



Regional Flyway Initiative · Site Study

May 2026

RFI Priority Site · Sonadia Island

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General Site Information

Country	Bangladesh		
RFI Site Name	Sonadia Island	ID006	
City/ Municipality, Province, Region	Cox's Bazar, Chattogram Division		
Geographical coordinates	21.50°N, 91.88°E	Area (has)	9,823 ha
Key species	Spoon-billed Sandpiper, sea turtles of two species		
Key habitats (biomes)	permanent shallow marine waters, marine subtidal aquatic beds, sand, shingle, or pebble shores, estuarine waters, intertidal mud, sand or salt flats, intertidal marshes, and intertidal forested wetlands		
Key ecosystem services	Coastal protection, provisioning services (fishery resources)		
Key drivers of change	Expansion of settlements/residential areas, marine pollution, unsustainable fishing		
Conservation status (mark all that applies)	<input type="checkbox"/>	Protected Area	<input checked="" type="checkbox"/> Flyway Network Site
	<input type="checkbox"/>	Ramsar Site	<input type="checkbox"/> Others _____
IBA/ KBA name (and number) and other designations	Sonadia Island		
Management Stakeholders	Forest Department, Bangladesh Economic Zones Authority (Beza), Department of Environment		
With management plan?	Yes		
Project concept themes	Protected area establishment, sustainable coastal fisheries. Ecotourism		
Length of project	5 years		
Sector/s	To be confirmed		
No. of potential beneficiaries	12,000 people		
Indigenous Peoples	<input type="checkbox"/>	No	<input checked="" type="checkbox"/> Yes _____
Anticipated Implementation Risks	Reduced livelihoods for fishers impacted by restrictions and bans on fishing, impact of ecotourism on wildlife disturbance and waste pollution, and overlaps of administrative roles of wetland management stakeholders		
Estimated Project Budget (US\$)	4,950,000 over five years		
Potential Source/s of Financing	<input type="checkbox"/>	Loan	<input type="checkbox"/> Private Sector
	<input checked="" type="checkbox"/>	Grant (to be identified)	<input type="checkbox"/> Public-Private Partnership

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Abbreviations

ADB	Asian Development Bank
AWC	Asian Waterbird Census
BEZA	Bangladesh Economic Zones Authority
BFD	Bangladesh Forest Department
BDT	Bangladesh Taka
CREL	Climate Resilient Ecosystems and Livelihoods
CSR	Conservation Status Review
DMC	Developing Member Country
EAAFP	East Asian-Australasian Flyway Partnership
ECA	Ecologically Critical Area
IBA	Important Bird and Biodiversity Area
IUCN	International Union for the Conservation of Nature
NGO	Non-governmental Organisation
RFI	Regional Flyway Initiative
TESSA	Toolkit for Ecosystem Services Assessment
USAID	United States Agency for International Development
USD	United States Dollars
VCG	Village Conservation Group

Executive Summary

Sonadia (21.50°N, 91.88°E) is a low-lying, elongate barrier island located on the far southeastern coast of Bangladesh: the site lies a few kilometres north of the Teknaf Peninsula, and northwest of the major city of Cox's Bazar. Sonadia Island is separated from Cox's Bazar by the shallow Moheshkhali Channel and holds a complex of coastal and estuarine wetland habitats, with the eastern part of the site fed by freshwater from the Bakkhali River estuary and Moheshkhali channel, and the western part from the Kuhelia River. An intertidal sandy beach and sand dune ridge extends along the length of the western coast of Sonadia, broken by a lagoon in the southeast. There are several salt marsh and mudflat areas fringed with intertidal grassy vegetation and regenerating mangroves. Sonadia is the most important wintering site for the Spoon-billed Sandpiper *Calidris pygmaeus* (CR) in Bangladesh, supporting close to 2% of the global population of the species in some years, alongside five other threatened and near-threatened waterbird species such as Spotted Greenshank *Tringa guttifer* (EN) and Curlew Sandpiper *C. ferruginea* (NT). As such, the island is recognised nationally as an 'Ecologically Critical Area' (ECA) and has been designated as an EAAFP Flyway Network Site since 2011, with the Department of Environment responsible for the management of the ECA, and the Forest Department for mangroves and wildlife. At present, significant drivers of change to Sonadia's wetlands include the expansion of commercial and industrial areas, which alter natural habitats and worsen coastal pollution with marine plastic waste. Unsustainable fish practices and harvest of other aquatic resources, and wildlife hunting are substantive threats to biodiversity, while the development of new settlements, including those for cross-border (from Myanmar) refugees, further fragments the landscape.

At present, although Sonadia draws a steady stream of tourism from Cox's Bazar, there are limited economic opportunities for local communities from ecotourism. There is substantive scope to strengthen nature-based tourism infrastructure and capacity for local communities currently largely dependent on coastal fisheries, including through small-scale financing for local tourism and boat operators in Cox's Bazar. Local people will need to acquire better resources to serve tourism activities (including boats and their maintenance) and this can be financed by microloans, potentially set up in coordination with community-led bodies. Over time, there are opportunities to develop new infrastructure for ecotourism to support alternative livelihoods for the local communities, which can include shelters and signages around Sonadia, jetties and small-scale accommodation for visitors, and better management of plastic waste. This needs to be done in alignment with a robust site management and zoning plan and biodiversity monitoring framework in place, with delineation of important areas for waterbird conservation and marine turtle nesting, in coordination with village conservation groups (VCGs), new or established. There is also scope to strengthen the capacity of government agencies (Forest Department) to better manage Sonadia with the longer-term view of creating a protected area on Sonadia. Managing grazing activities from cattle in critical bird habitats is also necessary to minimise disturbance to sensitive areas for migratory waterbird congregations. Lastly, there is a need to strengthen local fishery cooperatives and management structures, again through improving access to financing (microcredit), while promoting and encouraging sustainable fishing practices for small-scale fisheries on the Sonadia Island coast.

1. Background of the Regional Flyway Initiative

In July 2021, the Asian Development Bank made a commitment to develop a long-term Regional Flyway Initiative (RFI) in the East-Asian Australasian Flyway (EAAF) (Sovereign Project 55056-001) to protect and restore priority wetland ecosystems and the associated ecosystem services they provide in the EAAF, the most threatened migratory bird flyway globally. The Initiative is slated for implementation in nine ADB developing member countries (DMCs) in East, South and Southeast Asia: Mongolia, People's Republic of China (PRC), Bangladesh, Viet Nam, Cambodia, Philippines, Thailand, Malaysia and Indonesia. In 2023, the geographic scope of the RFI was further extended to two DMCs in Southeast Asia and the Pacific respectively, Lao PDR and Papua New Guinea.

The primary aim of the RFI is to enhance and expand the existing efforts in conserving and managing wetlands of the highest priority for migratory birds within the EAAF through innovative loan and grant financing, and at scale. Consultations and analyses over the development period help identify key interventions to strengthen the management of wetlands, enabling the implementation of nature-based solutions while strengthening biodiversity protection. Over time, the RFI seeks to leverage collaborative opportunities by developing partnerships among important stakeholders including national governments, civil society organizations, communities, regional organizations like the East Asian-Australasian Flyway Partnership (EAAFP), development agencies, the private sector, and other relevant entities.

Through the RFI Technical Assistance (TA) implemented over the RFI's development phase from 2021 to 2024, BirdLife International takes the lead in providing and coordinating technical support for development of the RFI. This is carried out in collaboration with the EAAFP and a consortium of international non-governmental organizations including Wetlands International and the Paulson Institute, as well as two universities, namely the University of Southampton, UK and the National University of Singapore. Over the development phase, the TA team undertook a site selection analysis to identify priority wetland sites in all 10 countries based on recent bird data benchmarked against internationally accepted criteria under the Convention on Wetlands of International Importance (or Ramsar Convention), EAAFP Flyway Network Sites and Important Bird and Biodiversity Areas (IBAs). The team further developed ecosystem services profiles for prioritised wetlands using a multi-pronged approach used the TESSA ecosystem services assessment tool, and data-driven modelling of water-based ecosystem services and stored carbon.

In Bangladesh, a total of 20 wetland sites, including many Asian Waterbird Census (AWC) count sites, were initially assessed through data analysis and expert consultation, of which eight (8) were defined and identified to be RFI priority sites on the basis that they support more than 1% the flyway population of at least one EAAF migratory waterbird species. Five of the RFI sites identified in Bangladesh are coastal wetlands, a consequence of the country's long coastline and its estuarine geography, with the largest cluster of priority sites being the Sundarbans and the Meghna Delta, which consist of a cluster of three sites. 17 EAAF species exceeded the 1% threshold at the site level in Bangladesh, with species such as Masked Finfoot reaching in excess of 50% of its flyway (and global) population (eastern Sundarbans) and the Spoon-billed Sandpiper. Other species with important non-breeding populations in the Bangladesh include the Indian Skimmer *Rynchops albicollis* and the Baer's Pochard *Aythya baeri*.

2. Site profile of Sonadia Island

Location: This site includes Sonadia Island (Figure 1), a gently sloping low-lying barrier island, and adjacent Moheshkhali Island, both of which lie within Kutubjum Union, Moheshkhali Upazilla, Cox's Bazar District, Chittagong Division. Located on the far southeastern coast of Bangladesh, the site lies a few kilometres north of the Teknaf Peninsula, northwest of Cox's Bazar town. Sonadia Island is separated from Cox's Bazar by the Moheshkhali Channel and from Moheshkhali Island by the Bodor Khal.

Area: The Sonadia Island RFI site has an area of 9,823 ha.

Altitude: 0-4 m asl.

Geographical coordinates: 21.50 N, 91.88 E

Description of site: Sonadia Island is a complex of coastal and estuarine habitats, with the eastern part of the site fed by freshwater from the Bakkhali River estuary and Moheshkhali channel, and the western part of the site by the Kuhelia River. An intertidal sandy beach and sand dune ridge extends for approximately 12.5 km along the western side of Sonadia Island, from northwest to southeast. There are several sand bars/shoals along the upper northwestern part of the site (approximately two km in length) and adjacent to the Moheshkhali channel (approximately four km in length, but not continuous). Sonadia Island has two lagoons, one located in the south-eastern corner, approximately 35 ha in size, and the other in the north-western corner, approximately 2 ha in size. There are several salt marsh and mudflat areas fringed with intertidal grassy vegetation and mangrove saplings, with the largest undisturbed salt marshes in the south of Sonadia Island. The site supports the last remaining remnant (total area 500 ha) of natural mangrove forest in south-east Bangladesh, where the mangroves have developed in a lagoonal coastal setting rather than in a deltaic formation. The beaches and shallow shoals surrounding the site provide an excellent staging area and wintering ground for migratory waterbirds, and the sand dunes provide nesting grounds for marine turtles. The site is susceptible to cyclones and tidal surges and is predicted to be seriously impacted in the future by sea-level rise associated with climate change. The AWC counting locations at Sonadia Island are Beleker Dia (Sonadia), Kaladia (Sonadia), Kharir Char (Sonadia) and Tajiakata.

Site administration, management and land tenure: Sonadia Island is considered by the Bangladesh Government as an Ecologically Critical Area (ECA) and it was established as an EAAFP Flyway Network Site in 2011. The Department of Environment is responsible for ECA management, and the Forest Department is responsible for mangrove plantation and wildlife management. All wetlands in Bangladesh are government property controlled by the Ministry of Land, and Sonadia Island is managed by the district and upazilla land administration authorities (<https://eaaflyway.net/the-flyway/flyway-site-network>).

Social and economic values: Sonadia Island is located in a very densely populated region of Bangladesh, but there is limited development and disturbance there because the sandy beaches and sand-dunes are too unstable to support permanent buildings and other infrastructure, and freshwater is scarce in the tidal areas during the dry months. The current economic activities on the island include shrimp farming, salt farming during the dry season, and salt crop agriculture. A survey by Ilyas & Thompson (2018) estimated

12,000 people across five villages, mostly dependant on harvesting natural resources. A major section of the mangrove forest on Sonadia was lost prior to 2007 through local land grabs for shrimp farming and salt crop agriculture, but there are some newly forming mangrove forests along the island’s eastern and western coasts, as well as a plantation of mangrove trees managed by the Forest Department. The Bangladesh Government is planning to develop Sonadia Eco-Tourism Park, an international eco-tourist destination that aims to encourage sustainable tourism, but which has the potential to unintentionally harm the natural environment through park construction and the influx of tourists (Hossain *et al.* 2023).

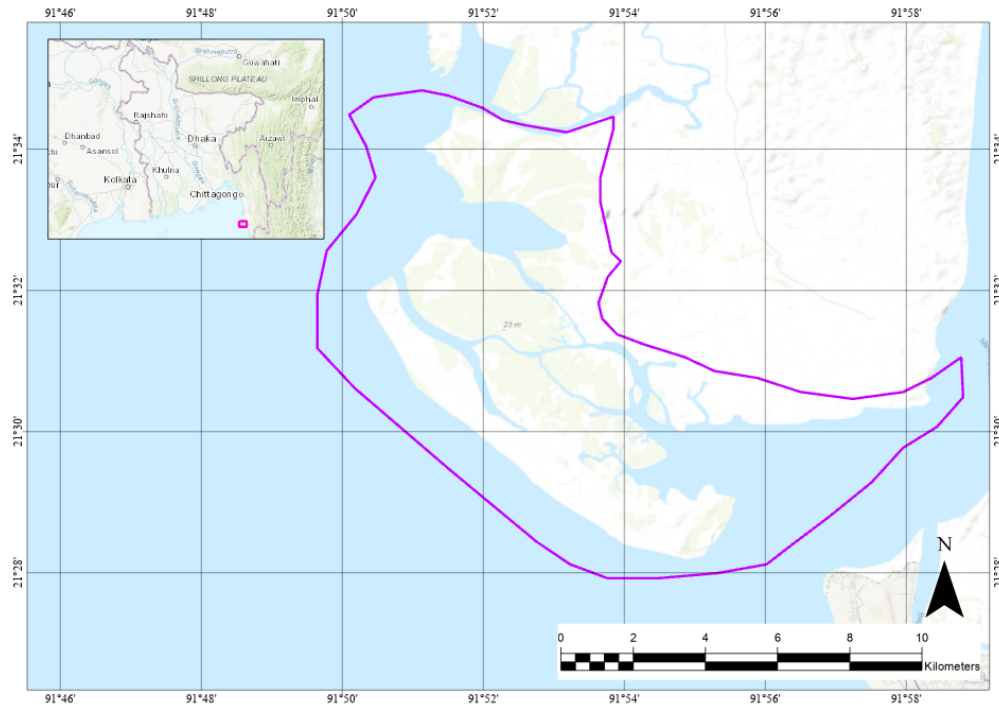


Figure 1 Map of Sonadia Island, showing its boundary (in purple) and location within Bangladesh (in pink) (data from EAAFP Site Information Sheet).

As a remote wetland in Cox’s Bazar where the main source of local livelihoods for local communities (estimated at 12,000 people by Ilyas & Thompson (2018)) is fishing and shrimp collection, Sonadia’s coastal wetlands face many threats ranging from unsustainable fisheries, illegal wildlife hunting to marine plastic pollution (Howlader et al. 2024). The main management stakeholder for Sonadia, until recently was the Bangladesh Economic Zones Authority (BEZA) although some rights in the management of the estimated c. 3,800 hectares of land on Sonadia has recently been transferred to the Bangladesh Forest Department for biodiversity conservation purposes. A part of Sonadia Island is also recognised as an ‘Ecologically Critical Area’ by the Government. To date, several village-level conservation groups (VCGs) have been established in Sonadia by the Department of Environment (see Ilyas & Thomson 2018) and local conservation organisations working on shorebird conservation projects, including the ‘Bangladesh Spoon-billed Sandpiper Project’ and IUCN Bangladesh. The recent transfer of jurisdiction of land on Sonadia to the BFD presents new opportunities to strengthen the management of Sonadia’s intertidal

wetlands, while increasing the participation of the local communities in natural resources management groups such as 'village conservation groups. These groups can play a bigger role in supporting biodiversity monitoring and implementing regulations to manage grazing activities.

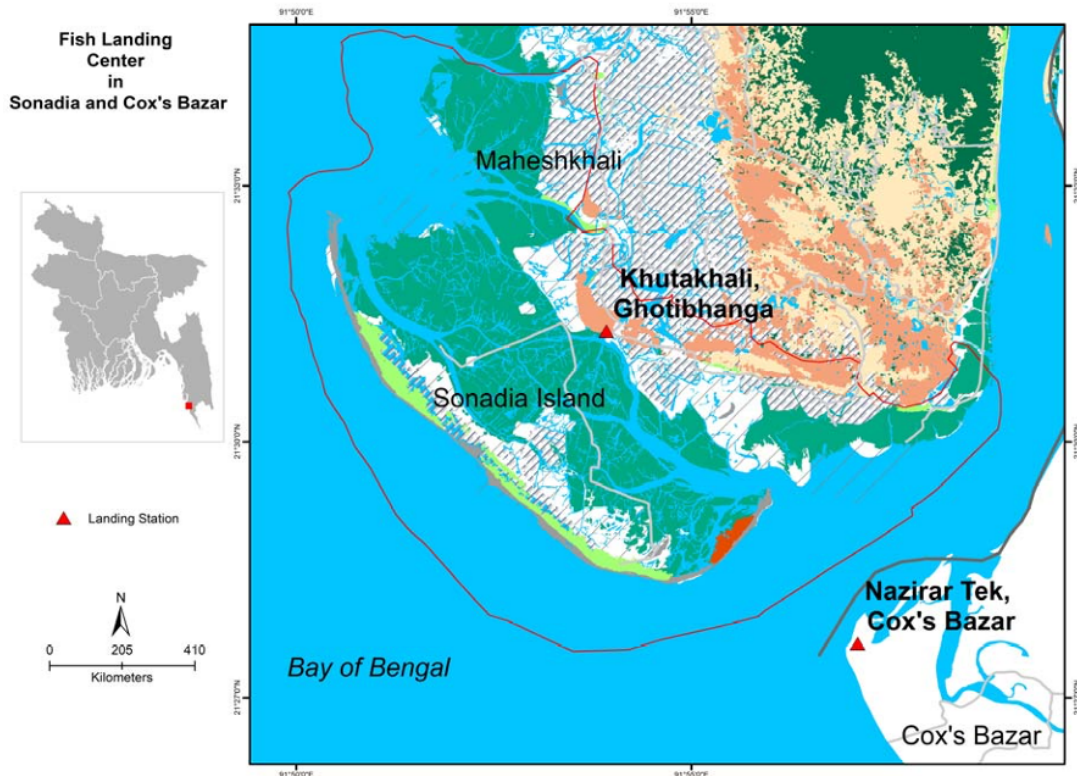


Fig. 6.1 Location of Sonadia ECA and fish landing centers monitored by CREL

Figure 2 Fish landing areas in Sonadia Island and adjacent parts of Cox's Bazar (adapted from Ilyas & Thompson 2018)

3. Biodiversity value of Sonadia Island

3.1. Key habitats

Sonadia Island is separated from Cox's Bazar by the shallow Moheshkhali Channel and holds a complex of coastal and estuarine wetland habitats, with the eastern part of the site fed by freshwater from the Bakkhali River estuary and Moheshkhali channel, and the western part from the Kuhelia River. An intertidal sandy beach and sand dune ridge extends along the length of the western coast of Sonadia, broken by a lagoon in the southeast.

There are several salt marsh and mudflat areas fringed with intertidal grassy vegetation and mangrove saplings, with the largest undisturbed salt marshes in the south of Sonadia Island. The site supports the last remaining remnant (total area 500 ha) of natural mangrove forest in south-east Bangladesh, where the mangroves have developed in a lagoonal coastal setting rather than in a deltaic formation.

Key habitat types in Sonadia Island, based on the stakeholder-based assessment at the Regional Flyway Initiative workshop in May 2024, included permanent shallow marine waters, marine subtidal aquatic beds, sand, shingle, or pebble shores, estuarine waters, intertidal mud, sand or salt flats, intertidal marshes, and intertidal forested wetlands.

3.2 Importance of Sonadia Island to migratory waterbirds

The intertidal wetlands at Sonadia Island are important feeding and roosting habitats for many migratory (and resident) waterbirds. Count data from the 2014, 2015, 2016, 2017 and 2020 Asian Waterbird Census (AWC) was used in the RFI priority sites analysis. The count results were averaged over these five years, and then compared against the Conservation Status Review (CSR1) 1% population estimates to calculate a score for each species. The two migratory waterbird species were found to regularly exceed the 1% population thresholds during these five years (see Table 1), and the CSR1 scores for these species were summed to produce the overall site score.

Sonadia Island is outstandingly important for Spoon-billed Sandpiper *Calidris pygmaeus* (CR), with the CSR1 score indicating that this site regularly supports almost 2% of the flyway (and global) population of the species (see also Chowdhury & Foysal 2017). In addition, the AWC recorded small numbers of five other threatened and near-threatened waterbird species on Sonadia Island between 2014 and 2020, namely Spotted Greenshank *Tringa guttifer* (EN), Curlew Sandpiper *C. ferruginea* (NT), Red-necked Stint *C. ruficollis* (NT), Black-headed Ibis *Threskiornis melanocephalus* (NT) and Eurasian Curlew *Numenius arquata* (NT). A survey of Sonadia Island in March 2010 recorded 25 Spoon-billed Sandpiper (well over 5% of the global estimated population), 28 Spotted Greenshank and 433 Great Knot *Calidris tenuirostris* (EN).

Table 1 List of migratory species (based on the EAAFP list of species) with globally significant congregations on Sonadia Island.

Species name	IUCN	Average count	CSR1	CSR1 score
Lesser Sandplover <i>Charadrius mongolus</i>	LC	924	300	3.1
Spoon-billed Sandpiper <i>Calidris pygmaea</i>	CR	15	8	1.8

3.3 Other notable biodiversity

Sonadia Island is an important nesting ground for both Olive Ridley *Lepidochelys olivacea* (VU) and Green Turtles *Chelonia mydas* (EN) (Ahsan et al. 2014), and the globally threatened Indo-Pacific Finless Porpoise *Neophocaena phocaenoides* (VU) and Irrawaddy Dolphin *Orcaella brevirostris* (EN) also occur there.

4. Ecosystem services

4.1. Ecosystem services provided by Sonadia Island

Sonadia Island encompasses diverse coastal habitats, providing valuable provisioning and regulating ecosystem services (Figure 3). The results from the RFI workshop¹ highlight the top ecosystem services provided by the site, emphasising their essential and non-substitutable nature (Table 2). Provisioning services, particularly fresh water and cultivated food, benefit communities within and adjacent to the site. Regulating services such as flood hazard regulation, storm hazard regulation, and erosion regulation are crucial, benefiting communities within, adjacent to, and, in the case of storm hazard regulation, distant from the site.

¹ Asian Development Bank. (2024, May 27–29). *Bangladesh: Wetland Ecosystem Services Workshop* [Workshop]. Srimangal, Moulvibazar, Bangladesh. <https://events.development.asia/learning-events/bangladesh-wetland-ecosystem-services-workshop>

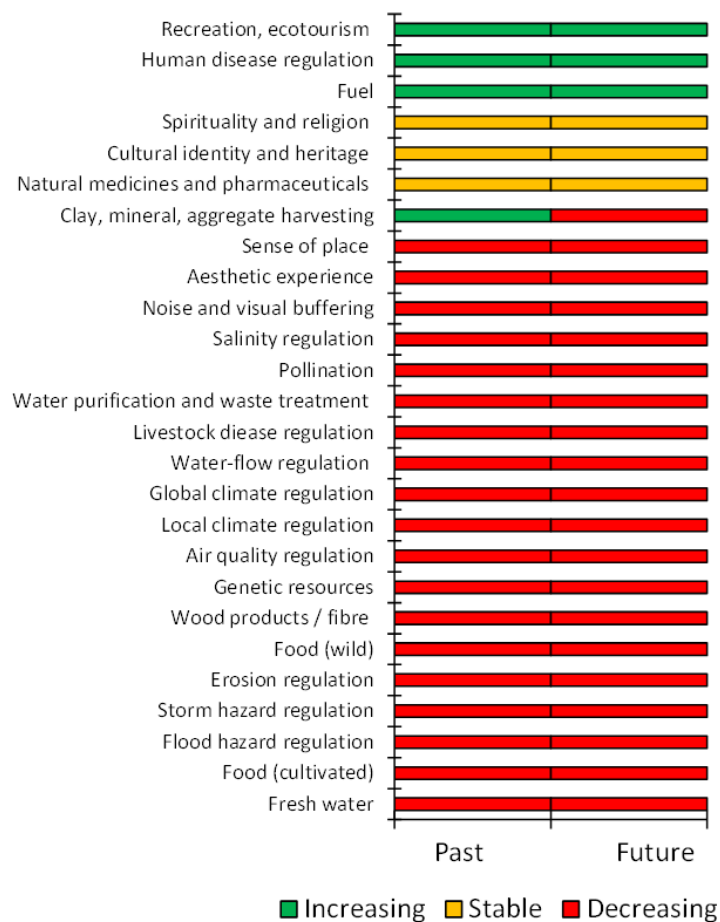


Figure 3 List of ecosystem services provided by Sonadia Island, as identified through stakeholder consultation at the Regional Flyway Initiative workshop.

Table 2 List of top ecosystem services provided by Sonadia Island.

Ecosystem services	Essential or non-substitutable	Benefits to communities			Change	
		Within the site	Adjacent to the site	Distant to the site	Past	Future
<i>Provisioning services</i>						
Fresh water	Yes	✓	✓		Decrease	Decrease
Food (cultivated)	Yes	✓	✓		Decrease	Decrease
<i>Regulating services</i>						
Flood hazard regulation	Yes	✓	✓		Decrease	Decrease
Storm hazard regulation	Yes	✓	✓	✓	Decrease	Decrease
Erosion regulation	Yes	✓	✓		Decrease	Decrease

4.2. Global climate regulating services

Based on systematic reviews (Chen and Lee, 2022; Stankovic et al., 2023), the amount of carbon stored in Sonadia Island is estimated to range from 174,000 to 1,120,000 tonnes, while the annual carbon sequestration rate is estimated to be between 5,860 and 7,330 tonnes per year.

4.3. Coastal protection services

The coastal protection services provided by Sonadia Island were assessed using both biophysical indices and monetary values (see Tables A1 and A2, and Annex 1 for details). When compared to both the average of the five RFI coastal sites and the average of all other coastal areas in Bangladesh (Table A3 in Annex 1), Sonadia Island shows some only partly mixed results in terms of risk level:

1. for the potential exposure to coastal hazards, Sonadia Island is consistently above average compared to RFI coastal sites (index: 3.45 vs. 3.13), but above average compared to all other coastal areas (index: 3.45 vs. 2.99);
2. for the contribution to reducing coastal risk as a proportion of population density within 2.5 km of the coast, Sonadia Island is also consistently above average (89 vs. 26 people/ha for RFI coastal sites 12 vs. 38 people/ha for all other coastal areas); and
3. for the contribution to reducing coastal risk as a percentage of the maximum potential exposure, Sonadia Island is below average compared to RFI coastal sites (2.27% vs. 2.39%) but above average compared to all other coastal areas (2.27% vs. 1.69% for all other coastal areas).

In monetary terms (Table A4 in Annex 1), Sonadia Island ranks well below both the national RFI and overall country averages in terms of total annual benefits per ha of mangroves (7,176 vs. 165,936 or 18,638 USD/ha). Moreover, Sonadia Island is also below the average of all RFI coastal sites in Bangladesh regarding benefits against 100-year return period storms (73 vs. 544 million USD).

5. Drivers of change and their potential impacts on Sonadia Island

5.1. Current drivers of change and their level of impact

Stakeholders at the RFI workshop² identified 53 drivers of change impacting Sonadia, and their corresponding levels of impact on the wetland site (Table 3). High-impact drivers include commercial and industrial areas, which significantly alter natural habitats and contribute to pollution. Biological resource use, such as fishing, killing, and harvesting of aquatic resources, poses substantial threats to biodiversity. Housing and settlement developments further fragment the landscape, while industrial mining, military effluents, and mining and quarrying degrade the environment. Other high-impact activities include isolation from natural habitats, loss of hydrological connectivity, loss of keystone species, oil and gas drilling, large-scale port operations, and recreational activities, along with tourism infrastructure. Natural events such as storms and flooding add to the site's high-impact challenges.

Medium-impact drivers involve agricultural and forestry effluents, which degrade water quality. Additional medium-level impacts include air-borne pollutants, non-timber crop production, and hydrological modifications due to dams. Habitat clearing, shifting, erosion, siltation, garbage and solid waste, livestock farming, household sewage, and urban wastewater contribute to habitat degradation. Other medium-impact factors include shipping lanes, temperature extremes, and restoration for conservation, which has moderately modified the site.

² Asian Development Bank. (2024, May 27–29). *Bangladesh: Wetland Ecosystem Services Workshop* [Workshop]. Srimangal, Moulvibazar, Bangladesh. <https://events.development.asia/learning-events/bangladesh-wetland-ecosystem-services-workshop>

Table 3 Drivers of change and their potential impact on the integrity of Sonadia Island based on consultations with stakeholders.

Driver of change	Impact
Commercial and industrial areas	High
Fishing, killing and harvesting of aquatic resources	
Housing and settlement	
Increased fragmentation within the wetland site	
Industrial, mining and military effluents	
Isolation from other natural habitats	
Loss of hydrological connectivity	
Loss of keystone species	
Mining and quarrying	
Oil and gas drilling; extraction of sand	
Ports with large scale loading and unloading of goods	
Recreational activities and tourism	
Storm and flooding	
Tourism and recreation infrastructure	
Agricultural and forestry effluents	Medium
Air-borne pollutants	
Annual and perennial non-timber crop production	
Dams within or upstream of the wetland site, which alter the hydrological regime	
Dams, hydrological modification and water management/use	
Desertification	
Drought conditions	
Earthquakes/tsunamis	
Erosion and siltation/deposition	
Garbage and solid waste	
Habitat clearing	
Habitat shifting and alteration	
Household sewage and urban wastewater from outside the wetland site	
Livestock farming and grazing	
Restoration for conservation	
Shipping lanes and canals	Low
Temperature extremes	
Activities of site managers	
Collecting terrestrial plants or plant products (non-timber)	
Destruction of cultural heritage buildings, gardens, sites, etc.	
Droughts	
Drug cultivation	
Energy generation, including from hydropower dams, wind farms and solar panels	
Excess energy	
Hunting, killing and collecting of terrestrial animals	
Introduced genetic material	
Invasive animal species	
Invasive plant species	
Loss of cultural links, traditional knowledge and/or management practices	
Marine and freshwater aquaculture	
Natural deterioration of important cultural wetland site values	
Pathogens	
Research, education and other work-related activities	
Roads and railroads	
Sewage and wastewater from wetland site facilities	
Utility and service lines	
Vandalism, destructive activities or threats to staff and visitors	
Water extraction/diversion within the wetland site or catchment	
Wood pulp and plantations	

5.2. Potential alternative state of Sonadia Island under current drivers of change

Stakeholders at the RFI workshop³ defined the most plausible future alternative state (to 2035), and how this will translate to a net change in the cover of different types of wetland habitat types within this site (current habitat cover vs future alternative cover; Figure 4). The alternative state of the site assumes there will be no changes in the current drivers of change impacting the site, and the current management regime (also see Nusrat et al. 2024).

³ Asian Development Bank. (2024, May 27–29). *Bangladesh: Wetland Ecosystem Services Workshop* [Workshop]. Srimangal, Moulvibazar, Bangladesh. <https://events.development.asia/learning-events/bangladesh-wetland-ecosystem-services-workshop>

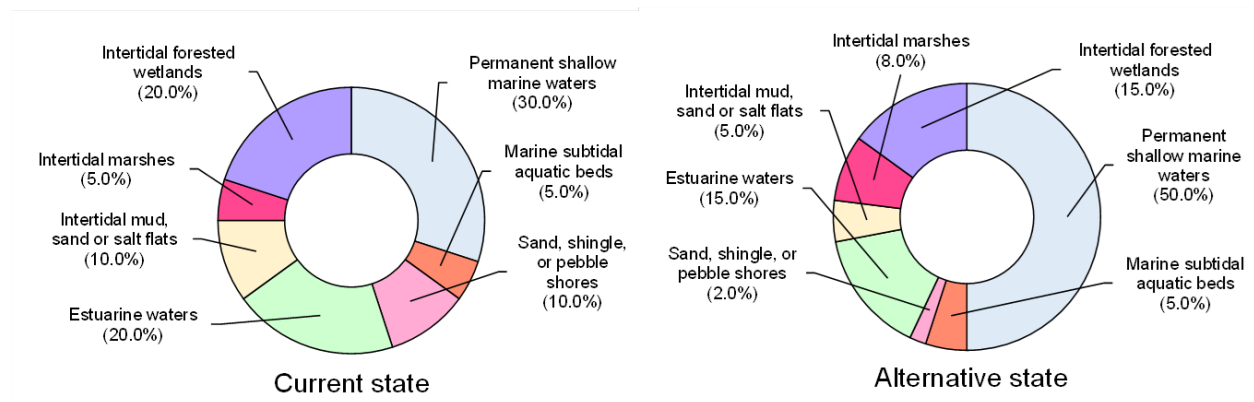


Figure 4 The proportional change in the extent of different habitat types between the current and alternative states of Sonadia Island.

5.3. Expected changes in the ecosystem services of Sonadia Island

Stakeholders at the RFI workshop⁴ documented the future trends in the provision of ecosystem services in Sonadia Island, indicating if the ecosystem services provided by this site (to 2035) will increase, decrease, or will remain stable if the current drivers of change impacting this site will continue in their present condition, with the intervention remains unchanged.

Figure 2 and Table 2 highlight that provisioning services for fresh water and cultivated food have experienced a decrease in the past and are projected to continue declining in the future. Regulating services such as flood hazard regulation, storm hazard regulation, and erosion regulation have shown a decrease in the past and are expected to continue declining.

In the alternative state, the loss of 25% of mangrove and 13% of intertidal mudflat will result in a loss of stored carbon, estimated to be between 27,700 and 236,000 tonnes, and a decrease in carbon sequestration rate (carbon accumulation) by approximately 1,240 to 1,610 tonnes per year.

A loss of 491.2 ha of mangroves as presented in Table A5, however equivalent to only 5% of the total land use for the site, is expected to result in roughly a 16% reduction in coastal protection. This may amount to approximately 3.5 million USD in lost total benefits per year (based on 7,176 USD per hectare of mangroves) and 11.6 million USD in lost total benefits per 100-year return period storm.

⁴ Asian Development Bank. (2024, May 27–29). *Bangladesh: Wetland Ecosystem Services Workshop* [Workshop]. Srimangal, Moulvibazar, Bangladesh. <https://events.development.asia/learning-events/bangladesh-wetland-ecosystem-services-workshop>

6. Capacity needs in Sonadia Island

The stakeholder consultation and analyses with stakeholders representing government and civil society identified at least eight stakeholder groups with defined roles in the sustainable management of wetlands in Sonadia Island and the adjacent Chattogram coastline. The Bangladesh Forest Department, a key stakeholder, for instance, currently (and is expected to play) key roles in ensuring that the Sonadia’s wetland landscape is well managed and protected (see Table 4), but it faces major capacity limitations for site management and enforcement of regulations on the ground. The second largest stakeholder group are the local communities (including farmers, fishers and salt farmers) – an estimated 12,000 people live on Sonadia Island and actively benefit from the rich fisheries in the coastal waters. Some local or village conservation groups have been formed by the Department of Environment to drive the implementation of environmental protection measures such as the development of alternative livelihoods, managing a turtle hatchery, and the restoration of degraded vegetation (Ilyas & Thomson 2018).

Another gap identified is the unclear administrative jurisdictions and policy overlaps across different government stakeholders, a problem faced by many wetland sites; addressing it will require concerted efforts to strengthen coordination and organisation structures across government bodies. In parallel, there is a clear need to continue work to strengthen livelihood means of local communities, including through co-management structures already tried and tested elsewhere in Bangladesh.

Table 4 Stakeholder groups and their corresponding capacity gaps and needs.

Stakeholder group	Current role in wetland management	Challenges faced and capacity gaps	Form of capacity development (e.g. training, organisational strengthening etc.)
Bangladesh Forest Department	Develop and implement management plans; biodiversity conservation and site management. Enforcement of environmental regulations.	Capacity gaps in monitoring and enforcement. Overlap in jurisdictions with other government bodies.	Training on how to access to global carbon markets to strengthen site management. Strengthening technical framework and basis of monitoring and enforcement.
Department of Environment	Enforcement of environmental regulations.	Capacity gaps in monitoring and enforcement	Strengthening technical framework and basis of monitoring. Strengthen capacity for enforcement of environmental regulations.
Bangladesh Economic Zone Authority (BEZA)	Oversee and manage the acquisition of land and economic activities. Oversee management of pollution.	Overlap in jurisdictions with other government bodies on land use and management.	Strengthen coordination and consultation with other government bodies.

Stakeholder group	Current role in wetland management	Challenges faced and capacity gaps	Form of capacity development (e.g. training, organisational strengthening etc.)
Local governments and administration	Administration of local land rights; litigation. Oversight and management of community structures.	Jurisdiction overlaps (intrusions)	Organisation strengthening, and improve coordination with other government stakeholders
Local communities	Harvest fish and other marine products from coastal waters and wetlands.	Illegal encroachment and harvest approaches, overharvests	Participation in local conservation groups. Training to undertake environmental protection and conservation activities (including shorebird and turtle conservation work)
Tourism operators	Positive contribution to livelihoods and the local economy	May contribute to novel environmental issues.	Strengthen awareness in sustainable tourism activities
Conservation organisations (NGOs) and research institutions	Contribute to local development and biodiversity conservation. Drive capacity building for local stakeholders	High	Provide continued capacity building for local stakeholders

7. Opportunities for RFI interventions

7.1 Recommended Interventions

Over time, there are new opportunities to develop new infrastructure for ecotourism, which can include shelters and signage (around Sonadia). This needs to be done in alignment with a robust site management plan and a biodiversity monitoring framework in place. There is scope under any proposed new project to strengthen the capacity of government agencies (Forest Department, Department of Environment) for biodiversity protection and site management, including a revision of the site management plan for Sonadia. Managing grazing activities from cattle and human use in critical bird habitat to minimise disturbance to sensitive areas for migratory waterbirds.

Sonadia draws a steady stream of tourism from Cox’s Bazar, but there are limited resources and capacity for local communities to strengthen ecotourism infrastructure and services. This may be achieved through small-scale microloan financing for local tourism operators in Cox’s Bazar and communities on Sonadia. This will enable local people to acquire better resources to serve tourism activities (including boats and their maintenance)

Local fishery cooperatives will need to be strengthened, again by including improved access to financing (microcredit), while sustainable fishing practices are promoted and encouraged for small-scale fisheries on the Sonadia Island coast, given that current catches (of mostly small fish) suggests that Sonadia’s waters have been unsustainably fished.

Table 5 Summary of key RFI interventions proposed for Sonadia Island.

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
<i>Component 1: Coastal wetland habitat protection and management</i>					
Stronger wildlife protection with focus on migratory birds. Addressing illegal hunting of birds.	Restoration of wildlife populations. Increased protection for migratory species.	Number of wildlife protection policies facilitated	50,000.00	2 years	Bangladesh Forest Department Department of Environment
Improve zonation of the Ecologically Critical Area (ECA) for biodiversity protection, led by the Forest Department.		Number of improved ECA zonation facilitated	50,000.00	5 years	Bangladesh Economic Zone Authority (BEZA) Local governments and administration

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Improving waste management infrastructure to address coastal and marine (plastic) pollution.	Marine pollution is reduced. Overall impact on fisheries reduced.	Number of improved waste management facilities Volume of waste diverted from nature through recycling, proper segregation and collection, and landfill management	500,000.00	2-3 years	Local communities Conservation NGOs Research institutions
<i>Component 2: Strengthening sustainable wetland-based ecotourism</i>					
Strengthening ecotourism opportunities with a focus on building the capacity of small-scale operators through training on best practices.	Improved livelihoods for some local communities, through alternative income streams.	Number of people benefitting from livelihood activities, with up to 30% beneficiaries from women, youth, elderly, indigenous people, and other vulnerable groups	1,000,000.00	2 years	Bangladesh Forest Department Department of Environment Bangladesh Economic Zone Authority (BEZA)
Establishing of new ecotourism cooperative, with access to a revolving fund for local communities.		Number of people trained on livelihood activities and microcredit. New ecotourism cooperative organized	200,000.00	2-3 years	Local governments and administration Local communities Conservation NGOs
Socioeconomic surveys and consultation meetings with local communities. Maintenance and creation of existing VCGs.				100,000.00	5 years
Total investment for five years			4,950,000.00		

7.2 Potential Financing

The estimated project cost is USD 4,950,000 over a five-year period. This project budget includes consultation meetings with local communities, capacity-building activities for sustainable fisheries and ecotourism, the construction of new ecotourism infrastructure, the establishment of a waste management and disposal system, the creation of new protected wetland areas, and the updating of the site management plan to incorporate a biodiversity monitoring framework.

7.3 Proposed Institutional Arrangements

A track record of local community participation and empowerment has been developed in parts of Sonadia Island through existing projects, which have culminated in the establishment of several village conservation groups to bring together stakeholders from local communities.

Capacity-building and awareness activities may be led by the Bangladesh Forest Department and the Fisheries Department, in coordination with conservation organisations and local administrations, and implemented over a period of 3-5 years. Civil society organisations with a focus on biodiversity conservation and fisheries (rural) development can play a major role with leading and delivering training activities on the ground at the selected villages. The Fisheries Department in coordination with the local administration, may lead the implementation of fishery-related components of the project, focusing on activities to, (1) establish new co-management structures and RMOs, (2) scope and develop co-management plans (2-4 years) at selected communities, and work with conservation NGOs to implement the management plans.

7.4 Project Beneficiaries

The current economic activities on the island include shrimp farming, salt farming during the dry season, and salt crop agriculture. A survey by Ilyas & Thompson (2018) estimated 12,000 people across five villages, mostly dependent on harvesting natural resources.

There are few indigenous communities in Sonadia, but there are major opportunities to strengthen the representation of women and poor fishing communities (including fishing households not represented in any wider frameworks) across the nearly 2,000 households along the Sonadia coast. This includes establishing or influencing co-management structures for fisheries and village conservation groups.

7.5 Anticipated Implementation Risks

Social Safeguards: The implementation of new fish harvesting regulations, as part of a wider fisheries management strategy, is expected to have major implications on the livelihoods and incomes of local communities in the short term, due to reduced number of fishing days, and banning of unsustainable practices. Scoping studies will be needed to assess the impact of fishing quotas on domestic incomes and the challenges of implementing quotas in a complex environment.

Environment: Most proposed interventions are relatively soft and have a low environmental impact, but it may be necessary to consider the effects of expanding tourism on Sonadia, which could increase anthropogenic pressures on the island's wetlands and lead to increased disturbance to wildlife. Planning with stakeholders on how to reduce noise pollution during the construction of ecotourism facilities and ongoing ecotourism activities, as well as managing waste pollution from the influx of tourists, is essential.

Political and Governance: Understanding the relevant management stakeholders, their roles, conservation priorities, and capacity is essential for implementing project interventions effectively. This will also help map out administrative jurisdictions and policy overlaps related to wetland management across different government stakeholders.

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Annex 1. Supplementary information on coastal protection services

To further validate the identification of the top ecosystem services by means of stakeholder consultation, an expectedly essential or non-substitutable regulating service across all RFI sites, namely coastal protection and flood mitigation (i.e., storm and flood hazard regulation), was assessed based on a combination of globally available datasets supplemented by web-based tool Co\$tingNature (Mulligan, 2022). Estimates for coastal protection by mangroves (after the effects of coral reefs) were spatially inferred in QGIS from a selection of metrics expressing different biophysical and monetary values modelled by Chaplin-Kramer et al. (2023) and Menéndez et al. (2020), respectively.

The key metrics selected for biophysical values (Table A1) were current maximum potential exposure to coastal hazards, which is a vulnerability risk index calculated in InVEST^[1] for several hazard variables (i.e., wind, waves, sea level rise, geomorphology, and bathymetry) in the hypothetical absence of current mangrove extent, and nature’s (i.e., the mangroves’) contribution to reducing this coastal risk, both as an absolute value multiplied by the local population affected and a percentage of the maximum potential exposure.

Table A1. Contribution of mangroves to coastal protection as a critical natural asset in Sonadia Island based on site-level (biophysical) values inferred from Chaplin-Kramer et al. (2023) and expressed as ranges to represent the resulting uncertainty. Key metrics are in italics.

Critical contribution of mangroves to coastal protection (metrics)	Risk levels
Current population density within 2.5 km of the coast (number of people per hectare)	1,055 – 1,217
<i>Current maximum coastal risk to be mitigated, or potential exposure to coastal hazards (unitless index)</i>	<i>3.37 – 3.53</i>
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC’s Shared Socioeconomic Pathway #1 ‘Sustainability’ (unitless index)	3.78 – 3.97
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC’s Shared Socioeconomic Pathway #3 ‘Regional Rivalry’ (unitless index)	4.04 – 4.24
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC’s Shared Socioeconomic Pathway #5 ‘Fossil-fueled Development’ (unitless index)	4.24 – 4.45
Current proportional risk reduction, nature’s contribution to reducing coastal risk as a proportion of maximum coastal risk (unitless index)	0.05 – 0.11
<i>Nature’s contribution to reducing coastal risk as a proportion of population density within 2.5 km of the coast (# of people per hectare)</i>	<i>57 - 121</i>
<i>Nature’s contribution to reducing coastal risk as a percentage of the maximum potential exposure (%)</i>	<i>1.47 - 3.07</i>

The key metrics selected for economic values (Table A2) were the annual expected flood protection benefits to total stock, which is the monetary value of the averted damages to the industrial and residential stocks (i.e., property) in 2015 US\$, the same total annual benefits expressed per hectare of mangroves, and the total benefits in the event of a 100-year return period storm, which are the rarest of cyclonic conditions but cause the most flood damages to property (i.e., maximum level of coastal protection by mangroves).

Table A2. Coastal protection benefits offered by mangroves in Sonadia Island based on site-level (monetary) values inferred from Menéndez et al. (2020) and expressed as ranges to represent the resulting uncertainty. Key metrics are in italics.

Benefits of mangroves in terms of coastal protection (metrics)	Avoided costs (US\$)
Mangrove extent (hectares) ^[2]	30 – 3,873
Annual expected flood protection benefits to people (number of people)	25,377 – 28,574
Annual expected flood protection benefits to Industrial Stock (US\$)	13,754,779 – 15,487,340
Annual expected flood protection benefits to Residential Stock (US\$)	8,108,946 - 9,130,355
<i>Annual expected flood protection benefits to Total Stock (US\$)</i>	<i>20,754,000 – 23,368,188</i>
<i>Annual expected flood protection benefits to Industrial Stock per hectare of mangroves (US\$ per hectare)</i>	<i>6,751 – 7,602</i>
1-in-100-year return period damage in terms of area flooded (number of hectares)	8,001 – 8,223
<i>Total expected flood protection benefits of mangroves per 100-year return period storms (US\$)</i>	<i>71,614,864 - 73,599,251</i>

Table A3. Biophysical benefits from RFI coastal wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	Max pot exp (index)	Risk reduction (index * pop)	Risk reduction (% max pot exp)
Central Meghna Delta	3.11 (±0.02)	17 (±2)	0.61 (±0.11)
Eastern Meghna Estuary	3.09 (±0.05)	No Data	No Data
Eastern Sundarbans	2.91 (±0.02)	29 (±2)	4.00 (±0.16)
Nijuhum Dwip NP & FNS	3.10 (±0.06)	0 (±0)	5.06 (±0.69)
Sanadia Island FNS	3.45 (±0.08)	89 (±32)	2.27 (±0.80)
Bangladesh RFI average	3.13	26	2.39
Bangladesh national average	2.99	38	1.69

Table A4. Monetary benefits from RFI coastal wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	Total annual benefits (US\$)	Per mangrove area (US\$/ha)	For 100-yr return period storms (US\$)
Central Meghna Delta	385,472,048 (±48,974,595)	794,504 (±100,942)	1,476,259,077 (±858,019,635)
Eastern Meghna Estuary	8,289,751 (±48,734)	1,050 (±6.17)	53,592,048 (±786,645)
Sundarbans	167,762,956 (±54,512,767)	5,607 (±1,822)	1,098,664,838 (±3,285,219,032)
Nijhum Dwip NP & FNS	19,582,720 (±994,316)	21,346 (±1,084)	19,090,534 (±19,325,668)
Sonadia Island FNS	22,061,094 (±20,477,324)	7,176 (±425)	72,607,057 (±992,19)
Bangladesh RFI average	120,633,714	165,936	544,042,711
Bangladesh RFI total	603,168,569	Not Applicable	2,720,213,554
Bangladesh national average	15,050,804	165,936	87,177,719
Bangladesh national total	872,946,651	Not Applicable	4,533,241,399

Table A5. Key habitat types in Sonadia Island based on stakeholder-based assessment at the Regional Flyway Initiative workshop in May 2024.

Habitat type	Current state		Alternative state (2035)	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)
Permanent shallow marine waters	2946.9	30.0	4911.5	50.0
Marine subtidal aquatic beds	491.1	5.0	491.1	5.0
Sand, shingle, or pebble shores	982.3	10.0	196.5	2.0
Estuarine waters	1964.6	20.0	1473.4	15.0
Intertidal mud, sand or salt flats	982.3	10.0	491.1	5.0
Intertidal marshes	491.1	5.0	785.8	8.0
Intertidal forested wetlands	1964.6	20.0	1473.4	15.0
Total	9822.9	100.0	9822.9	100.0