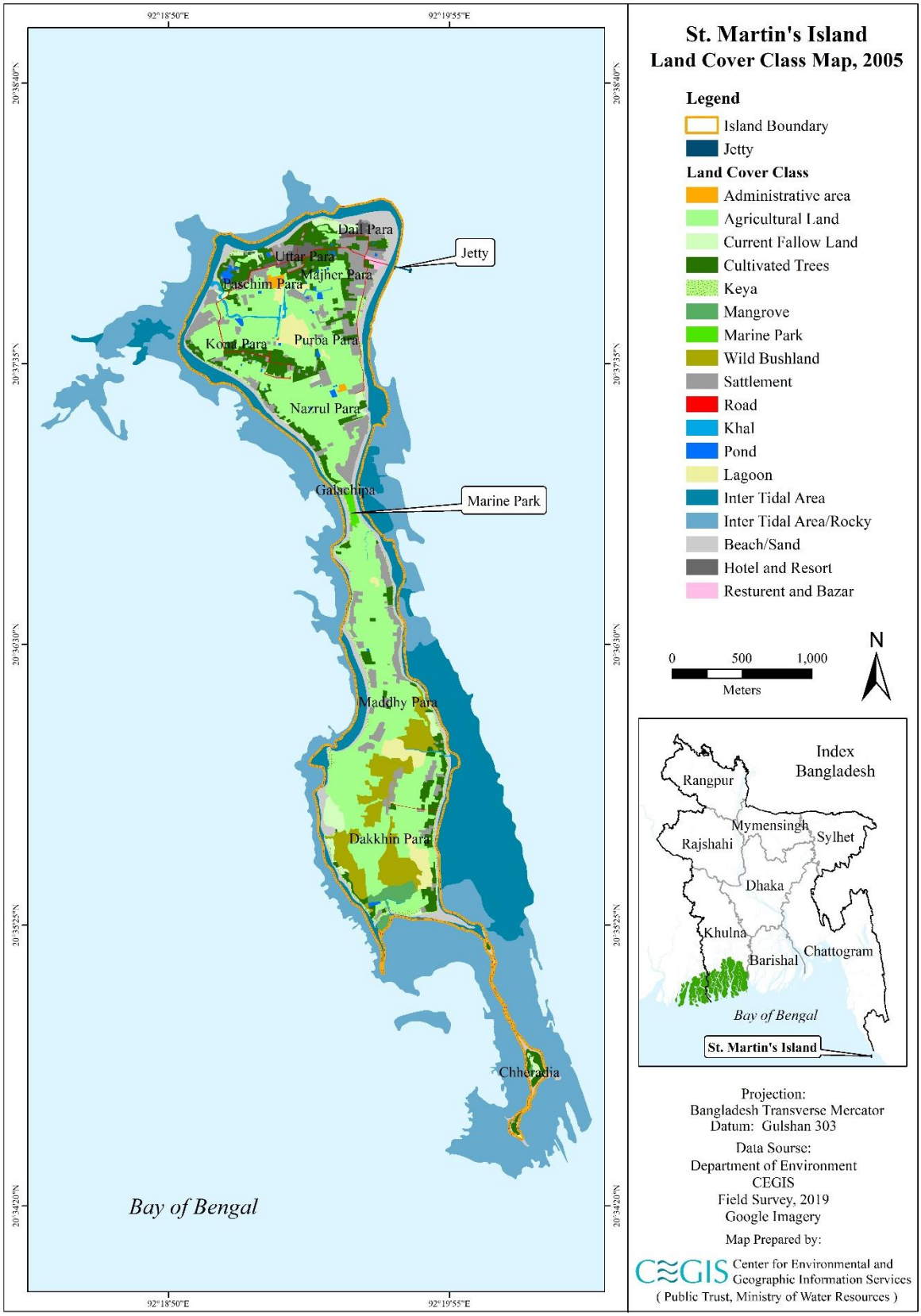


Figure 4.1: Land Cover Map 2005

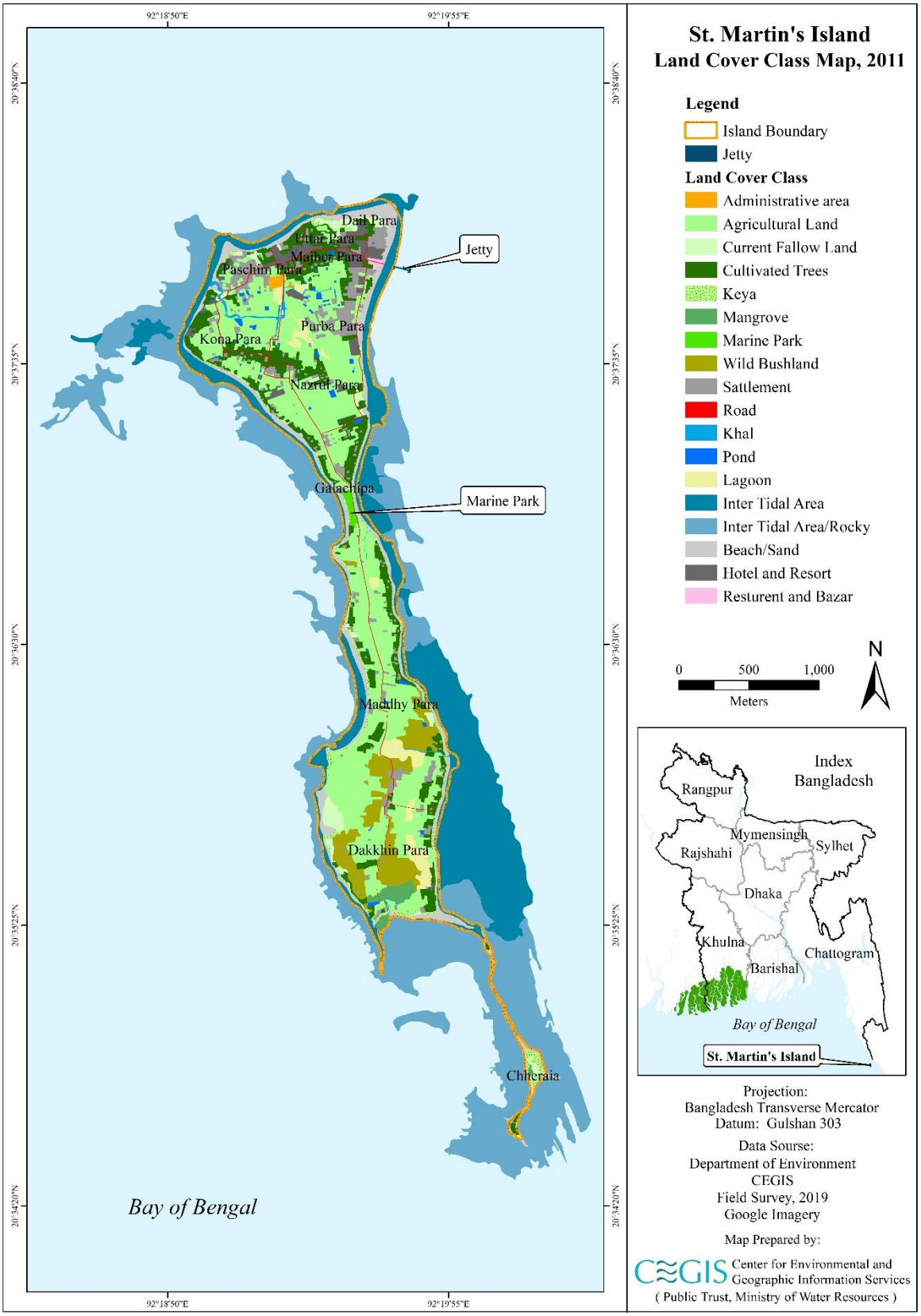


Figure 4.2: Land Cover Map 2011

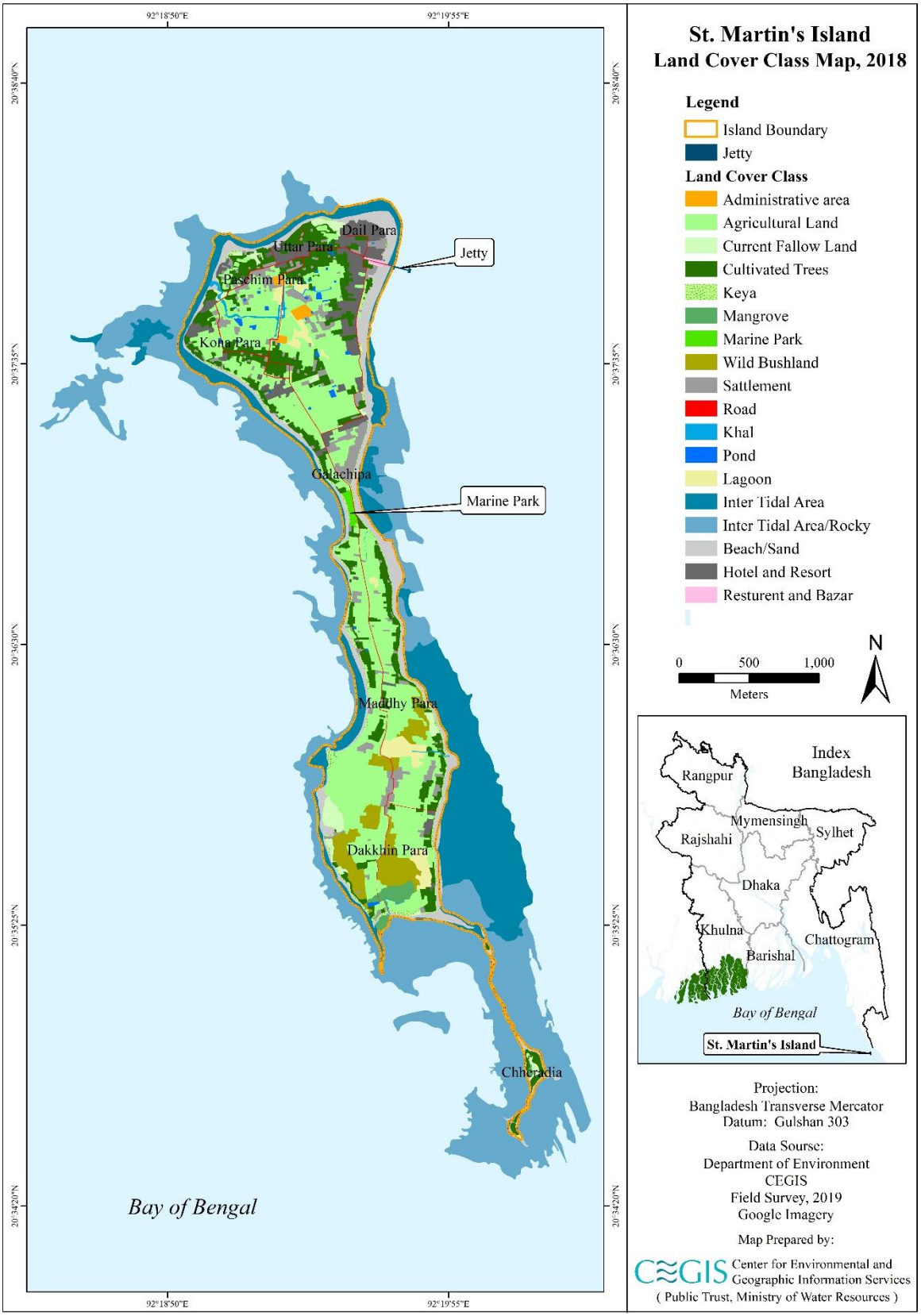


Figure 4.3: Land Cover Map 2018

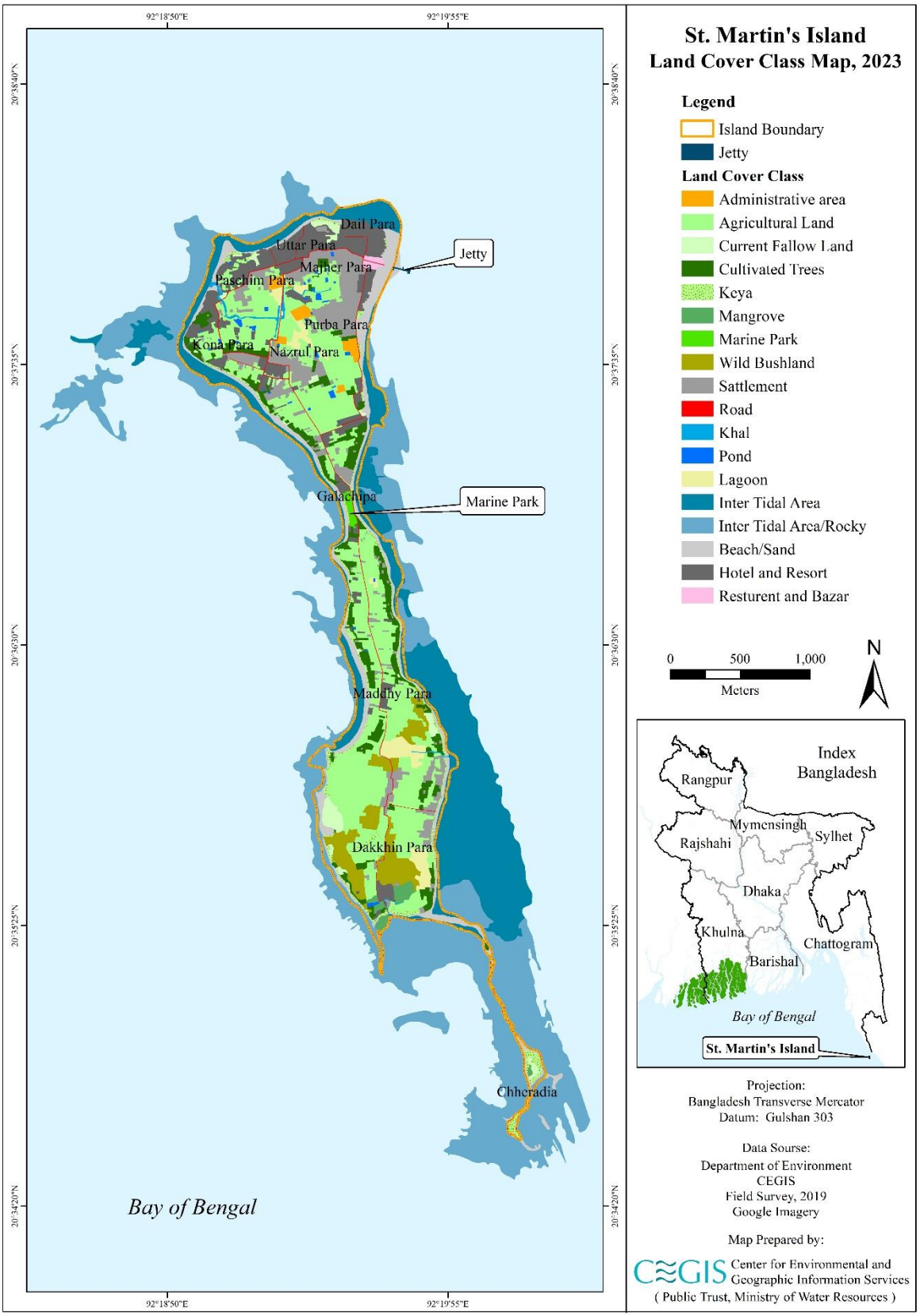


Figure 4.4: Land Cover Map 2023

4.3 Class-wise Land Cover Transition

4.3.1 Developed Area

Between 2005 and 2011, a total of 57.57 Ha of Developed Area was retained, with minor portions shifting to Waterbodies (1.35 Ha), Mangrove (0.02 Ha), Vegetation Area (26.85 Ha), Agricultural Land (9.77 Ha), and Open Area (4.45 Ha). During 2011–2018, maintenance of Developed Area increased to 80.17 Ha, accompanied by limited conversions to Vegetation Area (17.73 Ha), Agricultural Land (1.41 Ha), Waterbodies (0.08 Ha), and Open Area (0.62 Ha). From 2018 to 2023, the majority of the Developed Area remained constant at 92.3 Ha, with modest transitions to Vegetation Area (1.65 Ha), Agricultural Land (5.33 Ha), Waterbodies (0.03 Ha), and Open Area (0.68 Ha); notably, no transitions to Mangrove were recorded. These trends demonstrate that while the Developed Area has predominantly persisted across these periods, localized shifts to vegetated, agricultural, and open land types have occurred.

Table 4.3: Transition of Developed Area into Other Classes (%)

Transition Period	Developed Area (Retained)	Waterbodies	Mangrove	Vegetation Area	Agricultural	Open Area
2005 to 2011	57.57	1.35	0.02	26.85	9.77	4.45
2011 to 2018	80.17	0.08	0.00	17.73	1.41	0.62
2018 to 2023	92.30	0.03	0.00	1.65	5.33	0.68

4.3.2 Waterbodies

From 2005 to 2011, the majority of the Developed Area underwent conversion to Waterbodies (99.78%), with only minimal proportions persisting as Developed Area (0.01%) or transitioning to Mangrove (0%), Vegetation Area (0.01%), Agricultural Land (0.05%), and Open Area (0.16%). During 2011–2018, almost all Developed Area continued to be converted to Waterbodies (99.96%), accompanied by a slight increase in Agricultural Land (0.03%) and negligible retention or change to other categories. In the period from 2018 to 2023, 99.99% of the area was transferred to Waterbodies, with just 0.01% shifting to Open Area and no recorded transitions to Mangrove, Vegetation Area, or Agricultural Land.

Table 4.4: Transition of Waterbodies into Other Classes (%)

Transition Period	Developed Area	Waterbodies (Retained)	Mangrove	Vegetation Area	Agricultural	Open Area
2005 to 2011	0.01	99.78	0.00	0.01	0.05	0.16
2011 to 2018	0.01	99.96	0.00	0.00	0.03	0.00
2018 to 2023	0.00	99.99	0.00	0.00	0.00	0.01

4.3.3 Mangrove

From 2005 to 2011, 85.59 % of mangrove areas were preserved, with minor conversions to developed area (0.32 %), waterbodies (1.76 %), vegetation area (2.05 %), agricultural land (3.55 %), and open area (6.72 %). During the period from 2011 to 2018, mangrove retention increased to 97.6 %, accompanied by a small transition to agricultural land (2.4 %) and no notable changes to other categories. From 2018 to 2023, mangrove areas experienced complete retention (100 %), with no observed transitions to any other land use types.

Table 4.5: Transition of Mangrove into Other Classes

Transition Period	Developed Area	Waterbodies	Mangrove (Retained)	Vegetation Area	Agricultural	Open Area
2005 to 2011	0.32	1.76	85.59	2.05	3.55	6.72
2011 to 2018	0.00	0.00	97.60	0.00	2.40	0.00
2018 to 2023	0.00	0.00	100.00	0.00	0.00	0.00

4.3.4 Vegetation Area

Between 2005 and 2011, 73.72% of the Vegetation Area remained intact, with smaller fractions converting to Developed Area (10.62%), Waterbodies (1.03%), Mangrove (0.29%), Agricultural Land (8.54%), and Open Area (5.8%). From 2011 to 2018, retention increased marginally to 81.47%, accompanied by limited conversions to Developed Area (9.45%), Waterbodies (1.07%), Agricultural Land (6.67%), and Open Area (1.34%); notably, there were no transitions to Mangrove during this period. In the subsequent interval from 2018 to 2023, 68.01% of the original Vegetation Area was preserved, while 26.03% shifted to Developed Area, 3.47% to Agricultural Land, and 2.49% to Open Area; transitions to Waterbodies or Mangrove were not recorded in this timeframe.

Table 4.6: Transition of Vegetation Area into Other Classes

Transition Period	Developed Area	Waterbodies	Mangrove	Vegetation Area (Retained)	Agricultural	Open Area
2005 to 2011	10.62	1.03	0.29	73.72	8.54	5.80
2011 to 2018	9.45	1.07	0.00	81.47	6.67	1.34
2018 to 2023	26.03	0.00	0.00	68.01	3.47	2.49

4.3.5 Agricultural

From 2005 to 2011, 83.52% of Developed Area remained unchanged, while specific proportions were converted to Developed Area itself (7.35%), Waterbodies (2.47%), Mangrove (0.09%), Vegetation Area (6.15%), and Open Area (0.41%). During the 2011–2018 period, retention increased to 92.32%, with limited transitions to Developed Area (5.64%), Waterbodies (0.15%), and Vegetation Area (1.89%); there was no recorded conversion to Mangrove or Open Area. In the interval between 2018 and 2023, 94.93% of Developed Area was retained, with modest portions shifting to Developed Area (2.81%), Waterbodies (0.11%), Vegetation Area (1.68%), and Open Area (0.48%), and no detected conversion to Mangrove.

Table 4.7: Transition of Agricultural into Other Classes (%)

Transition Period	Developed Area	Waterbodies	Mangrove	Vegetation Area	Agricultural (Retained)	Open Area
2005 to 2011	7.35	2.47	0.09	6.15	83.52	0.41
2011 to 2018	5.64	0.15	0.00	1.89	92.32	0.00
2018 to 2023	2.81	0.11	0.00	1.68	94.93	0.48

4.3.6 Open Area

Between 2005 and 2011, 94.9% of Open Area was preserved, with minor portions converted to Developed Area (0.26%), Waterbodies (2.99%), Mangrove (0.04%), Vegetation Area (1.57%), and Agricultural Land (0.25%). From 2011 to 2018, the rate of retention increased to 99.09%, accompanied by minimal transitions to Developed Area (0.24%), Waterbodies (0.55%), Vegetation Area (0.06%), and Agricultural Land (0.05%), while no measurable change was recorded for Mangrove. During 2018–2023, Open Area retention reached 99.59%, with only negligible conversions to Developed Area (0.23%), Waterbodies (0.01%), and Vegetation Area (0.18%); there were no observed transitions to Mangrove or Agricultural Land.

Table 4.8: Transition of Open Area into Other Classes (%)

Transition Period	Developed Area	Waterbodies	Mangrove	Vegetation Area	Agricultural	Open Area (Retained)
2005 to 2011	0.26	2.99	0.04	1.57	0.25	94.90
2011 to 2018	0.24	0.55	0.00	0.06	0.05	99.09
2018 to 2023	0.23	0.01	0.00	0.18	0.00	99.59

5. Delineation of Conservation Management Zones

5.1 Introduction

This chapter presents a functional zoning framework for the Ecologically Critical Area of Saint Martin's Island. Its primary objective is to conserve the island's unique and critical species and habitats while ensuring the continued provision of essential ecological services. Additionally, the chapter addresses strategies to minimize conflicts between conservation priorities and economic development on SMI.

The zoning initiative was designed with several key objectives: (a) to identify, allocate, and delineate specific geographical areas within SMI based on varying levels and intensities of permitted human activity and conservation needs; (b) to establish permissible activities and attendant restrictions for each designated zone; (c) to recommend differentiated management actions to support sustainable resource management across zones; and (d) to provide actionable guidance for the Department of Environment and other stakeholders.

Employing an eco-management zoning model and a multidimensional methodology, the zoning plan was developed through the identification, assessment, and prioritization of conservation features—both species and habitats—along with their spatial distribution within SMI. The process also encompassed the evaluation of biodiversity threats and resource pressures, as well as the analysis of economic and social priorities. This comprehensive approach required extensive fieldwork, thorough data collection, and consultation with both experts and local stakeholders. All previous zoning plans for the island were systematically reviewed to assess implementation outcomes, management efficacy, prevailing challenges, and lessons learned from both research and operational perspectives.

The resulting zoning scheme for SMI aligns with the IUCN Protected Area Management Categories (IUCN, 1994), incorporating modifications tailored to the island's distinct ecological and social context. Geographical conservation areas were identified and validated using a scoring matrix, which applied quantitative parameters to categorize and assign conservation zones appropriately.

5.2 Purpose of Zoning Plan

The primary goal of the current zoning plan is to promote the conservation of distinctive and essential species and habitats within SMI, ensuring the continued provision of its ecological services while minimizing conflicts between environmental protection and economic development.

The specific purposes are as follows:

- To identify, allocate, and delineate geographic regions within SMI for designated levels and intensities of human activity and conservation efforts;
- To establish permitted activities and associated restrictions in each defined area;
- To recommend adaptive management strategies for sustainable resource use in other specified locations;
- To offer comprehensive guidance for all forms of land and resource utilization;

5.3 Guidelines for Zoning Plan

The guidelines presented below for the development of zoning plans are adapted from publications by the Great Barrier Reef Marine Park and the International Union for Conservation of Nature (IUCN), with essential modifications made to address the specific context of SMI.

General, Legislative, and Management Requirements

- The zoning plan should be designed with maximum practicability and simplicity in mind.
- Regulatory measures on human activities should be minimized, provided that the goals of protection, restoration, responsible use, education, and enjoyment of the area are met.
- Wherever feasible, the plan should align with existing zoning frameworks for the nation's other ECAs and Protected Areas (PAs).
- Zoning patterns should avoid sudden transitions between areas of strict protection and those with lower levels of protection.
- Buffer zones should be established so that highly protected areas are bordered by zones affording moderate protection.
- Each zone should encompass geographically discrete features, such as an island or reef.
- Zoning boundaries should, whenever practical, be defined using recognizable geographical features.
- Zoning plans should, as far as possible, support and enhance existing regulations and management practices.

Conservation of Significant Habitats

- Wherever practicable, areas of global, regional, or local importance to threatened species (such as turtles, spoon-billed sandpipers, corals, etc.) should receive suitable protective zoning measures.
- Significant spawning, breeding, or nursery sites should, where feasible, be afforded elevated levels of protection, especially for species subject to harvesting activities—through mechanisms such as IUCN Category I or II zoning, seasonal closures, or Replenishment Area designation.
- Where possible, sources of coral and other sedentary species' larvae that replenish surrounding regions should be identified via "source-sink" larval movement studies and designated as highly protected through appropriate zoning.
- Generally, areas acknowledged or utilized for reasonable extractive purposes (i.e., the removal of animals, plants, or objects) should be zoned to permit public use.
- Sites of significance for non-extractive activities should be assigned to IUCN Category I or II zoning.
- When specific activities are excluded from an area by zoning, alternative access should be provided elsewhere whenever feasible.

Commercial and Recreational Activities

- Generally, areas designated for reasonable extractive activities, those involving the removal of animals, plants, or objects, should be allocated for public use.
- Areas identified as significant for non-extractive purposes are best assigned IUCN Category I or II zoning classifications.
- Where a reef or reefs are zoned to prohibit certain activities, efforts should be made, where feasible, to provide access to alternative suitable locations.

Traditional Fishing

Where a consistent tradition of fishing exists among local residents for subsistence or cultural purposes, such practices should generally be permitted within management plans. However, in situations where the target species are endangered or have become extremely scarce, it may be necessary to restrict or prohibit traditional use. Nonetheless, provisions should be made, insofar as practicable, to accommodate traditional hunting and fishing by Indigenous peoples within protected areas.

Anchorages

Zoning for principal anchorage sites should allow the continuation of current overnight and extended vessel anchoring practices. The plan will aim to preserve access for small vessels to essential all-weather anchorages, while guaranteeing unrestricted entry to all zones during emergency situations. Where feasible, in less sensitive and potentially high-traffic areas, anchoring demand should be addressed by providing moorings and mandating their use.

Scientific Research

Arrangements should be established to conduct scientific research across all zone areas. Nevertheless, exclusive zoning for scientific research should only occur where current and foreseeable research programs demonstrate a consistent and substantial need for such use.

5.4 Factors for Zoning Plan

This section presents an integrated zoning plan aimed at promoting the sustainable use of natural resources, facilitating balanced tourism development, and ensuring the smooth functioning of daily life for residents in SMI. The new plan incorporates insights and recommendations from the three previous zoning systems, striving for ecosystem compatibility and practical management strategies. Key steps in the planning process included comprehensive field observations, surveys of natural resources, ecosystem identification, current land-use delineation, and assessment of local community perceptions.

The following summarizes the key attributes of this zoning system:

Alignment of conservation and socio-economic priorities: The current zoning framework acknowledges local needs and development objectives, ensuring that social and economic interests are balanced alongside biodiversity conservation. Designated zones support economic and tourism-related activities.

Mitigation of land-use conflicts: By reserving specific areas for socio-economic activities such as organic farming and ecotourism—and incorporating community participation into the planning process—the new zoning approach aims to minimize regional disputes over resource use.

Streamlined and practical design: The system consists of four functional zones devised with management requirements in mind. Its straightforward structure adheres to zoning principles and existing land-use patterns, effectively supporting conservation goals.

Consideration of natural features and socio-economic conditions: Ecosystem types, habitats, socio-economic profiles, and tourism initiatives serve as central factors informing this zoning strategy.

Integrated and comprehensive approach: This plan builds upon previous zoning frameworks, incorporating pertinent elements from earlier plans through direct engagement with local stakeholders, implementing agencies, and community representatives.

Utilization of recent and comprehensive data: Development is grounded in field assessments, detailed surveys, and insights gained from prior systems, addressing practical applicability and identified gaps.

Management guidelines: The zoning scheme assigns specific activities to designated areas, establishes regulations for each zone, and provides operational directives outlining the actions required of the DoE to fulfil management objectives.

5.5 Delineation of Management Zones

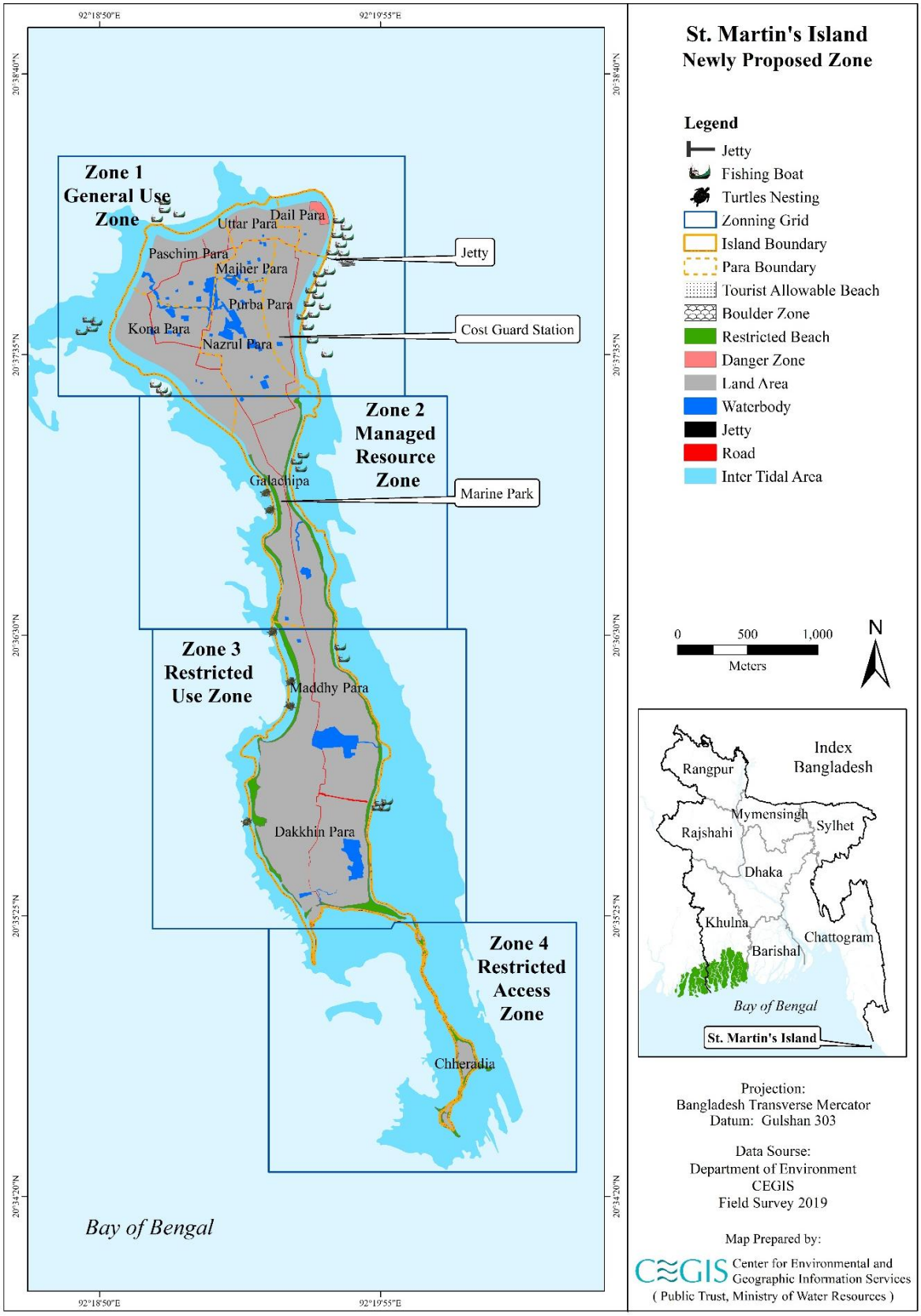
To ensure sustainable management of the island's resources, the entire area has been classified into four distinct conservation management zones. The definitions for each zone are provided below, with their locations illustrated in Figure 5.1.

General Use Zone: This zone permits a variety of activities, including habitation, resource extraction, regeneration, economic operations, and infrastructure development, as long as they comply with established sustainable development guidelines (2020d).

Managed Resource Zone/Sustainable Use Zone: Intended to safeguard significant ecological attributes, this zone allows for regulated human habitation, resource use, and regeneration activities in accordance with sustainability principles and ecotourism standards.

Restricted Use Zone: Access is limited to guided ecotourism within designated areas; resource extraction and other human activities are strictly prohibited.

Restricted Access Zone: Human presence and activities are not permitted to maintain the area's natural state. However, essential maintenance and targeted restoration initiatives may be authorized when necessary.



Source: DoE, 2020d

Figure 5.1: Newly Proposed Zoning of Saint Martin's Island

5.5.1 General Use Zone

Management Strategy, Approach and Objectives

The approach for this zone is to maintain its status as a multiple-use area, mirroring current functions, while restricting unsustainable practices, minimizing unnecessary infrastructure expansion, and supporting sustainable development to ensure a continual supply of natural products and services for the local community.

Specific objectives include:

- Fostering sustainable tourism in accordance with the island's carrying capacity, with a focus on redirecting a portion of revenues to benefit local communities;
- Preventing further degradation of ecosystems and their associated biota;
- Promoting the prudent and sustainable utilization of resources;
- Ensuring all economic activities align with sustainable development principles, thereby limiting land conversion and superfluous infrastructure development;

Management Approach: Deliver comprehensive on-site information and interpretation, collaborate closely with local authorities and civil society, and implement and enforce clearly defined regulations for users.

General Rules and Regulations

Given its high population density, extensive infrastructure, significant economic activities, and limited ecological sensitivity, this zone is designated for general use. Consequently, flexible rules and regulations will be applied, prioritizing sustainable development and social well-being.

The recommended guidelines and restrictions for this zone are as follows:

- The zone is open to sustainable development initiatives, with a focus on organic farming, traditional practices, cultural events, and production of arts and crafts.
- Tourism operations must adhere to the island's carrying capacity, considering the ecological attributes of Saint Martin's ECA and MPA.
- Only essential infrastructure may be developed, subject to the findings of Environmental Impact Assessment (EIA) studies.
- Land conversion should be minimized wherever possible.
- Agricultural activities and the cultivation of native species (e.g., coconuts) shall take precedence over non-native species (e.g., eucalyptus, koroi).
- An Environmental Clearance Certificate (ECC), based on the results of an EIA and approved by ECA authorities, is mandatory for all development projects within this area.
- Fishing activities must avoid harmful gear, operate outside coral bed areas, and comply with DoE and Department of Fisheries (DoF) regulations.
- Any activity that could degrade the natural conditions of this or other zones on the island is strictly prohibited.
- Boat anchoring is permitted only in specified locations as indicated on the zone map.

The following activities are not permitted in this zone:

- Collection of corals and other invertebrates from sub-tidal and intertidal areas.
- Removal of coral stones for any purpose.
- Use of night-time lighting or visitors' movement on the beach at night.
- Activities causing air, water, or land pollution.
- Actions altering the site's natural characteristics.
- Cutting of natural vegetation, or hunting and killing wildlife.
- Commercial use of chemicals or pollutants with negative environmental impacts.
- Discharge of used fuels, lubricants, or solid waste from engine boats into the sea.
- Disposal of land-based solid or liquid waste into lagoons or the sea.
- Operation of two- and three-wheeled vehicles, motorized or non-motorized, on the beach at any time.

Oversight of site activities shall be the responsibility of the DoE or local Community-Based Organizations (CBOs).

Required Management Actions by DoE

- Take proactive measures to promote sustainable tourism practices on the island.
- Increase local awareness regarding zone management and biodiversity conservation efforts.
- Ensure meaningful local stakeholder participation in zone management processes.
- Implement and support an effective system for land-based solid waste collection, storage, recycling, and disposal.

5.5.2 Managed Resource Zone

Management Strategy and Objectives

The management strategy for this zone is to utilize it as a buffer, thereby alleviating pressure on the more sensitive southern areas. Concurrently, the site will benefit the community by ensuring a sustainable supply of ecosystem services and products through environmentally responsible practices, such as organic agriculture, while safeguarding key habitats and biodiversity.

The specific objectives for this zone are as follows:

- Preserve the current diversity of natural features and encourage restoration to optimal functional conditions.
- Maintain a balanced interaction between the natural environment and cultural heritage through the protection of both landscape and seascape elements.
- Promote livelihoods and economic activities that align with ecological sustainability and support the preservation of the social and cultural traditions of local communities.

Management Approach

On-site information dissemination and interpretation will be provided. Rigorous monitoring protocols will be implemented, alongside active engagement with local authorities and civil society. Clearly defined user regulations will be enforced to ensure compliance with management goals.

General Rules and Regulations

This zone should be managed to ensure sustainable use of natural resources, preventing environmental degradation while maintaining the integrity of the natural ecosystem. Additionally, nature-based interventions will be supported, protected, and monitored to restore ecological functionality.

To achieve the objectives of this zone, the following regulations are recommended:

- Expansion of illegal resorts, motels, hotels, or restaurants is strictly prohibited, and existing unauthorized establishments must be removed.
- Development of human settlements that damage or destroy the natural ecosystem or encroach upon areas of native vegetation is not permitted.
- Any activities that may result in the deterioration of the zone's natural conditions shall be disallowed.
- Use of chemicals (fertilizers and pesticides) for agriculture must be limited, with harmful substances banned wherever feasible.
- Encroachment on the beach area and destruction of floral vegetation are strictly forbidden.
- Only native species and designated beach protection plants may be introduced.
- The operation of motorized or non-motorized two- and three-wheelers is strictly always prohibited in the beach area.

The following activities are specifically forbidden within the zone:

- Strict prohibition of turtle egg collection and beach cycling along the shoreline.
- Restriction on the collection of coral or other invertebrates from intertidal and sub-tidal areas.
- An Environmental Clearance Certificate, based on an Environmental Impact Assessment, is required for any development project within the zone.
- Approval from relevant ECA authorities is mandatory prior to issuance of any Environmental Clearance Certificate.
- Boating and beach roasting are not allowed during nighttime.

Required Management Actions by the DoE

- The DoE should clearly delineate and demarcate the site boundary and install signage to notify stakeholders of the zone boundaries and permitted or prohibited activities.
- Promote local awareness regarding zone management and biodiversity conservation.
- The DoE should undertake the relocation of turtle eggs to support successful hatching.
- Ensure meaningful participation of local stakeholders in zone management processes.
- Remove illegal resorts, hotels, and restaurants within the designated area.

5.5.3 Sustainable Use Zone

Management Strategy and Objectives

The management strategy for this zone is focused on preserving biodiversity and maintaining associated habitats in their natural state wherever possible. The area will be managed to prevent the

expansion of agricultural activities, restrict settlement development, prohibit the construction of resorts and hotels, and safeguard the natural environment. Additionally, efforts will include the careful planting of indigenous herbs and shrubs, as well as the conservation of mangroves and turtle nesting areas.

The specific management objectives for this zone are as follows:

- Ensure conservation and maintenance of the natural landscape values, supporting opportunities for tranquil enjoyment of nature and sustaining ongoing ecological processes;
- Permit biological processes to proceed with minimal intervention and restrict human access;
- Limit public entry and minimize disturbance to wildlife;
- Facilitate survey, research, monitoring, and allow strictly regulated, low-impact recreational activities with minimal facilities;

Management Approach

Protection will be achieved through regular patrolling and the enforcement of clearly defined rules and regulations.

General Rules and Regulations

This zone is subject to stringent regulations governing the use of natural vegetation, bushland, mangroves, and lagoons. Any complex development or significant landscape alteration requires prior authorization from the appropriate authorities. Continuous monitoring of both floral and faunal biodiversity, including coral beds, is mandatory. Special attention must be given to turtle nesting grounds to preserve morphological integrity, maintain beach quality, and prevent disturbances.

The following rules and regulations are strongly recommended for implementation within this zone:

- Human settlements, associated infrastructure, and related activities are strictly prohibited.
- Modification of natural features or landscapes, such as the collection of biological materials, is only permitted with proper authorization.
- Expansion of illegal resorts, motels, or restaurants, as well as the demolition of existing unauthorized structures, is forbidden.
- Construction activities may not proceed without approval from the relevant authority or the Department of Environment (DoE).
- Tourist access and roaming during designated times are not permitted.
- Cutting mangrove trees is strictly prohibited.
- Encroachment into lagoon areas is forbidden.
- Disposal of solid waste, oil, or other pollutants into terrestrial, marine, or estuarine environments is strictly prohibited.
- Activities that could alter the natural processes of terrestrial ecosystems are not allowed.
- Hunting or disturbing wildlife by any means is strictly prohibited.
- The cutting of natural forests, and the killing or hunting of wildlife, is not permitted.
- Collection of turtle eggs and intertidal invertebrates is prohibited.

- Operation of two- and three-wheeled vehicles, whether motorized or non-motorized, is strictly forbidden on the beach at all times.

Required Management Actions by the DoE

- The Department of Environment (DoE) should acquire the entire Dakshinpara area.
- The DoE should physically delineate and demarcate the zone boundary and all restricted areas, installing adequate signage and billboards featuring relevant messaging.
- Organize a community-level meeting with local stakeholders to communicate the locations and regulations of restricted zones and associated activities.
- Carry out awareness programs focused on rules, regulations, and biodiversity conservation within the local context.
- Install fencing along the southern boundary of the zone to prevent unauthorized access to adjacent restricted areas.
- Promote awareness among local residents regarding zone management and conservation of biodiversity.
- Facilitate meaningful local participation in the management of the zone.

5.5.4 Restricted Access Zone

Management Strategy and Objectives

This zone aligns with Category I of the IUCN, designated as a "Strict Nature Reserve," and is primarily intended for conservation and scientific research. The management strategy emphasizes preserving biodiversity and associated habitats in their natural state. The area is managed to accommodate only regulated scientific research and environmental monitoring activities. Conservation of natural features and ecological processes is prioritized above all other uses within this zone.

Management Objectives and Goals:

The foremost priority is the conservation of species, habitats, ecosystems, landforms, and landscapes, typically permitting only limited, nondestructive, and management-oriented research and monitoring.

Specific management objectives for this zone include:

- Preserving habitats, ecosystems, and species in as undisturbed a condition as possible;
- Limiting public access and minimizing disturbances to wildlife and aquatic fauna;
- Protecting structural landscape and geological formations;
- Ensuring representative examples of the natural environment are retained for scientific research and environmental monitoring.

Management Approach

Comprehensive protection is achieved through active patrols, strict enforcement measures, and ongoing monitoring.

General Rules and Regulations

The zone shall be subject to a high standard of protection as previously justified. Accordingly, development and human interventions are prohibited, with access permitted solely for regulated scientific research and ecological monitoring purposes.

Access to this zone is restricted exclusively to authorized management personnel and research scientists, contingent upon submission of appropriate documentation.

- Human settlements, infrastructure development, and associated practices are not permitted.
- The collection of natural resources—including corals, invertebrates, shells, and any other materials—is strictly forbidden.
- Activities that may alter the natural processes of terrestrial or marine life are prohibited.
- Any form of hunting or disturbance of wildlife is expressly prohibited.
- A no-fishing policy applies within a 1,000-meter radius from the shoreline.
- Activities leading to air, water, or land pollution are not allowed.
- Actions resulting in changes to the natural characteristics of the area are not permitted.

Required Management Actions by the DoE

- Clearly delineate and mark the zone boundaries with sufficient posts and signage.
- Enhance local awareness regarding zone management and biodiversity conservation initiatives.
- Engage in dialogue with local boat owners concerning the transport of tourists to Chera Dwip and implement restrictions on tourist travel to the area.
- Provide alternative livelihood opportunities to boat owners to ensure their economic security is not compromised.
- Implement measures to prevent unauthorized entry into the designated zone.
- Facilitate effective local participation in the management of the zone.

5.6 Assessment of Carrying Capacity

Saint Martin's Island is one of Bangladesh's most visited tourist destinations, noted for its pristine coral reefs, rich biodiversity, unspoiled sandy beaches, expansive ocean views, and mangrove ecosystems. Nevertheless, tourism exerts significant pressures on the island's natural environment. As such, a thorough understanding of tourism/tourist carrying capacity (TCC) as an environmental management tool is crucial to ensure a balance between resource use and conservation.

Through an evaluation of habitat conditions and conservation priorities, this study determines that only 4.1 km of beach located within the General Use Zone of the Conservation Management Zones of Saint Martin's Island (commonly known as Uttarpara) should be allocated for tourism activities (refer to Figure 5.3). By excluding sensitive and hazardous areas, applying appropriate correction factors, and considering effective beach management capabilities, the study recommends the island accommodate approximately 500–900 tourists per day during the tourism season, in line with a moderate conservation approach (see Table 5.1).

Table 5.1: Tourism Carrying Capacity of Saint Martin's Island

Standards	Physical Carrying Capacity (visitors/day)	Real Carrying Capacity (visitors/day)	Effective Carrying Capacity (visitors/day)
6 m^2	45,500	4,408	882
10 m^2	27,300	2,645	529

Source: DoE, 2020e

Figure 5.2: A Photograph of Tourists Flow at Saint Martin's Island

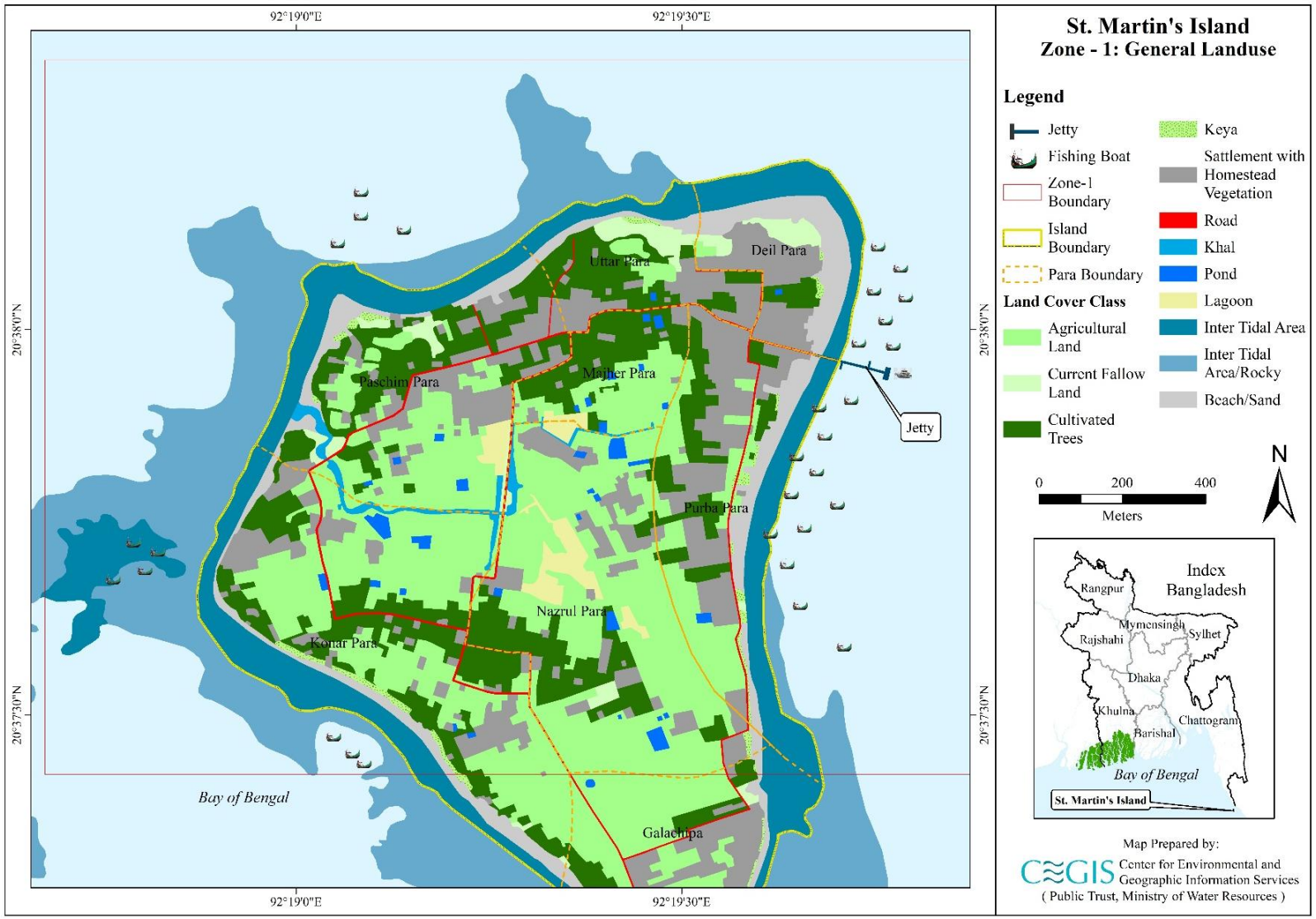


Figure 5.3: Available Beach Area Demarcation for Tourist Roaming in the Island

6. Conservation Policy and Acts

6.1 Overview

The Master Plan has been developed with the primary objective of preserving and safeguarding the island's ecosystem. It aligns with pertinent national plans, regulations, and legislation governing the water and environmental sectors. This alignment facilitates the effective resolution of challenges, integration of key concepts, and implementation of advancements identified in relevant national frameworks, thereby ensuring ongoing compliance. During the study period, a thorough review of all applicable acts, regulations, policies, strategies, and plans was conducted. This chapter provides an overview of the essential acts, rules, policies, strategies, and plans relevant to the SMI Master Plan, which are integral to the sustainable development and management of the island.

6.2 Legal and Policy Instruments

The national framework delivers a comprehensive overview of institutional barriers and regulatory authorities that affect local implementation. These legislative instruments offer legal and ethical support for all conservation efforts. Below is a summary of key legislative and policy measures that collectively establish the conservation regime for Saint Martin's Island.

Environmental Conservation Act (ECA), 1995 (Amended 2010)

The Environmental Conservation Act of 1995 constitutes Bangladesh's primary legal foundation for environmental protection, further strengthened by the 2010 amendment (Act No. 50 of 2010). Its principal objectives include conserving the environment, improving standards, and controlling pollution nationwide. The Act establishes requirements for environmental clearance of industrial projects, waste management, and designation of Ecologically Critical Areas (ECAs)[3],[4]. The 2010 amendment enhanced definitions of core environmental terms such as 'ecosystem,' 'pollution,' 'waste,' and 'hazardous substances' to facilitate enforcement. The declaration of ECAs under this Act is especially pertinent to Saint Martin's Island, enabling restrictions on activities that could threaten its vulnerable ecosystem.

Wildlife (Conservation and Security) Act, 2012

The Wildlife (Conservation and Security) Act, 2012 provides a crucial legal framework for biodiversity protection in Bangladesh, including Saint Martin's Island. It authorizes the government to declare locations as sanctuaries, national parks, or eco-parks, directly relevant to the island's status as a Marine Protected Area. By emphasizing conservation, prohibiting hunting, and regulating conduct within protected areas, the Act empowers authorities to safeguard the island's biodiversity and ecological integrity.

Environmental Conservation Rules (ECR), 2023

Building upon the ECA 1995, the Environmental Conservation Rules (ECR), 2023 introduce technical and operational procedures for implementation. Superseding previous guidelines (ECR 1997), the new rules significantly upgrade environmental standards, detailing stricter protocols for industrial emissions, waste management, and projects[5] clearance. While not directly linked, these rules supply

[3] https://faolex.fao.org/docs/pdf/bgd167046.pdf

[4] https://news.mongabay.com/2022/12/in-bangladesh-ecologically-critical-areas-exist-only-on-paper/

[5] https://juralacuity.com/bangladesh-environment-conservation-act-1995/

essential regulatory tools to counteract threats from tourism-driven pollution and inadequate waste disposal on Saint Martin's Island.

The direct applicability of these regulations to Saint Martin's Island may be limited. However, they offer essential regulatory mechanisms to effectively address the island's primary challenges, including pollution arising from the growing tourism industry, insufficient management of solid and liquid waste, and emissions generated by tourist vessels.

Ecologically Critical Area (ECA) Management Rules, 2016

The Ecologically Critical Area (ECA) Management Rules, 2016 were established by the Ministry of Environment, Forest and Climate Change under the Bangladesh Environment Conservation Act, 1995. These regulations are intended to facilitate the effective management and sustainable development of areas designated as ECAs owing to their substantial ecological value and susceptibility to environmental degradation. The rules provide a structured legal foundation for the identification, declaration, and administration of such ecologically sensitive zones throughout Bangladesh (Sajal, 2018).

The ECA Management Rules, 2016 specify the procedures for declaring environmentally endangered areas and outline activities that are strictly prohibited, including development, resource extraction, and other actions detrimental to environmental integrity. Furthermore, the rules mandate the formation of local and national committees tasked with overseeing conservation efforts and ecosystem restoration. These provisions are particularly vital for the ECA of Saint Martin's Island, establishing regulations on human activities and tourism while safeguarding the island's distinctive biodiversity, such as coral reefs and marine ecosystems, to mitigate ongoing degradation[6].

Solid Waste Management Rules, 2021

The Solid Waste Management Rules (SWMR) of 2021, established under the Bangladesh Environmental Conservation Act, 1995, offer a comprehensive legal framework for solid waste management nationwide. These regulations focus on promoting effective waste collection, segregation, transportation, processing, and disposal, prioritizing the 3R principles Reduce, Reuse, and Recycle.

The Solid Waste Management Rules 2021 play a critical role in addressing the acute waste management challenges facing Saint Martin's Island. The rise in tourism has led to a significant increase in solid waste generation, particularly plastics, which frequently end up in the ocean and pose a threat to coral reefs and marine biodiversity. SWMR 2021 provides the necessary legal basis for implementing a systematic and sustainable approach to waste management, encompassing source segregation and environmentally sound disposal practices. Successful implementation will require substantial investment in infrastructure, capacity development for local authorities, and rigorous enforcement of the rules, especially in relation to tourist activities and commercial entities.

National Environmental Policy, 2018

The National Environmental Policy 2018, established by the Ministry of Environment, Forest and Climate Change, functions as a comprehensive framework for environmental management across Bangladesh. This policy is designed to seamlessly integrate environmental objectives into the national development strategy, in accordance with constitutional mandates and broader governmental priorities. Its principal aims encompass the preservation of ecological balance, pollution control,

[6] https://www.dhakatribune.com/bangladesh/348739/govt-moves-to-protect-ecologically-critical-areas

biodiversity conservation, climate change mitigation, and the sustainable utilization of natural resources.

In relation to Saint Martin's Island, the Environmental Policy 2018 outlines essential principles and strategic guidelines for all conservation and management initiatives. The policy highlights the necessity of safeguarding ecologically sensitive zones, fostering responsible tourism, and addressing climate change impacts on fragile coastal areas. The focus on sustainable resource use and rigorous pollution control measures is especially pertinent for supporting the enduring ecological stability and resilience of Saint Martin's Island.

National Land Use Policy, 2001

The "National Land Use Policy," introduced in 2001, was designed to address a range of land-related challenges and opportunities. Despite its introduction, substantial portions of the policy remain unimplemented, underscoring the necessity for a comprehensive review and update to address current nationwide issues. Specifically, for St. Martin's Island, the 2001 policy highlights the importance of effective land utilization and conservation measures.

Coastal Zone Policy, 2005

The Coastal Zone Policy of Bangladesh, established in 2005, serves as a comprehensive framework for the sustainable management and development of the nation's coastal regions. It acknowledges these areas as possessing both significant challenges and valuable opportunities. Saint Martin's Island is directly referenced within the policy due to its coral ecosystems. Key components of the policy—such as fostering economic growth through responsible resource management, mitigating risks associated with natural disasters, and preserving essential ecosystems are particularly pertinent to Saint Martin's Island.

Environment and Biodiversity Conservation of Saint Martin's Island and Eco-Friendly Tourism Guidelines, 2023

On May 23, the Ministry of Environment, Forest and Climate Change announced a gazette notification outlining 35 directives under the title "Environment and Biodiversity Conservation of Saint Martin's Island and Eco-Friendly Tourism Guidelines, 2023," with immediate implementation[7] required by all relevant authorities.

Key elements of the guidelines include stringent regulation of infrastructure development, strictly prohibiting any new construction or expansion that may negatively impact the environment. All tourists are now required to register online prior to visiting the island, and an entry fee has been instituted to control visitor numbers in accordance with the island's effective carrying capacity. The guidelines detail permissible and prohibited activities for both tourists and residents, emphasizing the preservation of biodiversity and ecological integrity. These provisions encompass restrictions on waste disposal, mitigation of noise pollution, and bans on collecting or purchasing marine organisms such as corals, shells, and starfish. Additionally, the use of motor vehicles on the island is forbidden, with rickshaws and bicycles permitted only on specified routes, never on the beach.

Waste management protocols require proper disposal practices and expressly prohibit the discharge of waste into the ocean. The directives further promote the restoration of seaweed and coral populations, regulate tourist vessel speeds, and mandate safe anchoring distances from shore to protect marine habitats.

[7] https://businesspostbd.com/front/strict-steps-to-save-saint-martins-2023-06-10

Implementation will be coordinated by a group of government bodies including the Civil Aviation and Tourism Ministry, Fisheries and Livestock Ministry, Cox's Bazar Development Authority, Department of Environment, Forest Department, Shipping Department, Bangladesh Oceanographic Research Institute, Cox's Bazar District Administration, Teknaf Upazila Administration, and Saint Martin's Union Parishad. Additional partners comprise the Foreign Ministry, Land Ministry, Law and Justice Division, Bangladesh Police and Tourist Police, Bangladesh Coast Guard, Energy and Mineral Resources Division, Bangladesh Water Development Board, Beach Management Committee, and Department of Youth Development.

Marine Protected Area (MPA) Declaration

The Government of Bangladesh has designated a new marine protected area (MPA) encompassing 1,743 square kilometers (672 square miles) surrounding Saint Martin's Island. This MPA constitutes approximately 1.5 percent of Bangladesh's exclusive economic zone. The waters in this region support significant biodiversity, serving as critical habitat for the nation's only coral reef and supporting more than 230 finfish species. The newly established MPA is also intended to safeguard globally threatened species such as Indo-Pacific humpback dolphins, whale sharks, white-spotted whiprays, long-tailed butterfly rays, olive ridley, green, and loggerhead turtles.

Under MPA designation, a legal structure is implemented to regulate human activity within its boundaries, aiming to mitigate overfishing, curb destructive fishing methods, and reduce pollution. Management measures are structured to promote sustainable use, facilitate scientific research, and increase public awareness of marine conservation issues. Through the establishment of this protected area, Bangladesh affirms its ongoing commitment to preserving its marine resources and sustaining the ecological integrity of Saint Martin's Island (Das *et al.,* 2022).

Bangladesh Delta Plan, 2100

Bangladesh Delta Plan 2100 (BDP 2100) has been developed to guide Bangladesh's progress through the end of the 21st century. The plan encompasses a suite of long-term strategies and targeted interventions aimed at securing water and food resources, fostering economic growth, and promoting environmental sustainability. It also seeks to minimize vulnerability to natural disasters and strengthen resilience against climate change and other delta-related challenges by utilizing robust, adaptive, and integrated approaches alongside equitable water governance.

The adaptive management framework of the Delta Plan is particularly pertinent for coastal and island ecosystems such as Saint Martin's Island, which face considerable risks from climate change, rising sea levels, and natural hazards. Through the promotion of integrated water and land management practices, BDP 2100 aims to maintain the ecological integrity and socio-economic stability of deltaic regions. This includes efforts to conserve vital habitats and ensure the sustainable utilization of natural resources on islands like Saint Martin's (World Bank, 2023).

National Biodiversity Strategies and Action Plans (NBSAP), 2016-2021

As a signatory to the Convention on Biological Diversity (CBD), Bangladesh has established and regularly revised its National Biodiversity Strategies and Action Plans (NBSAP). NBSAP serves as the principal national mechanism for implementing the objectives of the CBD, effectively translating international biodiversity targets into actionable national measures. For example, the NBSAP 2016–2021 identified targeted strategies and initiatives to conserve biodiversity, promote sustainable utilization, and ensure the fair and equitable distribution of benefits derived from genetic resources.

Specifically, for Saint Martin's Island, the NBSAP provides a comprehensive framework that informs conservation activities, including habitat restoration, protection of endangered species, and

sustainable management of marine resources. It supports an integrated approach by engaging government entities, local communities, and various stakeholders in joint biodiversity conservation efforts.

Kunming-Montreal Global Biodiversity Framework (GBF), 2022

The Kunming-Montreal Global Biodiversity Framework (GBF) was adopted at the fifteenth meeting of the Conference of the Parties (COP 15), following a four-year process of consultation and negotiation. This landmark Framework builds upon previous Strategic Plans under the Convention and is aligned with the attainment of the Sustainable Development Goals. It establishes an ambitious roadmap towards the global vision of living in harmony with nature by 2050, including four primary goals for 2050 and 23 specific targets to achieve by 2030.

The principles and objectives set forth in the GBF are particularly pertinent to the conservation efforts on Saint Martin's Island. The Framework underscores the importance of implementing effective area-based conservation, restoring degraded ecosystems, and promoting the sustainable use of biodiversity. Furthermore, it calls for protected areas and other effective conservation measures to be expanded to encompass at least 30% of the planet by 2030, while acknowledging and respecting the rights and contributions of Indigenous peoples and local communities[8].

6.3 Policy Directives

The Master Plan functions as a conservation-focused initiative dedicated to preserving the ecosystem of St. Martin Island, which has been officially designated by the Government of Bangladesh as an Ecologically Critical Area (ECA). ECAs are identified specifically for conservation purposes, precluding development-focused activities.

The Land Use Policy of 2001 emphasizes the protection of agricultural land to support food security. Within the project area, current land use is largely characterized by ecologically sensitive zones, particularly with respect to marine biodiversity. All development activities will comply with stringent environmental protection standards, ensuring that agricultural land remains untouched by developmental interventions. Accordingly, existing policies and plans are aligned with this master plan, thereby minimizing risks to natural resources and local communities.

Historically, governmental agencies have enacted various restrictions to regulate tourism—such as imposing a cap of 1,250 daily visitors and prohibiting overnight stays—but these measures were consistently overturned under pressure from tourism stakeholders and ultimately left unimplemented implemented9. In contrast, the 2023 Guidelines were established as binding directives under the Bangladesh Environment Conservation Act, 1995, thus affording them substantial legal weight10. Their enactment marked a shift from years of fragmented and reactive management toward a proactive, comprehensive, and enforceable regulatory approach designed to harmonize tourism with ecological preservation objectives.

Considering environmental priorities and strict conformity with national policies and planning frameworks, it is recommended that the relevant authorities authorize the implementation of this plan. Furthermore, all programs executed under this plan must observe rigorous adherence to established policies, thereby preventing unsanctioned development and mitigating potential threats to both the environment and the resident population of St. Martin's Island.

[8] https://iucn.org/resources/issues-brief/kunming-montreal-global-biodiversity-framework

[9] https://www.tbsnews.net/features/panorama/limiting-tourism-st-martins-just-first-step-saving-island-981506

[10] https://www.jagonews24.com/national/news/973326

7. Formulation of Strategy

7.1 Overview

The Saint Martin's Master Plan delineates a comprehensive strategy integrating both physical and non-physical approaches for the conservation and restoration of natural resources, including habitats, under a framework of sustainable management. Additionally, achieving an environmentally pollution-free island is addressed through efficient waste management and alleviating pressure on existing resources beyond their carrying capacity. Bangladesh assigns equal importance to enhancing socio-economic conditions and preserving natural resources, as reflected in pertinent legislation, policies, and strategic frameworks. As Saint Martin's Island is designated as an Ecologically Critical Area in Bangladesh, its management is primarily governed by the Ecologically Critical Area Management Rules, 2016, and the Bangladesh Biodiversity Act, 2017.

Furthermore, the Government of Bangladesh upholds its commitments under the Convention on Biological Diversity (CBD). The Kunming-Montreal Global Biodiversity Framework (GBF), ratified during the fifteenth Conference of the Parties (COP 15) to the CBD in December 2022, marks a significant milestone in the pursuit of global biodiversity conservation. This framework outlines an ambitious agenda to halt and reverse biodiversity loss by 2030, envisioning a future where humanity coexists harmoniously with nature by 2050. It establishes four long-term goals for 2050, alongside 23 actionable global targets requiring immediate implementation by 2030[11].

Outlined below are key targets[12] from the Kunming-Montreal Global Biodiversity Framework and their direct relevance to Saint Martin's Island:

Target 1: Plan and Manage all Areas to Reduce Biodiversity Loss

This objective is essential for Saint Martin's Island, underscoring the importance of robust and equitable management of its designated Marine Protected Area (MPA) and Ecologically Critical Area (ECA). The island's coral reefs and marine biodiversity face ongoing risks due to unregulated tourism, inadequate waste management, and overfishing. To successfully attain this goal, it is necessary to enhance the management framework for the MPA and promote ecological connectivity, thereby ensuring the long-term protection of this unique marine environment.

Target 2: Restore 30% of all Degraded Ecosystems

For Saint Martin's, this target serves as a clear directive for action. It requires active restoration initiatives focused on the island's degraded coral reefs and other marine ecosystems. Rather than relying solely on protective measures, the approach encompasses direct interventions such as the restoration of corals and associated species, along with rehabilitation of their habitats.

Target 3: Conserve 30% of Land, Waters and Seas

This objective underscores the essential need to harmonize conservation efforts with community interests. In the context of Saint Martin's Island, this entails implementing regulations on activities such as overfishing, unlawful collection of corals and shells, and unsustainable tourism practices.

Target 6: Reduce the Introduction of Invasive Alien Species by 50% and Minimize Their Impact

This objective highlights the importance of implementing proactive and preventive strategies to protect the unique flora and fauna of Saint Martin. Addressing one of the primary global threats to

[11] https://www.cbd.int/gbf

[12] https://www.cbd.int/gbf/targets

biodiversity, the prevention of alien species introductions and the management of existing populations are essential to maintaining the island's fragile ecological equilibrium.

Target 7: Reduce Pollution to Levels That are not Harmful to Biodiversity

This objective focuses on mitigating the significant impact of plastic waste and sewage produced by tourism and local activities, which adversely affect the marine environment. The preservation of the island's coral reefs and the overall ecosystem health necessitate the implementation of effective waste management systems and the promotion of responsible tourism practices.

Target 10: Enhance Biodiversity and Sustainability in Agriculture, Aquaculture, Fisheries, and Forestry

This objective supports the incorporation of sustainability principles into the island's primary economic sectors. It advocates for the implementation of responsible fisheries and aquaculture methods designed to reduce adverse effects on marine biodiversity.

Target 16: Enable Sustainable Consumption Choices to Reduce Waste and Overconsumption

The objective is to significantly decrease waste production by promoting sustainable consumption practices among both visitors and local residents, thereby addressing the root causes of the issue.

7.2 Principles

This master plan integrates (i) the conservation of the island's existing natural resources and (ii) enhancements in targeted regions, accompanied by sustainable management practices. These initiatives were agreed upon following consensus regarding the conservation and management of biodiversity. Figure 7.1 illustrates the interrelationships among these guiding principles.

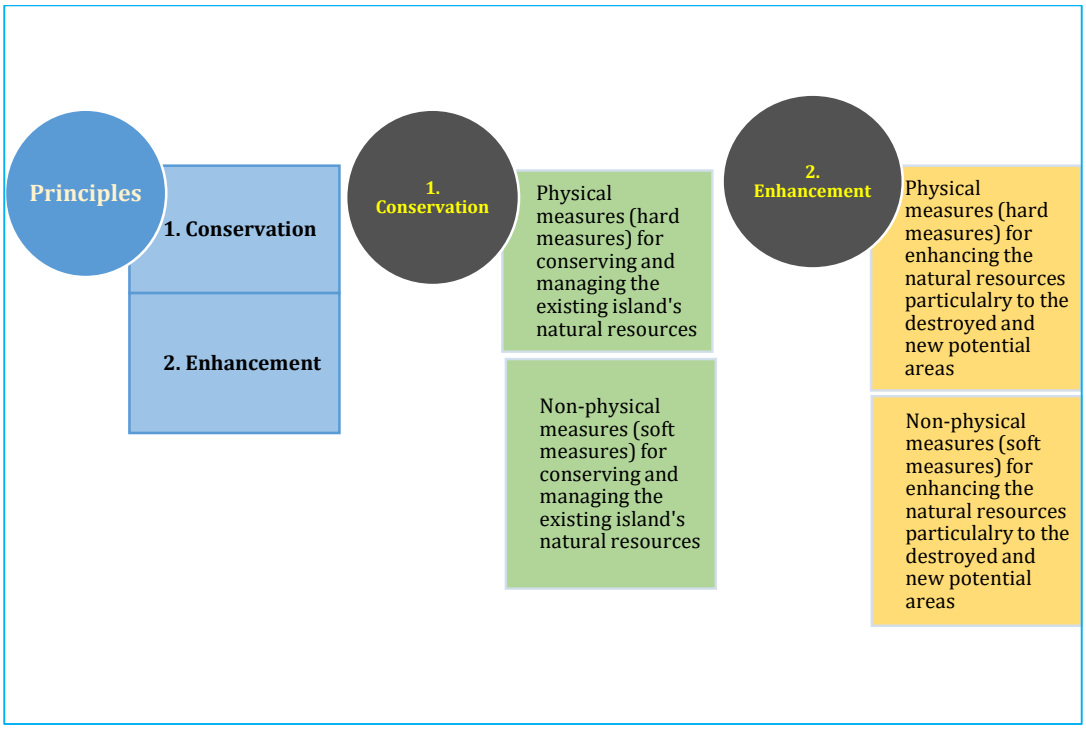


Figure 7.1: Guiding Concepts for Creating Saint Martin's Island's Master Plan

7.3 Key Aspects for Conservation and Sustainable Management

7.3.1 National Conservation Vision and Priorities

Article 18A of the Constitution of Bangladesh obligates the State to actively preserve and enhance the environment, natural resources, biodiversity, wetlands, forests, and wildlife for the benefit of both present and future generations. The Environmental Protection Act, initially enacted in 1995 and revised in 2010, establishes comprehensive measures for environmental conservation and pollution control. The Act provides standards for environmental preservation, pollution reduction, and the regulation of industrial activities, including requirements for environmental clearances. It also empowers the government to designate specific regions as "Ecologically Critical Areas" and prohibits practices such as hill cutting and the alteration of designated water bodies.

The establishment of the Marine Protected Area (MPA) in the Swatch-of-No-Ground (SoNG) and adjacent coastal waters fulfills Bangladesh's commitments under the 2020 Bangladesh Biodiversity National Assessment and Program of Action, as well as its obligations pursuant to the Convention on Biodiversity. This initiative is also consistent with the United Nations Framework Convention on Climate Change, to which Bangladesh is a signatory.

In developing the master plan, particular attention is given to approaches that support the conservation, development, and sustainable management of SMI resources. Previous studies have addressed 'Conservation Management Zones', 'Tourism Carrying Capacity', and 'Land Cover Changes' in SMI. The findings from these studies have informed recommendations for integration into the master plan for SMI.

7.4 Problem Significance and Ranking

Each of the aforementioned issues has been assessed from two perspectives: the "effectiveness or seriousness" of the problem and its "consequences." Excessive tourism has emerged as a primary activity responsible for significant challenges on the island. Tourism generates various forms of pollution and contributes to biodiversity loss, such as:

- Oil pollution from tourist vessels;
- Plastic waste resulting from discarded beverage bottles and food packaging;
- Noise disturbances caused by tourist movement;
- Light pollution associated with tourist accommodation;
- Liquid waste produced by tourists that runs off into wetlands and marine environments;
- Damage to coral reefs and native vegetation due to increased foot traffic, particularly in the southern part of the island;
- Land use changes driven by the development of resorts, cottages, and hotels;

The impacts of tourism are substantial, as illustrated in Figure 7.2.

A secondary concern is the increasing volume of waste, which is expected to rise alongside growing tourist numbers and population expansion. Inadequate waste management poses risks to both near-shore marine and inland wetland water bodies, adversely affecting aquatic life, including fish and turtles and leading to degradation of soil quality.

Coastal erosion represents another major issue, contributing to the decline of mangrove coverage and the destruction of habitats for marine birds and upland wildlife.

Livelihood uncertainty has also become increasingly prevalent as the population grows. Fishing, the principal occupation on Saint Martin's Island, is vulnerable to fluctuations in coastal and offshore conditions, reflected in declining catch volumes. This vulnerability extends to tourism-related livelihoods, influenced by overcapacity and regulatory infractions. The construction of resorts and related infrastructure has resulted in alterations to land use, infilling of wetlands, and further depletion of natural vegetation.

Additional concerns relating to housing, settlements, social services, and transportation remain significant, all originating from the central problems discussed. Issues concerning power, energy, and health have not yet emerged as leading challenges.

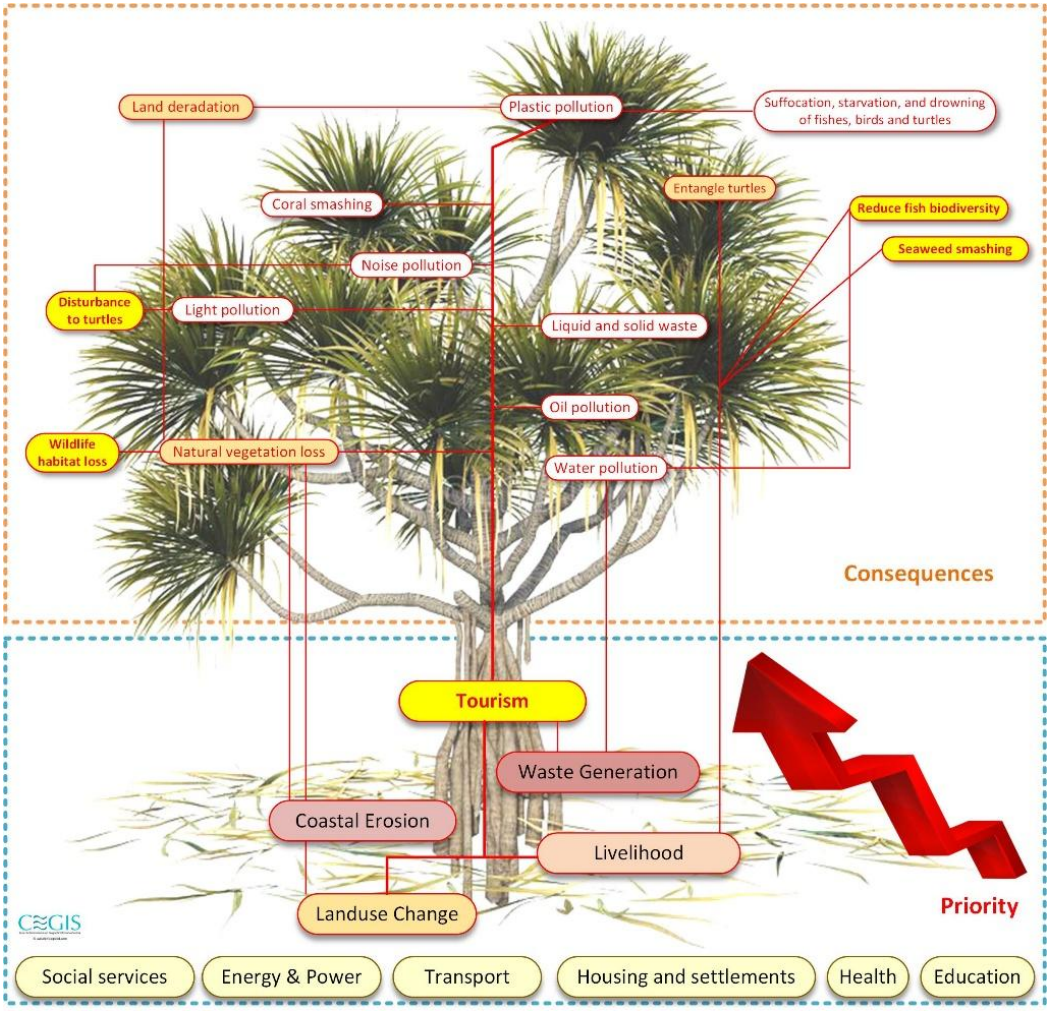


Figure 7.2: Ranking of Problems in SMI and Its Consequence

Priority Setting Matrix for the Identified Problems

Problems	Extent	Degree of Impact/Effect	Occurrences (how frequent)	Score	Rank
Climate change (erosion, cyclones, sea level rise, waves etc.)	1	1	2	4	6
Damages and destruction of natural vegetation including mangroves	2	3	3	8	2
Degradation/loss of coral habitats	3	3	2	8	2
Disturbances to other wildlife (except turtles)	1	1	1	3	7
Disturbances to turtle nesting sites	3	3	2	8	2
Insufficient health facility	2	2	2	6	4
Insufficient quality education services	1	1	1	3	7
Internal communication and transportation infrastructures	2	1	2	5	5
Lack of employment opportunities	2	1	1	4	6
Lack of sufficient power and energy for the islanders	3	2	3	8	2
Liquid waste discharges to lagoons and marine environment	2	2	2	6	4
Overharvesting and illegal fishing	3	3	3	9	1
Poor water supply and sanitation systems	3	1	2	6	4
Shortage of groundwater availability during dry season	2	2	2	6	4
Solid waste dumping to natural environment	3	2	2	7	3
Uncontrolled tourism (resorts/hotels/huge tourists)	3	3	3	9	1

Extent

1. Low
2. Moderate
3. High

Degree of Impact

1. Low Impact
2. Moderate Impact
3. High Impact

Rate of Occurrences

1. Slow pace
2. Moderate Pace
3. Rapid Pace

Multiple issues have been identified through an analysis of both the baseline conditions and public perceptions regarding Saint Martin's Island. Expert evaluations were subsequently conducted, resulting in each issue being ranked according to its scope, degree of impact, and frequency of occurrence. The findings indicate that overharvesting and illegal fishing represent critical concerns, alongside vegetation loss, habitat disturbances affecting turtles and corals, deficiencies in power and energy supply, and broader environmental degradation. The problems, organized by their ranking, are presented in the matrix below.

Sl.	Problems	Rank
1	Over harvesting and illegal fishing	1
2	Uncontrolled tourism (resorts/hotels)	1
3	Damages and destruction of natural vegetation including mangroves	2
4	Degradation/loss of coral habitats	2
5	Disturbances to turtle nesting sites	2
6	Lack of sufficient power and energy for the islanders	2
7	Solid waste dumping in the natural environment	3
8	Insufficient health facility	4
9	Liquid waste discharges to lagoons and the marine environment	4
10	Poor water supply and sanitation systems	4
11	Shortage of groundwater availability during the dry season	4
12	Internal road network and transportation infrastructures	5
13	Climate change (erosion, cyclones, sea level rise, waves etc.)	6
14	Lack of employment opportunities	6
15	Disturbances to other wildlife (except turtles)	7
16	Insufficient quality of education services	7

7.5 Prioritization of Problems

Saint Martin's Island has been designated as an Ecologically Critical Area (ECA) by the Department of Environment (DoE), primarily due to its vital habitats and ecosystems. This designation necessitated a thorough assessment of ecosystem threats and human-induced impacts to inform planned development and sustainable management initiatives. Furthermore, the conservation management zones established for the island (DoE, 2020d) illustrate the interactions and areas of conflict between human activities and natural systems. As a small island governed by a comprehensive nature-community management framework, its advancement relies on accurate problem analysis and genuine recognition within this Master Plan. The priorities outlined in the Master Plan are determined by two main factors:

- real-time problem analysis incorporating community perspectives and evaluation of natural resource conditions; and
- recommended rules and regulations within conservation management zones.

Problem analysis serves to identify and prioritize actions for the improvement of Saint Martin's Island, as detailed in Table 7.1.

Table 7.1: Evaluation of Sectors to be Prioritized for the Development of the SMI Master Plan

SL	Problems	Problem Assessment Ranks	Prioritizing Sectors
1	Over harvesting and illegal/unauthorized fishing	1	Reducing pressures on natural resources, particularly fish and other benthic communities
2	Uncontrolled and unplanned tourism (resorts/hotels/huge tourists)		Sustainable management of tourism in Saint Martin's Island
3	Damages and destruction of natural vegetation including mangroves	2	Conservation and enhancement of natural flora and fauna along with the mangrove's habitats and their ecosystems
4	Degradation/loss of coral		Conservation of coral habitats and coral associated flora and fauna
5	Disturbances to turtle nesting sites		Conservation of turtle nesting sites
6	Lack of sufficient power and energy for the islanders		Use of renewable energy for electricity generation on the island
7	Solid waste dumping in the natural environment	3	Management of waste (solids and liquids) on the island
8	Insufficient health facility	4	Good health facility development
9	Liquid waste discharges to lagoons and the marine environment		Management of wastes (solids and liquids) in the island
10	Poor water supply and sanitation systems		Proper water supply and sanitation facility development
11	Shortage of groundwater availability during the dry season		Sustainable management of groundwater resources and increasing of groundwater recharge through nature-based solutions
12	Internal road network and transportation infrastructures	5	Nature friendly infrastructural development particularly for internal roads construction
13	Lack of employment opportunities	6	Alternative Income Generating (AIGs) Activities introduction for the local communities

Only the first five key issues identified on the island have been considered during the assessment of prioritized sectors. The primary objectives of this master plan are the protection and enhancement of the island's natural resources. To support these objectives, the "Environment, Biodiversity and Sustainable Tourism Management Plan of Saint Martin's Island" comprehensive management framework will be implemented, as the island is designated as an ECA. The DoE has evaluated the short-, medium-, and long-term activities assigned to various ministries. Therefore, the sole focus of this master plan remains the preservation and improvement of the island's natural assets.

The theme areas for the development of the Island Master Plan have been selected based on sector prioritization analysis. Presented below are the thematic areas derived from these prioritized sectors:

- Sustainable tourism management;
- Conservation of fish resources and benthic communities;
- Protection of coral resources as well as coral-dependent flora and fauna;
- Conservation of turtles and their nesting sites;
- Preservation and further development of terrestrial flora and fauna resources;

- Waste management;
- Sustainable management of groundwater resources, including enhanced recharge by nature-based solutions;
- Development of internal road communication and infrastructure;
- Improvement of livelihood opportunities for island residents;

7.6 Development of Strategy

The development strategy for the Master Plan of the SMI has been formulated in alignment with the 2041 vision. Various consultation methodologies, including PCM, FGD, and KII, involving diverse stakeholders, have been utilized to inform the master plan. A range of strategies were evaluated to manage and enhance the nine thematic sectors. Ultimately, these development sectors were consolidated into six, combining corals, turtles, flora, fauna, and fish under the central theme of Biodiversity Conservation and Restoration (see Figure 7.3).

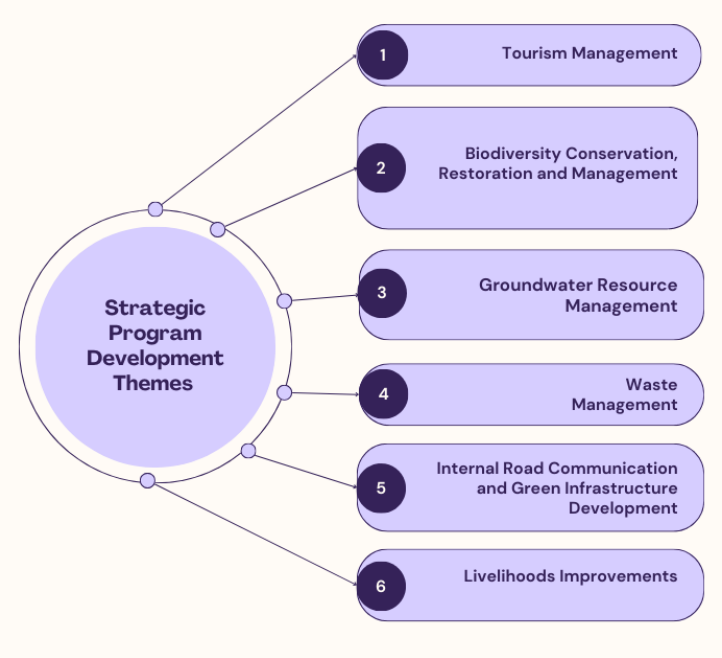


Figure 7.3: Project Development Themes of the Master Plan, Saint Martin's Island

Sustainable Tourism Management

SMT Island possesses significant tourism potential due to its exceptional natural beauty. However, the current influx of tourists exceeds the island's carrying capacity, posing risks to the marine ecosystem. To enhance its appeal to international visitors, the site could benefit from the development of eco-friendly luxury infrastructure encompassing accommodation, communication, and recreational facilities while ensuring security and comprehensive promotion efforts. Consequently, the DoE has initiated the development of a Master Plan focused on preserving the sustainability of the island's ecosystem.

The proposed plan aims to support socio-economic advancement and poverty alleviation through both direct and indirect local employment opportunities. Moreover, it is anticipated that the plan will help mitigate ecosystem vulnerabilities and guide associated regional development. In addition to generating revenue through sustainable tourism, this initiative seeks to showcase local heritage and identity at national and international levels, encouraging communities to preserve their traditions and cultures. The MP for SMI has been conceptualized to strategically manage visitor volume, thereby reducing stress on the existing ecosystems.

Biodiversity Conservation and Restoration

Over recent decades, biodiversity loss has become a global concern due to its rapid rate of decline. It is generally recognized that the most immediate impacts are felt by those who rely closely on local ecosystems for their livelihoods, particularly disadvantaged populations. On Saint Martin's Island, the most threatened yet critical elements of biodiversity include: (i) fish resources, including benthic communities; (ii) coral resources and coral-dependent flora and fauna; (iii) turtles and nesting sites; and (iv) terrestrial flora and fauna, especially mangrove ecosystems.

The following strategies have been integrated into the Saint Martin's Master Plan:

- Conservation of extant fish species and associated benthic communities;
- Protection and restoration of coral habitats and dependent biodiversity;
- Study and conservation of turtle populations, with emphasis on nesting grounds;
- Enhancement of wild forest and bushlands, along with mangrove regeneration initiatives;

Solid and Liquid Waste Management

Adhering to the national 3R (Reduce, Reuse, Recycle) waste management framework, the Master Plan includes:

- Eliminating disposal of waste in open dumps, creeks, and marine environments;
- Mandating source-segregation and promoting recycling;
- Developing markets and incentives for recycled products, extending these initiatives to tourists;
- Addressing the concern of solid waste through community-based recycling projects;

Sustainable Management of Groundwater Resources & Groundwater Recharge Enhancement

To fulfil the vision of the Master Plan, the following measures have been adopted:

- Requiring licenses from the Upazila Parishad for any tube well installations;
- Implementing rainwater harvesting systems at the household level;
- Identifying aquifers vulnerable to saltwater intrusion and managing them accordingly;
- Ensuring rainwater harvesting systems in hotels to meet increased water demand from tourism;
- Reducing reliance on limited freshwater groundwater resources;

Internal Road Communication and Infrastructure Development

Infrastructure development on Saint Martin's Island should pursue green growth strategies to ensure environmental sustainability, reduce degradation, and support economic development while maintaining essential natural resources. To safeguard the island's biodiversity and resilience, climate adaptive infrastructure must combine natural resource management with structural interventions. The focus is on maximizing natural capital and harnessing its economic value while addressing climate challenges.

Innovative nature-based solutions should be prioritized, supporting ecosystem-based adaptation for sustainable management and restoration of island ecosystems. This approach delivers benefits in human well-being, clean air and water provision, food production, and resilient biodiversity. Recommended climate-resilient, green structures include:

- Vertical greening systems (VGS), which can retrofit existing or enhance new buildings for improved thermal insulation;
- Introduction of "cool pavements" within the road network to lower surface temperatures and minimize heat absorption;
- Implementation of smart growth practices that balance environmental protection with community attractiveness and economic vitality;
- Promotion of ecotourism focused on biodiversity conservation, leveraging Saint Martin's rich cultural heritage alongside conventional tourism offerings;

Livelihood Improvement of the Islanders

Key strategies for improving local livelihoods include:

- Poverty reduction through alternative income-generating activities and micro-credit services for rural residents;
- Promoting participatory ecosystem management within designated zoning areas, ensuring equitable decision making and benefit sharing for local populations;
- Establishing and managing buffer zones as alternative resource use regions, setting sustainable exploitation limits in fishing areas to achieve ecological and economic stability for local communities;

8. Investment Portfolios

8.1 Introduction

St. Martin's Island is distinguished by its variety of habitats, which include mangrove forests, coral-associated biodiversity, coral-algal communities, and native flora such as seaweeds. Notably, its picturesque sandy beaches and clear continental shores make it one of Bangladesh's most popular tourist destinations. However, the island's natural ecosystems are experiencing significant stress due to increased tourism and a rising local population. These ecosystems encompassing corals, benthic communities, mangrove forests, wild bushlands, and screw-pine plants play a vital role in coastal protection against erosion and cyclones.

The DoE currently administers multiple projects focused on ecosystem management and conservation. Historically, these initiatives functioned as sectoral programs with limited coordination, impeding the sustainable management of the island's ecosystems, resources, and socio-economic development.

To address these challenges, DoE has introduced the "Ecosystem-based Development, Management, and Conservation of the Saint Martin's Island Project," aiming to safeguard the island's biodiversity through a comprehensive approach that incorporates both socioeconomic and ecological considerations. Key objectives include managing distinct zones for conservation and resource utilization, assessing vital natural resources such as corals, benthic communities, turtles, terrestrial vegetation, and mangrove ecosystems, and developing a Master Plan for the long-term preservation and management of the island's resources.

This master plan provides a 10-year framework for the island's development, emphasizing the conservation and enhancement of existing ecosystems and natural resources. A systematic review of relevant policies, strategies, and plans for Saint Martin's Island has informed the establishment of targeted, achievable goals in alignment with the Master Plan. The holistic development of the Plan prioritizes ecosystem preservation, environmental sustainability, fisheries advancement, turtle protection, road network development, afforestation, and the generation of electricity from renewable sources.

8.2 Framework of the Plan

This Master Plan is a non-statutory document presenting a vision to guide the island's growth and development over the next decade. While not a detailed design, it serves as:

- A framework articulating how the area may evolve or be redeveloped in the future;
- A high-level plan that establishes objectives and strategies to manage development and change over time; and
- A process identifying elements of significance within the area, with recommendations on preserving, enhancing, and improving its character and quality.

The Master Plan provides a conceptual foundation for future growth and development. Distinct from a Biodiversity Management Plan, it offers a flexible approach, outlines development options, and directs activities across multiple sectors.

8.3 Project Portfolios

To conserve, protect, develop, and enhance the ecosystem of St. Martin's Island, it is essential that relevant agencies in Bangladesh promptly implement the following projects across various sectors. A

total of 26 projects has been identified to support the conservation and protection efforts of the island's unique environment:

- Sustainable Tourism Management (4 projects);
- Conservation of Fish Resources and Benthic Communities (2 projects);
- Coral Resources and Coral-Dependent Flora and Fauna Conservation (3 projects);
- Protection of Turtles and Nesting Sites (2 projects);
- Terrestrial Flora and Fauna Conservation and Development (6 projects);
- Waste Management Initiatives (2 projects);
- Groundwater Resource Management (2 projects);
- Internal Road Communication and Infrastructure Development (2 projects);
- Livelihood Improvement (3 projects);

These targeted initiatives are designed to preserve and improve the ecological integrity of St. Martin's Island, ensuring its sustainability for future generations.

Figure 8.1: Project Portfolios of the SMI

I. Sustainable Tourism Management

Project Code	ST-01	**Project Title**	Development of Saint Martin's Tourism Monitoring Information System (SMT-MIS)
Objectives	o To develop an integrated MIS for tourism on Saint Martin's Island. Specific objectives are: - To develop a SMT-MIS; - To develop an Online Registration System Portal for the tourists; - To develop a SMT-Dashboard (SMTD) for monitoring tourism related indicators;		
Rationale	A Management Information System (MIS) is a computer-based framework designed to equip managers with essential tools for organizing, evaluating, and optimizing departmental operations. The SMT-MIS will manage comprehensive data on tourist influx, oversee the registration system, and facilitate digital monitoring of key tourism-related indicators on Saint Martin's Island. This system will enable planners and managers to understand the evolving dynamics of tourism on the island, supporting informed decision-making for its ongoing development and ensuring the promotion of sustainable tourism practices.		
Project components/Actions	The main actions of the project are: o System planning, analysis, design, development, and implementation of the SMT-MIS under the authorization of the designated line agency; o Development of an Online Registration Portal for tourists under SMT-MIS; o Development of an SMT-Dashboard for monitoring the tourism indicators under 7 broad categories: (i) Resources, (ii) Visitors, (iii) Residents, (iv) Accommodations, (v) Transportation, (vi) Other tourism business, and (vii) Other tourism-related development;		
Benefits	o It is hoped that SMT-MIS can play an important role in increasing public awareness about tourism's multifaceted characteristics and in assisting decision-making and policy development by the government and the relevant industry; o Strengthening information infrastructure and enhance their management capability; o Sustainable management of tourism on the Island; o Monitoring and tracking the tourism sector with up-to-date information;		
Indicative Cost (100,000 BDT)	80.00 (Eighty Lakh BDT)		
Duration	9 months		
Implementing Agency	Department of Environment (DoE)	**Lead Ministry**	MoEFCC
Supporting Agency	Bangladesh Parjatan Corporation (BPC)		
Private Sector Potentiality	Yes. The private tourism business sector needs to be incorporated in developing and implementing the SMT-MIS.		
Requirements of Feasibility	No feasibility is required to develop SMT-MIS and its implementation, operation and maintenance.		
Intervention Sites	Not applicable.		

Project Code	ST-02	**Project Title**	Assessment and introduction of Payment-For-Ecosystem Services (PES) for SMI-Island tourism;	
Objectives	○ The specific objectives are: - Assessment of Payment-For-Ecosystem Services of Saint Martin's Island Tourism through internationally recognized approaches and methods; - Introduction of PES on Saint Martin's Island Tourism developing an appropriate legislative framework;			
Rationale	Payments-for-Ecosystem Services (PES) refer to arrangements wherein beneficiaries of ecosystem services such as mangroves, beaches, forests, coral reefs, and other underwater resources offer direct economic incentives to local land stewards for the preservation of existing ecosystems and environmental services, including watershed conservation, biodiversity, underwater benthic resources, and scenic value. This mechanism aligns with the SMI framework. Implementing PES may present a feasible strategy for the effective conservation of the island's natural resources and the rehabilitation of degraded ecosystems.			
Project components/Actions	The main actions of the project are: ○ Identification of the specific resources (corals, mangroves, Chera Dwip, scenic beauty, bathing, etc.) or ecosystem for which the PES should be evaluated; ○ Assessment of PES for the identified resources or ecosystem of Saint Martin's Island; ○ Assessment of the appropriate legislative framework and institutional framework for the implementation of PES for SMI-tourism;			
Benefits	○ Funding arrangement for the conservation of the existing natural resources and its proper enhancement; ○ Mainstreaming the value of ecosystem services and achieving the SDG goals of 14 and 15;			
Indicative Cost (100,000 BDT)	70.00 (Seventy Lakh BDT)			
Duration	6 months			
Implementing Agency	Department of Environment (DoE)	**Lead Ministry**	MoEFCC	
Supporting Agency	Bangladesh Parjatan Corporation (BPC), Bangladesh Forest Department (BFD), Local Government Institutions (LGIs)			
Private Sector Potentiality	Yes. The private tourism business sector needs to be incorporated in assessing and implementing the PES for SMI.			
Requirements of Feasibility	No feasibility is required to assess PES and its implementation particularly for SMI.			
Intervention Sites	Not applicable.			

Project Code	ST-03	**Project Title**	Development of Beach Amenities and Tourism Guideline for Saint Martin's Island
Objectives	o The specific objectives are: - Identification of suitable tourism amenities on the allowable beach areas of Saint Martin's Island; - Design and development of the selected amenities, their operations, and maintenance; - Visitors/Tourism guideline preparation for visiting the SMI Island;		
Rationale	The island offers approximately 2.5 kilometers of beach areas accessible to tourists. Visitors frequent these beaches to enjoy the island's natural beauty and engage in recreational activities. However, there are currently no tourism information centers available to provide guidance regarding local attractions or regulations. Additionally, various sections of the beaches present significant hazards, such as underwater coral boulders and strong shoreline currents. The absence of restroom and bathing facilities further impacts the visitor experience. Moreover, the island lacks adequate beach management and a dedicated rescue team to ensure tourist safety.		
Project components/Actions	The main actions of the project are: o Assessment and identification of suitable amenities for the beach areas on Saint Martin's Island. For instance: tourist police and beach management committee; lost and found center; rescue team, tourist information center; awareness through placard, banner, festoon installation; change and washroom development for the designated beach sites, etc.; o Environment-friendly design preparation for the selected beach amenities; o Building and installation of the beach amenities; o Beach and rescue committee formation with a detailed job description; o Institutional framework design for the beach and rescue committee and development of an operation and maintenance scheme with LGIs, VCG, and other stakeholders; o Preparation of the Visitors/Tourism guideline for visiting the SMI Island;		
Benefits	o Increase the quality of services to the tourists on the island; o Ensure the safety of tourists' personal properties and make the environment responsive enough to roam with calm and peace; o Improve beach and its resource management more effectively; o Proper management of beach activities; o Ensuring guided tourism and easy application of ECA rules and regulations;		
Indicative Cost (100,000 BDT)	500.00 (Fifty Million BDT)		
Duration	9 months		
Implementing Agency	Local Government Institutions (LGIs)	**Lead Ministry**	MoEFCC
Supporting Agency	Department of Environment (DoE); Bangladesh Parjatan Corporation (BPC)		
Private Sector Potentiality	Yes. The private tourism business sector needs to be incorporated in assessing, designing and developing selected beach amenities.		

Requirements of Feasibility	Strongly recommends feasibility study. Sites should be selected respecting natural resources, their dynamism, and beach morphology. In addition, tourist perception is also a requirement for assessing types of amenities and suitable sites.
Intervention Sites	Not Applicable.

Project Code	ST-04	**Project Title**	Community-Based Tourism (CBT) Development for Saint Martin's Islanders'
Objectives	o The specific objectives are: - To assess the relationships between Tourism Area Life Cycle (TALC) and Community-based Tourism (CBT) on Saint Martin's Island; - To assess the major challenges of CBT on the Island particularly local capacity, marketing and economic viability; - To identify and select the best model approach for CBT on Saint Martin's Island; - To design and implement the approved CBT modality for Saint Martin's Island;		
Rationale	Community-based tourism (CBT) represents an approach to tourism developed to mitigate adverse effects commonly associated with traditional or mass tourism, including economic leakages and diminished local control over natural resources. CBT is witnessing increased adoption and is frequently advocated as a strategy for poverty alleviation and the advancement of local community development.		
Project components/Actions	The main actions of the project are: o Assessing the relationships between TALC and CBT through surveys, meetings and case studies; o Assessment of tourism typology on the island; o Assessment of CBT and community participation interests of the islanders; o Evaluation of local capacity and economic viability of the implementation of CBT on the island; o Budget preparation and financing mechanism development for the implementation of CBT on the island; o Implementation of CBT on the Island;		
Benefits	o Reducing anthropogenic pressures on natural resources; o Assist the marginalized community to improve their livelihood status; o Making the tourism sector sustainable from the jeopardized existing tourism practices on the Island; o Creating a win-win environment for both the tourists and the local communities;		
Indicative Cost (100,000 BDT)	100.00 (10 million BDT))		
Duration	12 months		
Implementing Agency	Bangladesh Parjatan Corporation (BPC)	**Lead Ministry**	Ministry of Civil Aviation and Tourism
Supporting Agency	Department of Environment (DoE); Local Government Institutions (LGIs)		
Private Sector Potentiality	Yes. The private tourism business sector needs to be incorporated in assessing, designing and developing CBT on the island.		

Requirements of Feasibility	Feasibility is a must to assess the relationships between TALC and CBT, community interests and the sustainability of CBT on the Island.
Intervention Sites	Not applicable.

II. Fish Resources and Benthic Communities' Conservation

Project Code	FB-01	**Project Name**	Sustainable Fisheries Development in Saint Martin's Island	
Objectives	The overall objective of the project is to increase the productivity of fish through sustainable fisheries management of Saint Martin's Island. Moreover, specific objectives are: o 15% increase in fish production through coral-associated fish habitat protection and sustainable adaptation management; o 10% increase in fish productivity through modernization and mechanization of fisheries; and o To develop skilled and trained manpower in fisheries management.			
Rationale	Saint Martin's Island contains a highly diverse array of coral-associated aquatic resources. The island's coral-based ecosystems provide optimal conditions for a wide range of fish species, and the fisheries resources here represent a substantial contribution to the nation's overall marine fish production. However, recent large-scale pollution has negatively impacted this ecosystem, increasingly rendering it unsuitable for coral-associated fish communities and thereby diminishing marine fish yields. Therefore, this project is essential for ensuring the sustainable management of Saint Martin's Island's fisheries resources.			
Project components/Actions	o Protection of the natural breeding ground for strictly coral-associated fish species o Re-excavation and protection of lagoon-like waterbodies on the Island, o Declare the southwestern part of the Island's shore as the sanctuaries, o Development and construction of 3 post-fishing service centers; o Farm mechanization and automation of the Department of Fisheries in the form of a pilot, and setting up of 10 units of bio-flock exhibition, o The modernization of 10 existing fish markets will be done.			
Benefits	Contribution to GDP growth in the national economy, poverty alleviation, job creation, contribution to fish production and nutrition growth, foreign exchange earnings, and improvement of the livelihoods of fishermen.			
Indicative Cost (100,000 BDT)	300.00 (Thirty Million BDT)			
Duration	Five Years			
Implementing Agency	Department of Fisheries	**Lead Ministry**	Ministry of Fisheries and Livestock	
Supporting Agency	Bangladesh Fisheries Development Corporation (BFDC)			
Private Sector Potentiality	Yes			
Intervention Sites	o Southwestern side of Saint Martine's Island; o Lagoon-like Waterbodies inside the Island.			

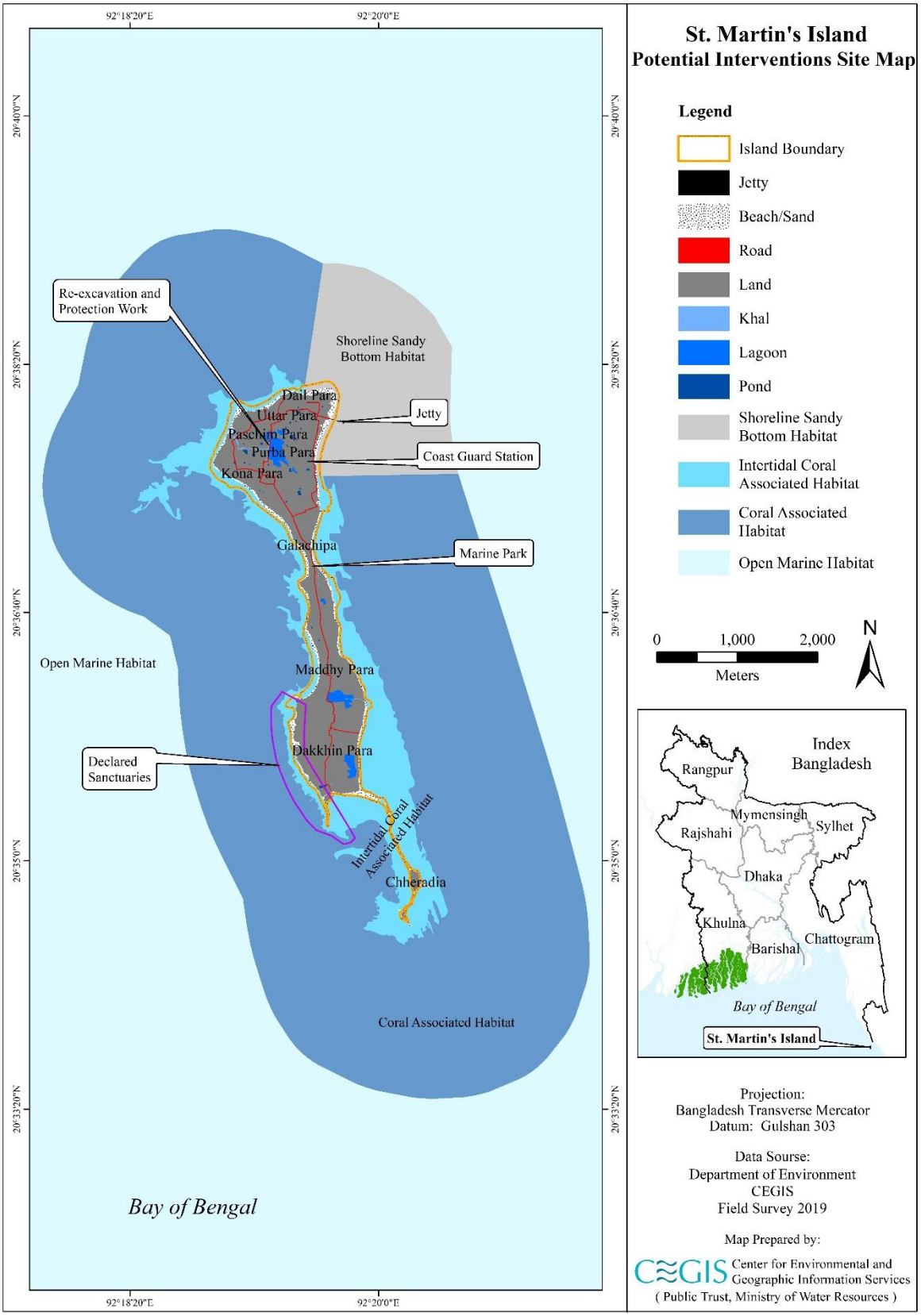


Figure 8.2: Potential Interventions Site in Saint Martin's Island

Project Code	FB-02	**Project Name**	Fisheries resource management and socio-economic development of the Fisher's in the Saint Martin's Island	
Objectives	o Strengthening the MCS system for indiscriminate effort control o Training on Aquaculture and fisheries management; o Development of the fish landing site infrastructure to ensure safe fishery production; o Awareness development; o Improvement of the socio-economic status of the poor in the project area;			
Rationale	Saint Martin's Island possesses significant fish biodiversity. However, natural and anthropogenic factors are progressively degrading these habitats. Additionally, rising tourism is impacting the coral ecosystem, thereby affecting its capacity to sustain coral-associated fish species. The local fishing community also faces challenges in achieving sustainable economic returns due to inadequate infrastructure and management of fish landing centers, as well as insufficient subsidies during the non-fishing (monsoon) season. Consequently, the activities outlined in this project are expected to enhance fisheries resources and contribute to the socio-economic development of the fishermen community on Saint Martin's Island.			
Project components/ Actions	o Establish MCS center with efficient technologies; o Increase technical and technical knowledge and skills of the manpower involved in the fisheries sector; o Cages culture in the deeper part adjacent to the island; o Providing AIGs to the fishermen community;			
Benefits	Contribution to GDP growth in the national economy, poverty alleviation, job creation, contribution to fish production and nutrition growth, foreign exchange earnings, adaptation to climate change, and improvement of the livelihoods of fishermen.			
Indicative Cost (100,000 BDT)	500.00 (Fifty Million BDT)			
Duration	Five Years			
Implementing Agency	Department of Fisheries	**Lead Ministry**	Ministry of Fisheries and Livestock	
Supporting Agency	Bangladesh Fisheries Development Corporation (BFDC)			
Private Sector Potentiality	Yes			
Intervention Sites	Saint Martine's Island.			

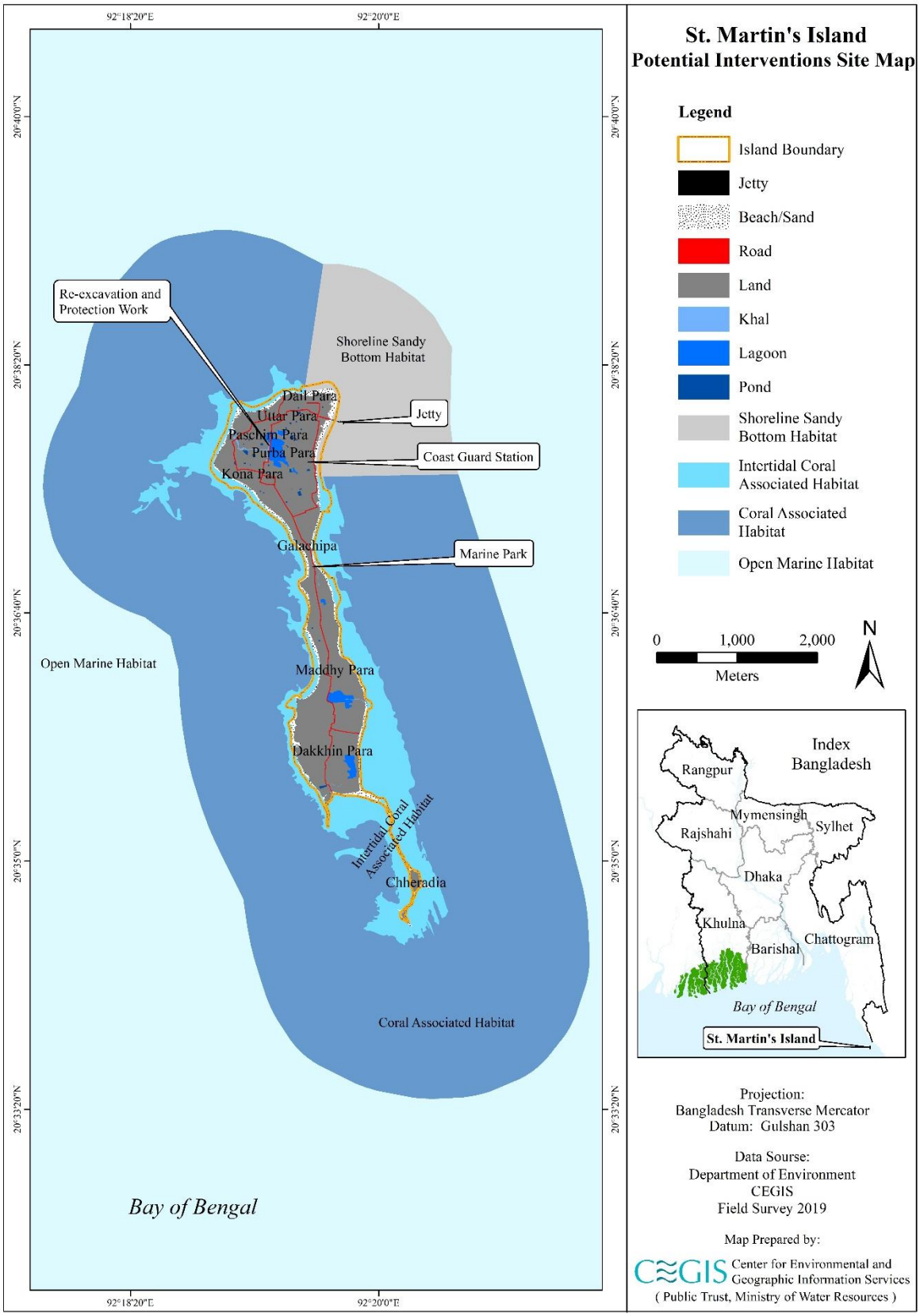


Figure 8.3: Potential Interventions Site in Saint Martin's Island

III. Coral Resources and Coral-Dependent Flora and Fauna Conservation

Project Code	CR-01	**Project Title**	Assessment of potential coral species regeneration schemes and its proper piloting on the SMI island	
Objectives	To increase the reef of coral at the potential sites surrounding the island and accelerate the coral formation;			
Rationale	Factors degrading coral reefs usually outpace measures aimed at reef regeneration. Thus, the most efficient and logical approach when we start a conservation or regeneration effort of a coral reef is to identify and eliminate the damaging factors. If this is achieved, damaged reefs are expected to recover, but slowly. Several cases, however, have shown that coral reefs suffering severe damage have not recovered at least during the period of observation. In these situations, in addition to the removal of the damaging factors, active measures become necessary. Consequently, studies and actual practices that enhance coral reef regeneration, especially the cultivation of corals in artificial environments, have received much attention. Coral reef degradation has been extensively documented worldwide over the past two decades, attributable to both natural phenomena and human activities. Extreme weather events such as typhoons and hurricanes can inflict considerable damage on reef ecosystems. Moreover, unsustainable fishing methods, vessel groundings, coastal development, increased sedimentation, eutrophication, and water pollution are recognized as primary contributors to reef deterioration at local and regional scales. Although reefs possess an inherent ability to recover once adverse conditions have been mitigated, restoration is generally a slow and prolonged process.			
Project components/Actions	The main actions of the project are: o Identification of the fast-growing coral species for the island; o Finalization of suitable propagation method(s) for Saint Martin's Island; o Propagation of coral species in nature; o Monitoring and mainstreaming the benefits of coral regeneration schemes on Saint Martin's Island;			
Benefits	o Reefs provide spawning, nursery, refuge and feeding areas for a large variety of organisms, including sponges, cnidarians, worms, crustaceans (including shrimp, spiny lobsters and crabs), mollusks (including cephalopods), echinoderms (including starfish, sea urchins and sea cucumbers), sea squirts, sea turtles and sea snakes; o Reef structures play an important role as natural breakwaters, which minimize wave impacts from storms such as cyclones, hurricanes and typhoons; o Also, their beauty makes coral reefs a powerful attraction for tourism, and well-managed tourism provides a sustainable means of earning foreign currency and employment for people around the world, even in remote areas of developing countries;			
Indicative Cost (100,000 BDT)	500.00 (Fifty Million BDT)			
Duration	60 months (seasonal activity)			
Implementing Agency	Department of Environment (DoE)	**Lead Ministry**	MoEFCC	

Supporting Agency	Bangladesh Oceanographic Research Institute (BORI); Bangladesh Institute of Maritime Research and Development (BIMRAD); Institute of Marine Sciences;
Private Sector Potentiality	Yes. Relevant local-level stakeholders, NGOs, and I-NGOs may be engaged.
Requirements of Feasibility	No feasibility is required.
Intervention Sites	Not applicable.

Project Code	CR-02	**Project Title**	Raising awareness on the importance of corals and their associated flora fauna
Objectives	o To better protect and restore the coral resources along with the coral dependent flora and fauna on the islands;		
Rationale	Increasing awareness within local communities facilitates social and economic development in villages, primarily through ecotourism and the restoration of marine biodiversity. Raising awareness for initiatives that may seem distant from daily life can present challenges. The CORAL exhibition engages visitors by highlighting the reality of degraded reefs, the actions of dedicated fishermen, and the progress made in reef restoration, delivering a message that is both urgent and optimistic. Integrating education about coral resources and their contributions to human wellbeing across all academic disciplines could be an essential strategy for the conservation of coral reefs. Instilling future generations with an appreciation for corals, often referred to as "***forests under the oceans***", is crucial to long-term preservation efforts. The effectiveness of any infrastructure designed to preserve coral reefs relies on communities recognizing their significance from both ecological and economic standpoints.		
Project components/Actions	The main actions of the project are: o Raising awareness among local populations (children, adults, fishermen, and boat captains); o Raising awareness on coral and their importance in schools on the Island; o Coral exhibition locally, regionally, and nationally including academic institutions; o Raising awareness kit development for children, adults, and tourists;		
Benefits	o Reefs provide spawning, nursery, refuge, and feeding areas for a large variety of organisms, including sponges, cnidarians, worms, crustaceans (including shrimp, spiny lobsters, and crabs), mollusks (including cephalopods), echinoderms (including starfish, sea urchins, and sea cucumbers), sea squirts, sea turtles and sea snakes; o Reef structures play an important role as natural breakwaters, which minimize wave impacts from storms such as cyclones, hurricanes, or typhoons; o Also, their beauty makes coral reefs a powerful attraction for tourism, and well-managed tourism provides a sustainable means of earning foreign currency and employment for people around the world, even in remote areas of developing countries;		
Indicative Cost (100,000 BDT)	65.00 (Sixty-Five Lakh BDT)		
Duration	12 months		

Implementing Agency	Department of Environment (DoE)	**Lead Ministry**	MoEFCC
Supporting Agency	Bangladesh Parjatan Corporation (BPC), Bangladesh Institute of Maritime Research and Development (BIMRAD); Institute of Marine Sciences;		
Private Sector Potentiality	Yes. Relevant local level stakeholders, NGOs and I-NGOs may be engaged.		
Requirements of Feasibility	No feasibility is required.		
Intervention Sites	Not applicable.		

Project Code	CR-03	**Project Name**	Monitoring of underwater coral and coral-related plants and animals in the vicinity of Saint Martin's Island
Objectives	o Maintaining records of coral health, habitats, coverage, and distribution, including the state of deterioration; o Preparing two-year monitoring reports so that the appropriate decisions may be made; o Updating the coral and coral-associated flora and fauna monitoring technique in accordance with the requirements;		
Rationale	Saint Martin's Island (SMI) boasts significant biodiversity, particularly in corals and their associated flora and fauna. SMI is the sole location in Bangladesh where corals are actively cultivated, serving as an important habitat for diverse marine species including fish, mollusks, and various crustaceans. Each year, approximately 3,000 to 7,000 tourists visit the island between October and March, attracted by its distinctive natural resources such as stony bushlands, mangrove forests, peripheral screw pine, pristine sandy beaches, turtle nesting sites, red crab colonies, underwater coral reefs, and coral-related ecosystems. Significant tourism activities generate both liquid and solid waste, which frequently enters the coastal areas without adequate treatment. Additionally, sedimentation of coral resources results from large vessels disturbing the shoreline and from engine-driven boats and speedboats visiting Chera Dwip Island. These factors contribute to the ongoing degradation of coral habitats. To safeguard underwater resources against threats, pollution, and extinction, it is essential to implement consistent monitoring and adapt management strategies that systematically document the status of corals and associated marine life.		
Project components/ Actions	o Establish the appropriate scientific methodology for monitoring corals, fishes associated with corals, and other life; o Determine the key species of corals and coral-associated flora and fauna to be monitored (identify the bio indicators for corals and other associated fishes and vegetation); o Conduct biennial monitoring of these resources using developed scientific methods; o Prepare a biennial report and distribute it to the appropriate authority to modify the current management solutions for the conservation of these resources;		
Benefits	o Tracking the conservation status of the target biodiversity may help policy makers rethink and make the conservation effort more effective; o Trend and Change analysis are the primary tasks of thoroughly understanding anything before introducing any management;		

	○ Periodic monitoring can provide information and status about the target resources that can be used to evaluate their population and overall habitat condition, including their conservation status;		
Indicative Cost (100,000 BDT)	600.00 (Sixty Million BDT).		
Duration	Biennial for 10 years' duration.		
Implementing Agency	Department of Environment (DoE).	**Lead Ministry**	Ministry of Environment Forrest and Climate Change (MoEFCC)
Supporting Agency	Institutions and organizations that are capable of diving in and have experience with this kind of endeavor.		
Private Sector Potentiality	-		
Intervention Sites	Coral distributed areas of Saint Martin's Island.		

IV. Conservation of Turtles and Turtles Nesting Sites

Project Code	TC-01	**Project Name**	Study of the Breeding Biology of Sea Turtles at Saint Martin's Island
Objectives	The overall objective of the project is to find breeding biology of sea turtles in detail. The specific objectives are to: ○ Identify sea turtle species along with their breeding biology; ○ account for breeding success and survival; and ○ Identify current threats to breeding success.		
Rationale	Saint Martin's Island was historically regarded as a secure breeding habitat for sea turtles, featuring numerous nesting locations. Research indicates that five species of sea turtles regularly visit the island. However, two decades ago, anthropogenic activities, including the harvest of turtle eggs from beaches and key nesting sites, were identified as contributing to a decline in the breeding population. In response, the Department of Environment initiated a project to establish a turtle hatchery near the beach to protect eggs from poaching. Nonetheless, evidence suggests that the hatchery alone may not be sufficiently effective. To enhance the protection and conservation of turtle breeding areas, comprehensive studies on sea turtle breeding biology are warranted. Such research will inform sustainable management and conservation strategies for this ecologically significant island.		
Project components/Actions	The main activities of this study are- ○ Literature review on previously done projects documents, research articles and consultations with local stakeholders; ○ Identify targeted outcome; ○ Design study guidelines and data collection approach; ○ Identify suitable technical tools for appropriate use in the field and lab; ○ Set analyses procedures; and ○ Identify limitations and provide recommendations for future research;		

Benefits	The overall benefit is the conservation of biodiversity in its natural ecosystem. The specific benefits would be o Natural beauty of this important coral Island; o Attract tourists for its uniqueness compared to other beach locations; and o Enhance the revenue of the government.		
Indicative Cost (100,000 BDT)	30.00 (Thirty Lakh BDT)		
Duration	12 months		
Implementing Agency	Department of Environment (DoE)	**Lead Ministry**	MoEFCC
Supporting Agency	Natural Resources Management Division, Department of Environment (DoE); International Union for Conservation of Nature (IUCN);		
Private Sector Potentiality	Yes. Engagement with either universities for MS, PhD researchers or NGOs/INGOs.		
Requirements of Feasibility	No feasibility is required.		
Intervention Sites	Not applicable		

Project Code	TC-02	**Project Name**	Study of the Sea Turtle population biology and population viability
Objectives	The specific objectives are to- o census of identified turtle species population; o distribution study; o identify habitat suitability; o habitat decline/shortage; o population viability;		
Rationale	Studying population biology is essential for assessing population status and identifying trends. The resilience of any population is influenced by factors such as survival rates, habitat distribution, species-specific body size, and movement patterns across all life stages. For sea turtles, integrating demographic data enables more precise estimations of age at maturity, growth, and survival rates. These key parameters equip conservation managers with valuable information to distinguish whether a population is in decline. When restoration efforts are necessary, effective recovery strategies can be developed following comprehensive data collection. Furthermore, this approach ensures access to reliable population data. Therefore, investigating the population dynamics of sea turtles is critically important considering increasing anthropogenic pressures on this emerging island.		
Project components/Actions	The main activities are- o Literature review on previously done projects documents, research articles and consultations with local stakeholders; o Design with a firm outcome of the study; o Research tools identification and validation; o Field data collection and analyses; and o Compilation of the field findings and recommendations for future research;		
Benefits	The benefits of this project are as follows, but not limited to -		

	○ retain functions of the ecosystem services; ○ keep the sea turtle within the viable population to sustain long-term; ○ increase the beauty of nature in terms of recreation; and ○ scope for research on sea/marine turtles;		
Indicative Cost (100,000 BDT)	30.00 (Thirty Lakh BDT)		
Duration	12 months		
Implementing Agency	Department of Environment (DoE)	**Lead Ministry**	MoEFCC
Supporting Agency	Natural Resource Management, Department of Environment (DoE)		
Private Sector Potentiality	Yes. Engagement with either universities for MS, PhD researchers or NGO/INGO		
Requirements of Feasibility	No feasibility is required.		
Intervention Sites	Not applicable.		

V. Terrestrial Flora and Fauna Resources Conservation and Its Further Development

Project Code	TF-01	**Project Name**	Nursery development for the plantation of mangroves species	
Objectives	○ Ecosystem restoration of mangrove species at suitable sites for increasing biodiversity;			
Rationale	○ Reduce mangroves destruction; ○ Increase the mangrove ecosystem as well as species composition both flora and fauna;			
Project components/Actions	○ Tree plantation (Mangrove species)			
Benefits	○ Improve invaluable ecosystem services; ○ To regulate air and water and minimize air and water pollution; ○ Increase faunal diversity; ○ Improve recreational site;			
Indicative Cost (100,000 BDT)	10.00 (Ten Lakh BDT)			
Duration	5 Years			
Implementing Agency	Bangladesh Forest Department	**Lead Ministry**	MoEFCC	
Supporting Agency	Local NGOs, Union Parishad, and Local Government Engineering Department (LGED)			
Private Sector Potentiality	Yes			
Requirements of Feasibility	-			
Intervention Sites	One site, Geo-coordinate: 20°36'4.66"N, 92°19'43.67"E			

Figure 8.4: Potential Interventions Site in Saint Martin's Island

Project Code	TT-02	**Project Name**	Conservation project for terrestrial degraded vegetation (Bushy lands with wild herbs and shrubs)	
Objectives	○ Conservation of wild species at suitable sites to increase greenery coverage;			
Rationale	○ Improve terrestrial vegetation as well as the Herbs and Shrub jungle; ○ Germplasm conservation of wild Herbs and shrubs; ○ Increase the Terrestrial ecosystem as well as species composition, both flora and fauna;			
Project components/Actions	○ Conservation of Germplasm;			
Benefits	○ Improve ecosystem services, especially provision and production; ○ Increase habitat areas for small mammals, reptiles, amphibians and birds; ○ Increase greenery coverage;			
Indicative Cost (100,000 BDT)	8.00 (Eight Lakh BDT)			
Duration	3 Years			
Implementing Agency	Bangladesh Forest Department	**Lead Ministry**	MoEFCC	
Supporting Agency	Local NGOs, Union Parishad			
Private Sector Potentiality	Yes			
Intervention Sites	One site, Geo-coordinate: 20°35'52.20"N, 92°19'44.17"E			

Figure 8.5: Potential Interventions Site in Saint Martin's Island

Project Code	TF-03	**Project Name**	Plantation project in the new potential areas for regenerating the terrestrial vegetation on the Island	
Objectives	○ Plantation of terrestrial species at suitable sites to increase biodiversity;			
Rationale	○ Improve terrestrial vegetation as well as green coverage; ○ Increase Terrestrial biodiversity both flora and fauna; ○ Increase habitat areas of migratory birds;			
Project components/Actions	○ Tree plantation (Terrestrial species);			
Benefits	○ Reduce coastline erosion; ○ Improve invaluable ecosystem services; ○ To regulate air and water and minimize air and water pollution; ○ Increase faunal and floral diversity;			
Indicative Cost (100,000 BDT)	10.00 (Ten lakh BDT)			
Duration	5 Years			
Implementing Agency	Bangladesh Forest Department	**Lead Ministry**	MoEFCC	
Supporting Agency	Local NGOs, Union Parishad			
Private Sector Potentiality	Yes			
Intervention Sites	Two sites, Geo-coordinate: 20°34'51.45"N, 92°20'14.62"E, 20°34'38.92"N, 92°20'10.47"E			

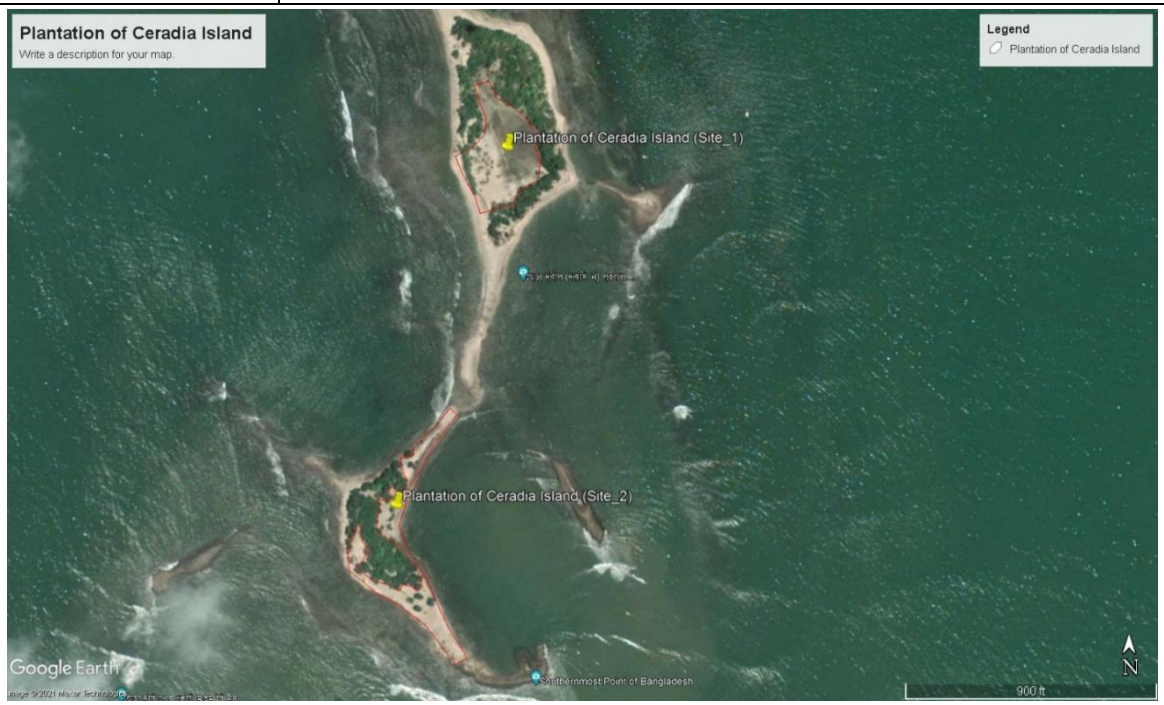
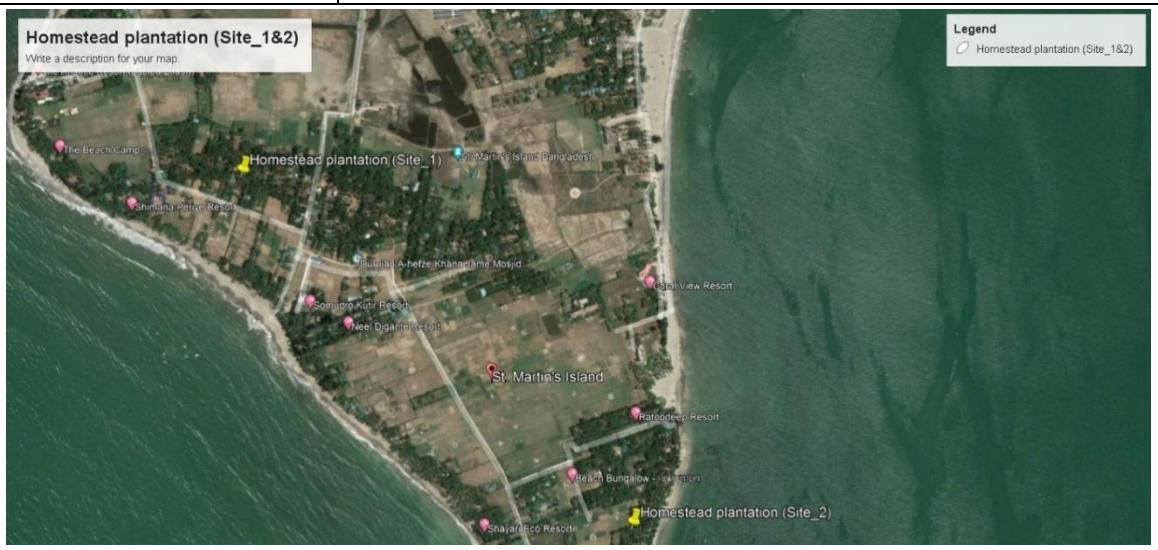


Figure 8.6: Potential Interventions Site in Saint Martin's Island

Project Code	TF-04	**Project Name**	Specific mixed plantation project for protecting the peripheries of the island through Screw pine and Keya
Objectives	○ Plantation of Screw pine and other native relevant species along the coastline due to erosion control;		
Rationale	○ To protect the peripherals of the island;		
Project components/Actions	○ Mixed Tree plantation (Screw pine and Keya species);		
Benefits	○ Reduce coastline erosion; ○ Improve invaluable ecosystem services; ○ To regulate air and water and minimize air and water pollution; ○ Increase faunal diversity;		
Indicative Cost (100,000 BDT)	12.00 (Twelve Lakh BDT)		
Duration	5 Years		
Implementing Agency	Bangladesh Forest Department	**Lead Ministry**	MoEFCC
Supporting Agency	Local NGOs, Union Parishad, and Local Government Engineering Department (LGED)		
Private Sector Potentiality	Yes		
Intervention Sites	One site, Geo-coordinate: 20°36'10.90"N, 92°19'35.48"E		

Figure 8.7: Potential Interventions Site in Saint Martin's Island

Project Code	TF-05	**Project Name**	Alternative fuel and timber wood plantation project at the homestead level with short rotational species (Kadamba, Shimul and Madar)
Objectives	○ Plantation of Timber and Fuel wood;		
Rationale	○ To increase the economic benefits of the community and enhance ecosystem services, we aim to improve the local vegetation health status with native species.		
Project components/Actions	Homesteads plantation for use of fuel and timber wood.		
Benefits	○ Improve ecosystem services, especially provision and production; ○ Increase habitat areas for small mammals, reptiles, amphibians and birds; ○ Increase greenery coverage;		
Indicative Cost (100,000 BDT)	9.00 (Nine Lakh BDT)		
Duration	5 Years (continuous activities)		
Implementing Agency	Bangladesh Forest Department	**Lead Ministry**	MoEFCC
Supporting Agency	Local NGOs, Union Parishad, and Local Government Engineering Department (LGED)		
Private Sector Potentiality	Yes		
Intervention Sites	Three sites, Geo-coordinates: 20°37'36.88"N 92°19'8.34"E, 20°37'16.01"N, 92°19'33.08"E, 20°35'56.75"N, 92°19'50.53"E		



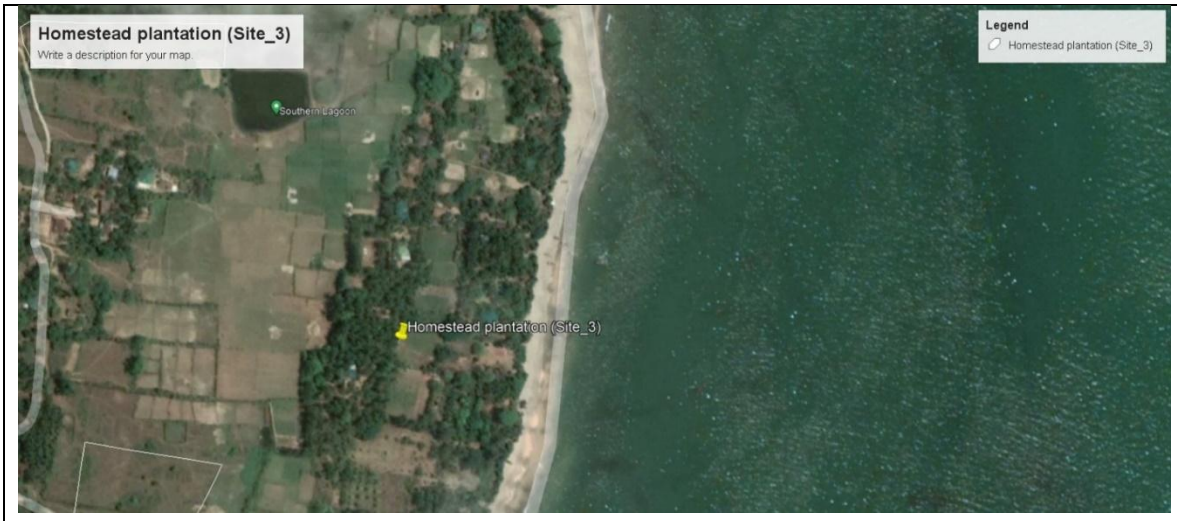


Figure 8.8: Potential Interventions Site in Saint Martin's Island

Project Code	TF-06	**Project Name**	Terrestrial wildlife and vegetation monitoring biennially
Objectives	○ Periodically Monitoring of local wildlife and planted vegetation;		
Rationale	○ Improve terrestrial vegetation with density and coverage; ○ Germplasm conservation of wild species (ex situ); ○ Increase species composition;		
Project components/Actions	○ Preparation of list of flora and fauna to be monitored or selection of bio indicators; ○ Develop scientific methodology for the biennial monitoring of terrestrial flora and fauna; ○ Biennial Monitoring of local and migrated wildlife; ○ Biennial Monitoring of local and mangrove vegetation;		
Benefits	○ Improve ecosystem services, especially provision and production services; ○ Increase habitat areas for small mammals, reptiles, amphibians and birds; ○ Increase greenery coverage; ○ Improve habitat and breeding sites;		
Indicative Cost (100,000 BDT)	300.00 (Thirty Million BDT)		
Duration	Biennially for 10 years of monitoring.		
Implementing Agency	Bangladesh Forest Department	**Lead Ministry**	MoEFCC
Supporting Agency	Local NGOs and Union Parishad		
Private Sector Potentiality	Yes		
Intervention Sites	Three sites, Geo-coordinates: 20°36'21.39"N, 92°19'36.18"E, 20°36'2.98"N, 92°19'47.59"E, 20°34'45.55"N, 92°20'13.70"E		

Figure 8.9: Potential Interventions Site in Saint Martin's Island

VI. Wastes Management

Project Code	**WM-01**	**Project Title**	**Sustainable Solid Waste Management System for Saint Martin's Island**
Objectives	o To transform Saint Martin's Island into a zero-waste, plastic-free eco-tourism hub; o To establish community-driven systems, circular economy practices, and climate-resilient waste infrastructure; o To protect the marine and terrestrial environment, conserve resources, and ensure public health;		
Rationale	Saint Martin's Island is currently experiencing significant challenges in waste management because of unregulated tourism and insufficient infrastructure. The increasing volume and complexity of waste generation pose considerable risks to the island's unique biodiversity, coral reef systems, and public health. Inadequate institutional capacity, limited awareness, and insufficient financial resources have led to improper storage, collection, and disposal of waste, including practices such as open burning and marine dumping. The absence of an integrated solid waste management system further exacerbates these issues. Implementation of this project is therefore critical to safeguarding both the environmental integrity and economic viability of the island's essential ecosystem.		
Project components/Actions	Phase 1: Short-Term (0-6 Months) **Institutional Strengthening:** Establish the Waste Management Coordination Committee (WMCC), implement comprehensive training programs, and assign dedicated personnel. **Community Engagement & Awareness:** Organize incentive-driven training sessions, engage youth groups in coordinated cleanup initiatives, and provide specialized instruction for waste management personnel. **Tourist Awareness Campaign:** Develop multi-platform campaigns utilizing SMS, social media, and ferry display screens; introduce regulatory guidelines featuring QR codes for compliance. **Waste Collection & Bins:** Install 30 color-coded communal bins and commence targeted door-to-door collection services in identified priority areas. **Plastic Control:** Educate tourists on plastic reduction, conduct routine inspections, train local women in preparing plastic-free food products, and launch a Plastic-for-Food exchange initiative. **Infrastructure:** Build a Secondary Transfer Station (STS) equipped with advanced baling machinery. **Waste Transportation:** Arrange monthly trawler transport of waste to the mainland and establish collaborative partnerships with recycling organizations. Phase 2: Mid-Term (6 Months – 2 Years) **Advanced Segregation:** Expand island-wide door-to-door collection, accompanied by comprehensive training for households and hospitality establishments. **Composting Set-Up:** Establish a small-scale composting facility adjacent to the Solid Transfer Station (STS) to process organic waste efficiently.		

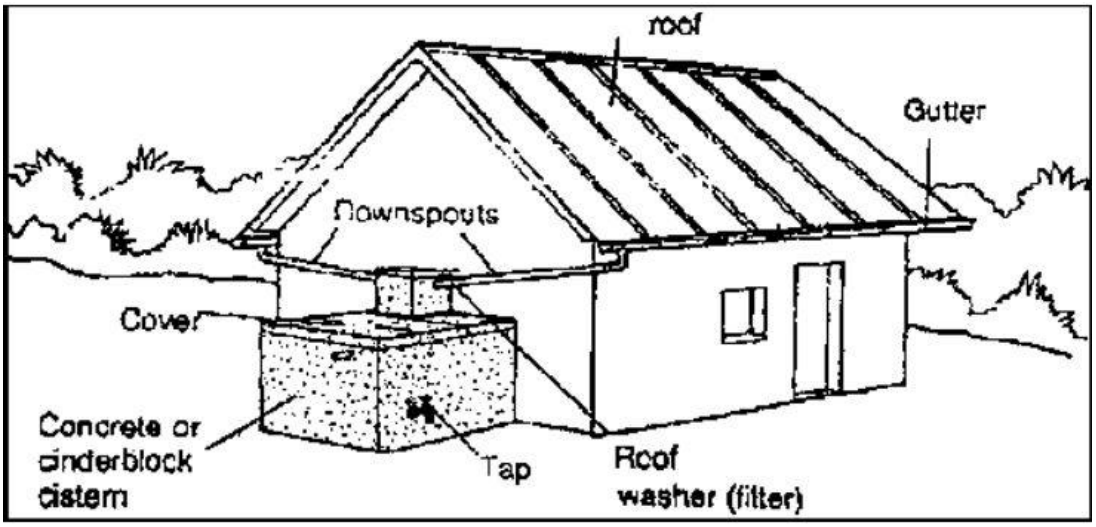
	Resource Recovery: Conduct a feasibility study to assess the development of a Material Recovery Facility (MRF). **Tourism-Linked Solutions:** Implement an eco-tax policy and enforce full compliance with plastic-free mandates across all hotels and resorts. **Marine Waste Action:** Initiate incentive-driven clean-up programs led by fishers and establish designated collection points for discarded fishing nets. **Policy & Enforcement:** Formulate a long-term Solid Waste Management (SWM) Master Plan supported by a dedicated government budget. **Sustainable Packaging:** Advance the adoption of eco-friendly packaging alternatives and introduce a plastic-free certification program for retail establishments.		
Benefits	o Establishes a functional 3R (Reduce, Reuse, Recycle) strategy and circular economy on the island; o Protects marine and terrestrial biodiversity, including critical coral reefs; o Improves public health and safety by eliminating open burning and dumping; o Creates new livelihoods (compost production, eco-friendly food sales, waste collection); o Enhances the tourist experience and promotes sustainable eco-tourism; o Develops a replicable model of island-based waste management for the country;		
Indicative Cost (100,000 BDT)	350.00 (Thirty-Five Million BDT)		
Duration	**Phase 1:** 6 Months (Oct 2025 - Mar 2026) **Phase 2:** 18 Months (Apr 2026 - Oct 2027) **Total:** 2 Years		
Implementing Agency	Department of Environment (DoE), Bangladesh Tourism Board, Union Parishad.	**Lead Ministry**	MoEFCC
Supporting Agency	Teknaf Upazila Parishad, Local Schools, Social Welfare Organizations, BIWTA, Tourist Police, Fishing Communities, Private Sector (Hotels, Resorts, Ship Operators).		
Private Sector Potentiality	Yes. The private tourism sector (hotels, resorts, shops, ship operators) must be incorporated into waste segregation, plastic reduction policies, and potentially funding mechanisms like the eco-tax.		
Requirements of Feasibility	**Yes, a detailed feasibility study is required for:** o Final site selection and engineering design for the STS and composting facility; o Identification of a suitable final disposal site on the mainland in coordination with Teknaf Municipality; o Techno-economic feasibility for the Mid-Term Material Recovery Facility (MRF); o Market analysis for compost and recycled materials;		
Intervention Sites	The entire Saint Martin's Island (Union Parishad). Specific infrastructure sites (STS, composting) will be identified based on the feasibility study, prioritizing areas away from residential zones and sensitive habitats.		

Project Code	WM-02	**Project Title**	Model development for an onsite liquid waste treatment facility	
Objectives	○ Treating wastewater of St. Martin Island; ○ Support to run a proper waste management system in St. Martin Island;			
Rationale	A wastewater treatment facility is a critical component of an effective and systematic waste management framework. The absence of such a facility on St. Martin Island currently presents significant risks to the marine ecosystem, the broader environment, and public health due to the direct discharge of untreated wastewater into the surroundings. Furthermore, the lack of wastewater treatment increases the likelihood of contamination of both groundwater and surface water sources. Therefore, it is imperative to incorporate a comprehensive wastewater treatment facility in the development of St. Martin Island's waste management plan.			
Project components/Actions	○ Estimating effluent load (how much wastewater is being discharged); ○ Identifying waste quality; ○ Introducing a small-scale Sewage Treatment Plant; ○ Identification of the proper technology of STP and capacity; ○ Identifying how much electricity, chemical and manpower, the plant requires to run; Operation and maintenance scheme development; ○ Total investment; ○ legal and regulatory frameworks;			
Benefits	○ Increase the quality of water; ○ Ensure the safety of the aquatic life; ○ Minimize health concern; ○ Improve the overall environmental quality of St. Martin;			
Indicative Cost (100,000 BDT)	500.00 (Fifty Million BDT)			
Duration	9 months			
Implementing Agency	Local Government Institutions (LGIs)	**Lead Ministry**	MoEFCC	
Supporting Agency	Department of Environment (DoE); Bangladesh Parjatan Corporation (BPC)			
Private Sector Potentiality	Hotel owners need to be included in assessing, designing and introducing small-scale STP			
Requirements of Feasibility	Yes			
Intervention Sites	Around hotel motels and residential areas depending on waste quality and wastewater load.			

VII. Groundwater Management

Project Code	GW-01	**Project Title**	Development of Community-based Rainwater Catchment System to Provide Freshwater Resilience for Saint Martin's Island
Objectives	o To design and construct a rainwater harvesting structure with enough capacity to collect sufficient freshwater to supply the people of the island during rainy seasons; o To implement an equitable distribution system for harvested rainwater to ensure a reliable supply to all households on the island during dry periods; o To educate and train local residents on the proper operation, and maintenance of the system;		
Rationale	Rainwater harvesting is essential in regions that experience significant rainfall yet lack a conventional, centralized supply system, as well as in areas where high-quality fresh surface or groundwater resources are unavailable. Saint Martin's Island has no surface water reservoirs, such as springs, rivers, or lakes. Population growth and increased tourism have intensified pressure on groundwater supplies, resulting in saltwater intrusion into potable sources. Consequently, the island community faces heightened vulnerability during the dry season. Strengthening resilience to freshwater scarcity is imperative for residents. Implementing rainwater harvesting infrastructure would allow efficient use of substantial monsoonal rainfall. The project demonstrates promise through a system design that considers catchment productivity, storage objectives, distribution strategies, governance frameworks, and feasibility analysis.		
Project components/ Actions	o Assess historical rainfall patterns, project future precipitation changes and calculate rainwater harvesting potential; o Design an optimal network of rainwater collection surfaces and gutters to channel water based on community layout; o Engineer appropriate water storage tanks, both at household and community scales, to meet dry season demand; o Develop an equitable rainwater distribution system through gravity-fed pipes connecting households; o Implement rainwater quality testing protocols for system maintenance; o Implement workshops and participatory training sessions to encourage community involvement and promote conservation; o Build rainwater catchment infrastructure and implement procedures for sustainable operation and maintenance;		
Benefits	This project will: o Provide more reliable access to safe, fresh water by capturing adequate seasonal rainwater for dry periods; o Provide an essential reserve in times of emergency and/or breakdown of public water supply systems, particularly during natural disasters; o Save residents' money; reduces dependence on expensive imported and bottled water; o The physical and chemical properties of rainwater may be superior to those of groundwater or surface waters that may have been subjected to pollution;		
Indicative Cost (100,000 BDT)	300.00 (Thirty Million BDT)		
Duration	1 year		

Implementing Agency	Department of Public Health Engineering (DPHE)	**Lead Ministry**	Ministry of Local Government, Rural Development and Co-operatives
Supporting Agency	Social Welfare, NGOs		
Private Sector Potentiality	Yes		
Requirements of Feasibility	Adequate Rainfall, Land availability, Community water demand assessment, Local govt. capacity		
Intervention Sites	Not applicable		



(Source: José Payero, Professor-Researcher, Department of Natural Resources, Higher Institute of Agriculture (ISA), Dominican Republic)

Figure 8.10: Schematic of a Typical Rainwater Catchment System

Project Code	GW-02	**Project Name**	Dune area demarcation dune vegetation regeneration and its proper conservation
Objectives	○ Conservation of wild species at suitable sites to increase greenery coverage;		
Rationale	○ Improve terrestrial vegetation as well as dune vegetation; ○ Germplasm conservation of wild species; ○ Increase the Terrestrial ecosystem;		
Project components/Actions	○ Conservation of dune vegetation;		
Benefits	○ Improve ecosystem services, especially provision and production ○ Increase habitat areas for small mammals, reptiles, amphibians and birds ○ Increase greenery coverage;		
Indicative Cost (100,000 BDT)	5.00 (Five Million BDT)		
Duration	2 Years		
Implementing Agency	Department of Forest	**Lead Ministry**	MoEFCC
Supporting Agency	Local NGOs, Union Parishad, and Local Government Engineering Department (LGED)		
Private Sector Potentiality	Yes		
Intervention Sites	Three sites, Geo-coordinates: 20°36'26.43"N, 92°19'34.44"E 20°36'46.48"N 92°19'31.76"E 20°36'39.74"N, 92°19'42.11"E		

Figure 8.11: Potential Interventions Site in Saint Martin's Island

VIII. Internal Roads Communication and Infrastructure Development

Project Code	ID-01	**Project Title**	Advancing road infrastructure in the Saint Martin Islands by introducing cool pavement
Objectives	The objectives of the project are mitigating heat, enhancing tourism experiences, improving energy efficiency, managing storm water, promoting community well-being, fostering innovation, integrating sustainable policies, building local capacity, realizing economic benefits, enhancing aesthetics, and contributing to climate change resilience through the strategic implementation of cool pavements.		
Rationale	The adoption of cool pavements in Saint Martin Island offers considerable advantages, largely due to the region's tropical climate and related environmental challenges. Persistent high temperatures throughout the year contribute to the heat island effect, which negatively influences the well-being of both residents and tourists. Cool pavements, distinguished by their reflective and permeable qualities, provide an effective mitigation strategy. The use of conventional concrete surfaces with a reflective grey finish facilitates the reflection of sunlight, resulting in reduced surface temperatures and diminished heat absorption. This method improves the comfort of urban spaces and is particularly valuable to the island's tourism industry by enabling visitors to participate in outdoor activities without excessive thermal discomfort. In addition, implementing cool pavements supports sustainable and climate-resilient urban planning, creating a more favorable and environmentally responsible future for Saint Martin Island.		
Project components/ Actions	The main actions of the project are: o Site assessment and planning by conducting a thorough assessment of key urban areas to identify high-temperature zones and prioritize locations for cool pavement implementation; o Pavement materials selection by proper research and considering factors such as reflectivity, permeability, durability, and compatibility with the local environment; o Initiating small-scale pilot projects in strategic areas to test the effectiveness of cool pavements in local conditions o Establishing technical standards and guidelines for the installation of cool pavements, including specifications for materials, construction techniques, and maintenance; o Implementing a monitoring system to track the performance of cool pavements over time and establishing a routine maintenance schedule;		
Benefits	o Cool pavements will help mitigate the heat effect by reflecting sunlight and reducing surface temperatures in the island during summer; o It will enhance the comfort of outdoor spaces, making them more enjoyable for residents and tourists; o The project can have positive implications for the tourism sector, as comfortable outdoor spaces attract more visitors; o Permeable cool pavements allow for better water infiltration which will help to manage storm water runoff; o It will open avenues for innovation and research leading to advancements in road infrastructure;		
Indicative Cost (100,000 BDT)	300.00 (Thirty Million BDT)		

Duration	1 Year		
Implementing Agency	Local Government Engineering Department (LGED)	**Lead Ministry**	Ministry of Local Government, Rural Development & Co-operatives
Supporting Agency	Local Government Division (LGD).		
Private Sector Potentiality	No.		
Requirements of Feasibility	A feasibility study is required as the Government of Bangladesh has declared St Martin's Island as a Marine Protected Area (MPA) to protect its rich biodiversity and ecosystem.		
Intervention Sites	Applicable along the main road that runs all the way around the island.		

Project Code	ID-02	**Project Title**	Integrating Vertical Greening Systems (VGS) into Green Building Design in Saint Martin Islands
Objectives	The project is designed to incorporate Vertical Greening Systems (VGS) into both current and future building developments within the Saint Martin Islands. Its primary objectives include enhancing thermal insulation, reducing the impact of the urban heat island effect, and lowering indoor temperatures. Through a focus on energy efficiency and the adoption of sustainable construction practices, the initiative seeks to position Saint Martin as a leading example of green infrastructure, fostering a resilient and environmentally responsible community.		
Rationale	Integrating Vertical Greening Systems (VGS) into the sustainable building design of Saint Martin Islands presents substantial opportunities for advancing the region's environmental objectives. The primary rationale for VGS implementation is its capacity to address pivotal architectural and ecological concerns. Through retrofitting existing structures or incorporating VGS into new construction, Saint Martin can effectively mitigate the urban heat island phenomenon, improve thermal insulation, and reduce internal building temperatures. These measures promote greater energy efficiency and lessen dependence on mechanical cooling systems, supporting the island's dedication to developing green infrastructure. Additionally, VGS enhances building aesthetics while offering a comprehensive strategy to counter climate change impacts, thereby fostering a more resilient and sustainable built environment for the local community.		
Project components/ Actions	The main actions of the project are: o Conducting a thorough analysis of existing buildings and potential sites for new constructions to identify optimal locations for Vertical Greening Systems (VGS); o Research and selection of appropriate VGS technologies and plant species that thrive in the local climate, ensuring maximum effectiveness and minimal maintenance requirements; o Fostering community awareness and participation by organizing workshops, seminars, and informational sessions to educate residents on the benefits of VGS; o Developing policies that incentivize the incorporation of VGS in building designs, promoting sustainable practices across the community;		
Benefits	o Promotion of sustainable practices, reducing the carbon footprint and supporting environmental stewardship; o Results in long-term cost savings by reducing maintenance and operational costs; o Adds visual appeal to buildings, enhancing the overall aesthetic of the built environment;		

	○ Contributes to community health and well-being by improving air quality and providing green spaces;		
Indicative Cost (100,000 BDT)	200.00 (Twenty Million BDT)		
Duration	6 months		
Implementing Agency	Housing and Building Research Institute (HBRI)	**Lead Ministry**	Ministry of Housing and Public Works
Supporting Agency	National Housing Authority		
Private Sector Potentiality	No		
Requirements of Feasibility	Feasibility is required.		
Intervention Sites	Not applicable.		

IX. Livelihood Improvements

Project Code	LI-01	**Project Name**	Micro Enterprise Training and Development for Women	
Objectives	○ Facilitate and organize micro enterprise base training for skill development; ○ Create economic opportunities; ○ Increase the economic stability of individuals to alleviate poverty; ○ Strengthen the decision-making power of women in and beyond the households;			
Rationale	Participants in micro-enterprise development initiatives support women in engaging with small businesses, fostering self-employment. As capabilities and resources grow, additional employment opportunities will emerge. This process contributes to enhanced economic stability for both individuals and communities, helping to reduce poverty and promote greater economic self-sufficiency.			
Project components/Actions	○ Need Assessment for identifying the potential opportunities; ○ Capacity Building Training on micro enterprise; ○ Micro Finance;			
Benefits	○ Ensure gender Equity; ○ Reduce income vulnerability; ○ Generate potential for ensuring income-generating activities; ○ Establish a mechanism for women empowerment;			
Indicative Cost (100,000 BDT)	100.00 (Ten Million BDT)			
Duration	5 Year			
Implementing Agency	Local NGOs, Department of Social Services	Lead Ministry	Ministry of Women and Children Affairs/Ministry of Business	

Supporting Agency	-
Private Sector Potentiality	Yes
Intervention Sites	Within Saint Martin's Island.

Project Code	LI-02	**Project Name**	Adopting smart technology and capacity development for sustainable agro firming
Objectives	o Facilitate and establish network for adopting new technology for agricultural farming; o Agro-based enterprise and entrepreneurship development; o Create income opportunities and grow innovative business model;		
Rationale	The adoption of innovative technologies is projected to enhance food grain production, particularly in challenging environments. This approach has the potential to serve as a model for local communities, fostering new opportunities and increasing income streams. Furthermore, in the context of capacity building, such advancements are integral to achieving both food security and sustainable livelihoods.		
Project components/Actions	o Training on Lift and Vertical farm production; o Microfinance /Credit Facilities for infrastructure development; o Sustainable and inclusive Business model development;		
Benefits	o Facilitate income sustainability and livelihood resilience; o Open a new sector for entrepreneurship development; o Generate potential for ensuring income-generating activities; o Establish a network to adopt new technology and innovation; o Develop a mechanism for potential capacity building and skill development;		
Indicative Cost (100,000 BDT)	500.00 (Fifty Million BDT)		
Duration	10 Years		
Implementing Agency	Department of Agricultural Extension (DAE)	**Lead Ministry**	Ministry of Agriculture (MoA)
Supporting Agency	-		
Private Sector Potentiality	Yes		
Intervention Sites	Within Saint Martin's Island.		

Project Code	LI-03	**Project Name**	Market Integration, Branding & Digital Livelihoods	
Objectives	o Strengthen access to domestic and external markets for coconut-based products; o Promote eco-friendly and innovative branding of island products; o Create sustainable digital livelihood opportunities for youth and women;			
Rationale	Coconut-based products originating from Saint Martin's Island present considerable potential for expansion in local, national, and digital markets. Nevertheless, challenges such as insufficient branding, packaging quality, and limited market connections currently constrain profitability. Leveraging digital platforms can offer meaningful employment prospects for young people, while sustainable branding initiatives are poised to solidify the identity of island products. This endeavor aims to bolster economic resilience, diversify sources of income, and facilitate broader market access for local enterprises.			
Project components/Actions	o Develop an inclusive business model tailored for island microenterprises; o Train youth and women on e-commerce platforms (Facebook Shop, WhatsApp Biz, Daraz, etc.); o Design eco-friendly branding and packaging for coconut products; o Facilitate market linkages with mainland (Cox's Bazar, Teknaf) and tourism channels;			
Benefits	o 100+ micro-Enterprises engaged in online and offline markets; o At least 40% women and youth-led businesses strengthened; o Enhanced product visibility and competitiveness through improved branding; o Increased household income by 25–40% from diversified market access;			
Indicative Cost (100,000 BDT)	100.00 (Ten Million BDT)			
Duration	3 Years			
Implementing Agency	Local NGOs but obviously under one independent monitoring authority.	**Lead Ministry**	Ministry of Agriculture / Ministry of Commerce (as applicable)	
Supporting Agency	PKSF, as a part of a Government Agency, with the help of FAO/UNDP (if donor added), BRAC, or Coast Foundation, can play the role of a supporting agency.			
Private Sector Potentiality	E-commerce companies, packaging industry, retailers.			
Intervention Sites	Within Saint Martin's Island.			

8.4 Benefits of the Plan

The Master Plan combines conservation, community development, and sustainable tourism to protect Saint Martin's Island's ecosystems and enhance local livelihoods. Its implementation will yield both measurable and qualitative benefits. Key initiatives include prohibiting engine-powered boats in coral areas, limiting resort development along beaches, enforcing fishing bans during spawning seasons, and designating wildlife habitats for protection through demarcation and community-led efforts. These measures are designed to mitigate ecological threats, prevent habitat loss, and foster ecosystem recovery. Sustainable tourism management will improve safety, service quality, and ensure equitable benefits for the community, supported by ongoing monitoring systems for policy guidance and adaptive interventions. Conservation of fish stocks and benthic habitats, alongside better support for fishermen, will bolster food security and resilience. Locally aligned income-generating opportunities aim to resolve conflicts between residents and management authorities while promoting inclusive economic growth. Restoration and protection of bushlands, mangroves, and lagoons will increase groundwater recharge, freshwater supplies, and biodiversity. Waste management projects are intended to reduce pollution across soil, air, and marine environments, resulting in improved public health. Collectively, these measures will restore the island's natural appeal, rehabilitate coral reefs and turtle populations, and position Saint Martin's Island as an exemplary model for sustainable island governance.

9. Institutional Arrangement

9.1 Institutional Framework

9.1.1 Regulatory and Planning Agencies

St. Martin's Island is administered under Teknaf Upazila, a sub-district within Cox's Bazar District. Governance of the island is overseen by the Deputy Commissioner (DC) of Cox's Bazar through the Upazila Nirbahi Officer (UNO) of Teknaf. The island constitutes a single administrative unit, St. Martin's Island Union, which comprises nine wards and 14 villages (UP Chairman, SMI, May 7, 2020).

The local government operates through an electoral system, with the Union Parishad (UP) led by an elected Chairman, supported by nine general members and three female members. Law enforcement responsibilities are managed by a police camp staffed with 8–10 officers, complemented by security forces from the Bangladesh Navy, Border Guard Bangladesh (BGB), and Coast Guard who maintain operations on the island according to their official mandates.

Regarding land tenure, most of the property is privately owned. Notable exceptions include 18.7 hectares at Cheradia recently secured by the Ministry of Environment and Forest, as well as several smaller public-use parcels designated for settlement or livelihood purposes. Figure 9.1 provides a visual representation of the Management and Governance Framework for St. Martin's Island.

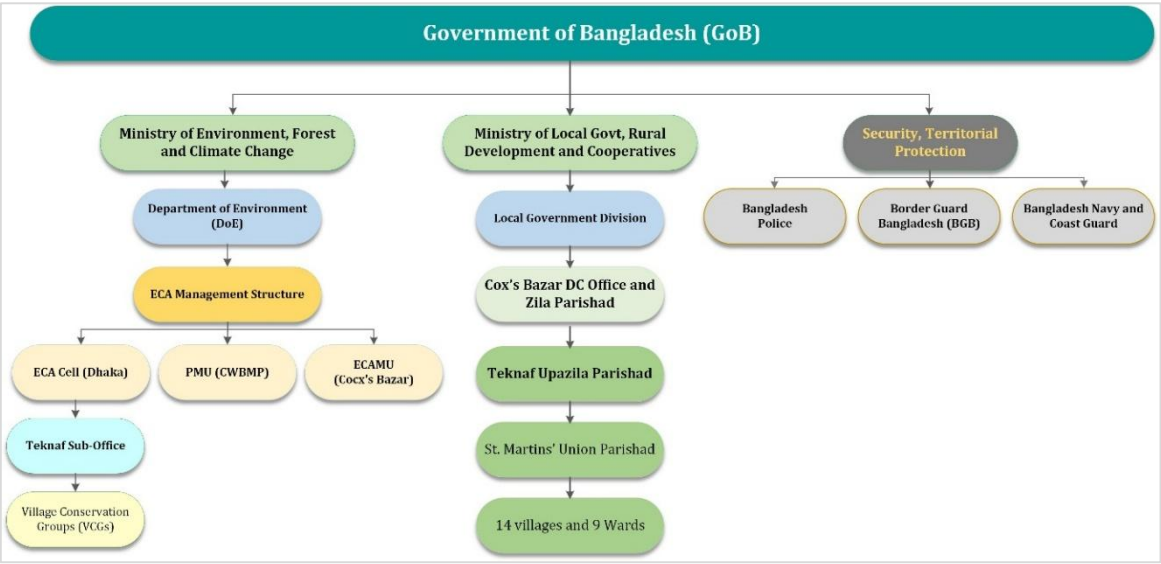


Figure 9.1: Current and Existing Administrative and Management Structure of St. Martin's Island

Over time, the institutional frameworks and capabilities associated with St. Martin's Island have developed through an integration of knowledge systems, belief structures, codes of conduct, legal frameworks, social norms, livelihood practices, resource use protocols, and an overarching ecosystem-based culture. The ecological attributes characteristic of wetlands, islands, and estuarine environments significantly inform both formal and informal institutions. Effective stewardship of St. Martin's Island necessitates collaboration among multiple institutions, departments, and ministries, as no single authority possesses the capacity to ensure the island's ecological sustainability independently.

Department of Environment (DoE) and Ministry of Environment, Forest and Climate Change

The Ministry of Environment, Forest and Climate Change (MoEFCC), established in 1989, is responsible for overseeing the environment, forests, ecological systems, biodiversity, wildlife, and the management of national parks and protected areas within Bangladesh. Operating under this Ministry, the Department of Environment (DoE) and the Forest Department (FD) are the principal agencies tasked with the protection, management, and conservation of natural resources and ecosystems, including those found on St. Martin's Island. In accordance with international obligations, the Government of Bangladesh has demonstrated a steadfast commitment to the preservation of the nation's sole coral resources, situated in this region.

The DoE is specifically mandated to conserve corals and related resources, as stipulated in the Ecologically Critical Areas (ECA) Rules of 1995 and subsequent amendments. Following St. Martin's Island's designation as an ECA in 1999, the DoE assumed responsibility for implementing measures aimed at conserving its delicate coral reef ecosystem. Early conservation initiatives on the island were primarily directed towards coral protection.

Overall management of ECAs falls under the jurisdiction of the MoEFCC, which coordinates efforts among the FD, DoE, and other relevant stakeholders. Presently, the DoE administers St. Martin's Island ECA through the Coastal and Wetland Biodiversity Management Project (CWBMP)—a collaborative venture involving the Government of Bangladesh (GoB), United Nations Development Programme (UNDP), and the Global Environment Facility (GEF). Implemented between 2002 and 2009, the project was designed to establish an innovative framework for ECA management in Bangladesh, ensuring the long-term viability of the nation's biodiversity resources. While the CWBMP established only an interim management structure, one of its principal objectives has been to institutionalize ECA governance by developing a permanent ECA Cell within the DoE.

9.1.2 Implementing Agencies

The sustainable planning and management of St. Martin's Island are founded on a collaborative framework involving government agencies, research institutions, and specialized organizations, all dedicated to harmonizing ecological conservation with community development objectives. These entities collectively establish an integrated governance system that addresses the island's environmental sensitivity, supports local communities, and aligns with national conservation priorities. Figure 9.2 presents a comprehensive overview of all implementing agencies, organized by lead ministry, implementing agencies, and supporting organizations. The roles and responsibilities of the principal agencies are outlined, with particular emphasis on their contributions to the implementation of the Master Plan.

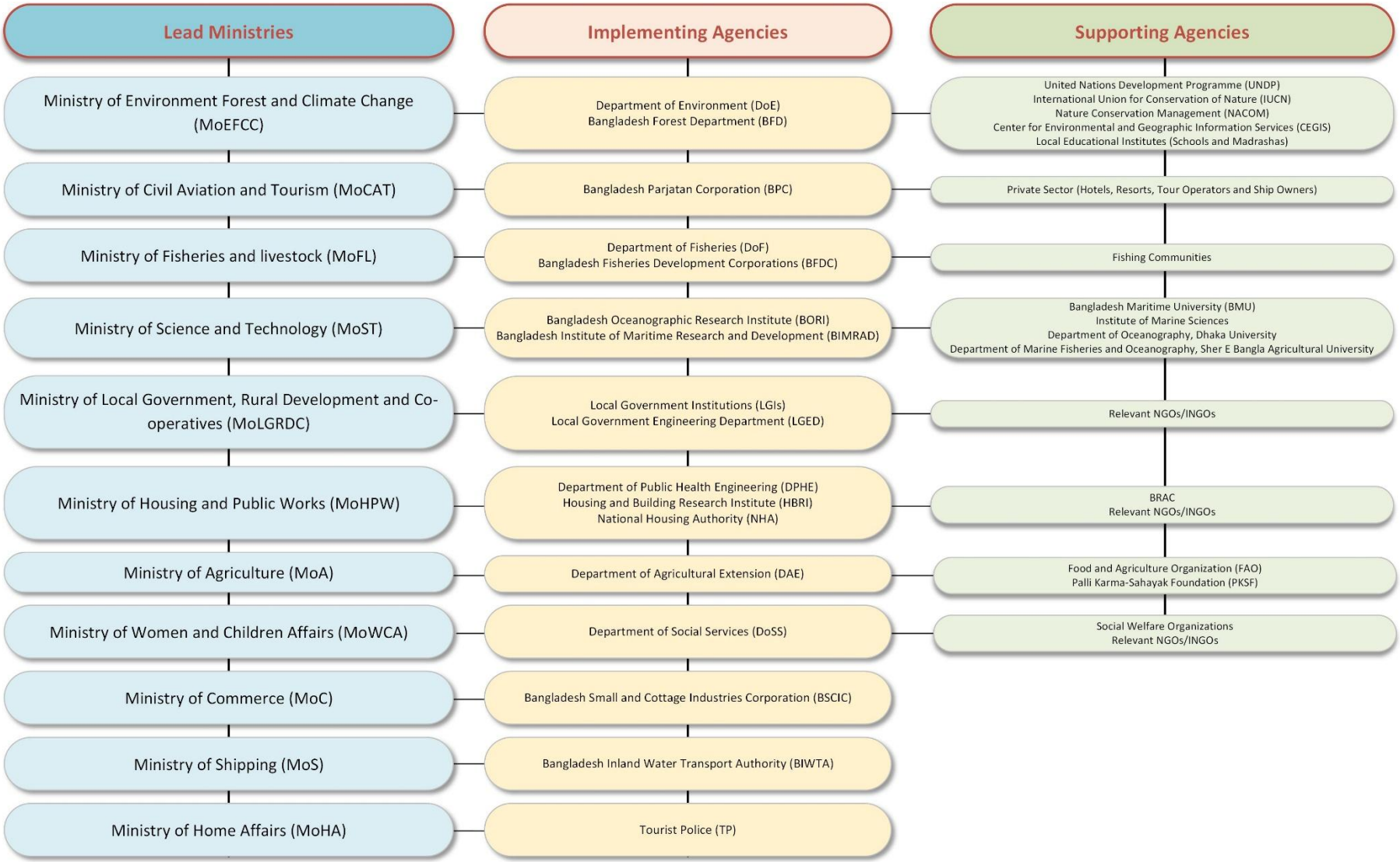


Figure 9.2: Proposed Institutional Framework of the Master Plan

Department of Environment (DoE)

Mandate of the Department of Environment (DoE)

Legal Authority: Established in 1989 under the Ministry of Environment, Forest and Climate Change (MoEFCC), the Department of Environment (DoE) derives its mandate from the Bangladesh Environmental Conservation Act of 1995. The DoE is responsible for overseeing environmental protection, regulating pollution, and enforcing environmental standards nationwide.

Vision & Mission: The organization aspires to create "a healthy, beautiful, and exemplary Bangladesh that is free from pollution." Its mission encompasses:

- Safeguarding a safe environment for present and future generations.
- Ensuring fair and robust enforcement of environmental legislation.
- Enhancing public awareness regarding environmental issues.
- Advancing sustainable development and green growth initiatives.

Role within Government Structure:

Functioning as the technical and enforcement branch of the MoEFCC, the DoE is tasked with environmental planning, regulation, monitoring, and governance. It works collaboratively with other agencies, including the Forest Department, Planning Commission, and various ministries, to mainstream environmental priorities across diverse sectors.

Key Activities and Functions of DoE

Regulatory Enforcement & Pollution Control

- **Issuance of Environmental Clearances:** The Department of Environment (DoE) inspects and evaluates both new and existing industrial projects, issuing Environmental Clearance Certificates (ECC). Projects classified as high-risk (Red category) are subject to a comprehensive Environmental Impact Assessment (EIA).
- **Mobile Courts & Legal Action:** DoE conducts mobile courts to enforce compliance with the Environmental Protection Act and related regulations, taking legal action against violations as necessary.
- **Pollution Monitoring:** Air and water quality are routinely monitored by DoE, which also analyses laboratory samples, tracks environmental data, and regularly disseminates assessment reports.

Environmental Impact Assessment (EIA)

- **EIA Review:** The department evaluates and approves EIA reports for development projects undertaken by governmental and non-governmental organizations and provides guidance throughout project implementation.

Ecosystem Protection

- **Designation of Ecologically Critical Areas (ECAs):** DoE holds the authority to designate ECAs regions identified for elevated protection due to environmental sensitivity or degradation.
- **Chemical & Ozone Regulation:** DoE regulates the importation, transportation, and use of hazardous chemicals, and enforces controls on ozone-depleting substances (e.g., CFCs).

Climate Change & Biodiversity Initiatives

- **Biodiversity Conservation:** The department engages in conservation initiatives within ecologically sensitive zones, encouraging active public participation.
- **Climate Adaptation & Awareness:** DoE develops and executes national and international projects/programs focused on adaptation of climate change.
- **Projects:** Notable involvement include:
    - Clean Air and Sustainable Environment (CASE), targeting pollution control in urban transport and brick manufacturing;
    - Coastal and Wetland Biodiversity Management in Cox's Bazar and Hakaluki Haor;
    - Institutional strengthening for ozone phase-out and greenhouse gas mitigation;

Education, Training & Public Engagement

- DoE organizes training sessions, workshops, and public seminars;
- promotes environmental awareness campaigns;
- celebrates key international environmental days; and
- publishes State of Environment Reports;

Institutional Support & Research

- The department undertakes environmental research and implements relevant projects,
- prepares policy recommendations and assessments for governmental and private sector initiatives, and
- enhances capacity for effective environmental governance through collaboration across public, private, and civil society sectors;

Relevant New Project Linkages:

- This master plan assigns DoE responsibility for solid and liquid waste management on the island.
- For establishing and managing a community-based village conservation group.
- Conservation oversight of Chera Dwip Island, now under DoE stewardship.
- Awareness-raising regarding the ecological value of the island's resources, including corals and other benthic communities.
- Monitoring pollution across the island.
- Supervising resort and hotel operations, ensuring their lawful status.
- Overseeing wildlife and vegetation monitoring within marine and terrestrial habitats.
- Overall management of the island.

Bangladesh Forest Department (BFD)

The primary objective of the Bangladesh Forest Department (BFD) is to enhance national natural resource management projects/programs and to provide leadership in policy development and implementation, considering inter-sectoral linkages (FAO, 2006). National forest monitoring systems support forest projects/programs and broader natural resource management efforts by systematically tracking changes in forest cover and services over time (FAO, 2013).

Comprehensive assessment and ongoing monitoring of forest and land cover dynamics are critical to ensuring sustainable natural resource management, environmental protection, biodiversity conservation, and the development of sustainable livelihoods, especially in densely populated countries such as Bangladesh.

The BFD, operating under the Government of Bangladesh, is responsible for the conservation of forests, environmental stewardship, biodiversity preservation, and socioeconomic advancement through the adoption of modern technologies and innovative approaches.

BFD's objectives include expanding forest areas, conserving biodiversity, alleviating poverty, and protecting wildlife, achieved through active stakeholder participation. The department has launched several initiatives related to land cover and forest mapping across Bangladesh at various intervals.

Relevant New Project Linkages:

- Nursery Development for the Plantation of Mangrove Species Project: This project directly supports BFD's afforestation and ecosystem restoration objectives.
- Assessment of Potential Coral Species Regeneration Schemes and Its Proper Piloting on the Island: This initiative complements BFD's mandate in biodiversity protection.

Bangladesh Parjatan Corporation (BPC)

The Bangladesh Parjatan Corporation (BPC), the government's tourism organization, serves as the principal agency for the advancement of tourism in Bangladesh. Since its inception, BPC has undertaken a dual mandate: promoting and developing the tourism sector, alongside establishing and operating various tourism facilities nationwide.

The corporation's primary objectives include fostering tourism within Bangladesh, enhancing the country's international reputation, developing essential tourism infrastructure, delivering high-standard services to visitors, maximizing the potential of existing tourism resources, and facilitating employment opportunities across the industry. These efforts contribute both to poverty reduction and to increased national GDP. With a commitment to providing exemplary service and maintaining quality standards throughout the country, BPC has consistently pioneered projects in key tourism areas and facilitated private investment initiatives.

Vision and Mission Statement of BPC

The vision of BPC is to "Develop Bangladesh as an Exotic Tourist Destination." The mission comprises:

- Establishing BPC as a center of excellence, empowered to regulate and facilitate the tourism industry in Bangladesh;
- Creating and sustaining internationally competitive tourism products and supporting facilities;
- Engaging government and encouraging private-sector participation in the development of physical infrastructure, such as roads, railways, air, and waterways, to ensure accessibility;
- Ensuring the safety and security of tourists;
- Streamlining visa and immigration procedures for visitors;
- Promoting pro-poor tourism models to foster economic improvement and empowerment;
- Advanced ecotourism initiatives grounded in natural and cultural heritage;
- Improving balance of payments, increasing employment prospects, alleviating poverty, and fostering social harmony through tourism;

- Expanding both domestic and international marketing of tourism products;
- Enhancing human resource capacity within the tourism sector;
- Strengthening public-private partnerships for industry development;
- Promoting collaboration with regional and international stakeholders; and
- Transitioning commercial ventures to private management where appropriate;

Relevant New Project Linkages:

- Development of Saint Martin's Tourism Monitoring Information System (SMT-MIS).
- Micro Enterprise Training and Development for Women.

Department of Fisheries (DoF)

The Department of Fisheries is dedicated to supporting the sustainable growth of fish, shrimp, and other aquatic resource production for both domestic consumption and export. It also oversees the management of open water fisheries resources through community engagement. The primary objectives and functions of the Department are as follows:

- Manage, develop, and enforce regulations related to fisheries; maintain statistics, ensure quality control, provide extension services, and deliver training projects/programs;
- Enhance fisheries resources by implementing conservation and management measures.
- Support the administrative ministry in formulating relevant policies, legislation, and regulations;
- Enforce quality assurance protocols and issue health certificates for fish and fish products intended for export;
- Conduct surveys and stock assessments to establish a comprehensive fisheries database for effective planning;
- Facilitate institutional credit access for fish and shrimp farmers, fishers, and traders;
- Promote alternative income-generating activities for rural populations and the unemployed to aid poverty alleviation efforts;
- Design and implement development projects aimed at the sustainable use of fisheries resources, thereby contributing to food security;

To date, the Ministry of Land has transferred 150 fisheries to the Department, enabling the application of management procedures outlined in the National Fisheries Management Plan (NFMP).

Relevant New Project Linkages:

- Sustainable Fisheries Development in the Saint Martin's Island Project: This initiative aligns directly with DoF's mission to promote sustainable fisheries growth and facilitate exports.
- Study of Breeding Biology of Sea Turtles at Saint Martin's Island: This project supports DoF's mandate to conserve aquatic biodiversity and manage wildlife.
- Assessment of Potential Coral Species Regeneration Schemes and Proper Piloting on the Island: This assessment complements DoF's commitment to research and the management of aquatic resources.

Bangladesh Fisheries Development Corporation (BFDC)

Established by ordinance in 1964 and later formalized under the Bangladesh Fisheries Development Corporation Act of 1973, the BFDC is an autonomous government body operating under the Ministry of Fisheries and Livestock. Its principal mandate encompasses comprehensive development of the national fishing industry, including the harvesting of marine resources, construction of critical infrastructure such as fish harbors, landing centers, and processing plants, as well as the advancement of marketing and distribution systems.

Given that fishing constitutes a central pillar of the local economy on Saint Martin's Island, BFDC's participation in the Master Plan is essential. The corporation is positioned to facilitate the transition from traditional fishing practices to sustainable models by providing modern, sanitary landing facilities aimed at reducing post-harvest losses, delivering training in sustainable fishing methods, and supporting the creation of value-added fish products. These initiatives will not only enhance the livelihoods of the local fishing community but also ensure alignment with the Master Plan's objectives for conservation of the island's marine resources.

Relevant New Project Linkages

- BFDC can be Linked to the projects on sustainable fisheries and resource management because its primary mandate is the development and management of the country's fisheries sector.

Bangladesh Oceanographic Research Institute (BORI)

Established under the Bangladesh Oceanographic Research Institute Act of 2015, BORI is the nation's primary governmental institution dedicated to oceanographic research and operates under the Ministry of Science and Technology. Its mandate encompasses conducting comprehensive studies of the marine environment, exploring and promoting the sustainable use of both living and non-living marine resources, monitoring environmental health, and examining coastal processes. BORI serves as an essential scientific partner for the Saint Martin's Master Plan. Its ongoing research activities on coral species, water quality, and micro plastic pollution on the island provide critical baseline data and long-term monitoring required to inform conservation strategies, evaluate the effectiveness of tourism restrictions, and guide the restoration of marine ecosystems.

Relevant New Project Linkages:

- BORI can be connected with projects on coral regeneration, underwater monitoring, and sea turtle biology through its mission to conduct scientific research on marine ecosystems and resources.

Bangladesh Institute of Maritime Research and Development (BIMRAD)

Established in July 2018, BIMRAD serves as a specialized maritime research think tank addressing a comprehensive range of maritime issues. Its mandate encompasses research on the Blue Economy, maritime security and strategy, marine environmental protection, coastal disaster management, and the advancement of sustainable maritime tourism. Within the context of the Saint Martin's Master Plan, BIMRAD's involvement would be both strategic and analytical. The institute is positioned to deliver high-level policy research focused on harmonizing economic pursuits with conservation efforts, developing practical eco-tourism models for the island, evaluating maritime security considerations due to its border location, and crafting strategies for climate change adaptation and coastal hazard mitigation.

Relevant New Project Linkages:

- BIMRAD can be linked to the tourism monitoring system project by providing policy and strategic research for the sustainable management of maritime tourism resources.

Local Government Institutions (LGIs)

Local Government Institutions, such as the Saint Martin's Union Parishad, serve as the principal administrative authorities at the community level, overseeing public service delivery and local development. Their responsibilities encompass the development and maintenance of local infrastructure, management of services including solid waste collection, and execution of government projects at the grassroots level. LGIs play an integral role in the implementation of the Saint Martin's Master Plan. Their active involvement is vital for the enforcement of regulations, operation of waste management systems, supervision of community-based conservation projects/programs, and effective delivery of alternative livelihood initiatives to residents. This positions LGIs as a crucial link between national policy directives and their acceptance and execution within local communities.

Relevant New Project Linkages:

- LGIs can be connected to the projects on waste management, rainwater systems, and community-based tourism as they are responsible for local public service delivery and infrastructure development.

Local Government Engineering Department (LGED)

The Local Government Engineering Department (LGED) is dedicated to the development and management of local infrastructure with the objectives of increasing agricultural and non-agricultural production, generating employment opportunities, improving socio-economic conditions, promoting effective local governance, reducing poverty, and serving as catalysts for change at the community level. LGED operates under the Ministry of Local Government, Rural Development and Cooperatives, with a principal mandate to plan, develop, and maintain rural, urban, and small-scale water resource infrastructure nationwide. Additionally, LGED is responsible for the development, maintenance, and management of transportation, commercial, and water resource infrastructure at the local level, ensuring participation from local government institutions (LGIs) and communities while addressing environmental and social concerns. The organization provides technical and institutional support to strengthen LGIs and serves local communities and stakeholders.

Given St. Martin’s Island's remote location and the prohibitive costs associated with connecting to the mainland grid, traditional electricity supply is challenging. Currently, LGED partially meets electricity demand using stand-alone diesel generators. This study models a hybrid electricity generation system tailored for a small island community, comprising solar photovoltaic (PV) panels, wind turbines, batteries, and a diesel generator. HOMER software was utilized to analyze and determine the optimal system configuration to meet the electricity needs of 100 households and 10 shops, targeting a daily primary load of 78 kWh and a peak load of 20 kW. Sensitivity analyses were conducted to assess the influence of solar insolation, PV investment cost, wind speed, and diesel fuel price on the optimal configuration. The analysis identified a hybrid system—consisting of 8 kWp solar PV, two 3 kW wind turbines, a 15-kW diesel generator, and 25 batteries (800 Ah each)—as the most cost-effective solution. This configuration yields the lowest cost of electricity (COE) at Tk 26.54/kWh (US$ 0.345/kWh) and a total net present cost (NPC) of Tk 10,620,388 (USD$ 137,927), with a renewable energy fraction of 31%. Implementing this system would reduce CO_2 emissions by approximately 14 tons annually compared to reliance solely on diesel generators.

Relevant New Project Linkages:

- Advancing road infrastructure in Saint Martin Islands by the introduction of Cool Pavement, complementing LGED's commitment to sustainable transport and infrastructure development.
- Development of a community and institution-based solid waste management framework, encompassing recycling, composting, reuse, and the transportation of non-biodegradable waste off the island, in alignment with LGED's mandate for urban infrastructure management and environmental stewardship at the local level.

Department of Public Health Engineering (DPHE)

The Department of Public Health Engineering (DPHE) serves as the principal government body overseeing the provision and maintenance of water supply and sewage systems throughout Bangladesh, apart from Dhaka, Narayanganj, and Chittagong. In addition, the DPHE monitors arsenic concentrations in drinking water and is responsible for drilling wells in rural communities.

On St. Martin's Island, the DPHE is instrumental in securing safe drinking water and managing sewerage systems for both residents and visitors.

Relevant New Project Linkage:

Development of Community-based Rainwater Catchment System to Provide Freshwater Resilience for Saint Martin's Island Project – DPHE will play a central implementation role, in collaboration with DoE.

Housing and Building Research Institute (HBRI)

Founded in 1975 under the Ministry of Housing and Public Works, the Housing and Building Research Institute (HBRI) is tasked with advancing research and development of affordable, sustainable, disaster-resilient, and environmentally responsible building materials and construction technologies. The institute priorities seeking alternatives to practices detrimental to the environment, such as using burnt bricks. Within the framework of the Saint Martin's Master Plan, HBRI's specialized knowledge is essential for mitigating the impacts of unsustainable and unregulated construction. The institute is positioned to formulate island-specific building codes that require lightweight, eco-friendly, and cyclone-resistant materials, inform the design of sustainable housing solutions for the local population, and establish technical specifications to ensure all future developments are consistent with the island's rigorous ecological conservation objectives.

Relevant New Project Linkages:

- HBRI can be linked to the projects involving cool pavements and vertical greening systems through its focus on researching and promoting sustainable and innovative building materials and technologies.

National Housing Authority (NHA)

Established on July 15, 2001, the National Housing Authority operates under the Ministry of Housing and Public Works. It is responsible for planning and developing housing projects, with a particular focus on serving low- and middle-income families throughout Bangladesh. In alignment with the Master Plan's emphasis on limiting new construction, the NHA plays a pivotal role in sustainably addressing the housing requirements of current residents. Its contributions include designing and implementing well-planned, environmentally sensitive housing schemes to enhance local living conditions, as well as facilitating the relocation of communities from ecologically sensitive areas to designated zones, consistent with the Master Plan's land-use strategy.

Relevant New Project Linkages:

- NHA can be associated with the homestead plantation project as its work involves the planning and improvement of residential settlements.

Department of Agricultural Extension (DAE)

The Agricultural Extension Policy (1996) advocates the adoption of sustainable technologies to enhance crop production systems, while also addressing environmental issues through the advancement of integrated pest management (IPM) and the increased application of composted fertilizers. In response to the rising significance of IPM in ensuring sustainable food production in Bangladesh, the National Integrated Pest Management Policy (2002) was established. The primary aim of the IPM policy is to empower farmers to cultivate healthier crops, thereby sustainably increasing their income and improving both environmental quality and community health.

Relevant new project linkage:

- Micro Enterprise Training and Development for Women – The DAE can play a key role in building capacity within agri-based enterprises, thereby supporting the advancement of sustainable rural livelihoods.

Department of Social Services (DoSS)

Established in 1961, the Department of Social Services (DoSS) operates under the auspices of the Ministry of Social Welfare and is tasked with supporting the nation's most vulnerable and disadvantaged citizens. Its principal responsibilities encompass the administration of social safety net programs, the advancement of poverty alleviation strategies, and the implementation of human resource development and community empowerment initiatives. The DoSS plays an integral role in mitigating the socio-economic consequences arising from tourism restrictions associated with Saint Martin's Master Plan. This agency is charged with the formulation and delivery of alternative livelihood programs, the provision of skills training, and the management of social safety net assistance for residents affected by income loss, thereby ensuring equitable transition and fostering public support for conservation efforts.

Relevant New Project Linkages:

- DoSS can be directly linked to the micro-enterprise training project for women, as its objectives include social welfare and facilitating economic empowerment for vulnerable groups.

Bangladesh Small and Cottage Industries Corporation (BSCIC)

Established pursuant to an Act of Parliament in 1957, the Bangladesh Small and Cottage Industries Corporation (BSCIC) serves as the principal governmental agency for advancing the development of small and cottage industries (SCIs). Its mandate encompasses the provision of training, technical and financial support, and marketing assistance to entrepreneurs, thereby facilitating industrial growth and employment generation. As the Master Plan aims to diversify the island's economy beyond mass tourism, BSCIC is positioned to foster a new economic foundation. The corporation can contribute to the establishment of sustainable and environmentally responsible cottage industries, such as handicrafts, food processing, and other ventures that leverage local resources while preserving ecological integrity. This approach offers resilient and viable alternative livelihoods for the island's residents.

Relevant New Project Linkages:

- BSCIC can be involved with the projects on micro-enterprise development and market integration through its core mission to promote and provide support to small-scale local businesses.

Bangladesh Inland Water Transport Authority (BIWTA)

Founded in 1958, BIWTA serves as the statutory authority overseeing the development, maintenance, and management of inland waterways and water transport. Its regulatory responsibilities encompass the approval of vessel schedules and routes, establishment of safety protocols, and enforcement of transport regulations. As Saint Martin's Island is accessible solely by maritime routes, BIWTA functions as the principal entity for tourism management on the island. Within the framework of the Master Plan, BIWTA is designated as the lead agency responsible for implementing and enforcing the daily visitor limit through stringent regulation of the number, capacity, and timing of tourist vessels permitted to access Saint Martin's. Additionally, BIWTA is accountable for ensuring that all authorized vessels adhere to environmental guidelines, including proper waste disposal systems, to prevent pollution and safeguard the island's ecosystem.

Relevant New Project Linkages:

- BIWTA can be linked to development of the community -based tourism projects by sustainably managing the jetties and access points used by vessels transporting tourists to the island.

Tourist Police (TP)

The Tourist Police is a specialized branch of the Bangladesh Police, tasked with providing security for tourists and safeguarding the nation's tourist destinations. Its mandate is to ensure a secure and positive experience for visitors while supporting the preservation of tourism sites. Under the Saint Martin's Master Plan, the Tourist Police act as the principal on-site law enforcement authority responsible for ensuring that tourists comply with the island's environmental regulations. Their responsibilities include patrolling beaches and restricted areas, preventing prohibited behaviors such as coral collection or littering, overseeing tourist conduct, and assisting visitors. Through these functions, the Tourist Police play an integral role in the consistent enforcement of conservation policies.

Relevant New Project Linkages:

- Tourist police can be associated with the development of tourism guidelines and monitoring systems to ensure the safety, security, and orderly conduct of tourists.

International and National Non-Government Organizations, Private Organizations and Educational Institutions

Non-government organizations (NGOs) are key contributors to development sectors and policy initiatives in collaboration with the government. They operate across multiple domains, including health, environment, education, women's development and empowerment, agriculture, disaster management, water development and management, capacity building, and training for disadvantaged populations.

Several international and national organizations—such as UNDP, FAO, IUCN, NACOM, PKSF, BRAC, and CEGIS—support awareness-building and advocacy in natural resource management, conservation, and climate change adaptation programs in the chars, island areas, and other regions of Bangladesh. NACOM has long been engaged in biodiversity conservation and natural resource

management for St. Martin's Island and Teknaf Peninsula through awareness initiatives and capacity-building by co-management approaches. CEGIS has conducted inland environmental studies and managed natural resources on the island for over a decade. The private sector also actively participates in the development and management of these sectors; its involvement encompasses consulting, contracting, equipment importation and supply, distribution and sales, service provision, equipment maintenance, training, and credit facilitation.

International and national NGOs serve as principal implementing agencies supporting conservation and sustainable development projects for Saint Martin's Island. Their roles include advancing biodiversity conservation, natural resource management, and climate change adaptation, alongside undertaking research, promoting community awareness, capacity development, and mobilizing local communities to enhance participation in resource protection.

Moreover, academic institutions such as Bangladesh Maritime University (BMU), the Institute of Marine Sciences, the Department of Oceanography at Dhaka University, and the Department of Marine Fisheries and Oceanography at Sher-e-Bangla Agricultural University may also contribute significantly to conservation and sustainable development initiatives for Saint Martin's Island.

Government Trust and Development Consulting Organizations

The Government of the People's Republic of Bangladesh founded the Center for Environmental and Geographic Information Services (CEGIS) as a public trust in 2002. CEGIS operates as a scientifically independent center of excellence dedicated to supporting natural resource management for sustainable socio-economic development through integrated environmental analysis, wetlands management, geographic information systems, remote sensing, and information technology. With established expertise in managing and developing the St. Martin's Island ecosystem, CEGIS has played a significant role in preparing the Master Plan and Action Plan for St. Martin's Island, offering direction for sustainable management, biodiversity conservation, and enhancing community resilience.

9.2 Current Management Arrangements

The management framework for St. Martin's Island under the CWBMP is structured around two principal units:

- The Project Management Unit (PMU), located at the DoE Headquarters in Dhaka.
- The ECA Management Unit (ECAMU), situated in Cox's Bazar.

Additionally, an ECA Cell was formally established on 31 July 2006. This entity comprises several senior officials from the Department of Environment, including the Director (Technical) as convener, Directors from the Chittagong and Khulna divisional offices, Deputy Directors from both the Sylhet divisional office and the Natural Resource Management division, two ECA Management Officers based in Cox's Bazar and Kulaura, as well as multiple Assistant Directors. The ECA Cell serves as the government's primary institution for ECA management and functions as a key mechanism to sustain activities following the conclusion of the CWBMP.

The responsibilities of the ECA Cell include coordinating ECA management nationwide, replicating proven ECA models, representing the Cell on the National ECA Committee, facilitating the enactment of regulations under BECA (1995), ensuring compliance with relevant environmental laws, and monitoring conservation activities outlined in site-specific management plans. During the duration of CWBMP, the PMU functions as the Cell's Secretariat. Furthermore, a project sub-office was established in Teknaf, the nearest mainland town to St. Martin's Island, to strengthen local coordination efforts.

Community-Level Institutions

Village Conservation Groups (VCGs) are integral to biodiversity preservation at the community level. Established through the CWBMP and CBA-ECA Project, these groups serve as the foundational framework for grassroots ECA management. Their central purpose is to conserve St. Martin's Island's biodiversity by encouraging active community involvement. To maintain their effectiveness and ensure long-term sustainability, VCGs need access to dependable funding sources that support ongoing operations and future growth.

Local Government Division

The Local Government Division (LGD), operating under the Ministry of Local Government, Rural Development, and Cooperatives, provides oversight and direction for local government units at both Union and Paurashava levels. This is achieved through district and upazila authorities for Union Parishads and through direct engagement with Paurashavas. The LGD is responsible for implementing and supervising policies and programs relating to urban and rural water supply and sanitation, rural works programs, and other initiatives, in collaboration with the Department of Public Health Engineering (DPHE), the Local Government Engineering Department (LGED), and Local Government Institutions (LGIs). In accordance with state policy and the recommendations of the Local Government Commission, Bangladesh is establishing three tiers of local government: Zila Parishad (ZP), Upazila Parishad (UZP), and Union Parishad (UP).

Zila Parishad

The Zila Parishad is tasked with overseeing all development initiatives across districts, upazilas, and municipalities, as well as constructing and maintaining roads, culverts, and bridges that do not fall under the authority of upazilas, municipalities, or the central government.

Upazila Parishad

The Upazila Parishad (UZP) primarily undertakes the preparation, approval, and execution of development plans within its jurisdiction.

Union Parishad

The Union Parishad (UP) is chiefly responsible for carrying out development projects assigned by UZPs, promoting the development and utilization of local resources, maintaining public assets, and monitoring the activities of all agencies operating at the union level.

9.3 Challenges in Policy Implementation

In 1995, the Government of Bangladesh officially designated Saint Martin's Island as an Ecologically Critical Area (ECA) due to its significant ecological value, even though much of the land remained privately owned by local residents. Tomascik (1997) recommended the establishment of conservation zones—including managed resource areas, sustainable use zones, and restricted access zones—for improved environmental management of the island; however, these recommendations have not yet been implemented by the government. The predominance of private ownership presents considerable challenges for regulating development, especially in the absence of an ecologically sound land use policy and comprehensive stakeholder engagement.

Additionally, external parties have acquired land illegally with intentions to construct hotels, motels, guest houses, and restaurants for commercial exploitation. These pressures, compounded by limited manpower and insufficient financial resources, present formidable obstacles to effective environmental management. Current findings indicate that the government's efforts to manage and conserve biodiversity against environmental stressors are insufficient. Environmental management

is further complicated by poverty and low levels of public awareness, particularly concerning climate change risks.

Over the past two decades, rapid infrastructure development has resulted in substantial ecosystem degradation. Unplanned construction activities, including ongoing jetties development, have disrupted local biodiversity and altered species habitats. For instance, the natural breeding grounds of turtles have been compromised, forcing sea turtles to nest in unsuitable and unprotected areas where their eggs are vulnerable to predation and human disturbance.

The rise of tourism has rendered the island a lucrative business location, prompting developers, political leaders, and entrepreneurs to pressure local residents into selling land for new hotels, restaurants, shopping centers, and offices. This expansion has significantly reduced agricultural and plantation lands, contributing to daily deterioration of the island's natural ecosystem (Bangladesh Poush, 2006; Molony, 2006). The proliferation of infrastructure, particularly hospitality establishments, has occurred without comprehensive planning or regulation. While the Department of Environment (DoE) has introduced regulations permitting only cottage-style structures within limited areas, inadequate implementation has led to unsustainable development.

Weak enforcement of existing laws, due to insufficient funding, limited staff, and under-resourced monitoring systems, has failed to halt ecosystem degradation concern expressed by nearly 90% of both government and non-government respondents. Furthermore, unregulated and poorly planned tourism was identified as a significant constraint on environmental protection.

Approximately 78% of non-government respondents viewed current tourism patterns during the winter season (November to February) as unsustainable and detrimental to the ecosystem. Additionally, 85% of non-government and 43% of government respondents indicated that tourists generate substantial plastic waste, which is often discarded directly into inland areas and the sea, exacerbating pollution. Fifteen percent of local non-government respondents assessed the situation as extremely poor. All respondents identified tourism as an immediate threat to biodiversity.

Historical planning initiatives for Narikel Jinjira (St. Martin's Island) proceeded largely without robust government involvement, despite early concerns about coral resources raised through the National Conservation Strategy (NCS), which recommended the declaration of St. Martin's Island and the Jinjira coral reef as Protected Areas and the development of a corresponding management plan. Although *the go*vernment declared the island an ECA in 1999, studies such as Kabir et al. (2009) suggest this designation failed to effectively protect biodiversity. Policy inconsistencies have further hampered conservation efforts, as simultaneous promotion of local tourism and approval of new infrastructure undermine protective measures. The ECA declaration also lacked clear identification of sensitive areas and permitted activities within those zones. Local administrative officials—including the District Commissioner of Cox's Bazar District, Upazila Nirbahi Officer of Teknaf Upazila, and Union Parishad Chairman and Members—have not played direct roles in the island's conservation and development.

10. Implementation Modalities

10.1 Introduction

The Department of Environment holds a critical mandate to ensure an ecologically sound environment for both current and future generations in Bangladesh. Its authority is rooted in the nation's Constitution; specifically, Article 18A of the Constitution of the People's Republic of Bangladesh states: "The state shall endeavor to protect and improve the environment and preserve and safeguard the natural resources, biodiversity, wetlands, forests, and wildlife for the present and future citizens." This provision encapsulates the fundamental state principle of the 'right to life' and is further supported by over two hundred laws focused on environmental conservation.

The Bangladesh Environmental Conservation Act of 1995 remains the cornerstone of national environmental legislation. It articulates the objectives of environmental conservation, improvement of environmental standards, and pollution control. The Act grants the Director General (DG) of the DoE the authority to implement its provisions while establishing a legal framework for citizens' rights and responsibilities concerning the environment. The DG is tasked with addressing a comprehensive range of environmental issues, guided by the National Environment Committee (NEC), the Executive Committee of the NEC, and the Ministry of Environment, Forest and Climate Change (MoEFCC).

Established as an autonomous agency under the MoEFCC in 1989, with activities dating back to 1977 through the Environmental Pollution Control Board, the DoE operates through a central office and six divisional offices situated in Dhaka, Chattogram, Khulna, Bogura, Barisal, and Sylhet. Recently, the government has expanded its presence by establishing 21 additional district-level offices.

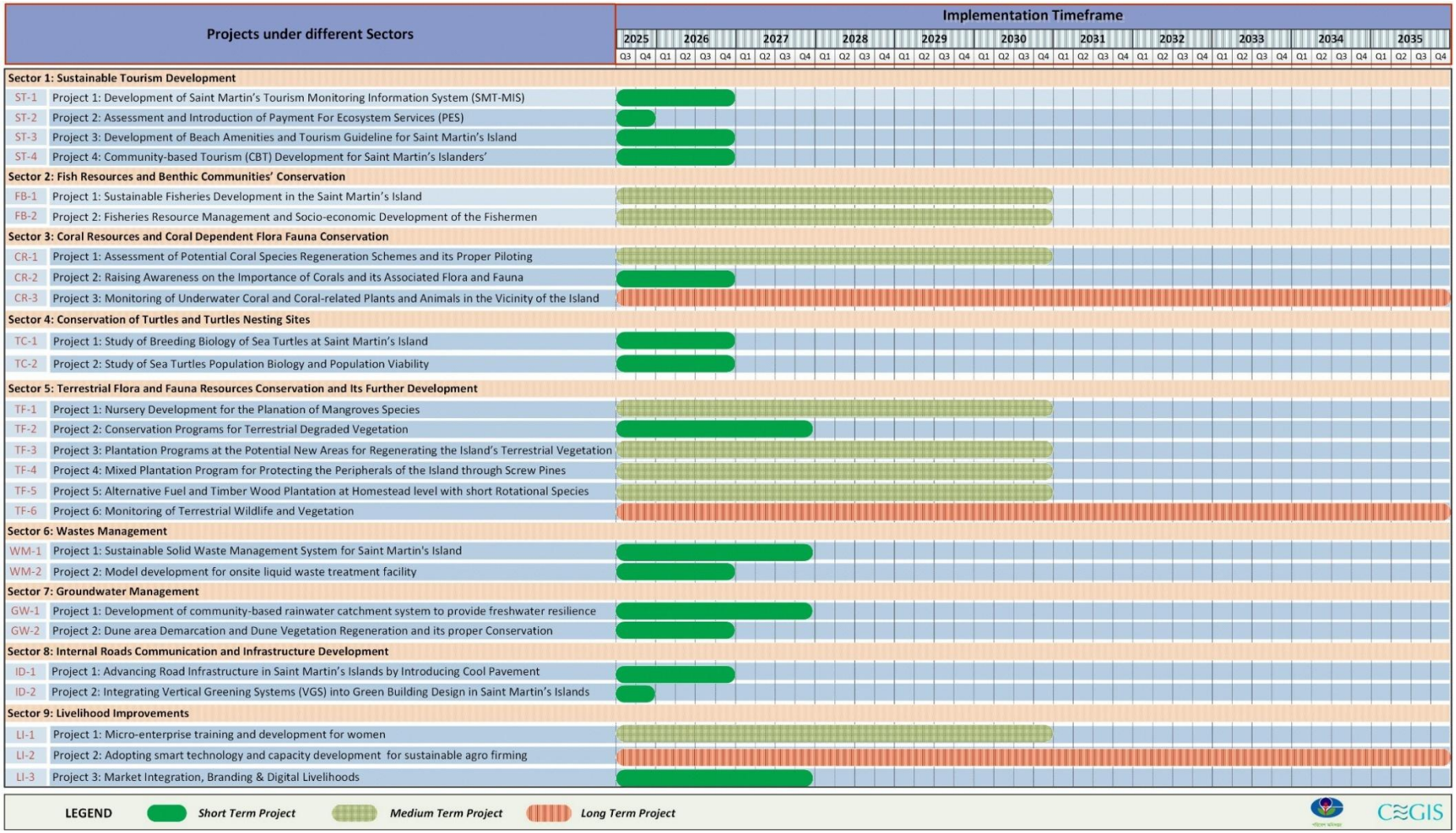
In pursuit of sustainable ecological management, the DoE is developing a Master Plan for St. Martin's Island. To this end, the DoE has engaged CEGIS to formulate a plan identifying potential project for the island's advancement. As a result, 26 projects have been finalized to support ecosystem preservation, conservation, and the enhancement of both international and domestic tourism. Detailed administrative and implementation procedures for these projects are outlined in the following sections.

10.2 Implementation Schedule

Implementation periods may be classified according to requirements and resource availability as follows:

- Short term: 1–3 years
- Medium term: 1–5 years
- Long term: 1–10 years

The project's implementation schedule is outlined below.



NB. The wet season is not considered for the implementation period usually.

10.3 Implementation Mechanism

10.3.1 Overall Project Management

The Ministry of Environment, Forests, and Climate Change, Government of Bangladesh, holds primary responsibility for the overall administration and coordination of the project. General guidance, policy recommendations, project activity coordination, and resolution of inter-ministerial matters will be facilitated by a Project Steering Committee (PSC). The Department of Environment, acting as the Project Implementing Agency (PIA), will execute the project through its Project Management Unit (PMU).

10.3.2 Project Steering Committee

The PSC will be composed of representatives from the Ministry of Finance, Planning, Civil Aviation and Tourism, Cultural Affairs, Power Energy and Mineral Resources, Housing and Public Works, Telecommunications and Information Technology, Local Government, Rural Development & Cooperatives, Agriculture, Fisheries & Livestock, and members of the local or district administration. The Secretary of Environment, Forest and Climate Change will assume the role of PSC Chair. The PSC is responsible for overseeing the project, providing guidance at the policy level, and facilitating interagency coordination. The Project Director of the PMU will serve as the Secretary of the PSC.

10.3.3 Project Management Unit

The DoE will establish a Project Management Unit (PMU) to oversee the development and administration of the project. The DoE will appoint a Project Director (PD) to lead the PMU, reporting directly to the Director General (DG) of the DoE and holding the rank of Director within the department. The PMU's central project office will be based at the DoE headquarters in Dhaka.

The PMU will be comprised of three core units: The Procurement and Finance Unit, the Engineering Unit, and the Planning Unit. Additionally, Field-Level Offices will be established, each headed by an Environmental Expert recruited specifically for the project. Due to inadequate road infrastructure, these Field Offices will be situated in the Cox's Bazar District.

The Procurement and Finance Unit

The DoE unit will be responsible for overseeing the project's entire procurement and financial management processes. In addition to preparing annual work plans, implementation reports, and updating all procurement and financial management documentation, the unit will also monitor project progress and liaise with the Bank. The procurement team will comprise a Senior Procurement Officer (Manager) and a Procurement Officer (Deputy Manager). The finance team will consist of a General Manager (Administration and Finance), a manager, two accountants, and supporting staff.

The Engineering Unit

This section will supervise the consultants responsible for the project's design and construction. To encourage effective coordination among the PMU, the supervising consultant, and the Field Office, a Project Manager (Civil) will lead the Engineering Unit, dedicating approximately half of their time to on-site activities. The Engineering Unit will comprise the General Manager (Civil), Manager (Civil), Deputy Manager (Civil), Executive Officer (Senior Engineers), and two Support Staff members.

Planning Unit

This unit will oversee compliance with environmental activities and implement the communication plan in collaboration with the engineering unit. The team will comprise an executive officer, support staff, a manager, a deputy project manager, and a planning manager.

Field Office

Each field office will include one Project Manager/Senior Environmental Specialist, one Fisheries Specialist, one Livelihood Specialist, one Biodiversity Specialist, and two Junior Environmental Specialists.

The following consultancies will provide support to the PMU:

- A Project Supervision Consultant Firm will assist the PMU in developing the detailed design for construction works and overseeing all stages of the construction process. For civil works contracts, the Project Director will act as the Employer, while the Project Supervision Consultant will fulfill the role of Engineer, responsible for both design and construction supervision.
- A Monitoring and Evaluation Consultant will facilitate the monitoring of project impacts, supervise implementation of project activities, and report outcomes to the PMU.

10.4 Regulatory Frameworks

The Bangladesh Environment Conservation Act, 1995 (as amended in 2002), alongside the Environmental Conservation Rules 1997 (ECR'97), stipulates that all development projects are required to secure environmental clearance from the Department of Environment (DoE) under the Ministry of Environment, Forest and Climate Change (MoEFCC) prior to initiating any civil works. The Project Coordinator must obtain Environmental Clearance from the DoE before project implementation. Additionally, the Planning Commission mandates an environmental impact assessment for projects seeking financial support.

As per Rule 7 (1) of the Environmental Conservation Rules 2023, industrial units and projects are categorized into four groups based on site characteristics and potential environmental impact: Category I (Green), Category II (Yellow), Category III (Orange), and Category IV (Red). The responsibility for conducting an Environmental Impact Assessment (EIA) lies with the proponent of the development proposal, while review and issuance of the Environmental Clearance Certificate (ECC) is undertaken by the DoE.

For "Red" Category projects, the following documentation is required:

- Initial Environmental Examination (IEE) report
- Environmental Impact Assessment (EIA) report
- Environmental Management Plan (EMP) report

Environmental clearance must be obtained by the implementing agency or project proponent from the DoE. The procedure for acquiring environmental clearance for Red Category projects involves the following steps: submitting an application to the DoE with the IEE report → obtaining site clearance → applying for environmental clearance with the EIA report → receiving environmental clearance → maintaining clearance through annual renewal.

10.5 Responsibilities

The Project Director (PD) holds primary responsibility for overseeing projects implementation and ensuring all obligations are met throughout the duration of the project. To facilitate this, the PD will receive support from engineers, environmental specialists, planning personnel within the PMU, as well as consultants and contractors.

10.5.1 Responsibilities of Units

Procurement and Finance Staff in PMU

To ensure effective management of project accounting and procurement processes, the PMU will establish a dedicated Procurement and Finance Unit. This unit will be led by the Project Manager, with responsibilities including oversight and administration of building material procurement as specified in the detailed study report. Personnel in this unit will be tasked with upholding quality standards for materials used in civil work.

Engineering Staff in PMU

The PMU will form an Engineering Unit to supervise all aspects of civil works associated with the project. Under the direction of the Project Manager, staff members within the unit will provide leadership and coordination in the execution of civil work, ensuring adherence to project specifications and regulatory requirements.

Planning Staff in PMU

A Planning Unit will be established within the PMU to monitor and enforce environmental measures related to the project. The Project Manager will guide efforts to ensure compliance with both construction and environmental protocols. Planning personnel will oversee the implementation and observance of relevant environmental and civil works regulations.

Responsibilities of the Project Office

The PMU will establish a Project Office on the island to manage and supervise civil construction activities onsite.

Responsibilities of Project Supervision Consultants

Supervision consultants are entrusted with:

- Comprehensive oversight of civil work and related activities;
- Ensuring quality control and reporting outcomes to the Project Director (PD);
- Supporting the Planning Unit in environmental compliance and progress monitoring, including the implementation of environmental measures (EM);
- Supervising contractors to ensure design adherence and workmanship quality;
- Employing suitably qualified and experienced environmental staff, including field-based environmental monitors, to supervise EM implementation;
- Monitoring contractor activities to confirm compliance with EM requirements;
- Maintaining effective coordination between environmental staff and the Engineering Unit for the successful execution of environmental obligations and commitments of the project.

Responsibilities of Contractor's Environment Supervisors

Contractors are required to engage a sufficient number of committed, competent, and experienced Environmental Supervisors to be present onsite. These supervisors will be responsible for implementing various EM components, with particular emphasis on mitigation strategies to ensure environmental impacts remain within permissible limits. Continuous coordination between Environmental Supervisors and the onsite Project Office is expected. Additionally, Environmental Supervisors will oversee the construction crew's environmental training.

10.6 Operation and Maintenance

Figure 10.1 outlines the recommended procedures for the operation and maintenance of projects within various projects. This arrangement will be implemented following the completion of each project under the specified projects. An independent O&M unit is proposed to be established at the DoE Head Office in Dhaka, comprising four staff members. This unit will oversee the activities of the O&M office located on the Island and permit parallel entry operations. A concise summary of O&M responsibilities is provided below.

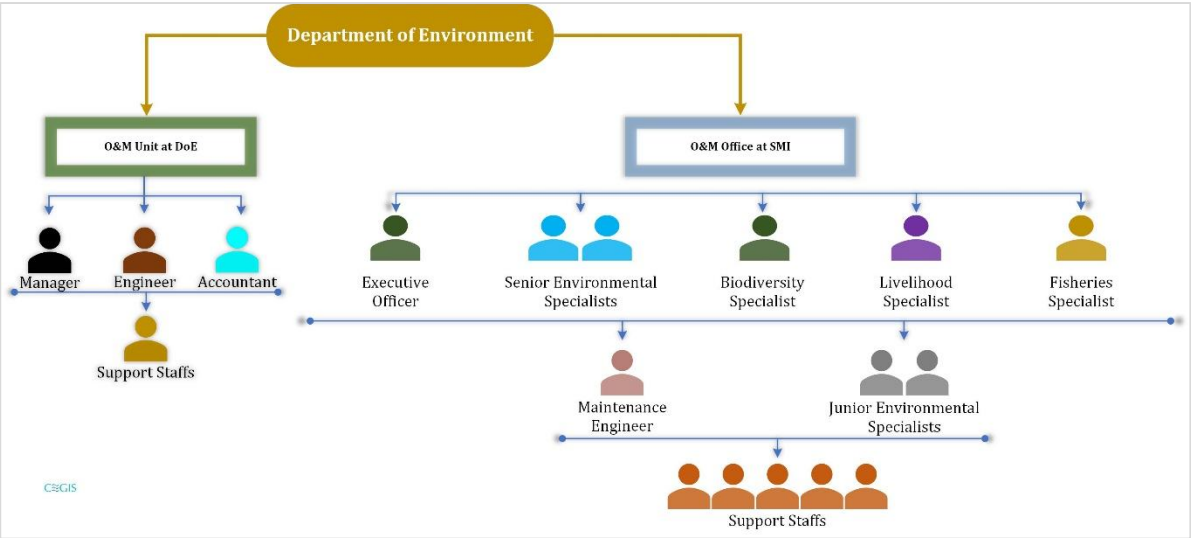


Figure 10.1: Institutional Setup for Operation & Maintenance

10.6.1 Operational Plan

The operational plan outlines the schedule of activities required for managing various project components within the organization, with a focus on maintaining cleanliness to meet tourist expectations. The following activities are recommended as part of the operational strategy for the 26 projects, serving as a central framework for ongoing operations:

- Regular monitoring of project status;
- Frequent inspection of facilities involved in each project;
- Condition surveys;
- Ongoing evaluation of project progress;

Additionally, these activities constitute standard monitoring responsibilities for the Operations & Maintenance (O&M) field staff of the DoE, which are fundamental to promptly identifying and addressing project issues.

During off-peak seasons, all projects within the scope of the different projects should undergo periodic evaluations by the designated maintenance engineer or environmentalist every three months. These

assessments aim to identify areas for improvement in tourist services. Conversely, during peak tourist seasons, it is crucial for the assigned maintenance engineer or environmentalist to conduct comprehensive daily inspections of all tourism-related infrastructure, activities, and services to detect potential concerns and ensure adherence to safety and quality standards. Any emergency repairs or urgent maintenance requirements must be addressed without delay to minimize disruptions and maintain a high-quality experience for tourists.

10.6.2 Frequent Activities under the Project

The principal objectives are to evaluate project management systems, assess sanitary conditions at tourist destinations, and gather feedback from both domestic and international visitors concerning service quality. The resulting reports contain thorough recommendations aimed at enhancing service standards at these destinations.

10.6.3 Condition Survey

A condition survey is a comprehensive, professional, and generally non-intrusive evaluation designed to identify existing defects, deficiencies, and future maintenance requirements. These assessments cover a broad range of services, infrastructure facilities, and properties, including structural elements, building fabric, mechanical systems, electrical installations, and utility networks.

The Operations and Maintenance (O&M) field staff perform annual condition surveys to systematically assess the physical status of structures under their care. These surveys are essential for identifying the specific maintenance services necessary to preserve the integrity and operational effectiveness of the facilities. Throughout the process, qualified personnel conduct thorough inspections of various structural components, identifying wear, damage, or other factors that may affect safety or performance. The field teams gather and analyze detailed data such as photographs, measurements, and documented observations to accurately record each structure's current condition. This organized methodology supports the efficient planning of routine maintenance activities. By evaluating physical conditions and highlighting required repairs or enhancements, the Department can allocate resources judiciously and prioritize maintenance operations effectively.

10.6.4 Supervision of Maintenance Works

The maintenance engineer is responsible for conducting preventive maintenance throughout the year. These tasks are fundamental, cost-effective, and ensure optimal efficiency; they are performed routinely and continuously. All preventive maintenance activities are supervised by the field personnel within the Operations & Maintenance (O&M) unit.

To maximize visitor satisfaction, thorough planning is essential in managing the operational aspects of the facilities. During peak travel periods, it may be necessary to implement monthly, weekly, or daily adjustments to operations. The need for such modifications will be determined through ongoing monitoring of the management system and regular assessment of tourist feedback.

10.7 Maintenance Plan

The Island's primary objective is the ongoing maintenance of its amusement facilities and facilities, which are essential for delivering a positive experience to tourists. Comprehensive upkeep safeguards substantial investments while ensuring infrastructure operates efficiently and remains safe for all patrons.

Priority should be given to regular maintenance at key tourist locations and amenities that directly impact visitor satisfaction. This includes attractions, dining venues, restrooms, and other fundamental

services integral to the guest experience. By employing a structured maintenance system, the Island can sustain a welcoming environment for visitors.

In addition to routine care, scheduled inspections and evaluations will be carried out to detect and address potential concerns before they develop into significant issues. These preventive strategies support the Island's commitment to high standards of safety and operational reliability, allowing guests to enjoy their visits without interruption. Through meticulous maintenance protocols, the Island demonstrates its dedication to ensuring a secure and enjoyable environment for all visitors.

10.7.1 Routine Maintenance

The primary goal of preventive maintenance is to maintain the system and all its components in optimal working conditions, thereby minimizing the frequency of periodic maintenance and mitigating substantial rehabilitation expenses. These procedures are straightforward and cost-efficient, executed by maintenance engineers or environmental professionals involved in the project through various projects. Preventive maintenance is conducted throughout the year, either continuously or as needed. The following activities are included:

- Management of vegetative cover across the island;
- Cleaning and washing facilities on the island by cleaning personnel;
- Maintenance of outfall drains;
- Restoration and cleaning of the tourist complex site after events such as surges or cyclones;

10.7.2 Periodic Maintenance

Periodic maintenance is undertaken to restore infrastructure components to their original design standards. This approach generally incurs higher costs than preventive maintenance and is administered by the central authority of the Department of Engineering (DoE). Periodic maintenance primarily encompasses repair work and is scheduled based on assessments conducted in the field at reasonably regular intervals.

- Minor Periodic Maintenance Works:
    - Facility repairs carried out by maintenance engineers;
    - Structural repairs completed by civil engineers;
- Major Periodic Maintenance Works:
    - Painting of structures located at tourist sites;
    - Substantial repairs to existing tourist facilities;

10.7.3 Emergency Maintenance

Emergency works refer to unanticipated actions that must be undertaken promptly to safeguard tourist facilities on the island, either wholly or partially, from the detrimental effects of natural disasters, including potential harm to lives and property. Such efforts demand immediate intervention, which may involve securing boundary walls, repairing or replacing damaged facilities, or executing necessary civil engineering works when structural integrity is compromised. These budget provisions address unexpected requirements arising from significant events such as cyclones or tidal surges.

10.8 Capacity Building and Training

Capacity building training should be conducted in the following areas:

- Training management-level officials of the Department of Environment (including three units) on environmental concerns and their responsibilities in implementing Environmental Management (EM).
- Recruiting civil engineers, architects, and other professionals with relevant environmental backgrounds as needed, and providing appropriate training.
- Organizing workshops and seminars with stakeholders to raise awareness of project objectives.
- Delivering specialized training programs for contractors and workers regarding EM practices and responsibilities, specifically for those involved in construction activities at tourist locations on the island.
- Ensuring all training programs are scheduled and delivered prior to the commencement of civil works, construction activities, or project implementation in tourist destinations on the island.

10.9 Updating the Plan

The St. Martin's Island Area Master Plan represents a comprehensive, long-term approach, intended to be effective for a minimum of ten years. Although systematic reviews and potential revisions are scheduled at five-year intervals, it is imperative to consider the plan as adaptive rather than fixed. As global climate change and other emerging factors provide new insights, original assumptions and projected demand scenarios may require modification.

The processes of monitoring, evaluation, and periodic updating of the Plan will inevitably become more intricate, thereby demanding a rigorous framework for ongoing assessment to preserve its relevance and efficacy. Central to this framework will be sustained stakeholder engagement, the integration of scientific research, and the capacity to respond to evolving environmental conditions all essential for safeguarding the Plan’s consistency and practical value over time.

11. Funding Mechanisms

11.1 Overview

This Master Plan comprises a set of initiatives designed to protect and conserve St. Martin's Island's ecosystem across all sectors and related areas. Through consultation with various stakeholders, nine priority sectors have been identified, resulting in corresponding Project Portfolios.

The projects were selected based on identified needs and challenges, though simultaneous implementation is constrained by capacity and resource limitations. Thus, prioritization of recommended projects is essential. The following criteria were applied in establishing priorities: project urgency, stakeholder interest, departmental commitment, and responsiveness to climate change risks.

Priorities are categorized as follows:

- **Top**: Projects to which the Government of Bangladesh is already committed and that will deliver immediate benefits to key ecosystems on the island.
- **High**: Initiatives of significant value to the region and local community, supporting both tourism and conservation, and requiring prompt action.
- **Medium**: Important projects slated for future implementation.
- **Low**: Initiatives dependent on resource availability for execution.

While early implementation is desirable for most projects, those classified as Top and High priority should be executed without delay.

11.2 Cost of Projects

The total estimated investment required is 547.9 million BDT. Project-specific investment requirements are detailed in Table 11.1. Of the proposed interventions, twelve have been designated as "High" priority, accounting for 194.5 million BDT, while three are identified as "Top" priority, necessitating an investment of 115.0 million BDT. Additionally, eight projects categorized as "Medium" priority require 138.4 million BDT, and three "Low" priority projects require 100 million BDT, respectively.

Table 11.1: Project Specific Budget Allocation

Code	Projects	Cost in BDT (100000)	Priority
ST-1	Project 1: Development of Saint Martin's Tourism Monitoring Information System (SMT-MIS)	80	High
ST-2	Project 2: Assessment and introduction of Payment-For-Ecosystem Services (PES) for the SMI-Island tourism	70	Medium
ST-3	Project 3: Development of beach amenities and tourism guideline for Saint Martin's Island	500	High
ST-4	Project 4: Community-based Tourism (CBT) Development for Saint Martin's Islanders'	100	High
FB-1	Project 1: Sustainable fisheries development in Saint Martin's Island	300	Top
FB-2	Project 2: Fisheries resource management and socio-economic development of the Fisher's in Saint Martin's Island	500	High

Code	Projects	Cost in BDT (100000)	Priority
CR-1	Project 1: Assessment of potential coral species regeneration schemes and its proper piloting on the SMI Island	500	Medium
CR-2	Project 2: Raising awareness on the importance of corals and their associated flora fauna	65	High
CR-3	Project 3: Monitoring of underwater coral and coral-related plants and animals in the vicinity of Saint Martin's Island	600	High
TC-1	Project 1: Study of breeding biology of sea turtles at Saint Martin's Island	30	High
TC-2	Project 2: Study of sea turtles population biology and population viability	30	High
TF-1	Project 1: Nursery development for the plantation of mangroves species	10	High
TF-2	Project 2: Conservation programs for terrestrial degraded vegetation (Bushy lands with wild herbs and shrubs)	8	High
TF-3	Project 3: Plantation programs at the potential new areas for regenerating the terrestrial vegetation in the island	10	High
TF-4	Project 4: Specific mixed plantation program for protecting the peripherals of the island through Screw pine and Keya	12	High
TF-5	Project 5: Alternative fuel and timber wood plantation program at homestead level with short rotational species (Kadamba, Shimul and Madar)	9	Medium
TF-6	Project 6: Terrestrial wildlife and vegetation monitoring biennially	300	Medium
WM-1	Project 1: Sustainable Solid Waste Management System for Saint Martin's Island	350	Top
WM-2	Project 2: Model development for onsite liquid waste treatment facility	500	Top
GW-1	Project 1: Development of community-based rainwater catchment system to provide freshwater resilience for Saint Martin's Island	300	Medium
GW-2	Project 2: Dune area demarcation and dune vegetation regeneration and its proper conservation	5	Medium
ID-1	Project 1: Advancing Road infrastructure in Saint Martin's Islands by Introducing cool pavement	300	Low
ID-2	Project 2: Integrating Vertical Greening Systems (VGS) into Green Building Design in Saint Martin's Islands	200	Low
LI-1	Project 1: Micro-enterprise training and development for women	100	Medium
LI-2	Project 2: Adopting smart technology and capacity development for sustainable agro firming	500	Low
LI-3	Project 3: Market Integration, Branding & Digital Livelihoods	100	Medium

11.3 Disbursement Schedule

Disbursement of cost under the projects schedule by priority and duration of implementation have been mentioned as follows:

Code	Name of Projects under Different Sectors	Distribution of Costs (BDT)				Cost in BDT (100000)
		Goods	Works	Consultancy	Non-consultancy	
Sector 1: Sustainable Tourism Development						
ST-1	Project 1: Development of Saint Martin's Tourism Monitoring Information System (SMT-MIS)	15	15	50	-	80
ST-2	Project 2: Assessment and introduction of Payment-For-Ecosystem Services (PES) for the SMI-Island tourism	5	-	65	-	70
ST-3	Project 3: Development of beach amenities and tourism guideline for Saint Martin's Island	170	30	300	-	500
ST-4	Project 4: Community-based Tourism (CBT) Development for Saint Martin's Islanders'	45	10	45	-	100
Sector 2: Fish Resources and Benthic Communities' Conservation						
FB-1	Project 1: Sustainable fisheries development in Saint Martin's Island	50	50	200	-	300
FB-2	Project 2: Fisheries resource management and socio-economic development of the Fisher's in Saint Martin's Island	100	50	350	-	500
Sector 3: Coral Resources and Coral Dependent Flora Fauna Conservation						
CR-1	Project 1: Assessment of potential coral species regeneration schemes and its proper piloting on the SMI Island	250	50	200	-	500
CR-2	Project 2: Raising awareness on the importance of corals and their associated flora fauna	10	15	40	-	65
CR-3	Project 3: Monitoring of underwater coral and coral-related plants and animals in the vicinity of Saint Martin's Island	50	150	400	-	600
Sector 4: Conservation of Turtles and Turtles Nesting Sites						
TC-1	Project 1: Study of breeding biology of sea turtles at Saint Martin's Island	5	5	20	-	30
TC-2	Project 2: Study of sea turtles population biology and population viability	5	5	20	-	30
Sector 5: Terrestrial Flora and Fauna Resources Conservation and Its Further Development						
TF-1	Project 1: Nursery development for the plantation of mangroves species	3	-	7	-	10

Code	Name of Projects under Different Sectors	Distribution of Costs (BDT)				Cost in BDT (100000)
		Goods	Works	Consultancy	Non-consultancy	
TF-2	Project 2: Conservation programs for terrestrial degraded vegetation (Bushy lands with wild herbs and shrubs)	3	-	5	-	8
TF-3	Project 3: Plantation programs at the potential new areas for regenerating the terrestrial vegetation in the island	4	-	6	-	10
TF-4	Project 4: Specific mixed plantation program for protecting the peripherals of the island through Screw pine and Keya	4	-	8	-	12
TF-5	Project 5: Alternative fuel and timber wood plantation program at homestead level with short rotational species (Kadamba, Shimul and Madar)	3	-	6	-	9
TF-6	Project 6: Terrestrial wildlife and vegetation monitoring biennially	100	100	100	-	300
Sector 6: Wastes Management						
WM-1	Project 1: Sustainable Solid Waste Management System for Saint Martin's Island	125	125	100	-	350
WM-2	Project 2: Model development for onsite liquid waste treatment facility	250	100	150	-	500
GW-1	Project 1: Development of community-based rainwater catchment system to provide freshwater resilience for Saint Martin's Island	150	50	100	-	300
GW-2	Project 2: Dune area demarcation and dune vegetation regeneration and its proper conservation	2.5	-	2.5	-	5
Sector 8: Internal Roads Communication and Infrastructure Development						
ID-1	Project 1: Advancing road infrastructure in Saint Martin’s Islands by Introducing cool pavement	230	20	50	-	300
ID-2	Project 2: Integrating Vertical Greening Systems (VGS) into Green Building Design in Saint Martin’s Islands	-	50	150	-	200
Sector 9: Livelihood Improvements						
LI-1	Project 1: Micro-enterprise training and development for women	20	10	70	-	100
LI-2	Project 2: Adopting smart technology and capacity development for sustainable agro firming	300	100	200	-	500
LI-3	Project 3: Market Integration, Branding & Digital Livelihoods	-	-	-	-	100

11.4 Ministry and Agency-wise Investment

The investment plan was developed using a cluster-based approach, supplemented by an extensive desk review of secondary information sources, including reports, various case studies, national and international journals, books, and documents. Primary data was collected through field interviews, structured discussions, and meetings with relevant stakeholders, officials, and other participants throughout the study period. Both qualitative and quantitative participatory methodologies were utilized to identify key focus areas for further interventions.

An assessment was conducted to evaluate the island ecosystem's current condition, constraints, and challenges, as well as to determine potential areas for future action. In addition to the methods, a combination of approaches was employed, such as participant observations from focus groups and consultations with key informants. The data gathered through these techniques was cross-verified and enriched with information from secondary sources, including government records, study reports, conference proceedings, and other pertinent national data.

A summary of the investment costs, categorized by ministry, is provided below:

Name of Ministry	Investment Cost (100000 BDT)
Ministry of Environment Forest and Climate Change	3074
Ministry of Civil Aviation and Tourism	100
Ministry of Fisheries and Livestock	800
Ministry of Local Government, Rural Development and Co-operatives	305
Ministry of Agriculture	600
Ministry of Women and Children Affairs/Ministry of Business	100
Ministry of Housing and Public Works	500
Total (100000 BDT)	**5479**

11.5 Funding Modality

11.5.1 Public Sector Involvement

Implementation modalities refer to the standardized instruments, methodologies, resources, and strategies required for executing the Proposed Project across the entire organization. The implementation of a Public Sector Investment Project commences following approval from the competent authority of the Government of Bangladesh and the allocation of funds through the Annual Development Programme (ADP) budget. Prior to this, the project must be developed based on a comprehensive feasibility study, SWOT analysis, identification of issues, and alignment with the goals outlined in the Environmental Policy 2018 of the Government of Bangladesh. In this context, effective implementation of Public Sector Investment Projects will provide essential guidance for the protection of the island.

11.5.2 Private Sector Involvement

In relation to potential involvement in and management of the facility, the private party is expected to contribute to the following areas for the protection of the island ecosystem:

- Implementation of projects focused on conservation and biodiversity management specific to Saint Martin's Island;
- Initiation of waste-to-resource initiatives tailored for Saint Martin's Island;
- Development and management of sustainable tourism strategies for the island;
- Conservation and management of coral resources and their associated flora and fauna;

12. Monitoring and Evaluation

12.1 Introduction

This Monitoring & Evaluation (M&E) chapter provides an operational framework for the Master Plan (MP) for Saint Martin's Island by establishing the systems, roles, and procedures necessary to transform objectives into measurable and actionable outcomes. The MP outlines a comprehensive ten-year agenda encompassing 26 projects across nine key themes: sustainable tourism, fisheries, coral and benthic conservation, turtles, terrestrial flora and fauna, waste management, groundwater resilience, internal roads and green infrastructure, and livelihoods. Given the geographic and institutional complexity of this portfolio, robust M&E practices are essential. The M&E system is designed to achieve two concurrent goals: to ensure implementation fidelity—confirming that activities, systems, and institutional reforms are completed according to specifications, within established timelines and budgets—and to verify impact by ensuring that project outputs lead to tangible ecological and socio-economic improvements such as enhanced coral health, reduced beach pollution, safer groundwater, and diversified local incomes.

This chapter outlines the MP's Monitoring & Evaluation (M&E) framework through a unified Development Results Framework (DRF), supported by a carefully selected set of SMART indicators—Specific, Measurable, Achievable, Relevant, and Time-bound. The DRF serves as the principal mechanism for defining, monitoring, and evaluating every project deliverable, intermediate result, and long-term impact. Each entry within the DRF includes details such as indicator definition, baseline and target values, units and measurement methods, data sources, frequency, verification procedure, and the responsible owner of the data. Incorporating SMART indicators into the DRF during the project formulation (DPP) stage enables the MP to establish a standardized reporting approach across all 26 projects and nine themes, promotes sector-wide aggregation, minimizes redundant reporting processes, and enhances accountability both nationally and among donors.

The DRF is operationalized through a centralized Management Information System (MIS/MP-Dashboard), which functions as the authoritative source of project data. This system maintains the DRF, stores time-series indicator values, receives secure API integrations from implementing agencies and financial systems, and facilitates both online and offline mobile data collection by field teams and Village Conservation Groups. Additionally, it generates automated dashboards and standardized reports for the PMU, Department of Environment (DoE), and the Project Steering Committee (PSC). The integrated architecture—comprising DRF, SMART, and MIS—aligns with national NAP MEL guidelines and is structured to support an iterative, learning-by-doing approach. DRF-based indicators inform routine operational management, annual outcome syntheses, and independent mid-term and final evaluations, thereby supporting adaptive decision-making to ensure the MP remains on track to achieve its objectives.

12.2 Indicator-based Approach

The complexity and geographic focus of the Master Plan necessitate a clear and unified measurement framework designed to achieve two objectives: (a) to confirm implementation fidelity by ensuring that infrastructure, institutional reforms, and service delivery are executed according to specifications, on schedule, and within budget; and (b) to verify impact by assessing whether these outputs generate measurable improvements in the island's ecological and socio-economic conditions, such as stabilized or increased live coral cover, reduced beach litter and microbial counts, enhanced groundwater quality, and more diversified, locally retained tourism income. Translating these dual requirements into operational practice calls for an indicator-based methodology, integrated within

the programmatic Development Results Framework (DRF) and managed through the MIS. The use of indicators enables implementers, the PMU, DoE, PSC, and funders to compare, aggregate, and act upon objective evidence, rather than relying on intuition.

Within this indicator framework, the MP utilizes the SMART criteria—Specific, Measurable, Achievable, Relevant, and Time-bound—as the guiding standard for all indicators in the DRF. A SMART indicator directs measurement toward a clearly defined outcome (for instance, "percentage live coral cover within designated transects" instead of the broader "improved reef health"), specifies the precise methodology for measurement (including unit, sampling design, instrument, or laboratory method), establishes attainable and verifiable targets and timeframes, and assigns both a data owner and a verification method to each indicator. This comprehensive approach achieves three key objectives: it eliminates ambiguity to ensure comparability across implementers and over time; it necessitates the inclusion of baselines and targets during the project preparation (DPP) phase; and it sets clear conditions for fiduciary release and adaptive management—enabling managers to identify specific underperforming metrics and address them effectively when deviations from projected trajectories occur.

The implementation of SMART design enhances interoperability and minimizes redundant reporting processes. Each indicator within the MP DRF should, where applicable, be mapped to relevant national indicator frameworks—such as the SDGs, national performance indicators, or MRV indicators—ensuring that MP reporting supports national requirements rather than establishing isolated systems. Furthermore, it is essential that SMART indicators are appropriately disaggregated (e.g., by sex, age, disability status, tenure) to highlight equity aspects in outcomes. For instance, this approach enables analysis of the relative growth in tourism-related income for women-owned enterprises or identifies disparities in access to safe water across different wards. The DRF should be structured from the outset to systematically capture these disaggregation variables.

Implementing SMART indicators effectively necessitates the use of rigorous metadata management. For each DRF indicator, the catalogue must include a detailed definition, measurement unit, baseline value (including collection date and methodology), target(s), frequency of measurement, designation of the responsible data owner, specific data collection tools (such as photogrammetry protocols, CPUE sampling methods, or ODK forms), verification and validation approaches (including routine checks and independent audits), and an estimated budget allocation for monitoring activities. Ensuring that these metadata components are integrated at DPP approval ensures that projects may not receive substantial disbursements until their principal SMART indicators—with baselines and targets—are incorporated into the DRF and uploaded to the MIS. This procedural rigor minimizes future disputes regarding attribution and facilitates efficient independent verification at mid-term and final evaluation points.

SMART indicators serve as a fundamental component of early-warning systems and adaptive management. Operational (output) indicators with short reporting intervals (monthly or quarterly) offer timely insights into implementation variances—such as procurement delays, contractor underperformance, or budget underspending. In contrast, outcome indicators, monitored at appropriate frequencies (seasonally, bi-annually for ecological metrics, or annually for socio-economic aggregates), help identify trends that necessitate programmatic adjustments. Importantly, the DRF integrates these levels, enabling the identification of causal links between adverse outcome indicators (e.g., declining coral recruitment) and contributing outputs (such as incomplete sediment control measures or malfunctioning wastewater systems). This structure facilitates targeted corrective actions by the PMU/DoE and the PSC.

SMART indicators provide a concrete foundation for accountability by clearly defining responsibilities regarding measurement, timing, methodology, and targets. They also facilitate the allocation of

monitoring resources through the inclusion of monitoring budget lines within each project. When integrated with a robust Management Information System (MIS) and comprehensive Standard Operating Procedures (SOPs) for data quality assurance, verification, and public reporting, SMART indicators elevate the M&E system from a passive collection of reports to an active MEAL (Monitoring, Evaluation, Accountability & Learning) framework that supports evidence-based management of the MP.

12.3 Management Information System

The Monitoring & Evaluation framework of the MP is built on an integrated technology and data infrastructure: a centralized Management Information System (MIS/MP-Dashboard) that incorporates the Development Results Framework (DRF), stores time-series indicator values, and unifies field reporting, financial tracking, and oversight dashboards into a single, authoritative source. The MIS serves as the project's operational core rather than a supplementary reporting tool, effectively connecting planning, budgeting, monitoring, verification, and learning processes. This integration ensures that each indicator is auditable, appropriately budgeted, and actionable.

At a practical level, the system is required to deliver three interconnected capabilities: (a) a canonical DRF implemented as discrete database records; (b) robust field data capture—both web-based and mobile—that aligns directly with DRF indicators; and (c) secure, automated interoperability with implementing agencies and financial systems, ensuring that physical progress can consistently be traced to funding and procurement status. The following points outline the essential design and operational rules that MIS must uphold.

DRF as the canonical data object — Each indicator within the DRF is represented as a unique record in the MIS, containing comprehensive metadata to ensure clear measurement and verification. Every DRF entry comprises:

- Indicator name and SMART definition (Specific, Measurable, Achievable, Relevant, Time-bound)
- Unit of measurement and established sampling/measurement protocol
- Baseline value (including date and method) and time-bound target(s)
- Identified data owner and validator
- Measurement frequency along with the approved collection instrument (such as transect, laboratory assay, administrative register, ODK form)
- Verification/validation methodology (e.g., routine quality assurance, third-party audit)
- Indicative monitoring budget line
- Operational rule: **Completion and upload of DRF entries to the MIS are required as part of DPP approval. Major disbursements are contingent upon DRF population.**

Core MIS Functional Capabilities:

- A centralized database with a configurable web dashboard that provides consolidated reporting for the Project Management Unit (PMU), Department of Environment (DoE), and Project Steering Committee (PSC).
- A secure, API-first architecture designed to receive and transmit modular data feeds from line agencies, private operators, laboratories, and national financial systems.
- Online and offline mobile data collection capabilities (using ODK or equivalent platforms) tailored for Village Community Groups (VCGs), field teams, and contractors.

- Geo-referenced mapping and time-series visualization tools covering coral transects, waste hotspots, sanitation and hydrological monitoring sites, road alignments, and turtle nesting locations.
- Role-based access controls, comprehensive provenance metadata (tracking contributor, validator, and timestamps), and automated validation procedures including range checks, temporal consistency, and geo-fencing.

Field Data Collection and DRF Mapping: Mobile forms are systematically pre-associated with DRF indicator records, ensuring that each field submission—such as survey entries, photographs, GPS traces, and laboratory files—is automatically aligned with the appropriate indicator, sample location, and project activity. All media and sensor files are securely stored alongside tabular data, establishing a comprehensive and auditable evidence trail. Offline functionality is essential, enabling VCGs and remote enumerators to collect data without uninterrupted connectivity; synchronization takes place once a connection is reestablished.

Financial and Procurement Interoperability: The MIS provides secure interfaces for integrating budget allocations, tracking disbursements against actual expenditures, and updating procurement milestones (preferably via a secure feed from the Ministry of Finance's iBAS++ or an equivalent system). This connection facilitates automated reconciliation between financial data and physical progress, supports the generation of quarterly fiduciary dashboards for PSC review, and enables attribution analysis that links outcome underperformance to funding or procurement gaps.

Automated Reporting and Analytics: The Management Information System (MIS) is required to generate standardized outputs, including monthly and quarterly operational reports for the PMU and PSC, an annual synthesis of outcomes, and properly formatted datasets for independent mid-term and final evaluations. Built-in analytics should provide deviation alerts (comparing indicators with targets), identify trends, implement basic attribution logic (associating outcome anomalies with related outputs or funding issues), and enable data export in widely used formats such as CSV, XLSX, and PDF to ensure compatibility with national reporting systems (including SDG portals and NPI registries).

Data Quality, Verification, and Budgeting: Each DRF indicator is accompanied by a detailed data quality statement, covering aspects such as sampling protocols, enumerator qualifications, and calibration or laboratory accreditation when applicable. The MIS systematically tracks the validation status of records (progressing from raw to validated to audited). It is mandatory for projects to allocate adequate resources for monitoring and independent verification within their DPP budgets, ensuring that these expenses are documented in the DRF to facilitate reconciliation during audits and evaluations.

Governance, Access, and Transparency: The MIS employs granular permission controls, enabling data owners to input and amend their records, allowing PMU/DoE validators to authorize official figures, and providing PSC members with access to read-only summary dashboards. Where feasible and secure, the MIS should disseminate public-facing dashboards and downloadable datasets to enhance transparency and facilitate stakeholder engagement, while safeguarding sensitive information.

Operational Discipline and Sequencing: Early deployment of the MIS is a priority (ST-01). Project sequencing should include: (1) finalization and upload of the DRF within each DPP to the MIS, (2) baseline data collection and registration of sampling points in the MIS, (3) deployment of ODK/mobile forms for key indicators (such as tourist registration, coral transects, waste logs, and sanitation checks), and (4) activation of financial and procurement data feeds. Conditioning disbursement on

DRF population ensures that monitoring capacity is adequately budgeted, data are auditable from project inception, and independent verification is feasible at both mid-term and completion stages.

In summary, the integrated MIS, DRF, and mobile data stack redefines monitoring as an active project management tool rather than a passive reporting requirement: indicators become contractual and budgeted components, field reports generate auditable evidence, financial integration assures verifiable attribution, and automated dashboards transform raw data into actionable management intelligence for the PMU, DoE, and PSC, supporting adaptive and transparent stewardship of the MP.

12.4 Operational M&E Framework

The MP's operational monitoring and evaluation (M&E) framework systematically links each project activity to quantifiable indicators through the Development Results Framework (DRF) and the central M&E Catalogue maintained in the Management Information System (MIS). Serving as the sole indicator registry, the Catalogue functions as the operational link between project design (DPP), implementation monitoring, financial oversight, and independent evaluation. Indicators are systematically organized into two interrelated streams: Implementation Monitoring (outputs) and Plan Evaluation (outcomes). The selection, definition, and verification of these indicators are governed by the SMART methodology, ensuring rigor and consistency across the framework.

12.4.1 Implementation Monitoring

Implementation Monitoring employs short-cycle, output-oriented indicators to verify the delivery of planned interventions and enable prompt operational responses. Key characteristics and protocols include:

Purpose: To ensure that physical works, systems, and capacity-building activities are completed according to specifications, within schedule, and within budget (e.g., commissioning of Material Recovery Facilities, completion of green pavement sections, installation of compliant septic systems at resorts, deployment of Management Information Systems, and recording the number of tourist registrations).

Cadence: Reporting is conducted monthly where practicable, with quarterly consolidation for Project Management Unit (PMU) operational dashboards and Project Steering Committee (PSC) review.

Responsibility: Primary data ownership lies with implementing agencies and contractors; the PMU is responsible for validating and publishing consolidated reports.

Applications: Utilized for operational dashboards, procurement tracking, contractor performance assessment, and supporting immediate corrective actions such as adjustments in procurement, staffing, or budget allocations.

Sample SMART Indicators – Implementation Monitoring Framework

No	Project / Theme	Output indicator (what to count/measure)	Unit / Method	Measurement frequency	Responsible Authority
1	MIS (ST-01)	MIS developed & online tourist registration portal live	Binary (Deployed = Yes/No); system uptime logs; number of registrations	Once (deployment) then **daily/weekly** for registrations	DoE (PMU) for deployment; DoE/PMU (operations); Third-party for acceptance test.
2	MIS / Tourism Management (ST package)	MT-Dashboard indicators operational across 7 categories (Resources, Visitors, Residents, Accommodation, Transportation, Other tourism business, other tourism dev.)	dashboard widgets live; completeness (% categories feeding data)	Once (setup) then **monthly**	PMU (DoE) + PCP; data owners: BIWTA, Resorts association, UP.
3	Waste management projects	Number of Material Recovery Facility (MRF) / community compost units built and operational	MRFs operating; functional status checks	Quarterly	Implementing agency (LGED/Local NGO) + PMU; validation by DoE/Third-party.
4	Sanitation / Sewage (part of ground water/waste)	resorts / hotels with compliant septic/onsite treatment installed	units commissioned; conformity to design (inspection)	Quarterly during roll-out	PMU / DPHE / Local Government; DoE for environmental compliance.
5	Coral monitoring & restoration (CR-3, CR-1)	Coral monitoring stations established; underwater surveys completed	transect points established; surveys/year	Bi-annual (wet/dry)	DoE / Implementing research partner (e.g., BORI/BIWTA/CEGIS) & VCGs for field assistance; Third-party QA.
6	Fisheries management (FB-1 / FB-2)	community fisheries agreements / no-take zones legally designated & signposted	agreements; km^2 of no-take area	Once then annual compliance checks	DoF + DoE + PMU; VCGs for local monitoring.
7	Livelihoods / market (LI-03 etc.)	microenterprises trained and women/youth engaged	trainees certified; % women/youth	Quarterly	Implementing agencies (NGOs/DAE) + PMU;

No	Project / Theme	Output indicator (what to count/measure)	Unit / Method	Measurement frequency	Responsible Authority
					monitoring by DoE/PMU.
8	Roads & green infra (ID-1/ID-2)	km of green/ 'cool' pavement delivered; VGS installed (nos.)	km; VGS installations	Quarterly during civil works	LGED / PMU; DoE for environmental safeguards.
9	Capacity building	capacity building events; officials trained (DoE/PMU/stakeholders)	workshops; participant lists; pre/post tests	Quarterly/annual	PMU (training unit) & DoE; evidence kept in MIS.
10	Finance & procurement	% of annual budget released & % procurement milestones completed	% disbursed vs approved; tender vs award ratio	Quarterly	PMU (financial officer) + Finance Division; audits by Ministry/Third-party.

12.4.2 Plan Evaluation

Plan Evaluation applies medium- and long-term, outcome-focused indicators to determine whether outputs are effecting change in ecological and socio-economic conditions as intended by the MP objectives.

- **Purpose:** Assess measurable changes in ecological health and human well-being attributable to the MP, including metrics such as percentage change in live coral cover within designated transects, trends in catch per unit effort (CPUE) and juvenile fish proportions, beach litter density (items/m), percentage of households with access to safe drinking water, and percentage increase in targeted household incomes.
- **Cadence:** Data is aggregated and reported on an **annual** basis for synthesis and policy application. Some ecological and fisheries indicators may require **bi-annual** or **seasonal** sampling to accurately capture natural variability and identify emerging trends. Evaluation outcomes inform both the mid-term evaluation (Years 3–4) and the final evaluation (Year 10).
- **Responsibility:** The PMU is responsible for consolidating and analyzing outcome data, with validation provided by the Department of Environment (DoE) and technical partners. Independent evaluators are engaged to verify results at both the mid-term and final stages.
- **Uses:** Supports decision-making, adaptive management, accountability to funders, and national reporting requirements.

Sample SMART Indicators – Master Plan Evaluation Framework

No	Theme	Outcome indicator (what we want to change)	Unit / method	Measurement timeframe	Responsible for measurement / validation
1	Tourism management	Average daily tourist arrivals within the island's effective carrying capacity (6 m^2 / 10 m^2 standard)	Visitors/day; compare to carrying capacity calculation	**Annual** + mid-term (Year 3–4) + final (Year 10)	PMU (tourism MIS) collects; DoE + PSC verify; independent mid-term evaluation.
2	Coral & benthic conservation	% live coral cover (change relative to baseline) & coral recruitment rate	% cover from transects/photogrammetry; recruits/m^2	**Bi-annual surveys**; aggregate annually; evaluation at Years 3, 5, 10	DoE / BORI / research partners; data uploaded to MIS; third-party QA.
3	Fisheries	CPUE (catch per unit effort) and juvenile fish proportion (indicator of stock health)	kg per boat per day; % juveniles in landings	**Annual** (seasonal comparisons)	DoF + PMU (market surveys) + fisheries associations; DoE oversight.
4	Waste & water quality	Beach litter density (items/m) and lagoon nearshore bacterial counts (FC), and % establishments with safe sanitation	items/m; CFU/100ml; % compliant establishments	**Quarterly** monitoring for beach; **annual** aggregated evaluation	PMU (waste unit) & DPHE/DoE; VCGs collect beach cleanup data; lab tests by accredited lab.
5	Groundwater & freshwater	% households with safe drinking water source; water table salinity (EC) in key aquifers	% households; EC mg/L or µS/cm	**Annual**	DPHE / DoE / PMU; hydrological monitoring program.
6	Turtle conservation	Number of nesting events and hatchling survival rate	nests/season; % hatchling survival	**Per nesting season** (annual report)	DoF / DoE / research partners; community (VCGs) reporting.
7	Terrestrial flora/fauna	Hectares of restored mangrove / key dune vegetation & native species richness	ha restored; species richness indices	**Annual** (with 5-yr evaluations)	DoE / Forestry / PMU; VCGs for maintenance.
8	Livelihoods & equity	% increase in average household income for target beneficiaries; % of tourism income retained locally	% Δ household income; % local ownership/employment in tourism	**Annual** with mid-term socio-economic survey at Year 3	PMU (socio-economic unit), NGOs, DoE; independent socio-economic evaluator.
9	Governance & compliance	Number of regulatory infractions (illegal coral extraction, improper sewage discharge) recorded	# incidents/year; enforcement actions taken	**Quarterly** reporting; annual trend analysis	DoE enforcement unit + BGB/Coast Guard/Local Police; PMU compiles.
10	Sustainable finance	% of planned annual budget mobilized (public + private + donor) and % revenue reinvested into conservation (PES / PES pilots)	% funds mobilized; % reinvested	**Annual** financial evaluation; mid-term & final financial audit	PMU finance + MoEFCC + Ministry of Finance; Third-party audit.

12.4.3 Selection of SMART Indicator

Indicator selection is a structured, consultative process in which the DRF/MIS catalogue serves as the central reference. Project proponents are required to propose indicators during DPP preparation and must complete DRF entries before any major disbursement occurs. The selection process is as follows:

- **Begin with the central repository:** Project teams select candidate indicators from the MIS-hosted national indicator library, which includes SDG, NPI, MRV, and validated sector lists.
- **Propose new SMART indicators only when essential:** In the absence of suitable national indicators, proponents may develop new SMART indicators, providing comprehensive measurement protocols and justifications.
- **Undertake review and approval:** The M&E cell within the PMU and the Project Coordination Platform (PCP) evaluate proposed indicators for technical rigor, feasibility, and alignment with national lists. They may request refinements to measurement protocols or suggest alternative indicators.
- **Ensure mandatory metadata and budgeting:** For each accepted indicator, full metadata and a provisional monitoring budget line must be included in the DPP. Projects lacking fully populated DRF entries will be ineligible for major disbursements.
- **Apply a social and equity lens:** Where appropriate, indicators should incorporate disaggregation by sex, age/youth, disability, location, and tenure to ensure inclusion outcomes are adequately captured.

12.4.4 M&E Catalogue Fields

Each DRF/Catalogue entry within the MIS must record the following fields to ensure that indicators are measurable, comparable, and auditable:

- Indicator name (abbreviated)
- SMART definition (comprehensive text)
- Unit of measurement
- Baseline value and date of collection (including metadata on methodologies and samples)
- Time-bound targets and corresponding target dates
- Data owner (primary reporting entity) and validator (PMU/DoE or designated third party)
- Measurement frequency (e.g., monthly, quarterly, seasonal, bi-annual, annual)
- Data collection method/instrument (such as belt transect, photogrammetry, CPUE protocol, laboratory assay, ODK form, or administrative record)
- Sampling design and sample size (if applicable)
- Verification/validation method (for example, routine QA checks or third-party audit protocols)
- Required standards and accreditations (including laboratory accreditation, calibration, or technical standards related to coral photogrammetry or fisheries sampling)
- Disaggregation fields (such as sex, age, locality, etc.)
- Linkage tags (SDG, NAP, BDP2100, etc.) to facilitate interoperability

- Indicative monitoring budget line and designated budget holder
- Provenance and data quality notes (e.g., expected margin of error, confidence intervals)

12.4.5 Measurement Methods and Technical Standards

Robust measurement necessitates the use of standardized methodologies and comprehensive quality assurance procedures:

Standard Protocols: The PMU/PCP will disseminate authorized standard operating procedures (SOPs) for each technical area, including coral transects, CPUE sampling, water microbiology, and socio-economic household surveys.

Laboratory Accreditation: All water quality and biological assays are to be conducted in accredited laboratories; the DRF is responsible for listing qualified laboratories or defining acceptable accreditation processes.

Enumerator Training & Calibration: Enumerators, VCG data collectors, and laboratory technicians must undergo standardized training and periodic refresher courses. Regular equipment calibration is mandatory, with logbooks maintained accordingly.

Data Quality Assurance: The MIS incorporates built-in data quality controls such as range checks, temporal continuity verification, geo-fencing, duplicate entry detection, and automated anomaly flags for validation by the PMU.

Verification Schedule: Regular internal validations will be conducted by the PMU, supplemented by annual desk audits and budgeted third-party audits. Verification activities are integrated with both mid-term and final evaluation processes.

12.4.6 Linking of Indicators

The DRF operates as a dynamic process: indicators are integrated into the DPP and uploaded to the MIS prior to disbursement. The following practical guidelines apply:

- **Conditional Finance:** Release of major tranches is contingent upon the DRF being populated (including baseline and targets) and verification of monitoring capacity—such as a staffed PMU M&E cell and a configured MIS module.
- **Automated Calculation & Dashboards:** The MIS system automates indicator calculations where feasible (e.g., percent cover derived from photo-quadrats, registration totals) and updates both operational and outcome dashboards accordingly.
- **Attribution Logic:** The DRF establishes clear links between outputs and proximate outcomes, enabling any underperformance in outcome indicators to be traced to specific outputs or funding gaps for targeted corrective action.

12.4.7 Examples of Indicator Sets

- **Implementation (output) examples:** Number of commissioned and operational MRFs; kilometers of green pavement completed; number of hotels with compliant septic systems; MIS deployed and percentage of implementing agencies publishing data in a timely manner.
- **Evaluation (outcome) examples:** Percentage change in live coral cover within designated transects (baseline versus year n); CPUE (kg per boat per day) and percentage of juvenile catch; beach litter density (items per meter); percentage of households with

access to safe drinking water; percentage increase in average household income among project beneficiaries.

This integrated framework ensures indicators are actionable and robust. Utilizing SMART selection minimizes ambiguity, while the DRF and M&E Catalogue guarantee that each indicator is budgeted, technically specified, and properly attributed. The MIS streamlines the collection, validation, and reporting processes. Furthermore, mandatory baselines, data disaggregation, and external verification strengthen the credibility of reported results. The PMU M&E cell and PCP are pivotal in reviewing, approving, and operationalizing indicators, thereby transforming measurement into a cornerstone of adaptive management for the MP portfolio.

12.5 Reporting Mechanism

This reporting architecture replaces a multi-tier feed-and-aggregate model with a **single-source, data-owner centric flow** that reduces duplication and clarifies responsibility while preserving a bottom-up logic for aggregation. The Concept Paper's emphasis on a web-based, dynamic M&E system and ODK for field collection informs this mechanism.

Reporting is organized in alignment with the DRF framework and prioritizes data ownership over administrative hierarchy. The core principle is that the entity responsible for executing an activity assumes primary stewardship of the relevant output indicators, while the PMU consolidates these data streams and disseminates standardized reports.

Primary Reporting (Monthly/Quarterly): Implementing agencies—including DoF, DPHE, LGED, local NGOs, and contractors—regularly submit output indicators and procurement or financial updates through structured templates to the MIS on a monthly basis. VCGs and field enumerators provide community and ecological observations via ODK forms, with daily or weekly submissions aggregated accordingly. The PMU reviews, validates, and publishes a consolidated operational dashboard every quarter.

Outcome Reporting (Annual): The PMU produces an annual outcome synthesis, compiling SMART outcome indicators spanning ecological and socio-economic domains, complete with trend analysis, attribution notes, and reassessments of risk and adaptive strategies. When ecological indicators necessitate more frequent sampling (such as biannual coral or seasonal fisheries surveys), raw data are submitted at their respective intervals and incorporated into annual trend analyses.

Independent Verification and Synthesis (Mid-term & Final): Third-party evaluators conduct mid-term (Year 3–4) and final (Year 10) assessments, involving targeted verification fieldwork, comprehensive review of PMU datasets, and financial audits, resulting in publicly disseminated evaluation reports.

Public Transparency and National Reporting: MoEFCC issues an annual M&E summary and a biennial synthesis for external reporting as needed. The MIS delivers public dashboards and downloadable datasets, providing transparency while maintaining appropriate safeguards for sensitive information.

This reporting structure replaces the previous multi-tiered feed-and-aggregate model with a **single-source, data-owner centric approach**, effectively reducing duplication, clarifying responsibilities, and supporting bottom-up data aggregation. The Concept Paper's recommendation for a web-based, dynamic M&E system and utilization of ODK for field data collection underpin this methodology.

12.6 Institutional Roles and Responsibilities

The following operational assignments are integral to project implementation:

PMU (DoE-hosted): Responsible for day-to-day monitoring and evaluation activities, management of the MIS system, aggregation of agency data, quarterly reporting, and coordination with implementing agencies.

Department of Environment (DoE): Oversees technical validation of ecological metrics, enforces regulatory compliance, and ensures quality assurance.

MoEFCC: Provides oversight as the host of the Permanent Steering Committee.

Project Steering Committee (PSC)/Permanent Steering Committee: Delivers cross-sectoral oversight, makes decisions, and manages adaptive resource reallocation informed by monitoring and evaluation outcomes.

Project Coordination Platform (PCP): Offers technical support, standardizes data processes, and serves as a liaison with development partners.

Implementing Agencies (line ministries, DoF, DPHE, LGED, DAE, local NGOs): Are tasked with delivering outputs and serving as data owners by providing information to the PMU/MIS.

Village Conservation Groups (VCGs) & Union Parishad: Conduct community-based monitoring, submit field reports, and perform localized verification.

Third-party/Independent Evaluator: Responsible for baseline verification, mid-term and final evaluations, and conducting financial audits.

Formal Memoranda of Understanding (MoUs) will institutionalize these roles and safeguard the integrity of information flow.

12.7 Data Quality and Validation

Robust evaluation depends on reliable data. Accordingly, the MP mandates that each SMART indicator within the Development Results Framework (DRF) be accompanied by a clearly defined **data quality statement** and anchored in comprehensive baseline data collected prior to significant disbursements. Baseline studies are required for all core outcome domains relevant to the Plan, including live coral cover and benthic composition, fisheries catch-per-unit-effort (CPUE) and juvenile ratios, hydrological indicators (salinity/EC), microbiological water quality, household socio-economic status, tourism dependency metrics, and other sector-specific indicators detailed in project DRFs. These baselines serve as the reference point for evaluating progress and attribution; thus, they must be scientifically robust, time-stamped, geographically referenced, and maintained in the MIS as the authoritative source.

Each DRF indicator entry in the MIS is to contain a concise yet comprehensive **data quality statement**. At a minimum, this should include:

- The approved **sampling protocol** and the rationale behind it (sample frame, sampling design, sample size);
- The specific **measurement method** employed (e.g., equipment used, laboratory assays, photogrammetry protocols, CPUE methodologies, ODK forms);
- Required **enumerator qualifications** and details of training schedules;
- **Equipment calibration** procedures and practices for maintaining calibration logs;

- Acceptable **laboratories** or accreditation standards for analyses (such as bacteriology, salinity) and methods for ensuring inter-laboratory comparability;
- **Data entry validation rules** (including range checks, allowable values, and mandatory fields); and
- The **verification method** (routine QA processes, validator roles, audit frequency);

Operational data quality protocols should integrate prevention, detection, and verification measures. Prevention includes publishing standard operating procedures (SOPs) for each technical area, ensuring both equipment calibration and laboratory accreditation, and investing in enumerator and VCG training before field deployment. Detection is facilitated by MIS automation—implementing validation rules and analytics such as range and temporal continuity checks, geo-fencing to confirm expected sample locations, duplicate detection, and statistical flagging for anomalies. Validation encompasses systematic reviews led by the PMU M&E cell and domain experts in DoE and associated agencies: any flagged irregularities are assessed, field verified as necessary, and either rectified (with provenance tracked) or escalated for further investigation.

Third-party verification remains fundamental to ensuring credibility and accurate attribution. Projects must allocate appropriate resources and scheduling for external verifications and audits within the DPP. Verification should comprise: (a) **pre-disbursement checks** verifying baseline completeness and DRF population; (b) **annual third-party data audits** scrutinizing pipelines, sampling compliance, and laboratory standards; and (c) **independent mid-term (Years 3–4)** and final (Year 10) evaluations to verify field data, reconcile finances, and analyze causal relationships. Such independent assessments underpin attribution, reveal systemic biases, and corroborate internal PMU analyses.

Special considerations apply for data sourced from communities and remote platforms. Village Conservation Groups (VCGs) and community reporters enhance coverage and cost-effectiveness, but their contributions require stringent quality assurance. This is achieved through standardized mobile forms with pre-filled metadata, regular spot-checks by PMU/DoE supervisors, cross-validation with professional surveys, mandatory photo documentation, and tracking validator credibility scores (e.g., the rate of accepted versus corrected submissions) in the MIS. Remote sensing and photogrammetry outputs should adhere to documented processing protocols, detail geo-referencing accuracy, and provide version-controlled classifications for consistent time-series analysis.

Strict adherence to data provenance, audit trails, and retention protocols is imperative. Each MIS record must identify the submitter, timestamp, device or instrument used, and validating party. Amendments must retain original data values and document reasons for modifications. The MIS should offer a data quality dashboard summarizing validation status, anomaly rates, lab turnaround times, and verifier workload, enabling governance entities (PMU, DoE, PSC) to monitor dataset integrity efficiently.

The following outlines key responsibilities:

- **PMU M&E cell**: Guarantees DRF completion before disbursement, maintains indicator catalogues, manages automated validation and triage, conducts periodic internal QA, oversees the data-quality dashboard, and coordinates third-party auditing.
- **DoE technical leads and sectoral agencies**: Approve SOPs, oversee technical training, validate specialized datasets (ecological, hydrological), and support verification activities.
- **Laboratories/accredited providers**: Execute assessments per established standards, submitting results with requisite accreditation metadata.

- **VCGs/community reporters**: Supply ongoing field observations via standardized digital forms with supporting evidence; their submissions undergo spot audits and receive credibility scoring.
- **Third-party evaluators/auditors**: Conduct annual, mid-term, and final audits and evaluations, providing independent reports to PSC and MoEFCC for oversight.
- **PCP/PMU procurement & finance**: Ensure proper budgeting for monitoring and verification in DPPs and facilitate transparent financial flows traceable in the MIS.

To implement these policies, projects must include a dedicated monitoring budget line in DPPs covering baseline establishment, routine monitoring, laboratory analyses, personnel training, data management, and scheduled third-party reviews. Both baselines and DRF completion are prerequisites for major funding releases, with disbursement conditional on documented baseline uploads and initial QA approval by the PMU. All verification-related outputs—including audit reports, QA logs, revised datasets, and independent evaluations—must be archived within the MIS and cited in annual outcome summaries to guarantee transparency, reproducibility, and defensible decision-making.

12.8 Financial Tracking

The MP's financial oversight is anchored by a dedicated Financial & Procurement Module within the MIS, designed to align expenditures with tangible results. This module systematically records budget allocations by project and DRF indicator, monitors commitments and disbursements, and links expenditures directly to outputs and outcomes. By integrating financial data with indicator monitoring and budgeting, the system facilitates reporting not only on achievements but also on the associated costs—an essential basis for attribution and fiduciary responsibility.

Seamless interoperability with national treasury systems is imperative. The MIS should be configured to receive secure disbursement feeds (preferably via an interface with the Ministry of Finance's iBAS++ or its equivalent), enable automated reconciliations, and promptly flag exceptions for immediate PMU action. Automation in reconciliation processes minimizes human error, expedites discrepancy resolution, and provides near-real-time insights into available, committed, and spent funds.

Procurement tracking is intrinsically linked to financial management controls. The MIS is required to capture key procurement milestones—including tender issuance, contract award, mobilization, and both interim and final acceptance—and to securely store supporting documentation. These milestones serve as payment triggers; any delay or omission activates alerts for PMU finance and procurement leads, potentially blocking tranche releases until corrective measures are implemented. Incorporating a contractor performance module (assessing timely delivery, quality compliance, and defect records) further enhances procurement decisions and accountability throughout the procurement lifecycle.

Reporting must accommodate both operational and requirements. Internally, the PMU Finance team generates monthly transaction summaries and exception reports. Quarterly automated dashboards present comparative analyses of budget versus actuals, procurement updates, co-financing inflows, and identified risks for PSC review. Annually, consolidated financial statements and dashboards underpin outcome synthesis and external audits, while donor-specific extracts are produced as required to meet conditional funding obligations.

Rigorous verification and audit protocols are indispensable. Automated reconciliations with treasury data should be supplemented with annual external audits addressing both financial statements and procurement compliance. Evaluators conducting mid-term and final reviews utilize the MIS financial

module to match expenditures against verified outputs and outcomes, scrutinizing attribution assertions and identifying inefficiencies or potential fund misdirection.

Clear delineation of roles and structured sequencing underpin effective system operation. The PMU Finance & Procurement Unit manages data entry, reconciliation, and reporting; implementing agencies upload invoices and certificates; the Ministry of Finance supplies disbursement data; the PSC reviews fiduciary dashboards and enforces remedial actions; and independent auditors and evaluators validate records. Initial priorities should focus on deploying the financial module and treasury interface, mandating a monitoring/audit budget line in each DPP, linking first tranche disbursement to DRF population and baseline uploads, and enabling automated procurement alerts alongside a contractor performance dashboard.

Collectively, these practices establish the MIS as the definitive ledger for both financial flows and results. Through DRF-linked conditionality, automated reconciliations, and institutionalized procurement gatekeeping, the MP mitigates implementation risks, accelerates corrective action when necessary, and produces auditable evidence verifying that public and donor resources are utilized to achieve validated environmental and socio-economic outcomes.

12.9 Capacity Building and Adaptive Management

The effectiveness of the MP's monitoring system relies on establishing robust institutional and human capacity. Within the first three months, a fully resourced Monitoring & Evaluation (M&E) unit should be established within the Project Management Unit (PMU), staffed by key personnel including an M&E lead, database administrator, GIS/remote sensing specialist, field data manager, and finance and procurement analyst. This team will oversee daily monitoring activities, maintain the Management Information System (MIS), and serve as the central hub for consolidating and validating data from line agencies, laboratories, and community sources. The absence of such a dedicated cell would undermine the effective functioning of both the Development Results Framework (DRF) and the MIS.

Capacity building efforts must address technical and institutional aspects. Technical training should encompass ecological monitoring techniques—such as coral transects, photogrammetry, and CPUE sampling—water quality analysis, socio-economic surveys, and the use of digital data collection tools like ODK. On the institutional front, it is critical to strengthen data governance through implementation of standard operating procedures, standardized metadata, and memoranda of understanding (MoUs) to facilitate data sharing. Training initiatives should be practical and continuous, combining classroom instruction with field exercises, and should extend to Village Conservation Groups (VCGs), local government units, line agencies, and tourism operators responsible for regulatory compliance.

Regular feedback mechanisms are vital for transforming collected data into actionable decisions. Structured opportunities for evidence-based course correction include monthly operational reviews within the PMU, quarterly consolidated reports for the Project Steering Committee (PSC), annual outcome syntheses, and a mid-term evaluation during Years 3–4. Each feedback product must not only present data but also offer recommendations, assign responsibilities, and set deadlines to ensure accountability. Furthermore, adaptive management processes should leverage validated MIS evidence to instigate timely corrective measures or redirection, with all actions documented in the MIS to uphold transparency.

Monitoring the development of capacity itself is essential. Key indicators—such as the proportion of trained staff, active participation rates among VCG members, and data quality check pass rates—should be tracked within the DRF to evaluate the sustainability of the system. When combined with joint learning exchanges and stress-testing exercises, these measures support the ongoing evolution of capacity development. In this manner, the MP's M&E system can function as a dynamic management

tool, capable of adapting to emerging challenges while safeguarding ecological integrity and supporting community livelihoods.

12.10 Implementation Steps

The MP's Monitoring & Evaluation system functions not merely as a reporting tool, but as an integrated **Monitoring, Evaluation, Accountability and Learning (MEAL) platform**. Its central objective is to facilitate continuous feedback from field data, financial flows, and institutional outputs into the decision-making process. The learning component is embedded through well-defined feedback mechanisms: monthly PMU meetings to address operational challenges, quarterly PMU-to-PSC evaluations for delivery assessment and resource adjustment, annual outcome syntheses guiding policy modifications, and independent mid-term reviews supporting comprehensive portfolio realignment. Each monitoring report is required to capture progress, lessons learned, analyses of performance shortfalls, and recommend remedial actions. This systematic approach aligns "learning-by-doing" with regular plan revisions, thus establishing DRF targets and MIS dashboards as the foundation for adaptive management.

To implement this approach, several immediate steps are necessary:

Baseline studies: Undertake robust baseline assessments for all SMART outcome indicators, including coral and benthic surveys, fisheries CPUE and juvenile ratios, water microbiology, and household socio-economic studies. Baselines must be established prior to significant fund disbursement.

DRF finalization: Projects are required to finalize their DRF during the DPP phase, outlining SMART indicators (linked to national lists where applicable), methods, baselines, targets, and ensuring monitoring budget allocation.

MIS & ODK deployment: Develop and introduce MIS and ODK-enabled mobile forms, prioritizing tourist registration, coral transect assessments, waste and cleanliness records, and procurement/financial updates. Integration with iBAS++ should be pursued for real-time fiduciary oversight.

PMU M&E cell staffing & training: Promptly recruit dedicated M&E personnel and deliver targeted capacity-building initiatives for line agencies, VCGs, and field staff.

Reporting cadence: Establish ongoing operational reporting cycles (monthly/quarterly), annual PMU-led outcome syntheses, and scheduled independent mid-term and final evaluations. Annual public-facing summaries published by MoEFCC will ensure transparency.

In conclusion, MP's M&E system constitutes a unified, SMART-based MEL framework. The DRF designates each indicator as a contractual commitment; the MIS guarantees traceability and auditability of all data; and the PMU/DoE/PSC governance ensures actionable insight. By integrating a central indicator repository, ODK-enabled field reporting, iBAS++ financial visibility, and MEAL-driven feedback processes, the MP streamlines operations and enhances clarity. Collectively, SMART metrics, rigorous baselines, independent verification, and iterative learning processes advance the MP from static planning toward a dynamic, evidence-informed program, supporting ecological sustainability and socio-economic resilience on Saint Martin's Island.

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Appendix A: Monitoring Plan for Corals and Its Dependent Flora and Fauna

Considering the criteria for developing monitoring protocol, a very simplistic coral and its dependent flora and fauna monitoring protocol has been developed and presented in the following Table.

Monitoring Plan of Corals, and Its Depended Flora and Fauna of SMI

Indicator	Method	Location	Frequency	Data format
Soft Coral	Underwater Quadrant survey in 15 sample plots	All coral areas and marked location	Annually	Species wise coral density and percentage coverage by corals of the total coral area
Hard Coral	Underwater Quadrant survey in 15 sample plots	All coral areas and marked location	Annually	Species wise coral density and percentage coverage by corals of the total coral area
Seaweed	Underwater sample collection from 10 spots across sub tidal and inter tidal areas are shoreline areas.	10 locations of Intertidal and sub tidal areas	Annually in winter	Species number and richness
Mollusk	Plot counting (10m X 10m) approx. at 10 spots on all invertebrate species seen	10 spots in intertidal rocky beach areas (spots to be determined)	Annually in winter	Species diversity, number of individuals per species; density per square meter by species
Fish	Survey fish landing area and fish market; and underwater survey	All fish landing spot at the island; and underwater in coral protection zone	Bi-monthly	Species list and abundance; landing data (size ranges, abundance)

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