



Regional Flyway Initiative · Site Study

May 2026

RFI Priority Site · Hakaluki Haor

Prepared by Ding Li Yong & Mike Crosby, with additional input from Billy Fairburn, Kelvin Peh, Evelyn Pina-Covarrubias, Stefano Barchiesi and Radhika Bhargava

BirdLife International, University of Southampton, University of Singapore

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General Site Information

Country	Bangladesh		
RFI Site Name	Hakaluki Haor	ID005	
City/ Municipality, Province, Region	Moulvibazar District, Sylhet Division		
Geographical coordinates	24.65 N, 92.08 E	Area (has)	19,225 has
Key species	EAAF migratory species: Common Pochard, Falcated Duck, Baer's Pochard. Other important species: Pallas's Fish Eagle, Fishing Cat		
Key habitats (biomes)	permanent freshwater marshes/ pools, seasonal/ intermittent freshwater marshes/ pools, shrub-dominated wetlands, freshwater, tree-dominated wetlands, seasonal/ intermittent/ irregular rivers/ streams/ creeks, permanent freshwater lakes, and seasonal/ intermittent freshwater lakes.		
Key ecosystem services	Flood protection services; cultivated goods (e.g. rice), wild harvested goods (fisheries)		
Key drivers of change	Livestock farming, water management, expansion of settlements/residential areas		
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	Hakaluki Haor		
Management Stakeholders	Department of Environment, District Land Administration		
With management plan?			
Project concept themes	Capacity building for local conservation groups. Alternative livelihood capacity building for nature-based tourism and sustainable fisheries.		
Length of project	5 years		
Sector/s	To be confirmed		
No. of potential beneficiaries			
Indigenous Peoples	<input type="checkbox"/> No	<input checked="" type="checkbox"/>	Yes _____
Anticipated Implementation Risks	Conservation priorities and capacity of wetland management stakeholders		
Estimated Project Budget (US\$)	5,500,000 over five years		
Potential Source/s of Financing	<input checked="" type="checkbox"/> Loan (to be identified)	<input type="checkbox"/>	Private Sector
	<input type="checkbox"/> Grant	<input type="checkbox"/>	Public-Private Partnership

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Abbreviations

ADB	Asian Development Bank
BDT	Bangladesh Taka
CREL	Climate Resilient Ecosystems and Livelihoods
CSR	Conservation Status Review
DMC	Developing Member Country
EAAFP	East Asian-Australasian Flyway Partnership
IBA	Important Bird and Biodiversity Area
MACH	Management of Aquatic ecosystems through Community Husbandry project
NGO	Non-governmental Organisation
RFI	Regional Flyway Initiative
RMO	Resource Management Organisation
TESSA	Toolkit for Ecosystem Services Assessment
USAID	United States Agency for International Development
USD	United States Dollars
VCG	Village Conservation Group

Executive Summary

Hakaluki Haor is a large freshwater wetland spanning Moulvibazar and Sylhet Districts, in northeast Bangladesh. As the largest freshwater wetland in the region, Hakaluki Haor covers an area of nearly 20,000 ha, although during the dry season, the *beels* or water bodies shrink to about 4,440 ha. The Hakaluki Haor wetlands support very large congregations of migratory ducks, of which four species were found to regularly exceed the 1% population thresholds at the EAAF level, notably Ferruginous Duck *Aythya nyroca* (NT). There are also small but regular numbers of five globally threatened and near-threatened species, including Falcated Duck *Mareca falcata* (NT), Common Pochard *Aythya ferina* (VU), Baer's Pochard *Aythya baeri* (CR), a species which has rapidly declined in recent decades. The Pallas's Fish-eagle *Haliaeetus leucoryphus* (EN), a well-known flagship species of South Asian wetlands is also known to breed here, with several known pairs. The wetlands of Hakaluki Haor are assessed to provide key ecosystem services for local communities, particularly in the form of flood protection, and the provisioning of freshwater for agriculture, harvested and cultivated goods. In fact, Hakaluki hosts one of the largest inland fisheries in Bangladesh. In recognition of its importance to migratory species, Hakaluki Haor was designated as an EAAFP Flyway Network Site in 2011. It is currently managed by the District Land Administration (of both Moulvibazar and Sylhet), and the Department of Environment (DoE), which considers the site an Ecologically Critically Area (ECA). Local people are also involved in the protection of the site in the form of village conservation groups, and they have some jurisdiction over 1,000 ha of wetlands.

Like wetlands across the Haor Basin, Hakaluki Haor is today experiencing significant environmental degradation as result of unsustainable use, in the form of agricultural intensification and unsustainable fishing levels, which have reduced the wetland's fish stocks. There is considerable scope for stronger management and conservation interventions, alongside interventions to promote livelihoods of local communities involved in fisheries (as most local people here are involved in fishing) and potentially nature-based tourism as a source of alternative livelihood. Strengthening the participation and involvement of local people in existing mechanisms for co-management of the wetlands and biodiversity conservation, including direct management rights can also be expected to ensure a more sustainable use of declining fisheries, while strengthening local people's involvement in conservation activities. To encourage sustainable use of fish resources, new fish sanctuaries should be established at Hakaluki Haor alongside alternative livelihoods to alleviate the impact of the unsustainable harvest of fisheries. Ecotourism offers a potential source of alternative livelihoods for local communities in Hakaluki Haor but has been little developed to date, due to the remoteness of the site. Strengthening access to Hakaluki Beel for domestic tourists can create the enabling conditions for tourism development. Limited infrastructure currently exists (and far less so than Hail Haor, for example), so there is potential for constructing (low intensity) access roads, waste disposal facilities, shelters, and hides for the benefit of visiting tourists. This can be complemented with targeted training programmes for local people to improve capacity for nature-based tourism, and initiatives to promote local awareness of migratory species. Finally, to strengthen the conservation of wetlands for biodiversity across Hakaluki Haor, there is a need to strengthen biodiversity considerations from plots of wetlands leased out for economic use.

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 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, with the largest cluster of priority sites being the Sundarbans and the Meghna Delta, which consist of a cluster of three sites. Three sites are floodplain wetlands in the Haor Basin of northern Bangladesh, in the watershed of the Brahmaputra. 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*, one of the most threatened duck species in Asia.

2. Site profile of Hakaluki Haor

Location: Hakaluki Haor is a large freshwater wetland located 30 km southeast of Sylhet city, in Kulaura, Barlekha and Juri *upazila* of Moulvibazar District, and Fenchuganj and Golapganj *upazilla* of Sylhet District, northeast Bangladesh (Figure 1). It lies in a shallow basin with the Patharia and Madhab Hills to the east and the Bathera Hills to the west.

Area: The Hakaluki Haor RFI site has an area of 19,225 ha. The area of the wetlands in and around the site varies widely during the year, with a wet season water area of as much as 20,400 ha, and a dry season water area of a mere 4,440 ha.

Altitude: 4-5 metres asl.

Geographical coordinates: 24.65 N, 92.08 E

Description of site: Hakaluki Haor is a complex of more than 80 inter-connecting beels, which is mainly fed by the Juri, Kantinala and Kuiachari Rivers and drains through a single outlet, the Kushiara River. During the wet season, the entire area floods, and the beels are united as one large lake with an area of up to 20,400 ha, the largest haor wetland in Bangladesh. The maximum depth of the water varies from 5-6 metres during the rainy season to about 1 metre at the end of the dry season. The AWC counting locations at Hakaluki Haor are Chatla Beel, Chokia Beel, Foot Beel, Fuala Beel, Gorkori Beel, Hakaluki Haor, Haor Khal (beel and near tower), Hawa-Bonna Beel, Juri River from Fenchugauj to Hakaluki Haor, Kalapani Beel, Kangli Beel (sanctuary), Kukurdubi, Loribai Beel, Maisla Beel and Nagoa-Dhulia Beel.

The Haor Basin of northern Bangladesh overlaps with several wetland landscapes of high conservation priority such as Hakaluki Haor. Fishing is a major source of livelihood for most communities in the wetlands, together with dry season rice agriculture and the harvesting of wetland products, but many communities remain below the poverty line, and fishery resources are in decline from overharvest, agricultural intensification and the long-term impacts of climate change (Khanum 2013; Aziz et al. 2022). Hakaluki Haor, like other Haor wetlands in the Brahmaputra floodplain, is experiencing significant environmental degradation as result of agricultural intensification in the surrounding landscapes, leading to increased siltation and declining fish stocks.

Site administration, management and land tenure: Hakaluki Haor was established as an EAAFP Flyway Network Site in 2011. It is managed by the District Land Administration, Moulvibazar; the District Land Administration, Sylhet; the Department of Environment (DoE), as it is an Ecologically Critical Area (ECA), and local communities through participation in the ECA CC Committee. Like all wetlands in Bangladesh,

Hakaluki Haor is government property controlled by the Ministry of Land. The Forest Department is responsible for Wildlife Conservation; the Bangladesh Haor Development Board under the Ministry of Water Resources is responsible for water management and water control infrastructure; and the Department of Fisheries under the Ministry of Fisheries and Livestock is responsible for fishery resources management as well as contributing to wetland management (<https://eaaflyway.net/the-flyway/flyway-site-network>). 12 beels in the wider Hakaluki Haor landscape is under conservation management, several led by VCGs (Thompson et al. 2018).

Social and economic values: Hakaluki Haor supports one of the largest inland fisheries in Bangladesh and provides the Government with a considerable source of income. It is leased by the district administration for fishing, which is the principal economic activity there, and most of the local inhabitants are in some way dependent on the wetlands for their livelihood. However, fishing is very intensive, and over-fishing has become a problem, for example water is periodically removed from the smaller beels to increase the harvest of fish, which has been particularly harmful. The aim of the management of the wetland is to protect and restore the aquatic biodiversity in Hakaluki Haor, particularly the fish and birds. A secondary aim is to create visitor facilities, to enhance enjoyment of the site and understanding of nature, the value of wetlands, and the need for their conservation. During the dry season, the margins of the beels are used for rice-growing and water from the beels is used to irrigate the paddy fields. Dry vegetation is collected from around the lakes for use as fuel for cooking, and each winter several herds of cattle are allowed to graze throughout the wetlands.

As an Ecologically Critical Area (ECA), a set of Village Conservation Groups (VCG) established for Hakaluki Haor have undertaken targeted conservation measures to protect over 1,300 ha of wetlands and flooded forests, while strengthening enforcement work to reduce illegal hunting of ducks. 12 beels have been designated as sanctuaries, some of which are managed by the VCGs (Thompson et al. 2018).

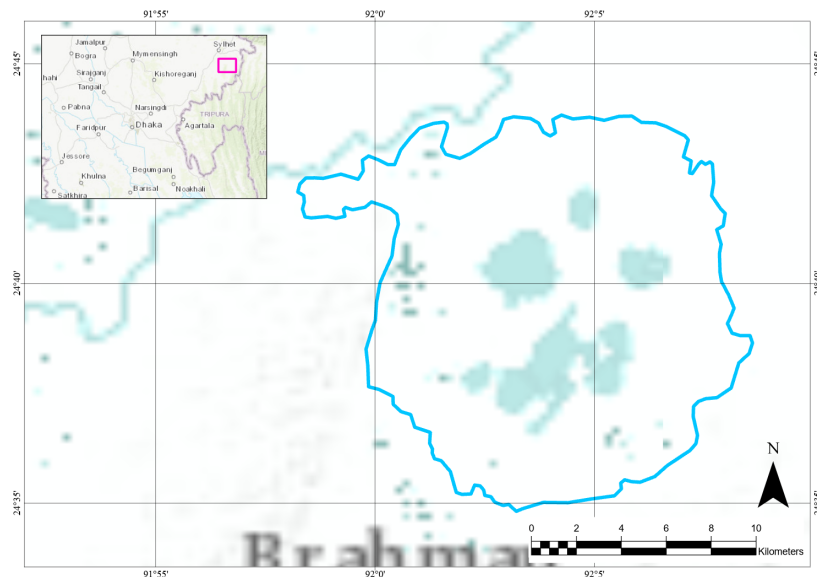


Figure 1 Map of Hakaluki Haor, showing its boundary (in blue) and location within Bangladesh (in pink) (data from EAAFP Site Information Sheet).

3. Biodiversity value of Hakaluki Haor

3.1. Key habitats

Hakaluki Haor is the largest wetland system in northern Bangladesh. It is a complex of more than 80 interconnected beels, which is mainly fed by the Juri, Kantinala and Kuiachari Rivers and drains through a single outlet, the Kushiara River. Key habitats include permanent freshwater marshes/pools, seasonal/intermittent freshwater marshes/pools, freshwater, tree-dominated, and shrub-dominated wetlands.

During the wet season, the entire area floods, and the beels are united as one large lake with an area of up to 20,400 ha, the largest haor wetland in Bangladesh. The maximum depth of the water varies from 5-6 metres during the rainy season to about 1 metre at the end of the dry season.

Key habitat types in Hakaluki Haor, based on the stakeholder-based assessment at the Regional Flyway Initiative workshop in May 2024, included permanent freshwater marshes/ pools, seasonal/ intermittent freshwater marshes/ pools, shrub-dominated wetlands, freshwater, tree-dominated wetlands, seasonal/ intermittent/ irregular rivers/ streams/ creeks, permanent freshwater lakes, and seasonal/ intermittent freshwater lakes.

3.2 Importance of Hakaluki Haor to migratory waterbirds

The extensive freshwater wetlands at Hakaluki Haor support important congregations of migratory (and resident) waterbirds, particularly migratory ducks, but their numbers have decreased in recent decades. Count data from the 2018-2022 Asian Waterbird Census (AWC) was used in the RFI analysis for this site. Two counts were conducted there annually in these years, and the results of these counts were averaged over this five-year period and then compared to the Conservation Status Review (CSR1) 1% population estimates to calculate a score for each species. The four migratory waterbird species in Table 1 were found to regularly exceed the 1% population thresholds during these five years, and the CSR1 scores for these species were summed to produce the overall site score.

In addition to Ferruginous Duck and Black-headed Ibis, the AWC recorded small numbers of five globally threatened and near-threatened species at Hakaluki Haor between 2018 and 2022, namely Falcatid Duck *Mareca falcata* (NT), Common Pochard *Aythya ferina* (VU), Baer's Pochard *Aythya baeri* (CR, a species which has rapidly declined in recent decades), Black-tailed Godwit *Limosa limosa* (NT) and Northern Lapwing *Vanellus vanellus* (NT). Hakaluki Haor supported one of the largest congregations of Baer's Pochards in the world, with a count in the 1990s detecting well over 1,000 individuals (Thompson et al. 2018). A threatened raptor species has bred there, Pallas's Fish-eagle *Haliaeetus leucoryphus* (EN).

Table 1 EAAF waterbird species that exceed their 1% flyway thresholds based on CSR1.

Species name	IUCN	Average count	CSR1	CSR1 score
Fulvous Whistling-duck <i>Dendrocygna bicolor</i>	LC	2,175	500	4.4
Ferruginous Duck <i>Aythya nyroca</i>	NT	1,151	1,000	1.2
Black-headed Ibis <i>Threskiornis melanocephalus</i>	NT	111	100	1.1
Asian Openbill <i>Anastomus oscitans</i>	LC	3,048	3,000	1.0

3.3 Other notable biodiversity

Hakaluki Haor supports a rich aquatic vegetation which varies in composition from season to season and from beel to beel. It originally had extensive areas of swamp forests, but these have been largely cleared. At least one threatened mammal species occurs there, Fishing Cat *Prionailurus viverrinus* (VU).

4. Ecosystem services

4.1. Ecosystem services provided by Hakaluki Haor

As among the largest wetland systems in northern Bangladesh, Hakaluki Haor supports diverse wetland habitats, contributing to valuable provisioning, regulating, and cultural ecosystem services (Fig. 2). The results from the RFI workshop¹ highlights 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 are crucial for communities both within and adjacent to the site. Fresh water has seen an increase in the past but is projected to decrease in the future. Cultivated food benefits communities at all distances and is expected to continue increasing, indicating its growing importance. Regulating services, such as local climate regulation and flood hazard regulation, primarily benefit adjacent communities. Local climate regulation has increased in the past but is expected to decrease in the future. Flood hazard regulation has experienced a decline in the past, with further decreases anticipated. Cultural services, specifically recreation and ecotourism, significantly benefit both within and adjacent communities. This service has shown an increase in the past and is expected to continue rising, underscoring the site's importance to both local and broader populations.

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>

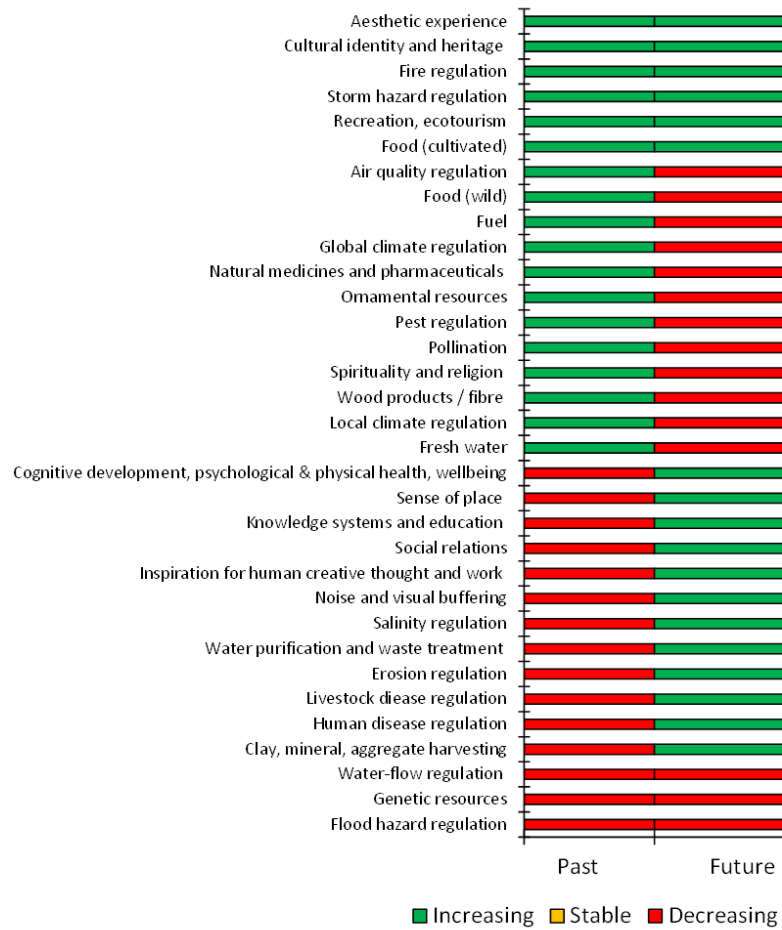


Figure 2 List of ecosystem services provided by Hakaluki Haor, as identified based on a national stakeholder consultation at the Regional Flyway Initiative workshop in Sylhet in 2024.

Table 2 List of top ecosystem services provided by Hakaluki Haor.

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	✓	✓		Increase	Decrease
Food (cultivated)	Yes	✓	✓	✓	Increase	Increase
<i>Regulating services</i>						
Local climate regulation		✓			Increase	Decrease
Flood hazard regulation		✓	✓		Decrease	Decrease
<i>Cultural services</i>						
Recreation, ecotourism	Yes	✓	✓		Increase	Increase

4.2. Global climate regulating services

Based on the look-up values from a FAO report (Dondini et al. 2023) and IPCC (2006), the amount of carbon stored in Hakaluki Haor is estimated to range from 58,800 to 85,000 tonnes, while the annual carbon sequestration rate is estimated at 4,130 tonnes per year.

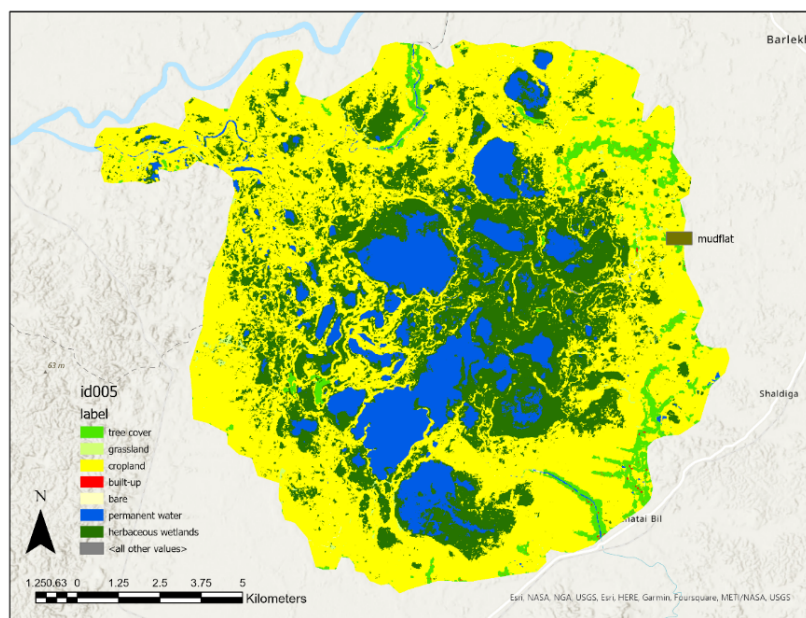


Figure 3 Map of Hakaluki Haor and land cover (map prepared by Radhika Bhargava)

4.3. Flood mitigation services

The flood mitigation services provided by Hail Haor were assessed using biophysical values only (see Table A1 and Annex 1 for details). When compared to both the average of the three RFI inland sites and the average of all other inland wetlands in Bangladesh (Table A2 in Annex 1), Hakaluki Haor shows some consistent results in terms of benefits and beneficiaries:

1. for the average green storage capacity per sq. km of wetland, Hakaluki Haor is below average (269 vs. 325 Giga Litres or GL of water per km² for RFI inland sites and 269 vs. 355 GL/km² for all other inland wetlands);
2. for the average population uniquely benefitting from influential green storage upstream per sq. km of wetland, Hakaluki Haor is also below the average (244 vs. 294 people/km² for RFI inland sites and 244 vs. 348 people/km² for all other inland wetlands); and
3. for the average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland, Hakaluki Haor is again below average when compared to RFI inland sites (0.40 vs. 0.96 ha/km²) or to all other inland wetlands (0.40 vs. 1.93 ha/km²) in the country.

5. Drivers of change and their potential impacts on Hakaluki Haor

5.1. Current drivers of change and their level of impact

Stakeholders at the RFI workshop² identified 54 drivers of change impacting Hakaluki Haor, and their corresponding levels of impact on the wetland site (Table 3). High-impact drivers include the destruction of cultural heritage buildings, gardens, and other sites, which significantly affects the cultural and ecological value of the wetland. Habitat shifting and alteration, along with housing and settlement developments, pose substantial threats by modifying the natural landscape. Livestock farming and grazing further contribute to habitat degradation. Additionally, water extraction or diversion within the wetland site or catchment area has a high impact on the hydrological regime and overall health of the ecosystem.

Medium-impact drivers consist of annual and perennial non-timber crop production, which alters land use and impacts habitat stability. Collecting terrestrial plants, dam construction, and hydrological modifications also moderately affect the site. Erosion, siltation, excess ponding of water, fire, fishing, habitat clearing, and hunting all contribute to the medium impact on biodiversity and ecological processes. Increased fragmentation, isolation from other natural habitats, logging, and loss of cultural links are also noted, along with marine and freshwater aquaculture. Other medium-impact factors include recreational activities, tourism infrastructure, temperature extremes, storms, and the presence of shipping lanes and canals.

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 Hakaluki Haor based on consultations with stakeholders.

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

5.2. Potential alternative state of Hakaluki Haor 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

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>

will be no changes in the current drivers of change impacting the site, and the current management regime.

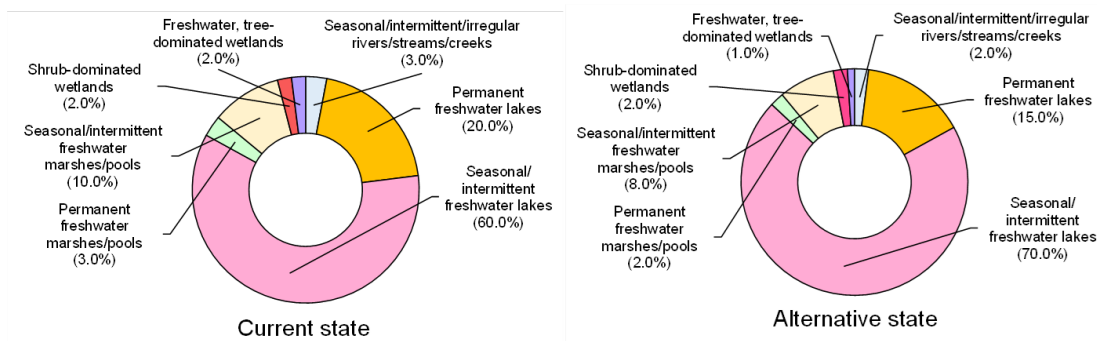


Figure 4 The proportional change in the extent of different habitat types between the current and alternative states of Hakaluki Haor.

5.3. Expected changes in the ecosystem services of Hakaluki Haor

Stakeholders at the RFI workshop⁴ documented the future trends in the provision of ecosystem services in Hakaluki Haor, 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 service for fresh water has seen an increase in the past but is projected to decrease in the future. Cultivated food is expected to continue increasing, indicating its growing importance. Local climate regulation has increased in the past but is expected to decrease in the future. Flood hazard regulation has experienced a decline in the past, with further decreases anticipated. Cultural service, specifically recreation and ecotourism, has shown an increase in the past and is expected to continue rising.

In the alternative state, the loss of 24% of wetlands (which include permanent freshwater marshes/pools, seasonal/intermittent freshwater marshes/pools, freshwater, tree-dominated and shrub-dominated wetlands) will result in a loss of stored carbon estimated to be between 13,800 and 20,000 tonnes, and a decrease in carbon sequestration rate (carbon accumulation) by approximately 973 tonnes per year.

A loss of 1,920 hectares of green water habitats including seasonal/intermittent rivers, permanent freshwater lakes, permanent and seasonal freshwater marshes, and freshwater tree-dominated wetlands as presented in Table A5, equivalent to 10% of the total land use for the site, is expected to result in an effective loss of 10% or 27 Giga Litres of green storage capacity per km². This reduction, proportional to the green habitat area, may amount to nearly 24 people and 0.04 hectares of built-up areas losing flood mitigation benefits per km² of wetland.

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 Hakaluki Haor

The stakeholder consultation and analyses of stakeholders representing government and civil society identified at least seven groups of stakeholders with clear roles in the long-term sustainable management of wetlands in Hakaluki Haor. There are major gaps and opportunities to build the capacity of government stakeholders on the management and restoration of wetland landscapes for ecotourism and biodiversity protection. As with other key sites in the Haor basin, the development of livelihood opportunities for local communities has been identified as the single most important developmental priority, and in the past, has been impeded by limited access to financing and capital (Ahmed & Haque 2023). There are major opportunities to strengthen livelihoods of local communities through ecotourism and fisheries, and potentially in partnership with the private sector.

Table 4 Stakeholder groups and their corresponding capacity gaps and needs in Hakaluki Haor.

Stakeholder group	Current role in wetland management (Positive or Negative)	Possible future role in wetland management	Current capacity for sustainable wetland management	Form of capacity development (e.g. training, organisational strengthening etc.)
District Administration	Government body with legal mandate to lease wetlands (or <i>khas</i> land) for use <i>jalmahal</i>	Continued work to lease wetlands through <i>jalmahal</i> scheme	Low	Training to strengthen awareness and <i>Jalmahal</i> policy frameworks for lease of wetlands; strengthen logistics and field coordination
Department of Fisheries	Oversee, monitor and protect fish sanctuaries	Oversee, monitor and protect fish sanctuaries	Medium	Strengthen organisational capacity for enforcement
Department of Environment	Oversee the enforcement of environmental regulations	Ensure compliance to wetlands policy and regulations	Medium	Training to strengthen organisational capacity for enforcement
Forest Department	Conservation of wildlife and restoration of degraded areas. Undertake biodiversity monitoring.	Conservation of wildlife and restoration of degraded areas. Support the creation of new protected areas (and their management)	Medium	Training to strengthen awareness of biodiversity issues' monitoring and species conservation

Stakeholder group	Current role in wetland management (Positive or Negative)	Possible future role in wetland management	Current capacity for sustainable wetland management	Form of capacity development (e.g. training, organisational strengthening etc.)
Department of Agricultural Extension	Oversee rice cultivation, and the cultivation of other crops	Oversee rice cultivation, and the cultivation of other crops	Low	Strengthen human resource capacity (manpower) Strengthening awareness on sustainable agricultural approaches
Local (fishing) communities	Key beneficiary of local fisheries.	Stronger participation on site management and co-management of fishing resources.	Low	Training and build capacity for community and co-management group establishment.
Non-government organisations	Support and drive capacity development for local communities.	Support awareness building for local communities	Medium	NA

7. Opportunities for RFI interventions

7.1. Recommended Interventions

There is therefore scope for stronger management and conservation interventions, alongside interventions to promote livelihoods of local communities involved in fisheries and potentially nature-based tourism as a source of alternative livelihood. Strengthening the participation and involvement of local people in existing mechanisms for co-management of the wetlands, including direct management rights (Ahmed et al. 2008) can also be expected to ensure a more sustainable use of declining fisheries, while strengthening local people’s involvement in conservation activities. To encourage sustainable use of fish resources, new fish sanctuaries can be established at Hakaluki Haor with support from the Department of Fisheries alongside alternative income-generating livelihoods to alleviate the impact from the unsustainable harvest of fisheries, while co-management structures have been established to regulate use and access to the wetlands. Village conservation groups have been established for several parts of Hakaluki Haor (e.g. Thompson et al. 2018) and can play a larger role in overseeing the implementation of conservation activities, including patrolling and enforcement to address the issue of illegal hunting. Other interventions may include excavating channels to link wetlands and establishing swamp plantations to facilitate fish migration and spawning.

Nature-based tourism offers a potential source of alternative livelihoods for local communities in Hakaluki Haor but has been little tapped or developed. Strengthening access to Hakaluki Beel for domestic tourists can create the enabling conditions for tourism development. Limited infrastructure currently exists (and far less so than Hail Haor, for example), so there is potential for constructing (low intensity) access roads, waste disposal, shelters, and hides for the benefit of visiting tourists. This can be complemented with targeted training programmes for local people to improve capacity for nature-based tourism, and initiatives to promote local awareness of migratory species.

Table 5 Summary of the key interventions needed to improve the management of the Hakaluki Haor wetlands.

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
<i>Component 1: Strengthening sustainable wetland-based ecotourism</i>					
Strengthen livelihoods through the develop of local products (including fishery-based	Improved (alternative) livelihoods for local communities (especially local people	Number of people benefitting from livelihood activities, with up to 30% beneficiaries from women, youth,	500,000.00	2 years (micro-finance mechanism should be established alongside	District administration Department of Fisheries

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
and agricultural products) for local communities.	collecting NTFPs, fishing). Biodiversity improved.	elderly, indigenous people, and other vulnerable groups Number of people trained on livelihood activities		capacity building activities)	Department of Environment Local communities Conservation NGOs
<i>Component 2: Coastal wetland habitat protection and management</i>					
Strengthen access of local communities to wetlands (leasing framework, tenure) and credit under existing co-management structures for local communities.	Long-term generation of revenue for local communities/government.	Number of community-led conservation areas creation facilitated Number of supported activities in community-led conservation areas	100,000.00	5 years	District administration Department of Fisheries Department of Environment Forest Department
Habitat restoration and biodiversity monitoring.	Wetland biodiversity more resilient. Wildlife population (e.g. especially migratory ducks and other waterbirds) sustained; wetland ecosystems sustained.	Number of monitoring activities conducted employing standardized methodology Area of wildlife habitat restored	500,000.00	3 years	Department of Agricultural Extension Local communities Conservation NGOs

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Identification and creation of new fish and bird sanctuaries.	Wetland biodiversity more resilient. Wildlife population (e.g. especially migratory ducks and other waterbirds) sustained; wetland ecosystems sustained.	Number of fishery management policies facilitated Number of established fish sanctuaries	500,000.00	5 years. Expected to involve targeted dredging and deepening of identified wetlands.	
Total investment for five years			5,500,000.00		

7.2. Potential Financing

The estimated project cost is USD 5,500,000 over a five-year period. This project budget includes conducting capacity-building activities in nature-based tourism, microfinancing, and sustainable fisheries for local communities, as well as biodiversity monitoring of migratory waterbirds, wetland management, and restoration activities. Additionally, it entails establishing at least two new fish sanctuaries and community-led protected areas.

7.3. Proposed Institutional Arrangements

Local communities can be more directly involved in the conservation and co-management of wetland sites within the wider Hakaluki Haor, for instance, by strengthening enforcement of take policies, addressing illegal and unsustainable fishing activities, and preventing encroachment.

Capacity-building and awareness activities will be led by the Bangladesh Forest Department and the Fisheries Department and implemented over five years. The Fisheries Department will lead the implementation of fishery-related components of the project, focusing on activities to strengthen co-management plans (2 years) at selected communities, and scope plans for the creation of new fish sanctuaries. Implementation will be coordinated with the local government, local administration, and civil society organisations. Civil society organisations with a focus on biodiversity conservation, ecotourism, and fisheries (rural) development can lead work to deliver training activities on the ground for ecotourism at the selected villages.

7.4. Project Beneficiaries

There are few indigenous communities in Hakaluki Haor, but there are major opportunities to strengthen the representation of women and marginalised fishing communities (including fishing households unrepresented in any wider framework) in establishing and/or influencing co-management structures that can otherwise affect their livelihoods.

7.5. Anticipated Implementation Risks

Political and Governance: Understanding the relevant management stakeholders, conservation priorities, and capacity is essential for implementing project interventions effectively. For Hakaluki Haor, it is managed by the District Land Administration, Moulvibazar; the District Land Administration, Sylhet; the Department of Environment (DoE), as it is an Ecologically Critical Area (ECA), and local communities through participation in the ECA CC Committee. Like all wetlands in Bangladesh, Hakaluki Haor is government property controlled by the Ministry of Land. The Forest Department is responsible for Wildlife Conservation; the Bangladesh Haor Development Board under the Ministry of Water Resources is responsible for water management and water control infrastructure; and the Department of Fisheries under the Ministry of Fisheries and Livestock is responsible for fishery resources management as well as contributing to wetland management (<https://eaaflyway.net/the-flyway/flyway-site-network>). Twelve beels in the wider Hakaluki Haor landscape are under conservation management, several led by VCGs (Thompson et al. 2018). Stakeholder mapping would facilitate better coordination with management stakeholders.

References

- Ahmed, I., Deaton, B. J., Sarker, R., & Virani, T. (2008). Wetland ownership and management in a common property resource setting: A case study of Hakaluki Haor in Bangladesh. *Ecological Economics*, 68(1-2), 429-436.
- Ahmed, S., & Haque, C. E. (2023). Wetland entitlement and sustainable livelihood of local users in Bangladesh: A case study of Hakaluki Haor communities. *Environmental Management*, 71(2), 334-349.
- Aziz, M. S. B., Alam, M. M., Haque, M. M., & Mondol, M. M. R. (2022). Reduction of fish production in Hakaluki haor caused by climatic and anthropogenic factors. *Journal of Bio-Science*, 30(2), 23-37.
- Chowdhury, S. U., Foysal, M., & Khan, N. U. (2022). Using community-based interviews to determine population size, distribution and nest site characteristics of Pallas's fish eagle in north-east Bangladesh. *Oryx*, 56(4), 627-635.
- Khanum, R. (2013). Socio-Economic Conditions of Fishermen: Evidence from Hakaluki Haor of Bangladesh. *Asian Business Review* 2: 77-79.
- Thompson, P., Haque, E.U., Chowdhury, S.U., & Mohsanin, S. (2018). Waterbird Trends and Impacts of Conservation and Co-management in Four Wetlands. CREL Technical Report No. 2. Climate-Resilient Ecosystems and Livelihoods (CREL) Project, Dhaka, Bangladesh.

Annex 1. Supplementary information on flood mitigation 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 flood mitigation were spatially inferred in QGIS from a selection of metrics expressing different biophysical values modelled online by the Water World component of this tool. Equivalent data to assess monetary values similarly to coastal protection were not available for the RFI region.

The key metrics selected for biophysical values (Table A1) were the average green storage capacity, which is the volume of water stored by each square kilometre of wetland itself as well as its soil and vegetation, and the direct influence of this storage capacity on beneficiaries found downstream of the wetland, both as the average number of people and the average built-up area that are uniquely benefitting from the resulting flood mitigation (and not from other green storage found upstream).

Table A1. Contribution of the wetland habitats to flood mitigation in Hakaluki Haor based on site-level (biophysical) values inferred from Mulligan (2022) and expressed as ranges to represent the resulting uncertainty.

Influence of the wetland on flood mitigation (metrics)	Benefit/Beneficiaries
Average green storage capacity per sq. km of wetland in million cubic metres (GigaLitres/km ²)	244 – 293
Average population uniquely benefitting from influential green storage upstream per sq. km of wetland (n/km ²)	222 – 265
Average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland (ha/km ²)	0.62 – 0.74

Table A2. Biophysical benefits from and beneficiaries of RFI inland wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	Green storage capacity (GigaLitres/km ²)	Downstream population (n /km ²)	Downstream built-up area (ha /km ²)
Hail Haor (Baikka Beel)	407 (±18)	382 (±17)	1.07 (±0.05)
Hakaluki Haor	269 (±24)	244 (±21)	0.40 (±0.06)
Tanguar Haor	299 (±19)	256 (±16)	1.13 (±0.07)
Bangladesh RFI average	325	294	0.96
Bangladesh national average	355	348	1.93

Table A5. Key habitat types in Hakaluki Haor 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 (%)
Seasonal/intermittent/irregular rivers/streams/creeks	576.8	3.0	384.5	2.0
Permanent freshwater lakes	3845.0	20.0	2883.8	15.0
Seasonal/ intermittent freshwater lakes	11535.1	60.0	13457.6	70.0
Permanent freshwater marshes/pools	576.8	3.0	384.5	2.0
Seasonal/intermittent freshwater marshes/pools	1922.5	10.0	1538.0	8.0
Shrub-dominated wetlands	384.5	2.0	384.5	2.0
Freshwater, tree-dominated wetlands	384.5	2.0	192.3	1.0
Total	19225.1	100.0	19225.1	100.0