



# UNITED NATIONS ENVIRONMENT PROGRAMME

Programme des Nations Unies pour l'environnement    Programa de las Naciones Unidas para el Medio Ambiente  
 Програма Организации Объединенных Наций по окружающей среде    برنامج الأمم المتحدة للبيئة

联合国环境规划署



## PROJECT DOCUMENT

### SECTION 1: PROJECT IDENTIFICATION

<b>1.1</b>	<b>Project title:</b>	Ecosystem-based approaches to Adaptation (EbA) in the drought-prone Barind Tract and Haor wetland Area	
<b>1.2</b>	<b>Project number:</b>	GFL/5456 PMS: 1150	
<b>1.3</b>	<b>Project type:</b>	FSP	
<b>1.4</b>	<b>Trust Fund:</b>	Least Developed Countries Fund (LDCF)	
<b>1.5</b>	<b>Strategic objectives:</b>	Climate Change Adaptation	
<b>1.6</b>	<b>UNEP priority:</b>	Climate Change Adaptation	
<b>1.7</b>	<b>Geographical scope:</b>	National	Bangladesh
<b>1.8</b>	<b>Mode of execution:</b>	External	
<b>1.9</b>	<b>Project executing organization:</b>	Ministry of Environment and Forests, Department of Environment (DoE)	
<b>1.10</b>	<b>Duration of project:</b>	48 months Commencing: 2016 Technical completion: 2020	
	<b>Validity of legal instrument:</b>	54 months	
<b>1.11</b>	<b>Cost of project</b>	<b>US\$</b>	<b>%</b>
	Cost to the GEF Trust Fund	<b>5,200,000</b>	<b>8.6</b>
	Co-financing		
	Grant		
	<b>The Barind Rain Water Conservation and Irrigation Project</b>	<b>5,850,000</b>	<b>9.7</b>
	<b>The Marketing of Agricultural Products through Development of Rural Agri-products Project</b>	<b>15,812,000</b>	<b>26.3</b>
	<b>The Haor Flood Management and Livelihood Improvement Project</b>	<b>25,830,000</b>	<b>42.9</b>
	<b>Strengthening Regional Co-operation for Wildlife Protection (SRCWP) Project</b>	<b>7,300,000</b>	<b>12.1</b>
	<i>Sub-total</i>	<b>59,992,000</b>	
	In-kind		
	<b>Ministry of Environment and Forests, Government of Bangladesh</b>	<b>240,617</b>	<b>0.4</b>
	<i>Sub-total</i>	<b>240,617</b>	
	<b>Total</b>	<b>60,232,617</b>	<b>100</b>

## **Project summary**

Dryland forests in the Barind Tract and swamp forests in wetlands of the Haor Area in Bangladesh provide goods and services to local communities. Communities living in the Barind Tract derive most of their income from agriculture. In the Haor Area, fishing and agriculture are important income-generating activities that support local communities. These livelihoods are underpinned by functional ecosystems and the services they provide such as nutrient cycling and pollination. Ecosystems in both areas also provide fresh water, reduce erosion and mitigate climate-related disasters, such as floods in the Haor Area and droughts in the Barind Tract.

Rapid population growth in both the Barind Tract and Haor Area is resulting in an increased demand for resources and clearing of forests for agricultural land. Dryland and swamp forests in these areas are consequently being degraded. This degradation is resulting in reduced forest cover, which in turn is leading to increased erosion. The effects of this increased erosion are: i) loss of fertile topsoils in the Barind Tract; and ii) increased sedimentation of beels and haors in the Haor Area. Additionally, unsustainable rates of groundwater extraction for irrigation in the Barind Tract are resulting in the lowering of the water table in this area. In the Haor Area, reduced cover of swamp forests is increasing the risk of damage from flash floods.

The effects of climate change are compounding the degradation of ecosystems in the Barind Tract and Haor Area described above. These effects are predicted to worsen in the future. In particular, climate change models predict an increase in mean annual temperature and a decrease in annual precipitation for the Barind Tract. Such changes will result in an increased frequency and severity of droughts in the area. Consequently, local communities in the Barind Tract are predicted to experience: i) decreased availability and quality of water for agriculture and household use; ii) reduced agricultural productivity; iii) decreased food security; and iv) increased risks to human and livestock health. Conversely, models predict an increase in annual precipitation and heavier and more erratic rainfall in the Haor Area. These changes will result in: i) increased river flows, causing breaching of embankments, widespread flooding and erosion; ii) damage to agricultural areas, infrastructure and homes located near rivers; iii) increased risk of water-borne diseases; and iv) increased sedimentation of beels and haors leading to decreased habitat quality for important indigenous fish species. Overall, climate change is consequently a major threat to the integrity of ecosystems in the Barind Tract and the Haor Area.

Given that the livelihoods of vulnerable, local communities in the Barind Tract and Haor Area are strongly linked to natural resources, an Ecosystem-based Adaptation (EbA) approach to climate change provides a cost-effective and low-risk means to reduce the vulnerability of these communities. This approach would enhance the provision of goods and services from functional, well-managed dryland and swamp forests to these communities

Currently, the Government of Bangladesh and local communities do not have adequate capacity to implement EbA as a means to adapt to climate change in a cost-effective and sustainable manner. This is because these stakeholders have limited knowledge on planning and implementing EbA. Additionally, there is a lack of rigorous, quantitative evidence of the effectiveness of EbA within Bangladesh. To address these problem, Least Developed Countries Fund (LDCF) resources will be used to increase the capacity of national and local government, and local communities living in the Barind Tract and Haor Area to plan and implement EbA. This will be achieved by: i) strengthening the technical and institutional capacity of policy- and decision-makers in Bangladesh to plan EbA; ii) demonstrating EbA and supporting adaptation technologies that will conserve surface water in the

Barind Tract (in three districts covering the Tanore, Nachole and Pirganj upazilas<sup>1</sup>) and reduce erosion in the Haor area (in two districts covering the Barlekha, Juri, Kulaura, Golapganj, and Fenchuganj upazilas); and iii) improving knowledge of national and local government, and local communities on effective EbA. By implementing these activities, the project will contribute to realising the objectives of national plans for climate change adaptation including the National Adaptation Programme of Action (NAPA 2009) and the Bangladesh Climate Change Strategy and Action Plan (BCCSAP 2009).

The project will build on several ongoing baseline projects, including the Barind Rain Water Conservation and Irrigation Project, the Marketing of Agricultural Products through Development of Rural Agri-products Project, the Haor Flood Management and Livelihood Improvement Project, and the Strengthening Regional Co-operation for Wildlife Protection Project. The project will be executed by the Department of Environment (DoE) under the Ministry of Environment and Forests (MoEF) of Bangladesh, and implemented by the United Nations Environment Programme (UNEP).

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<sup>1</sup> (an upazila is a geographical region in Bangladesh that functions as a sub-district) and

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## ACRONYMS AND ABBREVIATIONS

AusAID	Australian Agency for International Development
BCCRF	Bangladesh Climate Change Resilience Fund
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCCTF	Bangladesh Climate Change Trust Fund
BECA	Bangladesh Environment Conservation Act
BFD	Bangladesh Forest Department
BHWDB	Bangladesh Haor and Wetland Development Board
BMDA	Barind Multipurpose Development Authority
BMZ	German Federal Ministry for Economic Cooperation and Development
BWDB	Bangladesh Water Development Board
CbA	Community-based Adaptation
CBAECA	Community Based Adaptation in the Ecologically Critical Areas
CBD	Convention on Biological Diversity
CBMTHP	Community Based Management of Tanguar Haor Program
CBRMP	Community Based Resource Management Project
CCA	Climate Change Adaptation
CCC	Climate Change Cell
CCFP	Climate Change Focal Point
CDMP	Comprehensive Disaster Management Programme
CEDAW	Convention for the Elimination of All Forms of Discrimination Against Women
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CREL	Climate-Resilient Ecosystems and Livelihoods programme
CWBMP	Coastal and Wetland Biodiversity Management Project
DFID	Department for International Development
DLS	Department of Livestock Services
DAE	Department of Agricultural Extension
DoE	Department of Environment
DoF	Department of Fisheries
DRR	Disaster Risk Reduction
EbA	Ecosystem-based adaptation
ECA	Ecologically Critical Area
EFL	Ecosystems for Life
EKN	Embassy of the Kingdom of the Netherlands
GDP	Gross Domestic Product
GEF	Global Environment Facility
GGI	Gender Gap Index
GII	Gender Inequality Index
GoB	Government of Bangladesh
IU	Independent University
IUCN	International Union for Conservation of Nature
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LGED	Local Government Engineering Department

LoA	Letter of Agreement
M&E	Monitoring and Evaluation
MACH	Management of Aquatic Ecosystems through Community Husbandry
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forests
MoL	Ministry of Land
MoU	Memorandum of Understanding
MoWR	Ministry of Water Resources
MP	Muriate of Potash
NAP	National Adaptation Plan
NAPA	National Adaptation Program for Action
NBSAP	Biodiversity Strategy and Action Plan
NGO	Non-governmental Organisations
NoRAD	Norwegian Agency for Development Cooperation
NTFPs	Non Timber Forest Products
NWMP	National Water Management Plan
PPG	Project Preparation Grant
PSC	Project Steering Committee
SIDA	Swedish International Development Cooperation Agency
SRCWP	Strengthening Regional Co-operation for Wildlife Protection
TSP	Triple Super Phosphate
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCF	Village Conservation Fund
VCG	Village Conservation Group
VIA	Vulnerability Impact Assessment

## SECTION 2: BACKGROUND AND SITUATION ANALYSIS (BASELINE COURSE OF ACTION)

### 2.1. Background and context

1. The Least Developed Countries Fund (LDCF) has approved funds for the Full-Sized Project entitled; “Ecosystem-based approaches to adaptation (EbA) in the drought prone Barind Tract and Haor ‘wetland’ area” in Bangladesh. Hereafter this full-sized project will be referred to as the LDCF-financed project or the project.

#### *Brief introduction*

2. The Barind Tract and the Haor wetland areas of Bangladesh contain highly productive ecosystems that provide a wide range of valuable goods and services to local communities living in these areas. These ecosystems provide food (through forest products<sup>2,3</sup>, agriculture and fisheries in the areas) and fresh water, reduce erosion and mitigate floods (in the Haor wetland area). However, rapid population growth has resulted in unsustainable agricultural practices and agricultural expansion, which is resulting in a loss of dryland and wetland habitat.

3. The Barind Tract is a semi-arid region in the Bengal basin in the northwest of Bangladesh (see Figure 1). The drylands in this area contain fertile soils that are important for supporting agricultural production in the area. In addition to agriculture, local communities in the Barind Tract rely on ecosystems in this area for medicinal plants, grazing for livestock and income derived from the sale of forest products under social forestry rules. Rapid population growth has resulted in increased pressure on these ecosystems, fresh water and agricultural land. In addition, the increased population pressure has led to poorly planned development activities and unsustainable agricultural practices, which are further degrading the ecosystems in this area. This degradation has reduced the capacity of these ecosystems to adapt to natural and climate-related changes and provide valuable goods and services.

4. The Haor wetland area is located in the greater Sylhet District and includes Bangladesh’s most important freshwater wetland ecosystems. This area comprises a number of depressed basins – known as ‘haors’ – that are inundated by fresh water during the monsoon season and gradually dry out during the dry winter season. These wetlands sustain local fisheries and agriculture activities during the dry months, thereby enabling local communities to continue deriving an income. Moreover, these wetlands regulate water flow through the area, thereby protecting local communities from floods during wetter months. Rapid population growth in the Haor wetland area has led to the unsustainable management of these areas, including over-exploitation of natural resources and agricultural expansion in rims of the beels and haors in this area. In particular, high rates of deforestation, land degradation, and poorly planned development activities are resulting in increased erosion and the consequent sedimentation of wetlands and rivers in this area. These unsustainable management practices are resulting in irreversible consequences, such as changes in geomorphology, loss of habitat and hydrological functioning.

5. One of the wetland systems in the Haor Area that is experiencing high levels of degradation is the Hikaluki Haor, located between the Moulavibazar and Sylhet districts (see Figure 3). This haor is a complex ecosystem containing more than 238 interconnecting beels<sup>4</sup>, making it the largest inland freshwater wetland ecosystem in Bangladesh. It is a critical habitat and breeding ground for fish and

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<sup>2</sup>particularly in the Haor area.

<sup>3</sup>Chakraborty, T.R. Management of Haors, Baors, and Beels in Bangladesh, Lessons for Lake Basin Management.

<sup>4</sup>A beel is wetland which generally retains water throughout the year.

other aquatic species and is considered as one of the four main “mother fisheries” in Bangladesh. As a result of the high levels of degradation, the Hakaluki Haor was designated by the Government as an Ecologically Critical Area (ECA)<sup>5</sup> in 1999.

6. The unsustainable use and transformation of habitats in the Barind Tract and Haor Area is being compounded – and will be further exacerbated in the future – by the effects of climate change. Recent climate change models predict an increase in air temperature and decrease in precipitation in the Barind Tract, which will lead to increased evaporation and a reduction in the availability of surface water. In addition, the predicted increase in air temperature and decrease in precipitation will result in an increase in severity and frequency of droughts in this area. These extreme events will result in further degradation of the dryland ecosystems in the Barind Tract. Conversely, climate change models project an increase in precipitation – with heavier and more erratic rainfall – in the Haor Area. This projected increase in rainfall will result in: i) higher river flows and widespread flooding, resulting in damage to agricultural land and infrastructure; ii) increase river bank erosion; and iii) increased sedimentation of rivers, haors and beels, leading to poor drainage and the loss of important habitat for fisheries species. These projected changes predicted to worsen in the future. Climate change will therefore affect local communities in both of these regions. The effects of both droughts and floods in particular affect agricultural production. Reduced productivity of staple crops because of droughts causes increased food prices and decreased household food security. Furthermore, the decreased availability and quality of water during droughts and dry spells can result in increased incidence of illness. The impact of current and future climate change on the water, agricultural and other economic sectors in Bangladesh substantially reduce the country’s ability to reduce poverty and enable economic growth.

7. The LDCF-financed project aims to decrease the vulnerability of government and local communities living in the Barind Tract and Haor Area to the negative effects of climate change through the use of Ecosystem-based Adaptation (EbA) approaches. This will be achieved by: i) improving the technical and institutional capacity of policy- and decision-makers in Bangladesh to address climate change risks through the implementation of ecosystem-based adaptation (EbA); ii) implementing EbA and constructing infrastructure that conserves water in the Barind Tract and reduces erosion in the Haor Area; iii) promoting additional livelihood options in dryland ecosystems in the Barind Tract and wetlands in the Haor Area; and iv) improving knowledge of local communities and national stakeholders on effective EbA.

8. Additional information on the geographic, political, socio-economic, ecological and climate context in Bangladesh – relevant to the LDCF-financed project – is presented below.

### *Geographic context*

9. Bangladesh is a coastal country in South Asia, located on the northern coast of the Bay of Bengal. The country covers a total area of 147,570 km<sup>2</sup> and is bordered by India in the north, south, west, and Myanmar in the southeast. Bangladesh includes a broad range of ecosystem types, including tropical rain forests, mangrove forests, swamp forests (Haor Area), coastal wetlands, charlands<sup>6</sup>, floodplains, drylands (Barind Tract) and freshwater wetlands (Haor Area). The LDCF-financed project will implement activities in dryland ecosystems in the Barind Tract and inland wetlands in the Haor

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<sup>5</sup>under the provision of the Bangladesh Environment Conservation Act (BECA).

<sup>6</sup>Charlands are sandbars that emerge as islands within the river channel or as attached land to the riverbanks as a result of the dynamics of erosion and accretion in the rivers.

Area. These regions have been identified in the NAPA as critical areas that are most vulnerable to the effects of climate change.

10. The Barind Tract – known locally as *Barendra Bhumi* – is situated in the upper half of north-western Bangladesh, covering an area of 8,720 km<sup>2</sup> (see Figure 2). The Barind Tract is a semi-arid region of fertile alluvial sediment. Historically, vegetation cover in the Barind Tract was dominated by the Sal (*Shorea robusta*) and other semi-evergreen species. Presently, the Barind Tract is dominated by scrubs resembling those in semi-arid areas. This region encompasses the major parts of Rajshahi, Dinajpur, Rangpur, Bogra and Pabna districts.

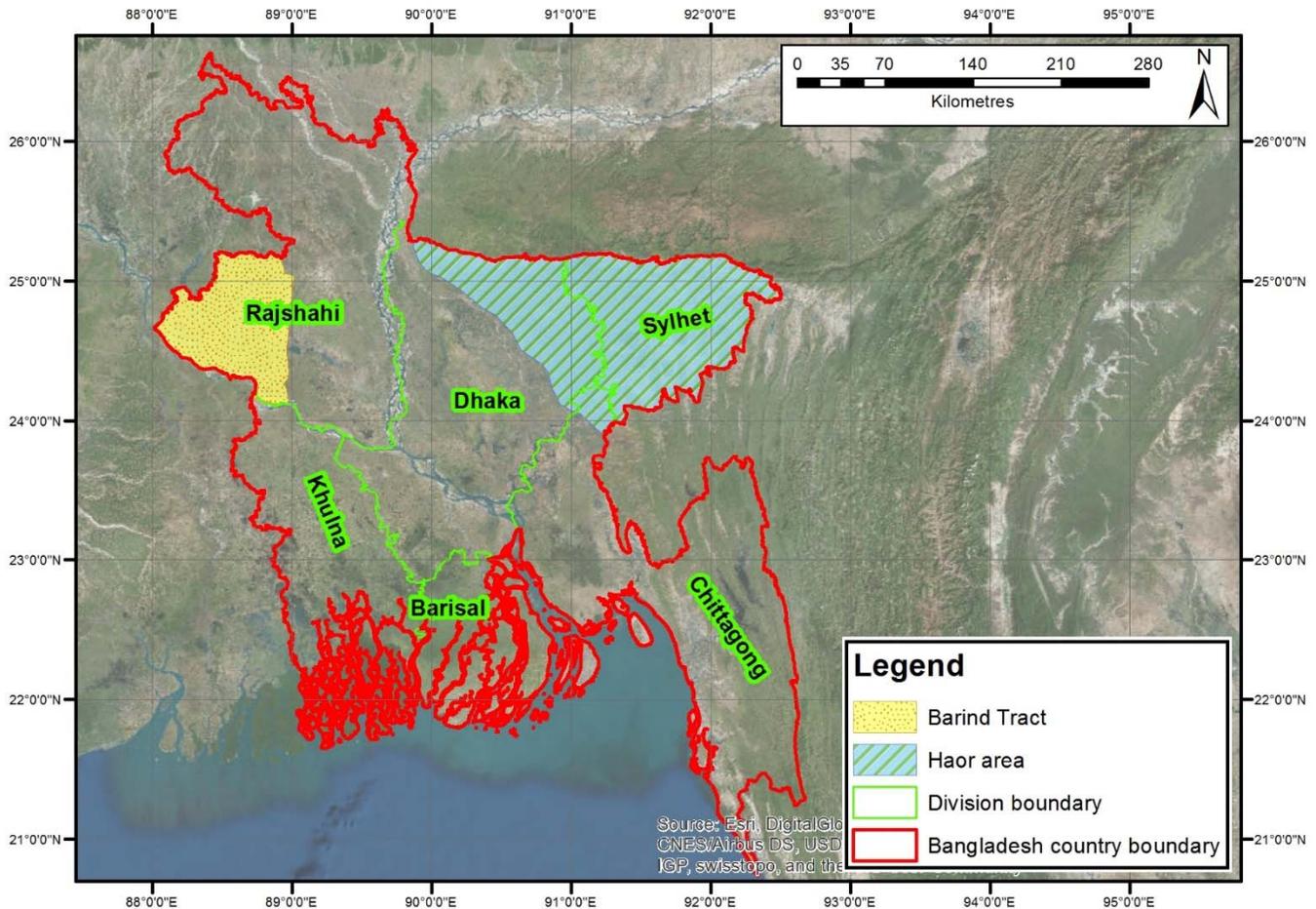


Figure 1. Map of Bangladesh showing the Barind Tract and Haor Area

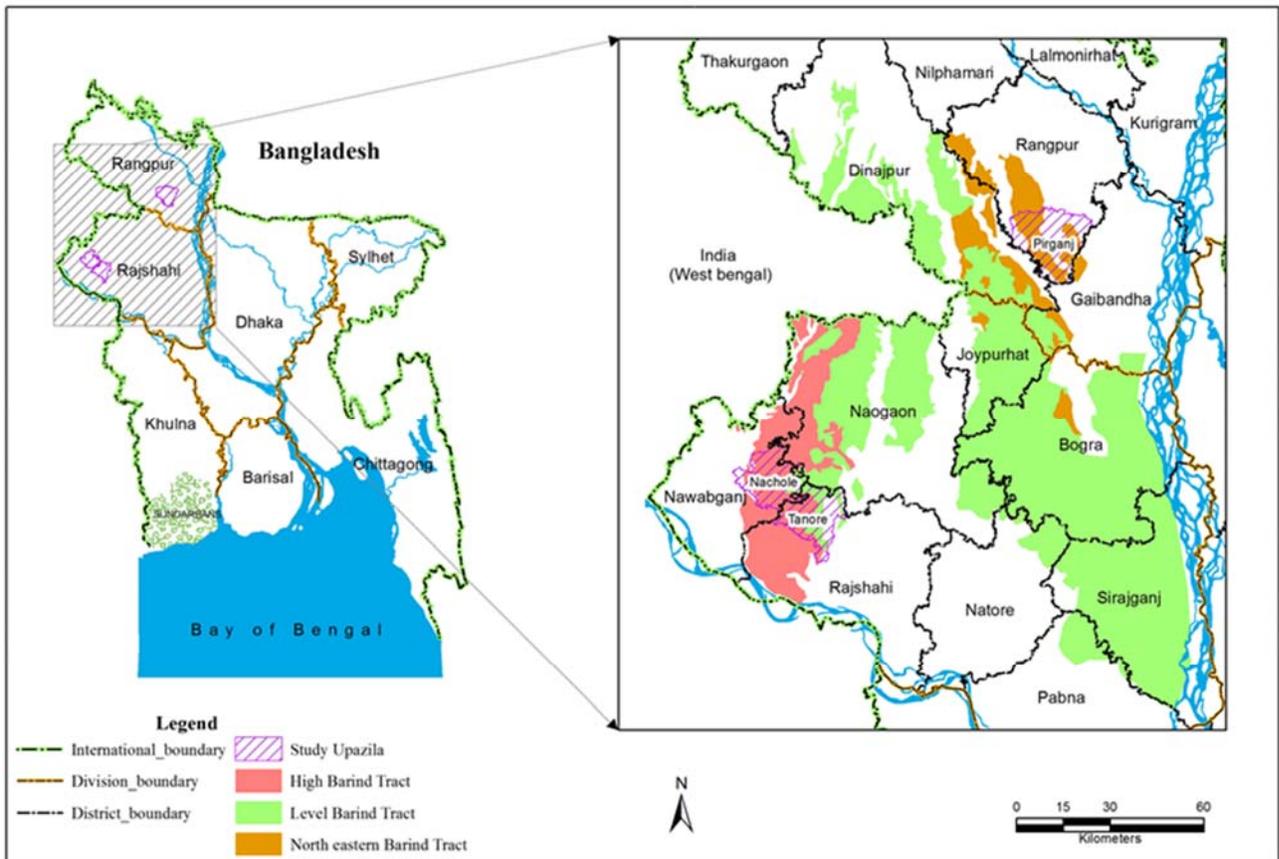


Figure 2. Map of project sites (upazilas<sup>7</sup>) in the Barind Tract

11. The Haor Area covers an area of 24,500 km<sup>2</sup> and consists of a mosaic of 414 wetland habitats<sup>8</sup>, including; i) rivers, streams and irrigation canals; ii) large areas of seasonally flooded cultivated plains; and iii) hundreds of haors and beels (see Figure 2). The area encompasses the major parts of Sunamganj, Habiganj and Moulvibazar districts in the Meghna basin and includes Bangladesh's most important freshwater wetlands. From the onset of the monsoon season in July, the area of the haor extends by 8,500-8,600 km<sup>2</sup> with the water level subsiding in October. This area is considered as a mother fishery area for indigenous fishes in Bangladesh.

<sup>7</sup>a geographical region in Bangladesh used for administrative or other purposes. They function as sub-units of districts.

<sup>8</sup>Trend analysis of climatic extreme events for the Haor Area of Bangladesh using Climatic indices. 2014. Available at: [http://www.academia.edu/8062063/Trend\\_Analysis\\_Of\\_Climatic\\_Extreme\\_Events\\_For\\_The\\_Haor\\_Area\\_Of\\_Bangladesh\\_Using\\_Climatic\\_Indices](http://www.academia.edu/8062063/Trend_Analysis_Of_Climatic_Extreme_Events_For_The_Haor_Area_Of_Bangladesh_Using_Climatic_Indices). Accessed 27 February 2015

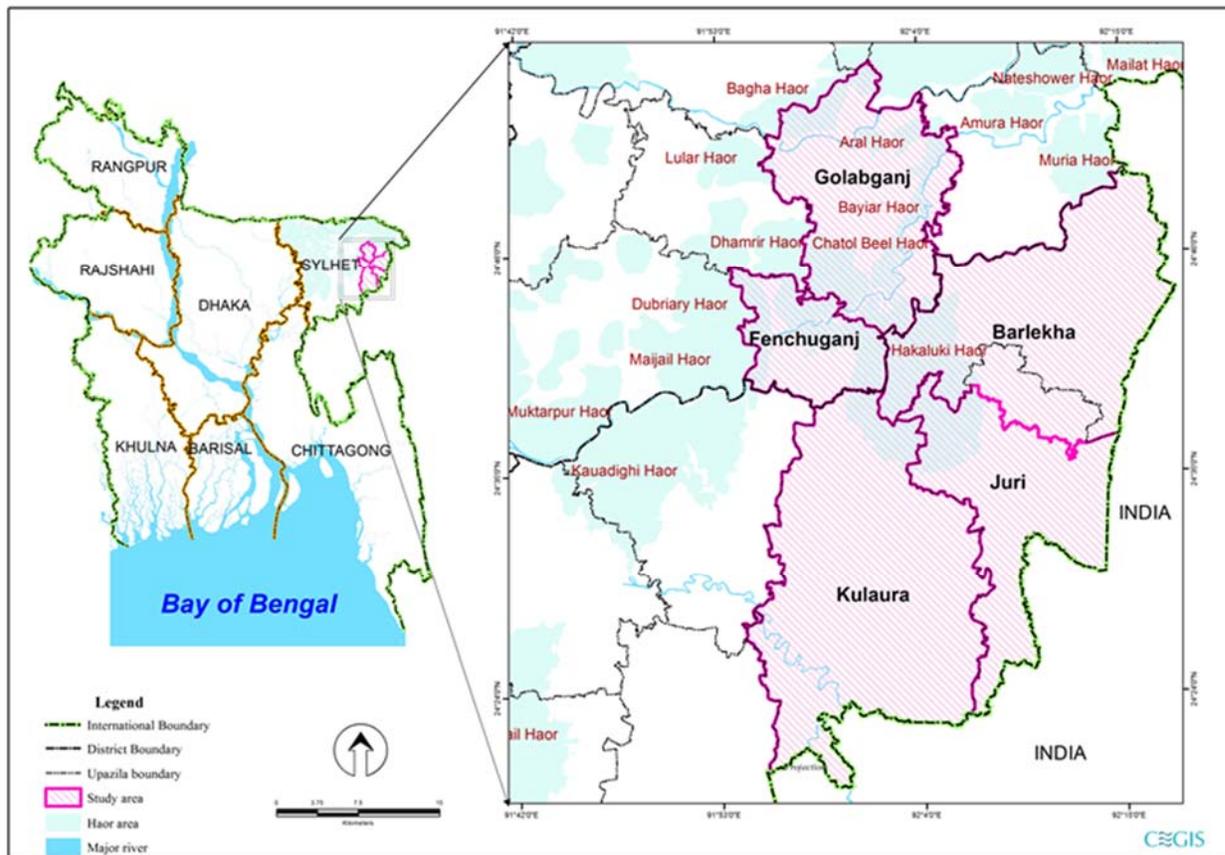


Figure 3. Project intervention sites.

#### *Political context*

12. Bangladesh consists of 64 administrative districts divided into rural, urban and hill districts under the seven divisions. Urban authorities are single-tier and include nine City Corporations and 315 Pourashava. The City Corporations are: Dhaka (North), Dhaka (South), Chittagong, Rajshahi, Khulna, Barisal, Sylhet, Rangpur, Narayanganj, Gazipur and Comilla. Rural local government has three tiers: 61 zila (district) parishads and 3 hill district council, 488 upazila (sub-district) parishads, and 4,550 union parishads. The upazilas are the second lowest tier of administration in Bangladesh. Upazila function as sub-units of districts. Union Parishad is the smallest rural administrative and local government units in Bangladesh.<sup>9</sup>

#### *Socio-economic context*

##### Population

13. In 2014, Bangladesh's population was estimated to be ~158 million with an annual growth rate of 1.48%. The average population density is above 832 inhabitants per km<sup>2</sup>, making Bangladesh one of the most densely populated countries of the world<sup>10</sup>. Approximately 70% of the population in Bangladesh live in rural areas.

<sup>10</sup>Gupta, A. D., Babel, M. S., Albert, X. & Mark, O. 2005. Water sector of Bangladesh in the context of integrated water resources management: a review. *Water Resources Development* 21: 385–398.

14. The Barind Tract has an estimated population of ~15 million people. The Haor Area is populated by ~20 million people with a relatively low population density – despite large-scale migration into the area – compared to the national average<sup>11</sup>.

15. Unemployment and poverty are ubiquitous across Bangladesh, with ~32% of the population living below the poverty line<sup>12</sup>. Poverty is prevalent among rural and landless communities that depend on natural resource. Consequently, ~53% of the population in rural communities are classified as poor.

### Gender

16. Women constitute ~57% of the total number of those employed nationally. In 2012, the female-to-male employment ratio was 0.69 while the employment rate of women of working age – between 15 and 65 – was 57% compared with 84% for men.

17. This disparity between men and women in Bangladesh is also reflected by the country's gender index scores for those categorised as 'poor'. For example, the Gender Inequality Index (GII) score for Bangladesh is 0.52, ranking the country 111th worldwide. The lower the GII ratio, the greater the inequality between the sexes. This is in contrast to the Gender Gap Index (GGI) where a high score indicates a larger gap between the sexes. Bangladesh's GGI is 0.69, placing it 68th out of 135 countries. These indices indicate that women in Bangladesh currently do not have equal access to resources such as health, education, economic participation and political engagement.

18. In Bangladesh, several laws and regulation were formulated to overcome discrimination and improve women's access to resources. To ensure the protection of women's rights, the Convention for the Elimination of All Forms of Discrimination Against Women (CEDAW) was ratified by Bangladesh on 6 December 1984. The convention aims to promote women's equal status and rights.

### Indigenous Communities

19. Approximately 2% of Bangladesh's population is comprised of indigenous people belonging to ~54 different ethnic groups. While indigenous groups in Bangladesh are recognised under the Small Ethnic Groups Cultural Institution Act (2010), they are among the most persecuted of all minorities – primarily because of their religious and ethnic differences, as well as their low socio-economic status. This persecution resulted in an armed uprising by the indigenous population in 1978. Following peace agreements between the indigenous population and the Government of Bangladesh in 1997, the Chittagong Hill Tracts (CHT) Accord recognised CHT as a "tribal inhabited" region, thereby providing the legal framework for indigenous self-determination. Government and non-government organisations have also implemented many development programmes – focusing on education, infrastructural development, rural electrification, health facilities – to increase the socio-economic status of these ethnic minorities<sup>13</sup>.

20. The Santal people in the Barind Tract are one of the oldest indigenous populations in Bangladesh. The population is concentrated in Jheolmari where the majority are employed as

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<sup>11</sup>Chowdhury A, H. The state of Community Based Sustainable Management of Tanguar Haor, What measures are to be taken? IUCN Bangladesh.

<sup>12</sup>CIA World Factbook 2013. Available at: <https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html>. Accessed 24 February 2015

<sup>13</sup>The Santals of Bangladesh : An ethnic minority in transition. Available at: <http://anthropology-bd.blogspot.co.za/2008/07/santals-of-bangladesh-ethnic-minority.html>. Accessed 3 December 2015.

agricultural labourers, although there has been increased migration to urban areas where opportunities for non-agricultural employment are available<sup>14</sup>. The Santals generally experience mass poverty as a result of: i) limited understanding of land ownership; ii) conflict with the majority Bengali population; and iii) language barriers.

### Education

21. Bangladesh has one of the largest primary education systems in the world with an estimated 16.4 million primary school aged children<sup>15</sup>. While primary education is free and compulsory for all children up to Grade 5, the average literacy rate in Bangladesh is low at ~55%. This ranks Bangladesh as 194 out of 216 countries for literacy. In addition, the government's expenditure on education – 2.2% of the GDP – is one of the lowest in the world<sup>16</sup>.

22. Current government projects to promote the education of children in Bangladesh include compulsory primary education for all, free education for girls up to grade 10, stipends for female students, a nationwide integrated education system and a food-for-education literacy movement. A large section of the country's national budget is set aside to help put these programs into action and to promote education and make it more accessible. In addition, numerous measures have been taken by the GoB to integrate knowledge on climate change in primary, secondary and tertiary education levels. For example, in 2006, ActionAid conducted a climate change awareness programme called Disaster Risk Reduction (DRR) in schools in Kurigram and Patuakhali. This programme: i) introduced disaster awareness; and ii) promoted action for disaster risk reduction.

23. The largest barriers to educational opportunity are based on geographic location and economic status. Children living in rural areas have lower rates of participation, higher dropout rates and low contact time with teachers. This has resulted in the literacy rate in rural areas being lower than the national average (as an example, the literacy rate in the Haor Area is ~38%).

### Economy

24. In 2013, Bangladesh's Gross Domestic Product (GDP) was calculated to be ~US\$324 billion with an annual per capita GDP of US\$2,100<sup>17</sup>. Exports contribute ~US\$26.91 billion to the country's economy. Rice is the major cereal crop while jute, sugarcane, and tea are the main cash crops. Other important crops are wheat, tobacco, vegetables and tree fruits. The main exported products include *inter alia*: i) garments; ii) raw and manufactured jute goods; iii) tea; iv) fish; and v) hides and skins. Despite increasing poverty of local communities, Bangladesh's GDP has grown at an average rate of ~6% per annum since 1996.

### Agriculture

25. Agriculture is the single largest producing sector of Bangladesh's economy; contributing to ~18.6% of the country's GDP and employing ~45% of the total labour force. As a result, this sector has an effect on major macroeconomic objectives including employment generation, poverty alleviation, human resources development and food security.

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<sup>14</sup> The Santals of Bangladesh : An ethnic minority in transition. Available at: <http://anthropology-bd.blogspot.co.za/2008/07/santals-of-bangladesh-ethnic-minority.html>. Accessed 3 December 2015.

<sup>15</sup>UNICEF Quality Primary Education in Bangladesh. Available at: [http://www.unicef.org/bangladesh/Quality\\_Primary\\_Education\(1\).pdf](http://www.unicef.org/bangladesh/Quality_Primary_Education(1).pdf)

<sup>16</sup>CIA World Factbook 2013. Available at: <https://www.cia.gov/index.html>. Accessed 24 February 2015

<sup>17</sup>Bangladesh Economy Profile 2014. Available at: [http://www.indexmundi.com/bangladesh/economy\\_profile.html](http://www.indexmundi.com/bangladesh/economy_profile.html). Accessed 24 February 2015

26. Bangladesh's main agricultural products are rice, jute and tea. Because of the country's fertile lands, favourable geographical location and extensive water supply from the three major river system – the Ganges, Brahmaputra and Meghna – rice can be grown as much as three times a year in many areas. This is important for promoting food security in the country as rice is cultivated predominantly for domestic consumption<sup>18</sup>. In contrast, jute and tea – in addition to wheat, sugarcane, potatoes, tobacco, pulses, oilseeds, spices, fruit, beef, milk and poultry – are the dominant export products<sup>19</sup>.

27. Agriculture or crop cultivation is the main source of income for local communities in the Barind Tract. However, despite considerable efforts to increase the production of rice in the area, rural communities experience constant and acute poverty and often suffer from food insecurity and malnutrition. Furthermore, agricultural production in the Barind Tract is reduced by droughts in the area.

28. In the Haor Area, the rims of the haors and beels are used for winter rice cultivation. Almost 80% of the arable land is covered by Boro rice, while only about 10% of the area is covered by *T. Aman*. Recent fluctuations in yields have been associated with early floods, hailstorm and droughts.

### Livestock

36. The livestock sector plays an important role in Bangladesh's economy. This sector contributes ~2% of national GDP with ~20% of the population being directly involved in the sector. Moreover, currently there is a focus on developing this sector to contribute to the major macroeconomic objectives in Bangladesh including employment generation, poverty reduction and women empowerment. In addition, meat from livestock is an important source of protein for local communities, with the current per capita availability of milk, meat and eggs being 108.66 ml/day, 80.64 gm/day and 66.20 eggs/year respectively<sup>20</sup>.

### Fisheries

29. The fisheries sector plays an important role in the economy of Bangladesh, contributing ~4% of the national GDP and ~23% of the agricultural GDP. This sector has experienced consistent growth– from ~7% in 2009-10 to ~5% in 2012-13. During the last 10 years, the average growth of this sector was around 5.5%. In addition, this sector provides about 60% of the national animal protein, with more than 17.5 million people being engaged in this sector on a full time and part time basis<sup>21</sup>.

30. Despite the potential of the inland capture fisheries to contribute to the GDP and income of local communities, this segment is underperforming mainly because of over-fishing, the use of destructive fishing methods, siltation of water bodies, closure of natural fish passes, encroachment, and pollution of water bodies by agro-chemicals, industrial and urban waste. As a result, these fisheries – which are a main source of livelihoods and protein for many rural households – have declined. Importantly, the Haor Master Plan (HMP, 2012) describes the Haor Area as having notable potential to contribute to the fisheries sector.

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<sup>18</sup>Encyclopaedia of the Nations. Available at: <http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Bangladesh-AGRICULTURE.html>. Accessed 25 February 2015

<sup>19</sup>Encyclopaedia of the Nations. Available at: <http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Bangladesh-AGRICULTURE.html>. Accessed 25 February 2015

<sup>20</sup>DLS, 2014.

<sup>21</sup>DoF, 2014.

31. Most of these beels<sup>22</sup> are leased out by the GoB to local community members for fishing activities. These leases can last for up to a period of three years, with the chance of renewal. The average monthly income to local community households in the Haor area from capture fisheries is ~16,000 BDT per household, with nearly half of households being engaged in this activity. There are claims that under the current practice of land leasing, the Hakaluki Haor – which falls in the project area – is in danger of losing nearly 32 fish species because of over fishing<sup>23</sup>. This is a serious threat to fish stocks in the Haor Area.

### Water resources

32. In Bangladesh, water resources are essential in supporting agricultural production – a sector that the majority of the population depend on for their livelihoods. However, Bangladesh's water resources are under stress as a result of: i) rapid population growth; ii) development in the upstream areas of the basin– less than ~10% of the total water flow originates from catchments in Bangladesh with the rest coming from India, Nepal and Bhutan; iii) deforestation; and iv) confinement of rivers by dikes. Consequently, the majority of the rural population are vulnerable to severe water shortages<sup>24</sup>. Similarly, severe flooding – caused by high flows in transboundary rivers, heavy rainfall, low-lying topography and cyclonic surges – is decreasing agricultural security in the country.

33. Groundwater is the main source of water for domestic, industrial and irrigation supplies. Currently, ~80% of agricultural land in Bangladesh relies on groundwater for irrigation. While, groundwater irrigation has promoted agricultural practices in dry areas – such as the Barind Tract – excessive withdrawal has resulted in the lowering of the water table in this area<sup>25</sup>. In the Barind Tract, groundwater extraction is particularly problematic, as this area does not experience seasonal flooding.

### Ecosystems, protected areas and conservation

34. Ecosystems across Bangladesh provide diverse goods and services upon which the main economic sectors depend. Consequently, ecological security and livelihood security in Bangladesh are critically dependent on biodiversity and its components. The ecosystems of Bangladesh are categorized into two major groups: terrestrial and aquatic. The terrestrial ecosystems include: i) forests; and ii) drylands. Aquatic ecosystems include: i) seasonal and perennial wetlands; ii) rivers; iii) lakes; iii) coastal mangroves; iv) coastal mudflats and charlands<sup>26</sup>; and v) marine. However, biodiversity in Bangladesh is threatened by several direct and indirect factors, including *inter alia*: i) land use; ii) habitat destruction; iii) invasive alien species; iv) economic policies; v) unsustainable exploitation of resources; and vi) weak management systems<sup>27</sup>.

35. Bangladesh is a country rich in biodiversity, with 650 species of birds, 126 species of reptiles, 22 species of amphibians, 708 species of freshwater and marine fish, and 400 species of molluscs and over 5,000 species of vascular plants having been recorded in the country. In addition, 54 species of

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<sup>22</sup>A beel (Bengali: বিল) is a term for billabong or a lake-like wetland with static water in the Ganges - Brahmaputra flood plains of the Eastern Indian states of West Bengal, and Assam and in the country of Bangladesh

<sup>23</sup>Natural Resource Economic Evaluation of Hakaluki Haor. 2006. Prepared by IUCN-Bangladesh.

<sup>24</sup>Gupta, A. D., Babel, M. S., Albert, X. & Mark, O. 2005. Water sector of Bangladesh in the context of integrated water resources management: a review. *Water Resources Development* 21: 385–398.

<sup>25</sup>Rahman, M.M& Mahbub, A.Q.M. 2012. Groundwater Depletion with Expansion of Irrigation in Barind Tract: A Case Study of Tanore upazila. *Journal of Water Resource and Protection*. 4: 567-575

<sup>26</sup>sandbars that emerge as islands within the river channel or as attached land to the riverbanks as a result of the dynamics of erosion and accretion in the rivers.

<sup>27</sup>Convention on Biological Diversity: Bangladesh country profile. Available at: <http://www.cbd.int/countries/profile/default.shtml?country=bd#facts>.

fish, eight species of amphibians, 58 species of reptiles, 41 species of birds and 40 species of mammals are listed as threatened<sup>28</sup>. Based on physiographical, hydrological, meteorological, and ecological features, the IUCN has delineated 25 bio-ecological zones in Bangladesh.

36. The GoB established 38 protected areas representing natural ecosystems in the country. These protected areas include Wildlife Sanctuaries and National Parks in accordance with the Bangladesh Wildlife (Conservation & Security) Act 2012, and cover ~10% of the total forest area in Bangladesh<sup>29</sup>.

37. The Barind Tract is considered an ecologically vulnerable ecosystem that is currently threatened by: i) infrastructural expansion; ii) agricultural extension; iii) the use of agrochemicals; and iv) illegal hunting. The vegetation cover in the area consists of a diverse array of herb, shrub and tree species<sup>30</sup>, particularly Sal (*Shorea robusta*) forest. These forests support a diverse array of wildlife<sup>31</sup>. Forests in the area— including homestead forests – consist of species of undergrowth wild plants (herbs, shrubs, creepers) and paddy, betel leaf and vegetables cultivation. Currently, there are very few natural Sal forests in the Barind Tract with the majority of forests being restricted to homestead forests. These homestead forest resources play an important role in the livelihoods of local communities since they provide additional income and nutrition.

38. The majority of the natural ecosystems of Bangladesh are wetlands. The floodplains of Bangladesh represent one of the world's most important wetlands<sup>32</sup> – home to hundreds of species of fish, plants, and wildlife and are critical habitat for thousands of migrating birds. Almost four million hectares of inland waters – including floodplain, beels, rivers, estuaries and sundarbans<sup>33</sup>, and kaptai lakes – support a great diversity of freshwater species. There are an estimated 260 species of finfish, as well as shrimps, turtles, snails, and other wetland resources. Consequently, the Hakaluki Haor – located in the North-East zone – was declared by GoB as an Ecologically Critical Area (ECA). The Haor basin is the only region in Bangladesh where remnant patches of freshwater swamp and reed lands still exist.

#### *General climatic conditions*

39. Bangladesh experiences a subtropical monsoon climate characterised by seasonal variation in rainfall, temperature and humidity. There are three distinct seasons in Bangladesh: i) a hot, humid summer from March – June; ii) a cool, rainy monsoon from June – October; and iii) a cool, dry winter from October – March. The maximum temperature of 40°C occurs during the hottest month of the year (April). January is the coldest month of the year, with an average temperature of 10°C<sup>34</sup>. During the long dry season, there is hardly any rainfall in Bangladesh, while ~80% of the yearly rainfall occurs during the monsoon season. Annual rainfall in the country is ~2000 mm.

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<sup>28</sup> IUCN Bangladesh, 2000

<sup>29</sup> <http://www.bforest.gov.bd> as accessed on 11 March 2015

<sup>30</sup> Tree species include: Aam (*Mangifera indica*), Litchu (*Litchi chinensis*), Taal (*Borassus flabellifer*), Sissoo (*Dalberzia sissoo*), Sal (*Shorea robusta*) are common. Other trees are Akashmoni (*Acacia auriculiformes*), Raintree (*Samanea saman*), Babla (*Acacia Arabica*), Tentul (*Tamarindus indica*), Narikel/Coconut (*Cocos nucifera*), Supari (*Areca catechu*), Khejur (*Phoenix sylvestris*), Kul (*Ziziphus mauritiana*) and Bamboo/Bash (*Bambusa Spp.*)

<sup>31</sup> Including Skipper frog (*Euphlyctiscyanophlyctis*), Cricket frog (*Limnodynasteslimnodynastes*), Mouse deer (*Tragulusememinna*), Rufous-tailed hare (*Lepus nigricollis*), Masked palm civet (*Pagumalarvata*), Lesser black krait (*Bungaruslividus*), Cantor's kukri snake (*Oligodoncyclurus*), Peacock-marked softshell turtle (*Aspidereteshuram*), Gray francolin (*Francolinuspondicerianus*), Eurasian golden oriole (*Oriolusoriolus*), Brahminy starling (*Strunuspagodorum*), Blossom-headed parakeet (*Psittularoseata*).

<sup>32</sup> Haor Master Plan 2012

<sup>33</sup> tidal halophytic mangrove forest

<sup>34</sup> Weather online: Bangladesh. Available at: <http://www.weatheronline.co.uk/reports/climate/Bangladesh.htm>. Accessed 27 February 2015.

40. The Barind Tract has a warm and humid climate and experiences low annual rainfall – ~1600 mm – compared to the rest of the country<sup>35</sup>. The maximum temperature in the Barind Tract is ~45°C, while the minimum temperature in this area is ~8°C. As a result of variable rainfall and high temperatures, this area is considered semi-arid and drought-prone.

41. The Haor Area has a typical temperate climate that is strongly influenced by monsoons. Summer temperature in the Haor Area can reach ~40°C, while winter temperatures are relatively cooler ranging from 8 to 22°C. Annual rainfall in this area is higher than the national average and ranges from 5,800 to 2,300 mm per year.

#### *Observed climate variability and change*

42. Bangladesh is extremely vulnerable to the current and future effects of climate change as a result of: i) its geographical location; ii) high population density; iii) high levels of poverty; and iv) the reliance of many livelihoods on climate-sensitive sectors – particularly rural agriculture and fisheries<sup>36</sup>. In addition, two-thirds of the country is less than 5 meters above sea level, making it one of the most flood prone countries in the world. Extreme events such as drought in the Barind Tract and heavy rains and floods in the Haor area, are causing habitat loss in these areas. In April 2014, Bangladesh experienced the highest temperature in 54 years (40.2°C) according to Bangladesh Meteorological Department.

43. Since 1983, annual and seasonal rainfall in the Barind Tract has been variable. The average temperature has increased by 0.3°C while mean annual rainfall has decreased by 4.41%<sup>37</sup> resulting in more severe and frequent droughts (Figures 4 and 5). One consequence of this water shortage is a decrease in agricultural production and a reduction in food security. Similarly, households that depend on agriculture for their economic stability will also be negatively affected. The reduced rainfall and the subsequent droughts from 2010 to 2013 has resulted in ~30% of the total cultivable land remaining fallow. In addition, the shortage of rainfall in this area has been shown to affect the critical reproductive stages and reduces the yield of Aman rice in the area<sup>38</sup>.

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<sup>35</sup>Ibid.

<sup>36</sup>Climate Change Cell key facts. Available at: <http://kmp.dmic.org.bd/bitstream/handle/123456789/50/230.%20Climate%20Variability%20and%20change%20factsheet.pdf?sequence=1>. Accessed 27 February 2015

<sup>37</sup><http://www.wamis.org/agm/meetings/rsama08/Bari201-Islam-Farming-Systems.pdf>

<sup>38</sup>Rahman, A. 2014. Climate Change Observed in the Barind Tract. *The Experiment* 21(4): 1499-1502

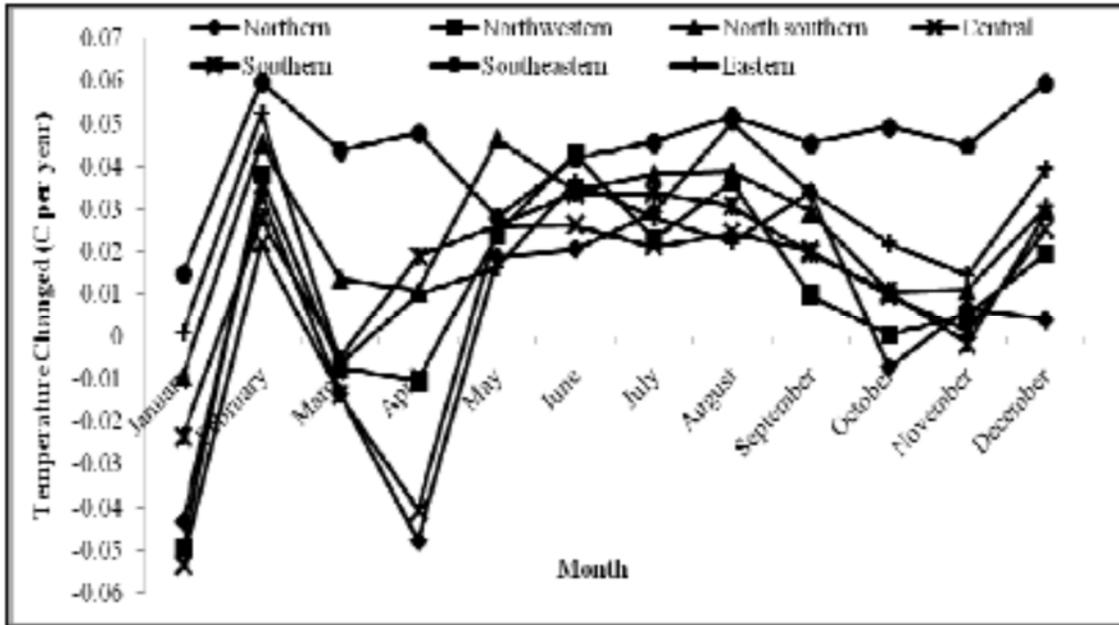


Figure 4. Observed changes in average monthly maximum temperature: 1976–2008<sup>39</sup>.

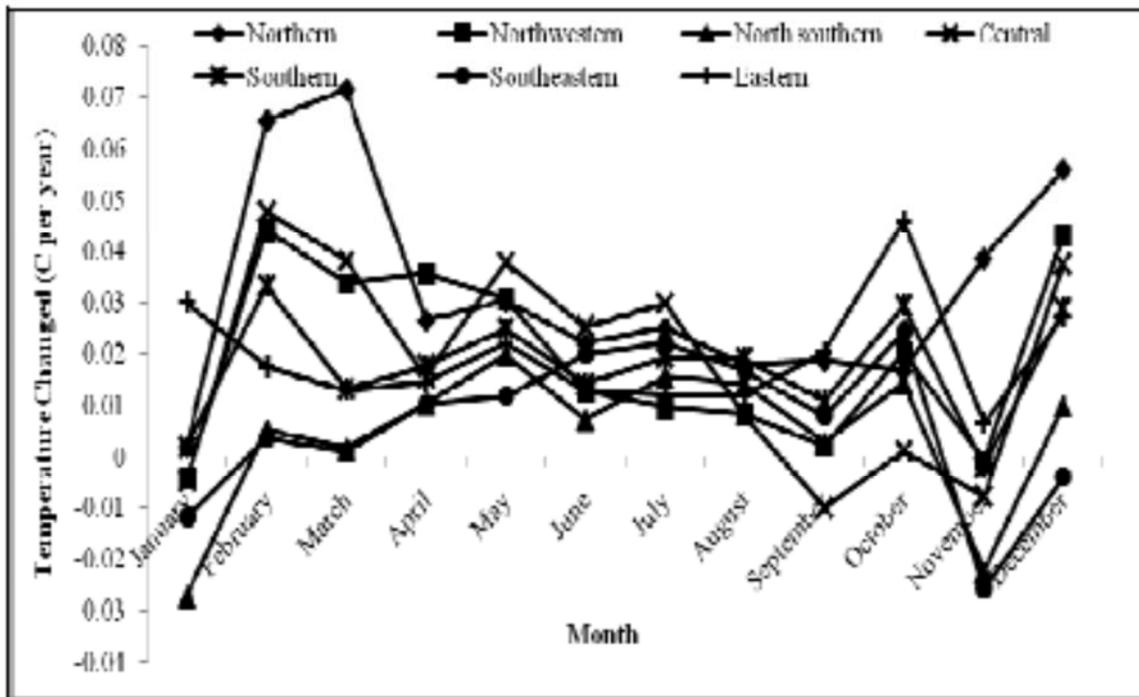


Figure 5. Observed changes in average monthly minimum temperature: 1976–2008<sup>40</sup>.

44. As a result of climate change, the mean annual rainfall in the Haor Area has increased<sup>41</sup> over the past four decades (see Table 1). This increase in mean annual precipitation has led to an increase in

<sup>39</sup>Basak, J.K., Titumir, R, A, M., Dey, N, C. 2013. Climate change in Bangladesh: A historical analysis of temperature and rainfall data.

<sup>40</sup>Basak, J.K., Titumir, R, A, M., Dey, N, C. 2013. Climate change in Bangladesh: A historical analysis of temperature and rainfall data.

floods, in particular flash floods, in the Haor Area. This increased flash flooding has had a severe effect on crop production. As an example, in 2003 over 80% of rice amounting to 0.6 million tons was completely damaged due to flash floods<sup>42</sup>.

Table 1. Observed changes in rainfall (mm per year) during four seasons: 1976–2008.

<b>Region</b> <b>Month</b>	<b>Winter</b>	<b>Pre-Monsoon</b>	<b>Monsoon</b>	<b>Post-monsoon</b>
North	-0.617	1.242	11.811	8.761
North West	-1.170	0.943	4.599	2.563
North South	-1.595	2.145	11.716	5.178
Central	-1.787	-1.659	2.274	5.484
South	-0.098	-1.321	7.362	2.503
Southeast	0.578	7.102	17.970	2.580
Eastern	0.795	0.999	8.639	0.449

### *Climate change predictions and predicted impacts*

45. GCM analysis indicates that the average temperature of Bangladesh will increase by 1.4°C by 2050. Based on the above projections, Bangladesh is likely to experience more hot days and heat waves annually, longer dry spells and higher drought risk<sup>43</sup>. In addition, climate change projections indicate a change in average monthly rainfall. Monsoon rainfall is expected to increase by 11% by 2030 and 27% by 2070. In addition, the general rise in surface average temperature will increase by 1.3°C by 2030 and 2.6°C by 2070. The number of rainy days will increase by ~20 days. These climate change scenarios suggest that ~18% of current flooded areas will be susceptible to higher levels of flooding. In addition, Bangladesh is expected to experience the following climate-related changes: i) more extreme hot and cold spells; ii) melting of the glaciers in the source areas of Bangladesh’s rivers, thereby altering the hydrological cycle; and iii) more powerful tornados and cyclones.

46. Recent climate change models predict an increase in air temperature and decrease in precipitation in the Barind Tract, which will lead to increased evaporation and a reduction in the availability of surface water. In addition, the predicted increase in air temperature and decrease in precipitation will result in an increase in severity and frequency of droughts in the Barind Tract. These extreme events will lead to further degradation of the area’s dryland ecosystems. Conversely, climate change models project an increase in precipitation with heavier and more erratic rainfall in the Haor Area. This projected increase in rainfall will result in: i) higher river flows and widespread flooding, resulting in damage to agricultural land and infrastructure; ii) increase river bank erosion; and iii) increased sedimentation of rivers, haors and beels, leading to poor drainage and the loss of important habitat for aquatic species. The effect of current and future climate change on relevant sectors in Bangladesh are described below.

<sup>41</sup>Saniruzzaman. 2014. Trend Analysis of Climatic Extreme Events for the Haor Area of Bangladesh Using Climatic Indices. Proceedings of the 2nd International Conference on Civil Engineering for Sustainable Development (ICCESD-2014)

<sup>42</sup>Adaptive Crop Agriculture Including Innovative Farming Practices in Haor Basin. 2009. Climate Change Cell Department of Environment

<sup>43</sup>Ramamasy, S. and Baas, S. 2007. Climate variability and change: adaptation to drought in Bangladesh. Food and Agricultural Organisation of the United Nations. Rome, Italy.

## Agriculture

47. Food security and agricultural production will be affected by changes in climactic variables, including *inter alia*: i) an increase in the intensity and frequency of extreme weather events such as flood and droughts; ii) increasing abnormalities in rainy season patterns; and iii) rising sea levels.

48. The agricultural sector is vulnerable to drought and high temperature, which are expected to increase under climate change<sup>44</sup>. For example, a 1°C increase in temperature was shown to decrease Aman-1 rice production by 17.20–53.06 tons<sup>45</sup>. Similarly – while a rise in CO<sup>2</sup> will have a positive effect on fertilization – a simultaneous increase in temperature will suppress crop production<sup>46</sup>.

49. In the Barind Tract, an increase in temperature and a decrease in rainfall will reduce ground water and river water for irrigation. This decrease in water resources for agriculture will result in a decline in agricultural crops – particularly rice – which require a large amount of water. Moreover, the changing climate will interfere with agricultural production, since the crop calendar is based on the temporal distribution of rainfall and temperature throughout the year. In addition, the increased temperature will increase the land surface temperature, resulting in a change to the soil organic composition and thereby affect plant and microbial functioning.

50. An increase in rainfall and more erratic rainfall events in high rainfall areas – such as the Haor Area – will increase flood durations. A consequence of this flash flooding is altered river water flow, resulting in loss of crops and agricultural lands. In addition, increased rainfall may lead to waterlogged soils thereby negatively affect crop production. For example, a 1 mm increase in rainfall was shown to decrease Aman crop production by up to 0.29 tons<sup>47</sup>.

## Livestock

51. Climate change is predicted to have a negative effect on the livestock sector in Bangladesh. In particular, climate change in the Barind Tract is expected to reduce the productivity of livestock in the area. For example, an increase of 1°C in mean annual temperature in this area will likely reduce the animal productivity<sup>48</sup>.

## Fisheries

52. Climate change in the Haor Area is predicted to have a negative effect on the fishery sector. An increase in mean annual rainfall and the subsequent increase in floods will increase the rate of siltation of the ponds, beels, haors and waterbodies in this area. This increase in sedimentation will negatively affect fish spawning and result in a reduction in the population of important fishery species<sup>49</sup>.

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<sup>44</sup>Understanding climate variability and climate change. Available at: <ftp://ftp.fao.org/docrep/fao/010/a1247e/a1247e02.pdf>. Accessed 2 March 2015.

<sup>45</sup>Climate Change Threat Agricultural production and Food Security in Bangladesh. Available at: [http://www.climateemergencyinstitute.com/uploads/M\\_\\_A\\_Climate\\_Change\\_Threat\\_Agricultural\\_production\\_and\\_Food\\_Security\\_in\\_Bangladesh.pdf](http://www.climateemergencyinstitute.com/uploads/M__A_Climate_Change_Threat_Agricultural_production_and_Food_Security_in_Bangladesh.pdf). Accessed 2 March 2015

<sup>46</sup>Understanding climate variability and climate change. Available at: <ftp://ftp.fao.org/docrep/fao/010/a1247e/a1247e02.pdf>. Accessed 2 March 2015.

<sup>47</sup>Climate Change Threat Agricultural production and Food Security in Bangladesh. Available at: [http://www.climateemergencyinstitute.com/uploads/M\\_\\_A\\_Climate\\_Change\\_Threat\\_Agricultural\\_production\\_and\\_Food\\_Security\\_in\\_Bangladesh.pdf](http://www.climateemergencyinstitute.com/uploads/M__A_Climate_Change_Threat_Agricultural_production_and_Food_Security_in_Bangladesh.pdf). Accessed 2 March 2015

<sup>48</sup>Dr. Hossain Salim, Department of Livestock Services. Pers. Comms.

<sup>49</sup>Bangladesh Environmental and Climate Change Assessment. 2013.

53. An increase in drought events in the Barind Tract will affect small-scale fisheries. Prolonged periods of droughts, increased frequency of dry years and high temperatures will: i) decrease water availability in ponds and other waterbodies; and ii) decrease the solubility of oxygen. Consequently, the growth and reproduction of fish will be negatively affected<sup>50</sup>. Prolonged drought leads to over-exploitation of ponds and water bodies for irrigation, which decreases the availability of surface water in these areas.

### Water

54. Approximately 80% of rainfall in Bangladesh occurs during monsoon season (June-September). The remaining 20% of rainfall events occur over eight months, including the winter months in which the high-yielding boro rice crop is grown. Monsoon season rainfall is projected to become heavier and more variable, resulting in intensified rainfall events and/or longer dry spells<sup>51</sup>. These drought periods are expected to exacerbate fresh water availability problems in the drought-prone areas of Bangladesh. These problems are intensified by increasing demand for water, with climate change models project that by 2018, the demand for irrigation may reach 58.6% of the total supply of water<sup>52</sup>.

55. Climate change is projected to result in a more erratic rainfall pattern. In high rainfall areas – such as the Haor Area – the projected increase in rainfall events will result in increased flow of river water and flood events. This results in erosion of riverbank soils and consequently a shortage of lands for agriculture and damage to existing agricultural areas, houses and other infrastructures.

56. In Barind Tract, climate-change related increase in temperature and reduction in rainfall will result in a shortage of groundwater supply, severely affecting irrigation. Increased temperature would also cause the nearby rivers and patches of wetlands to dry out, thereby decreasing crop and fisheries production.

### Health

57. Climate change in Bangladesh is predicted to have notable negative effects on the health sector. Changes in climatic conditions – such as increased temperature, droughts and flooding – will increase the probability of diseases including *inter alia*: i) cholera; ii) dysentery; iii) malaria; and iv) typhoid. The spread of infected disease will be exacerbated by the reduction in water quality and increase in water shortage. The projected decrease in water supply in the Barind Tract will increase the incidence of dehydration, which will be further exacerbated by extreme heat that will be experienced in this area. Similarly, climate change-induced floods in the Haor areas will reduce the availability of clean drinking water.

### Ecosystems, protected areas and conservation

58. Increased droughts in the Barind Tract have resulted in the degradation of forests and agricultural land in this area. The deterioration of these important ecosystems will result in a reduction in biomass of important crop and forest species, increasing the vulnerability of communities in the

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<sup>50</sup>Understanding climate variability and climate change. Available at: <ftp://ftp.fao.org/docrep/fao/010/a1247e/a1247e02.pdf>. Accessed 2 March 2015.

<sup>51</sup>Understanding climate variability and climate change. Available at: <ftp://ftp.fao.org/docrep/fao/010/a1247e/a1247e02.pdf>. Accessed 2 March 2015.

<sup>52</sup>Understanding climate variability and climate change. Available at: <ftp://ftp.fao.org/docrep/fao/010/a1247e/a1247e02.pdf>. Accessed 2 March 2015.

Barind Tract that rely on these resources for their livelihoods. Similarly, increased flooding – as a result of increased precipitation in the Haor Area – has resulted in the siltation and degradation of important beels and haors in this area. The deterioration of the highly productive beels and haors will result in a reduction of important fishery species in this area. Furthermore, the degradation of wetlands in the Haor Area will hamper conservation efforts.

## 2.2. Global significance

59. Through appropriately designed, implemented and monitored EbA interventions, the LDCF-financed project also contributes to the conservation and sustainable use of biodiversity, including species of global significance<sup>53</sup>. The LDCF-financed project will be implemented in the upazilas surrounding the Hakaluki Haor. This haor was declared as an Ecologically Critical Area (ECA). The Hakaluki Haor is a very important resting place for migratory birds, in particular the Adjutant Stork, Baer's Pochard, Falcated Teal, Broadbill Sandpiper, Spotted Redshank, Nordmann's Greenshank, Temminck's Stint, Steppe Eagle and Osprey. In addition, the Haor Area is the only region in Bangladesh where remnant patches of freshwater swamp and reed lands still exist<sup>54</sup>. The project provides global environmental benefits by reducing the vulnerability of ecologically important areas, and the threatened species therein, to climate change.

## 2.3. Threats, root causes and barrier analysis

60. The baseline context underpinning the problem induced by climate change is described in Section 2.1 under the heading “Predicted effects of climate change”. In addition, non-climate related threats are being exacerbated by the negative effects of climate change. These non-climate related threats are described below.

### Non-climate change related threats

#### *Unsustainable resource use*

61. In the Barind Tract and the Haor Area, increasing populations and urban expansion are resulting in: i) unplanned infrastructural development; ii) unsustainable land management practices; and iii) exploitation of natural resources. Consequently, forest and wetland ecosystems are being degraded. Effects of this ecosystem degradation include *inter alia*: i) increased erosion in both areas; ii) reduced rainwater infiltration and water availability in the Barind Tract; iii) reduced availability of important fish stocks in the Haor Area; iv) increased sedimentation of haors and beels in the Haor Area; and v) reduced food availability and food security in both areas. This reduced ecosystem functioning is described in detail below.

#### *Threats causing increased erosion*

62. In the Barind Tract and Haor areas of Bangladesh, deforestation and unsustainable agricultural practices have led to a reduction in the stability of soils, making them more susceptible to water erosion<sup>55</sup>. As a result, various types of soil erosion – including sheet, rill, gully and riverbank erosion – are occurring. In the Barind Tract, widespread deforestation and clearing of land for agriculture has led to a reduction in vegetation cover. This has exposed soils in the area to raindrop impact making them particularly vulnerable to rain damage. In addition, the reduced vegetation cover means that the soil

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<sup>53</sup> These species include Bamboo (e.g. *Melocanna baccifera* and *Bambusa tulda*), Sungrass (*Imperata cylindrica*), Cane (*Calamus viminalis* and *Calamus guruba*), Pati Pata (*Clinogynae dichotoma*), Gol-Pata (*Nypa fruticans*), Horitaki (*Terminalia chebula*), Amlaki (*Phyllanthus emblica*), and Bohera (*Terminalia bellerica*).

<sup>54</sup>Haor Master Plan 2012

<sup>55</sup>Bangladesh: State of the Environment 2001. Land Degradation. - [http://www.rrcap.ait.asia/pub/soe/bangladesh\\_land.pdf](http://www.rrcap.ait.asia/pub/soe/bangladesh_land.pdf)

contains fewer root systems to: i) bind soils; and ii) provide pathways for water to infiltrate the soil. Furthermore, the use of traditional cultivation methods in the Barind Tract has changed soil structures – making the soils more susceptible to erosion – and reduced soil productivity in this area<sup>56</sup>. This reduced soil productivity is further exacerbated by high temperatures and low rainfall in summer. These conditions increase the vulnerability of soils in this area to run-off erosion and wind erosion. As a result, accelerated rates of soil erosion have been occurring in the Barind Tract. Similarly, the expansion of agricultural activities into the rims of haors and beels, and the associated wide-scale deforestation in the Haor Area is resulting in increased riverbank and beel erosion<sup>57,58</sup>. The soils in this area retain less water from rainfall in wet seasons than before the degradation, which results in increased river flow in spring and early summer. Increased rates and volumes of water in riverbeds results in riverbank erosion. Consequently, areas of land adjacent to rivers that are used for growing crops are reduced. In the Haor Area, ~7 million hectares of floodplain areas are experiencing riverbank and beel erosion<sup>59</sup>.

#### *Threats causing a decrease in water availability in the Barind Tract*

63. Deforestation and unsustainable agricultural practices in the Barind Tract have led to a reduction in soils stability as discussed above. Because of soil crusting and reduced root systems, rainwater is only able to penetrate the shallow top layer of soils. Consequently, rainwater evaporates quicker because it is exposed to wind and sun. This increased evaporation results in less infiltration of rainwater into soil profiles – exacerbated by reduced rainfall and increased temperature in the Barind Tract – which further results in a decreased supply of surface water. Groundwater is, therefore, being extracted more frequently for irrigation during the dry season. Approximately 80% of agricultural land in the Barind Tract is currently under irrigation from groundwater. This increased rate of extraction has resulted in a lowering of the water table – at a rate of 1.37 ft/yr in the wet season and 0.72 ft/yr in the dry season – and the drying up of tube wells and community-based wells<sup>60</sup>. Of the total ground water that is extracted annually, the BMDA is currently extracting ~12% for irrigation, whereas the private sector is extracting ~88%<sup>61</sup>.

#### *Threats causing a reduction in availability of important fish stocks in the Haor area*

64. The majority of important fish species (such as the Knife fish, *Chitala chitala*) in freshwater wetlands of Bangladesh use beels and haors as breeding grounds<sup>62</sup>. The siltation of these beels and haors, as described above, reduces the depth of these areas, thereby decreasing the habitat available for breeding. In addition, swamp forests in the Haor Area are important nursery areas for fish species. The removal of these swamp forests – owing to agricultural expansion, and firewood and building material collection – results in the decreased availability of these nursery areas. Consequently, the survival rates of fry and fingerlings are reduced, thereby negatively affecting the overall fish stocks. The removal of important habitat is further exacerbated by the unplanned construction of dams, roads and embankments. This changes fish migration routes, which further decreases fish stocks in certain areas.

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<sup>56</sup>Ibid

<sup>57</sup>Bangladesh: State of the Environment 2001. Overview -[http://www.moef.gov.bd/html/state\\_of\\_env/pdf/overview.pdf](http://www.moef.gov.bd/html/state_of_env/pdf/overview.pdf)

<sup>58</sup>Hassan, M. Faisal, A.M., Islam, M.A. 2005. Reexcavation: A Major Step in Wetland Restoration in the Haors. IUCN – The World Conservation Country Office.

<sup>59</sup>Islam N.M., 1999. Embankment Erosion Control: Towards Cheap and Simple Practical Solutions for Bangladesh. Coastal Embankment Rehabilitation Project South Khulshi, Chittagong, Bangladesh.

<sup>60</sup>BMDA, 2014

<sup>61</sup>BMDA, 2014.

<sup>62</sup>Hossain M.H. and Kamp, K. pers. comm.

### *Threats causing a reduction in food availability and food security*

65. Increasing population pressure and urban expansion are resulting in deforestation and ecosystem degradation in the Barind Tract and Haor Area. As a result, agricultural land has been decreasing by ~0.6% per year. This loss of agricultural land is being further exacerbated by the loss of soil (as described above) and the limited supply of groundwater for irrigation, which is resulting in reduced productivity of important crop species in the Barind Tract. Furthermore, the increased erosion in both the Barind Tract and the Haor Area, as well as the associated siltation of dams results in: i) reduced productivity of fisheries in the Haor Area; and ii) constrained effectiveness of irrigation systems. As agricultural and fishery yields are reduced, rural communities become increasingly dependent on the food supplies from ecosystems to replace these yields.

### *Threats leading to increased flooding in the Haor Area*

66. In the Haor Area, expansion of agricultural land into areas adjacent to beels and haors has resulted in decreased natural vegetation cover of: i) swamp forest on the rims of these water areas; and ii) upland mixed evergreen forests situated at the beel fringe and at higher altitudes of associated watersheds. Consequently, the functioning of these ecosystems to regulate water is reduced. Moreover, reduced vegetation cover through deforestation in the upland region of haors and beels exposes soils to raindrop impact. This impact results in clay dispersion and soil crusting, and ultimately increased surface runoff and erosion. Increased erosion has led to increased siltation of rivers, haors and beels in this area. While increased siltation has reduced the drainage capacity of the haors and beels in the Haor Area increasing the likelihood of flash floods<sup>63</sup>.

### *Underlying causes on the threats described above*

#### Population pressure

67. Population pressure is the main driving force of land and forest degradation in Bangladesh. The population density of Bangladesh (>1,000 people/km<sup>2</sup>) is five times that of other 'mega' countries<sup>64</sup>, with more than ~70% of the population residing in rural areas. This great population density has resulted in unsustainable farming practices to increase agricultural production on a limited area of land<sup>65</sup>. Such practices include *inter alia* increased use of high yielding varieties of crops, chemical fertilizers and agrochemicals. As a result of this anthropogenic pressure on natural resources, ecosystems are being degraded<sup>66</sup> as described earlier in this Section.

#### Poverty

68. Bangladesh is one of the world's most densely populated countries with ~31% of the population living below the national poverty line of US\$2 per day<sup>67</sup>. Over 70% of the population resides in rural areas and are economically dependent on agriculture and fishing. To this end, ~45% of the population is employed in the agriculture sector. As a result, ~39% of households in the Haor Area

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<sup>63</sup>Bhuiyan, S.I. 2004. Rice Research and Development in the Flood-prone Ecosystem. Int. Rice Res. Inst.

<sup>64</sup>countries which have a population of 100 million or more.

<sup>65</sup>Bangladesh has the highest percentage of land under agriculture and degree of agricultural intensification. Alauddin M., and Quiggin, J. 2007 Agricultural intensification, irrigation and the environment in South Asia. Issues and policy options. Journal of Ecological Economics.

<sup>66</sup>Ali, A.M.S. 2004 Technological change in agriculture and land degradation in Bangladesh: a case study. Available at <http://onlinelibrary.wiley.com/doi/10.1002/ldr.617/abstract>.

<sup>67</sup>Bangladesh Poverty Assessment: Assessing a Decade of Progress in Reducing Poverty, 2000-2010.

live below the poverty line<sup>68</sup>. Rural populations are more vulnerable because they have limited financial resources and few livelihood options, which limit their capacity to adapt to the effects of climate change. Consequently, poverty in rural areas continues to be more pervasive and extreme than in urban areas.

#### Dependence on rain-fed agriculture in the Barind Tract

69. In Bangladesh, rain-fed crops play an important role in agriculture. Approximately 21% of rice in the Barind Tract is grown using rain-fed agriculture. In addition, ~90% of poor local communities depend on agriculture for their livelihoods<sup>69</sup>. Rain-fed agriculture has an increased risk of failing under conditions of climate change and variability. Because the agricultural productivity is dependent on rainfall, rain-fed agriculture exposes farmers to variations in the climate and prevents them from providing ideal amounts of water to crops at optimum times. In Bangladesh, most rural farmers do not have financial savings nor do they have access to capital to install irrigation systems. Moreover, uncertain land tenure makes investing in irrigation infrastructure unfeasible. Consequently, these farmers are vulnerable to the negative effects of climate change.

#### Land leasing system

70. Bangladesh has an under-developed system of property rights and land tenure, which has resulted in ~60% of rural families being landless<sup>70</sup>. These families are particularly vulnerable to the observed and predicted effects of climate change because they live on marginal land in the Barind Tract, and sandbars and swamplands in the Haor Area. In addition, approximately a quarter of farms in Bangladesh are rented out for sharecropping<sup>71</sup>. This approach to agriculture has been shown to be inefficient with per acre output being lower than other approaches such as owner-cultivation<sup>72,73</sup>. Furthermore, sharecropping arrangements are seasonal, thereby decreasing the benefits experienced by farmers – which are short term – compared with costs of investing in agricultural land.

### **The problem addressed by the project and the preferred solution**

71. Growing population pressure, agricultural expansion and unsustainable agricultural practices are resulting in the degradation of dryland ecosystems in the Barind Tract and wetlands in the Haor Area. This ecosystem degradation is reducing the capacity of ecosystems in the Barind Tract and Haor Area to provide valuable ecosystem goods and services (for further details see Appendix 22) that underpin the main livelihoods of local communities. The observed and predicted effects of climate change (see Section 2.1) – including increasing temperatures and decreasing precipitation – further exacerbate this ecosystem degradation.

72. The **problem** that this project seeks to address is that local communities in Bangladesh are vulnerable to climate change. Currently, the Government of Bangladesh and local communities do not

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<sup>68</sup>Khan I.M., Islam M.A. 2005. Poverty Status of a Critical Wetland Area. Hakaluki Haor IUCN - The World Conservation Union Bangladesh Country Office

<sup>69</sup>New Rice Varieties for Bangladesh from Client Oriented Breeding Rainfed Agriculture Impact Assessment Study No.3 Monitoring Impact and Learning (MIL) Component of the Research into Use (RiU) Programme.

<sup>70</sup>Tenaw, S., Zahidul Islam, K.M. and Parviainen, T. 2009. Effects of land tenure and property rights on agricultural productivity in Ethiopia, Namibia and Bangladesh. Discussion Papers no 33 Department of Economics and Management, University of Helsinki, Finland.

<sup>71</sup>Sharecropping is a system of agriculture in which a landowner allows a tenant to use the land in return for a share of the crops produced on the land.

<sup>72</sup>Hossain, M. 1977. Farm size, tenancy and land Productivity: Analysis of farm level data in Bangladesh Agriculture, The Bangladesh Development Studies.

<sup>73</sup>Jabbar, M.A., Relative productive efficiency of Different Tenure Classes in Selected Areas of Bangladesh. The Bangladesh Development Studies. Vol. V. No1.

have adequate capacity to implement EbA as a means to adapt to climate change in a cost-effective and sustainable manner. This is because these stakeholders have limited knowledge on planning and implementing EbA. Additionally, there is a lack of rigorous, quantitative evidence of the effectiveness of EbA within Bangladesh.

73. The **preferred solution** to the problem described above would see increased resilience of local communities and economic sectors in Bangladesh to climate change. Considering that functional, intact ecosystems underpin the main livelihoods of local communities; this increased resilience would be achieved through an Ecosystem-based Adaptation (EbA) approach. EbA is considered a cost-effective and low-risk approach in the long term (see Section 7.3), and is known to generate socio-economic benefits for the environment, citizens, and the local economy<sup>74</sup>. This preferred solution is further detailed below.

*Local community resilience to climate change is increased because of functioning natural ecosystems*

74. The preferred solution would see the discontinuation of unsustainable activities – such as agriculture expansion and the subsequent deforestation, and excessive groundwater extraction – in favour of sustainable agricultural practices (including spice cultivation through zero tillage) and climate-resilient livelihoods. It would also see the restoration of degraded dryland and swamp forest ecosystems using approaches that are resilient to climate change so that they continue to provide valuable ecosystem goods and services under conditions of climate change. This preferred solution would be achieved through the implementation of EbA throughout Bangladesh. By implementing EbA, ecosystem functioning would be enhanced, thereby increasing the supply of goods and services from these ecosystems. Local community livelihoods and economic sectors – including *inter alia* fishing and agriculture – would develop while simultaneously adapting to climate change. Additionally, restoration of dryland and wetland ecosystems would: i) improve water quality and groundwater replenishment in the Barind Tract; ii) reduce erosion; iii) reduce flooding in the Haor Area; and iv) enhance biodiversity conservation.

*The technical and institutional capacity to address climate change risks in dryland and wetland ecosystems through EbA is sufficient in Bangladesh*

75. The preferred solution would see the technical and institutional capacity of local/national government and local communities to effectively respond to and manage climate change risks in ecosystems strengthened. This would allow EbA to be integrated into: i) development planning; and ii) ecosystem management plans. EbA on a national scale would be supported by evidence-based research on this approach. Furthermore, the preferred solution would see lessons learned from EbA interventions shared amongst: i) the public; ii) policy- and decision-makers; and iii) projects engaging in ecosystem management. It would also see effective collaboration and information sharing between government departments to allow coordinated adaptation interventions and plans to be developed.

**Barriers to implementing the preferred solution**

76. There are a number of barriers to achieving the preferred solution in Bangladesh. These barriers are outlined below.

*Limited understanding of EbA*

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<sup>74</sup>Rao et al. 2013. An economic analysis of ecosystem-based adaptation and engineering options for climate change adaptation in Lami Town, Republic of the Fiji Islands. A technical report by the Secretariat of the Pacific Regional Environment Programme. Apia, Samoa.

77. In Bangladesh, limited awareness of EbA at the government and local level is a considerable barrier to the implementation of this approach. Although these stakeholders are involved in activities for ecosystem restoration and management, EbA is a relatively new concept in the country. As a result, there is limited knowledge on: i) what constitutes EbA best practice; ii) the costs and benefits of this approach; and iii) how to tailor EbA for particular ecosystems. Therefore, EbA is not considered or used as a means of adapting to the adverse effects of climate change.

*Limited technical and institutional capacity of government and local communities to plan and implement EbA*

78. Staff members within government ministries and departments – including Ministry of Environment and Forests (MoEF), Ministry of Water Resources (MoWR), Ministry of Agriculture (MoA), Department of Environment (DoE), Department of Agricultural Extension (DAE), Bangladesh Haor and Wetland Development Board (BHWDB), Department of Fisheries (DoF), Department of Livestock Services (DLS), the Barind Multipurpose Development Authority (BMDA) and the Bangladesh Water Development Board (BWDB) – do not receive training on EbA. Therefore, these national-level institutions do not have the technical capacity for planning and implementing this approach. This is also the case with the relevant local government, who provide technical support to local communities. Without the technical capacity to plan and implement EbA, local government are unable to share information on EbA with local communities. Therefore, these local communities have limited technical capacity to plan and implement EbA.

*Limited integration of EbA into development planning, frameworks and guidelines*

79. Policies and plans related to ecosystem management and national development have been developed for drylands and wetlands in Bangladesh<sup>75</sup>. However, these strategic documents do not include adaptation to climate change using EbA. Therefore, this approach is not integrated into development planning nor management of relevant sectors including *inter alia* environment, water, forestry, conservation and tourism.

*Limited coordination between government ministries, departments and institutions involved in ecosystem restoration and climate change adaptation*

80. An effective national response to climate change requires coordination among different national ministries, departments<sup>76</sup>, and scientific institutions. Currently, there is limited coordination between stakeholders involved in ecosystem restoration and climate change adaptation in Bangladesh. In the absence of coordinated communication between projects and departments with similar objectives, opportunities to upscale EbA effectively across Bangladesh are limited.

*Limited protocols/tools for implementing EbA in dryland and wetland ecosystems in Bangladesh*

81. To enhance adaptation to climate change and promote development of livelihoods, EbA should be tailored to particular ecosystems. However, protocols for implementing this approach do not exist. This is predominantly because EbA has not been implemented in Bangladesh (i.e. climate change projections are not considered in the design of interventions for restoration). People engaging

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<sup>75</sup>This includes the Haor Master Plan, Bangladesh's National Adaptation Programme of Action (NAPA) and National Action Programme (NAP) for Combating Desertification.

<sup>76</sup>such as the DoE, DAE, BHWDB, DoF and BMDA

in these activities do not therefore have access to appropriate tools or documents to guide the implementation of EbA.

*Insufficient on-the-ground demonstration of EbA where benefits are being measured*

82. To date, EbA has not been implemented in Bangladesh. As a result, the benefits and cost-effectiveness of this approach have not been demonstrated to policy- and decision-makers, and local communities. Furthermore, with insufficient demonstration it is unlikely that: i) the EbA approach will be integrated into local, regional and national policies, plans and legislation for dryland and wetland ecosystems; and ii) local communities will fully support EbA projects.

*Limited research on EbA*

83. Scientific knowledge on EbA is required to guide the implementation of appropriate EbA interventions. Currently, local research institutions do not include EbA in their curricula neither at an undergraduate nor post-graduate level. This is predominantly because: i) there is limited awareness of the benefits of EbA; ii) EbA is a relatively new concept; and iii) there are limited resources available for research on EbA at a post-graduate level.

The project will contribute to overcoming the barriers described above through the activities, outputs and outcomes described below.

*Improving understanding of EbA at the national and local level*

84. The interventions of the LDCF-financed project will: i) increase knowledge on EbA amongst government stakeholders and local communities; and ii) improve and facilitate the dissemination of relevant information on climate change and EbA. This will be achieved through three types of activities under Outcomes 1 and 3. Firstly, training on EbA will be provided for government and local communities. Secondly, a central information database to collect and share information will be established within an appropriate entity in the MoEF – e.g. the Climate Change Cell – to increase the availability and accessibility of information on EbA. Finally, postgraduate and post-doctorate students will be funded to undertake research on climate change risks and EbA.

*Increasing the technical and institutional capacity of national and local government to address climate change risks through EbA*

85. The technical and institutional capacity of national and local government will be strengthened by: i) providing support to propose revisions to policies, strategies related to dryland and wetland ecosystem management to promote EbA and national climate change budgets; ii) revising the mandate of the climate change cell to be able to better coordinate EbA in Bangladesh; iii) developing technical guidelines on EbA and; iv) distributing these guidelines to policy- and decision-makers. These guidelines will facilitate the move from EbA planning to implementation, which will support the upscaling of EbA throughout Bangladesh as a means of addressing climate change risks. Thereafter, government will be trained on these guidelines. This training will strengthen the technical capacity of government ministries and departments to: i) effectively select and plan appropriate EbA interventions; or ii) integrate this approach into on-going environmental projects, ecosystem management, and development planning.

*Improving coordination between government departments and institutions involved in ecosystem restoration and climate change adaptation*

86. The LDCF-financed project will include multiple executing partners – such as the BWDB, and BMDA – in the implementation of site-specific project activities in the Barind Tract and Haor Area (see Section 4 for further details on the executing partners). This collaborative approach will promote coordination between government departments and institutions.

*Demonstrating the benefits and cost-effectiveness of EbA through the implementation of on-the-ground EbA and EbA support interventions in dryland and swamp forest ecosystem.*

87. EbA interventions for the restoration of dryland ecosystems in the Barind Tract and swamp forest ecosystems in the Haor Area will be implemented (detailed in Section 3.2). These interventions will demonstrate the multiple benefits and cost-effectiveness of EbA to policy- and decision-makers in Bangladesh. In addition, protocols for EbA will be developed for the particular ecosystems in which on-the-ground activities will take place. Protocols will be tailored by synthesising scientific research with traditional knowledge of local communities. This approach will support the upscaling of EbA in similar areas across Bangladesh. Furthermore, interventions will be implemented using an adaptive management approach. Lessons learned will be synthesised and disseminated through a central information database that will be established under Outcome 3.

*Increasing the knowledge base on EbA*

88. EbA knowledge will be increased through activities under Outcome 3. Firstly, a central information database will be developed to gather and share information generated by the LDCF-financed project with national and local government officials, local communities and academics conducting research on EBA in the Barind Tract and Haor Area. Secondly, financial support will be provided to post-graduate and post-doctorate researchers – from appropriate local universities – to conduct research on: i) specific climate change risks; and ii) the effectiveness of the EbA interventions that will be implemented in the Barind Tract and the Haor Area. Thirdly, a knowledge management plan will be developed and implemented to capture and share information on: i) the effects of climate change; and ii) lessons learned while implementing adaptation interventions through the LDCF-financed project and similar initiatives throughout Bangladesh. Finally, a framework that supports replicating and upscaling of EbA in Bangladesh will be established. The particular deliverables of this framework will be presented to relevant national institutions including *inter alia* the DoE, HWDB and BMDA. These activities will strengthen the understanding of, and enhance the evidence base for EbA, promoting upscaling of EbA in dryland and wetland ecosystems across Bangladesh.

## **2.4. Institutional, sectoral and policy context**

### **Institutional context**

89. The LDCF-financed project will be implemented through the Department of Environment under the Ministry of Environment and Forests (MoEF) in Bangladesh. The MoEF's focus on environmental protection and climate change corresponds with the EbA objectives of the project. The institutional context in Bangladesh, particularly as it relates to the MoEF, is described further below.

90. Within Bangladesh, the MoEF is responsible for developing and enforcing policies related to the environment. The main priority of the MoEF is to develop policies, strategies and action plans to protect and manage the environment to ensure sustainable development. The DoE is responsible for addressing environmental issues including ecosystem preservation and restoration, promoting awareness of environmental issues, and the conservation of flora and fauna. With respect to climate change, the MoEF is tasked with *inter alia*: i) developing national policies on climate change

adaptation and mitigation; ii) integrate climate change considerations into existing development interventions; and iii) monitoring the implementation of environmental legislation.

91. In 2004, the MoEF established the Climate Change Cell (CCC) within the DoE. The objective of the CCC is to: i) enhance the technical capacity of DoE in supporting the Government in the development of climate change-related policies and programmes; ii) integrate climate change considerations into existing development interventions; and iii) support the Government in its role in coordination and negotiation efforts. In particular, the CCC is mandated to prepare technical papers for the MoEF to support international negotiations, formulate guidelines for mainstreaming climate change, and develop training materials to improve national government awareness on climate change.

### **Policy Context**

92. The Government of Bangladesh (GoB) has introduced multiple policies, strategies and legislation relating to appropriate environmental management and sustainable development. The legislative frameworks, strategies and multilateral environmental agreements relevant to the LDCF-financed project, and with which the project will comply, are presented below.

### **Legislative Frameworks**

93. The **Bangladesh Environment Conservation Act (BECA)** (1995) enforces the sustainable use of biological resources in the country. This Act creates an enabling environment for: i) ecological conservation; ii) the improvement of environmental standards; and iii) control of environmental pollution. The **amendment to the Bangladesh Environment Conservation Act** (2010) defines wetlands and Ecologically Critical Areas. This Act also stipulates that an Environmental Impact Assessment (EIA) be undertaken for all construction that may have a negative impact on the environment. The LDCF-financed project will comply with this Act by conducting EIAs for the construction of canals in the Barind Tract and Haor Area.

94. The **Water Supply and Sanitation Act** (1996) regulates the management of water supply and sanitation in urban and rural areas that are effected by climate-related natural hazards. The objective of this Act is to ensure hygiene and sanitation facilities are available during and after climate-related hazards at upazila, union and village levels.

95. The **Forest Act** (1927) promotes conservation of biological diversity by enabling the GoB to declare any area of forest as reserved or protected. In addition, this Act enables the GoB to establish control over private forests or assign control of reserved forests to local communities.

96. The **Pesticide Ordinance** (1971) enables the GoB to refuse registration rights to pesticides that are detrimental to vegetation, human or animal health.

97. The **Protection and Conservation of Fish Act** (1950) provides an enabling environment for the GoB to: i) implement water rules to protect fisheries; ii) prohibit use of fixed engines and construction of weirs, dams, bunds and embankments; iii) prohibit use of explosives, guns and bows in fishing; iv) prohibit use of poisoning, pollution and effluents in fishing; v) allocate fishing seasons; vi) prohibit fishing during spawning periods; and vii) assign officials to maintain the Act.

98. The **Bangladesh Wildlife Preservation Order** (1973) promotes the creation of game reserves, national parks and wildlife sanctuaries for the protection of wildlife and natural habitats. The **Bangladesh Wildlife (Conservation and Security) Act** (2012) includes a provision for the

conservation of biodiversity, forest and wildlife by repealing the current law relating to conservation and wildlife management in Bangladesh.

99. The **Irrigation Water Rate Ordinance** (1983) consolidates the regulation of water supply and storage for irrigation or drainage purposes.

100. The **Embankment and Drainage Act** (1952) consolidates laws relating to embankment and drainage. In particular, this Act includes provisions for the improved management of embankments and drainage to protect communities from water damage, including floods and erosion.

101. The **Groundwater Management Ordinance** (1985) authorizes the Thana Parishad to grant licenses for installing tube wells in their jurisdiction.

102. The **Water Reservoir Conservation Act** (2000) defines a ‘natural wetland’ as an area including rivers, canals, beels, ponds, streams, fountains and catchment areas.

103. The **Public Waterbody Management Policy** (2009) aims at ensuring full access of poor fishermen to public water bodies.

104. Bangladesh’s **National Environment Policy** (1992) regulates ecosystem dynamics and environmental development by: i) identifying activities that contribute to environmental degradation; ii) promoting development with minimal effect on the environment iii) supporting sustainable use of natural resources; and iv) maintaining awareness on international environmental initiatives.

105. The **National Forestry Policy** (1994–2015) implemented a twenty-year forestry master plan to conserve and develop Bangladesh’s forest resources. This policy is in line with the Forests Act (1927) and Wildlife (Preservation and Security) Act (2012). The objectives of the policy are to promote sustainable development/management of forest resources and alleviate poverty. These objectives are supported by local level participation in forest protection and management, and forestry development at the national level.

106. The **Water Supply and Sewerage Authority Act** (1996) regulates management of water supply and sanitation in areas that are effected by climate-related hazards. This Act ensures that hygiene and sanitation facilities are provided during and after the hazards at the upazila, union and village levels.

107. The **National Livestock Development Policy** (2007) promotes the provision of high quality animal protein by increasing livestock and poultry production and productivity. The policy also promotes self-employment by providing frameworks for the establishment of dairy, poultry, sheep and goat farms.

108. The **National Fisheries Policy** (1998) improves socio-economic conditions of fishermen by creating self-employment opportunities. In addition, this policy promotes exporting fish and fish products thereby contributing toward local economic growth. Under this policy, the national jalmahal policy was formulated by the GoB to reserve the rights of fishermen.

109. The **National Water Policy** (1999) provides guidelines for the preservation of wetlands and sustainable water management.

110. The **Bangladesh Water Act** (2013) provides an institutional framework for the development, management, extraction, distribution, usage, protection, and conservation of water resources.

111. The **National Agriculture Policy** (1999) promotes food security in Bangladesh by: i) increasing land productivity; ii) reducing reliance on single crop species; iii) increasing the production of nutrient-rich food crops; iv) maintaining current crop diversity; v) promoting sustainable agriculture; and vi) strengthening agro-forestry programmes.

112. The **Environment Court Act** (2000) established mobile courts throughout Bangladesh to impose penalties on individuals who misappropriate land and contribute to environmental degradation.

113. The **Water Conservation Act** (2000) makes provisions for the protection of natural wetlands.

114. The **National Water Management Plan** (2004) is an institutional framework for integrated water management. This plan aims to promote poverty reduction and disaster prevention thereby increasing the living standards of local communities in Bangladesh.

115. The **Bangladesh Water Development Board Act** (2000) was passed with a view to ensure development and management of water resources by rescinding provisions of the Bangladesh Water and Power Development Boards Order of 1972 under the Bangladesh Water and Power Development Board Order, 1972 (P.o. No.9 of 1972)

#### **Plans/Strategies**

116. **Bangladesh Forestry Master Plan** (1994) provides detailed guidelines and recommendations for afforestation, reforestation and developing a protected area system in Bangladesh. It includes a forestry biodiversity conservation plan.

117. **Biodiversity Strategy and Action Plan** (NBSAP) (2004) aims to conserve Bangladesh's biological diversity and maintain ecosystem services in a sustainable manner in order to ensure socio-economic development while ensuring livelihood security of the people for present and future generations.

118. **National Water Management Plan** (NWMP) (2004) aims to achieve harmonized socio-economic development through integrated management of water resources. The plan aims to address the major issues to achieving poverty reduction and disaster prevention to enhance the living standards of local communities in Bangladesh.

119. **Haor Master Plan** (2012) aims to: i) ensure crop production; ii) conserve biodiversity; and iii) protect vulnerable homesteads and infrastructure in the Haor Area.

120. **Conservation Management Plan for Hakaluki Haor** (2006) was developed by the Coastal and Wetland Biodiversity Management Project that was implemented by the DoE. This plan aims to ensure the conservation and sustainable use of globally significant wetland resources in the Hakaluki Haor through the management of this water body as an ECA.

121. **Bangladesh Sixth Five Year Plan** (2011-15) aims to accelerate growth and reduce poverty.

122. **Social Forestry Rules** (2004) were developed to ensure the active participation of rural people in the planning, implementation and benefit sharing of tree growing schemes in main land forestry programmes. The rules have brought important change in forest management, with notable success in poverty reduction, income and employment generation, as well as in the provision of other benefits to rural poor.

123. **National Adaptation Program for Action (NAPA)** (revised in 2009). In 2005, the GoB approved Bangladesh's NAPA. Through this process, 15 priority activities were identified to address urgent and immediate national adaptation priorities. These included project 6 "Mainstreaming adaptation to climate change into policies and programmes in different sectors (focusing on disaster management, water, agriculture, health and industry)", project 10 "Promotion of research on drought, flood and saline tolerant varieties of crops to facilitate adaptation in future.", and project 12 "Adaptation to agriculture systems in areas prone to enhanced flash flooding – North East and Central Region."

124. **Bangladesh Climate Change Strategy and Action Plan (BCCSAP)** (2009). The GoB prepared and adopted the BCCSAP as a dynamic document that incorporated and substantially expanded on the NAPA. The BCCSAP aims to eradicate poverty, increase employment opportunities, ensure food security, provide access to energy and power, and achieve economic and social well-being of all citizens of the country. The BCC Strategy 2009 prioritizes adaptation and the BCC Action Plan includes six main pillars including food security, social protection and health, comprehensive disaster management, infrastructure, research and knowledge management, low carbon development and capacity building.

125. The **Gender Equity Strategy (2001)**. The Ministry of Health and Family Welfare (MoHFW) developed and adopted the GES, which identifies violence against women as an important issue with the aim of enhancing the capacity of the HPSP to meet its objective of improving health in Bangladesh. This will be achieved by addressing the gender differentials and inequalities that undermine the health of women and children – particularly the poor – in Bangladesh.

126. **National Fisheries Policy (2006)** was developed and adopted to make aquaculture and fisheries management activities environmentally friendly and sustainable. This policy aims to increase fish production through the optimum utilization of available resources. Under this policy, the National Fisheries Strategy was developed and approved by the Ministry of Fisheries and Livestock in 2006. The Fisheries strategy is made up of eight sub-strategies and includes an action plan that deals with fisheries resources management.

### **Multilateral Environmental Agreements**

127. Bangladesh is a signatory to a number of multilateral environmental agreements as outlined below.

- **Convention on Biological Diversity (CBD)** was signed in 1992 and ratified by the GoB in 1994.
- **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)** was signed in 1975 and ratified by the GoB in 1982.
  - **Convention on the Conservation of Migratory Species of Wild Animals (CMS or the Bonn Convention)** was ratified by the GoB in 2005. To date, several agreements have been concluded under the auspices of CMS. Bangladesh also signed an MoU in 2004 to conserve **Marine Turtles** in the Indian Ocean and South-East Asia.
- **Convention on Wetlands of International Importance especially as Waterfowl Habitats** was ratified by the GoB in 1992.
- **United Nations Convention to Combat Desertification (UNCCD)** was signed in 1994 and ratified by the GoB in 1996.
- **United Nations Framework Convention on Climate Change (UNFCCC)** was signed in 1992 and ratified by the GoB in 1994.

- **Convention on the Elimination of Discrimination against Women (CEDAW)** was acceded to in 1984 and the Optional Protocol on CEDAW was subsequently ratified in 2000.

## 2.5. Stakeholder mapping and analysis

128. The LDCF-financed project has been country driven and developed through extensive consultations with national and multilateral stakeholders (see Appendices 21 and 25 for further details on the inception mission, workshops and stakeholder consultations). As a result, the project has been designed to address the priority adaptation needs identified by these stakeholders. This participatory approach to stakeholder engagement promotes ownership of the project by local communities. Consultations included: i) the inception workshop in November 2014; ii) regional workshops in the Barind Tract and Haor Area; iii) multiple meetings with international, national and local level stakeholders during November 2014 and November 2015; and iv) multiple remote consultations with national and multilateral stakeholders between October 2015 and November 2015. The main purpose of the stakeholder consultations was to identify: i) appropriate EbA interventions based on the vulnerabilities and needs of different groups within local communities (including Indigenous Communities, women and the youth); ii) on-going projects relevant to the activities of the project; iii) national and local government authorities relevant to the activities of the project; iv) relevant national policies and legislation; and v) additional information on the baseline context in Bangladesh. As a result of these consultations, the LDCF-financed project will be aligned with national policies and plans and will be feasible in the local context.

129. National and sub-national organisations and institutions were consulted during the Project Preparation Grant (PPG). These organisations and institutions are listed below.

### National stakeholders

- Center for Natural Resources Studies (CNRS)
- Center for Environmental and Geographic Information Services (CEGIS)
- Department of Environment (DoE)
- Department of Agriculture Extension (DAE)
- Department of Livestock Services (DLS)
- Department of Fisheries (DoF)
- Bangladesh Water Development Board (BWDB)
- International Union for Conservation of Nature (IUCN)
- JASHIS
- Soil Resource Development Institute (SRDI)
- Bangladesh Agricultural Research Institute (BARI)
- Independent TV

### Sub-national stakeholders

- Divisional Commissioner Office, Sylhet
- Indigenous Community, Barind Tract
- Shahjalal University of Science and Technology (SUST)
- Sylhet Sahitto Forum
- The Daily Sylhet
- Office of Regional Consultant of Food, Sylhet
- Department of Public Health Engineering (DPHE), Sylhet Circle
- The Independent, Sylhet
- Local Government Engineering Department (LGED), Sylhet

- Sylhet Agricultural University (SAU)
- Bangladesh Forest Department (BFD), Sylhet
- Divisional Family Planning Office, Sylhet
- Department of Livestock Services (DLS), Sylhet and Rajshahi
- Zonal Settlement Office (ZSO), Sylhet
- Department of Fisheries (DoF), Sylhet
- Shahjalal University of Science and Technology (SUST)
- Sylhet Press Club

130. A number of these stakeholders will be involved in project implementation. The participation of each institution in the implementation of the LDCF-financed project is described in Section 5.

## 2.6. Baseline analysis and gaps

### Baseline situation

*Component 1. Capacity development for implementing EbA and upscaling into national and local plans.*

131. Several projects in Bangladesh – such as the multi-donor supported UNDP Comprehensive Disaster Management Programme<sup>77</sup> – have included capacity-building activities for national government staff on climate change. For example, these stakeholders have received training on: i) the effects of climate change; ii) management and relief of climate-related disasters; and iii) climate-resilient crops for adaptation. Therefore, these stakeholders – including staff from MoEF, MoWR, MoA, DoE, DLS DoAE, WARPO, FD, BMDA and BWDB – have a good understanding of such topics. However, government staff have not received training on EbA. As a result, these authorities have limited knowledge on: i) the costs and benefits of EbA; ii) best practice for this approach; and iii) how to tailor EbA for particular ecosystems.

132. In 2004, the Ministry of Environment and Forests (MoEF) established the Climate Change Cell (CCC) within the Department of Environment (DoE). The objective of the CCC is to: i) enhance the technical capacity of DoE in supporting the Government in the development of climate change-related policies and programmes; ii) integrate climate change considerations into existing development interventions; and iii) support the Government to coordinate adaptation efforts in Bangladesh. Over the past decade, this cell has played an important role in coordinating climate-related activities across the country. However, national stakeholders – including members of the cell – have limited knowledge on: i) the benefits of EbA; and ii) how to integrate this approach into planning and coordination for adaptation.

133. In 2009, the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) was developed by the Ministry of Environment and Forests. This guiding document describes the climate-related problems in the country and provides recommended programmes for adaptation. However, policies and plans related to vulnerable sectors such as ecosystem management<sup>78</sup> were developed before: i) the BCCSAP was produced; and ii) awareness on climate change was enhanced amongst policy- and

<sup>77</sup>This project is funded by the United Kingdom Department for International Development (DFID), European Union (EU), Norwegian Agency for Development Cooperation (NORAD), Australian Agency for International Development (AusAID), Swedish International Development Cooperation Agency (SIDA), the United Nations Development Programme (UNDP) and the Government of Bangladesh (GoB).

<sup>78</sup>Examples of such policies and plans include *inter alia*: i) the National Water Management Plan; ii) Forestry Management Plan; and Haor Master Plan.

decision-makers. As a result, there is limited integration of adaptation to climate change into these policies and plans. In particular, EbA is not integrated into policies for relevant sectors such as agriculture, ecosystem management and water.

134. Financial allocations for adaptation to climate change are included in Bangladesh's national budget. Moreover, in 2009 the Ministry of Finance (MoF) created two separate funds for adaptation finance in the country, in line with the development of the BCCSAP. The first of the two funds is the Bangladesh Climate Change Trust Fund (BCCTF), which is sourced entirely from the government's own budget with an allocation of US\$100,000,000 per year<sup>79</sup>. The second is the Bangladesh Climate Change Resilience Fund (BCCRF), which consists of funds provided by developed countries or groups and is managed by the World Bank. The financial provisions within these funds enable: i) scientific research to inform climate change adaptation, and ii) implementation of projects for adaptation. However, budget provisions are not allocated to EbA in particular.

*Component 2. EbA interventions that reduce climate change vulnerability and enhance natural capital.*

In Bangladesh, there are multiple initiatives that have similar objectives to the LDCF-financed project. Within the districts in which the LDCF-financed project will be working, such initiatives are focused on: i) community-based management of ecosystems and improvement of livelihoods; and ii) adaptation to climate change using hard infrastructure such as deep tube wells and ponds. Projects that focus on community-based ecosystems management to improve livelihoods of local communities – such as the Barind Rain Water Conservation and Irrigation Project in the Barind Tract – do not currently include information on climate trajectories in the selection of plant species for afforestation or restoration of ecosystems that underpin local community livelihoods. Without the benefits of EbA to support objectives for livelihood improvement, these initiatives are at risk of being undermined under conditions of climate change. The benefits of EbA are also not realised through projects that focus on constructing infrastructure to promote livelihoods in the face of extreme weather events such as the aforementioned project and the Haor Flood Management and Livelihood Improvement Project. In particular, infrastructure implemented within these projects is not complemented by: i) drought-resilient dryland forests that reduce erosion and promote watershed conservation in dry areas; and ii) flood-resilient swamp forests that mitigate the impacts of floods in wetter areas. For example, drought-resilient species are not prioritised for restoring forests in the Barind Tract. Efforts to promote watershed conservation through such activities will therefore be unsustainable under conditions of climate change. In the Haor Area, restoration of swamp forests using flood-resilient species is not implemented as a cost-effective approach to protecting infrastructure for improved livelihoods, particularly fish production in the beels and haors.

135. Previous and current projects in the Barind Tract and Haor Area have raised awareness of the local communities in these areas on the effects of climate change. In addition, adaptation options – such as Community-based Adaptation (CbA) – have been promoted amongst these communities. However, EbA has not been promoted as one of these options. As a result, there is limited understanding among local communities on the benefits of this approach including additional livelihoods from functional ecosystems. Moreover, these communities have not received formal training on planning and implementing EbA. Consequently, there is limited opportunity for local communities to maximise the benefits of ecosystem restoration to increase their adaptive capacity to

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<sup>79</sup>The Climate Change Act stipulated that 66% of this amount will be spent on the implementation of projects/programmes prioritized in the BCCSAP, and 34 per cent will be maintained as a 'fixed deposit' for emergencies. Funds from the BCCTF can be used to finance public sector and non-government projects, and it is not mandatory to spend the total grant within a given financial year.

the adverse effects of climate change. In addition, there has been limited training on maintenance of infrastructure for adaptation to complement EbA.

*Component 3. Research and knowledge management for appropriate EbA design.*

136. Climate-related research is being undertaken in Bangladesh by a number of organisations including *inter alia* the Bangladesh Institute of Development Studies (BIDS), International Centre for Climate Change and Development (ICCCAD) and government research centres. These initiatives contribute to generating knowledge on climate change adaptation in Bangladesh. However, this knowledge is not currently managed effectively because of: i) limited coordination between relevant departments and institutions; ii) an inadequate centralised information database for climate change information; and iii) limited scientific research and information on the effects of adaptation interventions. In addition, frameworks to monitor the effects of adaptation interventions over the long-term have not been established. Information on the effects of climate change is consequently not effectively stored and disseminated to the public including government, the private sector and local communities.

137. Universities in Bangladesh – including the Independent University, Bangladesh (IUB) – currently offer courses in climate change and adaptation. A few students that are attending these universities are undertaking post-doctoral research on these topics<sup>80</sup>. Such research – mainly focused on developing drought- and flood-resilient agriculture – is being undertaken in the Barind Tract and the Haor areas. However, there is limited research on the effectiveness of adaptation interventions that have been implemented in these areas. To date, EbA has not been implemented in Bangladesh. As a result, there is a lack of scientific knowledge of how best to implement this approach in dryland and wetland ecosystems. Consequently, research on the benefits of this approach has not been initiated.

*Overall baseline situation*

138. The livelihoods of most local communities living in the Barind Tract and Haor Area are underpinned by functional, intact ecosystems and the services they provide. Given this dependency, these local communities are vulnerable to the observed and predicted effects of climate change. In particular: i) increasing temperatures and decreasing rainfall are resulting in more frequent and severe droughts in the Barind Tract; and ii) an increase in more erratic rainfall is resulting in more frequent and severe floods in the Haor Area (see Section 2.1). In the future, these climate-related effects are predicted to worsen.

**Baseline projects**

139. There are multiple on-going projects in the Barind Tract and Haor Area of Bangladesh that have objectives to: i) increase adaptation to climate change; and ii) improve livelihoods for local communities. However, these initiatives do not currently benefit from implementing EbA to enhance ecosystem services under conditions of climate change, which would provide a cost-effective and low-risk approach for adaptation. The LDCF-financed project will build on the ongoing activities of the two selected baseline projects in the Barind Tract and the two selected baseline projects in the Haor Area described below. As a result, the climate resilience of the baseline projects will be increased.

*Baseline projects in the Barind Tract*

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<sup>80</sup>For example, the Bangladesh Agricultural Research Institute (BARI) conducts research on *inter alia*, soil and water management, farming systems, and climate change resilient crops, while the International Centre for Climate Change and Development (ICCAAD) conducts research on aspects of Climate Change Adaptation.

140. The Barind Multipurpose Development Authority (BMDA), within the Ministry of Agriculture, is undertaking several projects in the Barind Tract to meet the following objectives: i) arrest desertification through large-scale plantations; ii) green the Barind Tract; iii) convert the Barind Tract into a granary of Bangladesh; and iv) improve the livelihoods of people. These projects are described below.

The **Barind Rain Water Conservation and Irrigation Project** (hereafter Irrigation Project) (2011-2017) is being implemented in nine districts of the Barind Tract. This programme has a total budget of US\$26,300,000 funded by the Government of Bangladesh (GoB), and will provide US\$5,850,000 co-financing for the LDCF-financed project. The objectives of this baseline project are to: i) increase the use of surface water in irrigation to reduce the demand for ground water; ii) create additional forest resources; iii) increase food production; and iv) generate employment through agricultural activities. These objectives are being achieved by: i) re-excavating ponds and water bodies to increase the rainwater-holding capacity of these reservoirs; ii) constructing submerged weirs; and iii) reforesting khas land<sup>81</sup> in the project area. Activities of the Irrigation Project will conserve rainwater and increase the supply of ground water available for irrigation, which will reduce the demand on ground water. In addition, the increased supply of surface water will enable a larger area of cultivatable land under irrigation, which will increase agricultural productivity.

Climate change will negatively affect the activities of the Irrigation Project. In particular, the predicted increase in temperature coupled with a reduction in precipitation will result in an increase in frequency and severity of seasonal droughts. This will reduce the amount of surface water available for irrigation to support agricultural activities in the Barind Tract. More frequent and severe droughts will also increase the erosion of productive topsoils when rain does occur. This erosion will cause siltation in water bodies that are being re-excavated by the Irrigation Project – such as ponds – thereby reducing the water-holding capacity of these features. Furthermore, more frequent and severe droughts will decrease forest productivity, which will compromise the success of the reforestation programme under the Irrigation Programme. In general, the effects of climate change will undermine the objective of the Irrigation to improve livelihoods for local communities living in the Barind Tract.

141. The LDCF-financed project will build on the Irrigation Project by strengthening the technical capacity of BMDA to plan and implement EbA to support livelihood improvement under conditions of climate change. This will be achieved by providing training for these stakeholders on: i) climate change risks and their impacts on water resources and irrigation and drainage; ii) lessons learned from other EbA projects; and iii) opportunities for EbA in the Barind Tract. Implementation of EbA in degraded dryland forests in khas land will climate-proof the on-the-ground afforestation initiatives of the Irrigation Project. In particular, indigenous, multi-purpose trees that are drought-resilient will: i) provide livelihood benefits for local communities; ii) promote groundwater recharge; and iii) reduce erosion of topsoils, thereby promoting conservation of watersheds in these areas. These interventions will support the Irrigation Project by improving water conservation and protecting irrigation infrastructure from siltation caused by increasing soil erosion under conditions of climate change. Additionally, by selecting tree species that contribute towards enhanced ecosystem goods and services, local communities' livelihoods will be improved under conditions of climate change.

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<sup>81</sup> Khasland or state-owned land is land which the government is entitled to both lease and give away to those in the country who do not own land.

The **Marketing of Agricultural Products through Development of Rural Communication Project** (hereafter the Agri-Products Project) (2010-2017) is being implemented in five districts<sup>82</sup> of the Barind Tract. This project has a total budget of US\$39,500,000, of which US\$15,812,000 is co-financing funded by the GoB. The main objectives of this project are to: i) facilitate rural communication by improving feeder road networks; ii) promote agricultural and commercial activities in the project area; iii) arrest the process of desertification and improve ecological balance; and iv) create employment opportunities in the project area. The objectives of the Agri-Products Project will be achieved by: i) constructing feeder roads to remote areas; and ii) implementing an afforestation programme alongside the feeder roads. The construction of feeder roads will provide local communities with access to markets, which will facilitate development of the local agricultural market, while the afforestation programme aims to arrest desertification in the region.

The effects of climate change – particularly drought – will reduce the efficacy of afforestation activities of the Agri-Products Project along feeder roadsides. The ability of these plantations to bind soils and reduce erosion will decrease under these conditions. As a result, increased erosion is likely to damage feeder roads. The general objective of the Agri-Products Project to promote agricultural and commercial activities in area will also be undermined by more frequent and severe droughts.

142. The LDCF-financed project will build on the objectives of the Agri-Products Project and increase the climate-resilience of its activities. Training provided under Outcome 1 will strengthen the technical capacity of local and national stakeholders – including the BMDA who are implementing this baseline project – to plan and implement EbA in the Barind Tract. Under Outcome 2, EbA will be implemented to afforest roadsides with drought-resilient species, thereby increasing the resilience of both the plantations and the road infrastructure to erosion. Furthermore, the adaptation technologies – such as ponds and rainwater harvesting devices – that will be implemented by the LDCF-financed project in the Barind Tract, will increase the quality and availability of fresh water in the area, which will support the objectives of the Agri-Products Project to promote agricultural and commercial activities. Through the development of additional livelihoods, the LDCF-financed project will support objectives to create employment of the Agri-Products Project by providing local communities with additional resources to be sold at markets. Reforestation of dryland forest on khas land in the Barind Tract will assist also in slowing the process of desertification and land degradation by reducing erosion and increasing water infiltration. .

#### *Baseline projects in the Haor Area*

143. There are ongoing projects in the Haor Area of Bangladesh, implemented by the Bangladesh Water Development Board (BWDB) and the Forest Department (FD), which are addressing some of the baseline problems identified above. This is being achieved by improving flood management, constructing and rehabilitating rural infrastructure and improving fisheries. These projects are described below.

The **Haor Flood Management and Livelihood Improvement Project (FMP)** (2014-2022) is funded by JICA and the GoB with a total budget of US\$118,000,000, of which US\$25,830,000 is co-financing for the LDCF-financed project. The project is being implemented<sup>83</sup> by the BWDB with the objectives to: i) reduce damage to infrastructure from floods; ii) improve access to basic infrastructure; and iii) increase agricultural and fish production in the Haor Area of the upper Meghna River Basin. The objectives of this project will be achieved by rehabilitating and constructing flood management

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<sup>82</sup> These districts include: Nawabganj, Rajshahi, Rangpur Moulvibazar and Sylhet

<sup>83</sup>In the Brahmanbaria, Habiganj, Kishorganj, Netrakona and Sunamganj districts of the Haor area.

facilities and rural infrastructure, and implementing activities that promote sustainable agriculture and fish production.

An increase in the frequency and severity of floods – as a result of increased annual precipitation and heavier, more erratic rainfall events – will negatively affect the construction and rehabilitation of flood management facilities and rural infrastructure activities of the FMP. In addition, these negative climate effects will result in reduced agricultural productivity, which will compromise the activities of the FMP to promote sustainable agriculture and fish production.

Under Outcome 1, the LDCF-financed project will strengthen the technical capacity of the implementing agencies – including the BWDB – to plan and implement flood management interventions under conditions of climate change. This will be achieved by providing training on opportunities for EbA in the Haor Area. In addition, staff from the BWDB will be trained on planning and implementing EbA in swamp forests. Under Outcome 2, restoration of swamp forests using EbA will increase the resilience of these ecosystems during extreme floods. This type of EbA will support the objectives of the FMP by mitigating the impacts of more frequent and severe floods, thereby complementing and protecting infrastructure constructed by the FMP. These interventions will also improve habitats for important fish, thereby supporting the baseline activities of FMP for sustainable agriculture and fish production.

The Forest Department under the Ministry of Environment and Forests is implementing the **Strengthening Regional Co-operation for Wildlife Protection** (SRCWP) Project (2011-2016), which has a total budget of US\$36,000,000, of which US\$7,300,000 is co-financing for the LDCF-financed project. The SRCWP is funded by the International Development Association (IDA) and the Government of Bangladesh (GoB) and has the following objectives: i) assist participating governments in building capacity and strengthening institutions, and sharing knowledge and expertise to jointly address illegal wildlife trade; and ii) improve management of endangered wildlife and their habitat by addressing selected regional conservation threats. These objectives will be achieved by: i) building capacity for wildlife conservation and cooperation for addressing the trans-boundary illegal wildlife trade in Bangladesh; ii) promoting wildlife conservation in South Asia, including the implementation of a wildlife habitat restoration programme; and iii) facilitating project coordination and communication. The SRCWP project will be implemented in 465 upazilas in 64 districts. In particular, the project will undertake activities in the Sylhet and Moulvibazar districts of the Haor Area in which the LDCF-financed project will be implemented.

Climate change will continue to change the functioning of ecosystems throughout Bangladesh. In the Haor Area, climate-related floods will result in degradation of swamp forests. To manage natural habitats and wildlife effectively, climate-related changes and effects need to be considered in the management of the SRCWP project.

144. The LDCF-financed project will contribute to establishing and conserving climate-resilient habitats for wildlife in the Haor Area, thereby increasing the climate resilience of the SRCWP project. Under Outcome 1, staff from FD will be trained on: i) opportunities for EbA in the Haor Area; and ii) planning and implementing EbA as a means of managing wildlife habitats. The LDCF-financed project will build on the wildlife conservation and habitat restoration objectives of the SRCWP project through the implementation of EbA in swamp forests and development of additional livelihood options. Such economic options will promote conservation of wildlife habitats by providing agricultural livelihoods for local communities as alternatives to continued unsustainable use of natural resources. Additionally, the proposed revision of policies and plans for ecosystem management to include EbA – under Outcome 1 – will promote the resilience of wildlife habitats to climate change.

## 2.7. Linkages with other GEF and non-GEF interventions

145. Numerous Global Environment Facility (GEF) and non-GEF national projects that focus on adaptation to climate change have been or are currently being implemented in Bangladesh. These initiatives provide opportunities for synergies and knowledge exchange with the LDCF-financed project. The project management team will coordinate efforts and establish linkages with similar projects. This will be achieved through the establishment of two regional project coordinators committee that will ensure communication between implementing partners and representatives from ongoing projects at the intervention sites. Furthermore, the LDCF-financed project will focus on collating, synthesising and disseminating the lessons learned from these projects using a standardised approach. This approach will: i) maximise synergies; and ii) avoid duplication of activities.

146. **International Centre for Climate Change and Development (ICCCAD)** was established in 2009 in partnership with IIED, Bangladesh Centre for Advanced Studies and Independent University Bangladesh (IUB). The Centre, based at IUB in Dhaka, holds short courses on numerous climate change topics, and as of 2013, has facilitated 14 courses. The objectives of ICCCAD include: i) training future and current leaders on climate change and development; ii) generating peer reviewed publications on climate change adaptation; iii) building capacity to adapt to climate change; and v) establishing a network of partners. The LDCF-financed project is well aligned with ICCCAD's mandate to improve knowledge on, and capacity to adapt to, climate change. The LDCF project will coordinate with ICCCAD and build on relevant trainings related to Component 1 and on the scientific knowledge created in Component 3.

147. Action Research on Community Adaptation in Bangladesh (ARCAB) (2010 – 2060) is a long-term action-research project– funded by the Department for International Development (DFID) – that is learning from and supporting vulnerable communities in Bangladesh as they adapt to human-induced climate change. ARCAB shares this learning with other developing countries. The project plans to follow how communities adapt to floods, droughts, cyclones and sea level rises at 20 climate-vulnerable sites in the country during the next 50 years or more. The LDCF project will generate lessons learned and create an evidence base on helping communities to adapt to climate change using EbA. ARCAB can use the projects sites as a useful learning tool and as a case study. In addition, the scientific papers produced by the LDCF project can feed into the long term research of ARCAB.

148. **Community Based Management of Tanguar Haor Program (CBMTHP)** (2005-15) is funded by the Swiss Agency for Development and Cooperation (SDC) and implemented by International Union for Conservation of Nature (IUCN) on behalf of the MoEF. The objective of the CBMTHP is to establish a management model to conserve and develop the natural resources of the Tanguar Haor for the benefit of local communities. This objective will be achieved by: i) facilitating access to social and economic services; ii) increasing the capacity of local communities to manage natural resources to generate income; iii) developing a community-led monitoring system for the Tanguar Haor; and iv) facilitating sustainable environmental protection measures and resource extraction<sup>84</sup>. The LDCF-financed project is well aligned with the second component of this IUCN, which is aimed at strengthening technical and institutional capacity to manage natural resources. The LDCF-financed project will consult with the IUCN project to build on experiences and lessons learned from work being done in other large wetlands in Bangladesh. In particular, the LDCF-financed project will apply lessons learned by the IUCN project in the restoration of wetlands in the Haor Area

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<sup>84</sup>[http://www.iucn.org/about/union/secretariat/offices/asia/asia\\_where\\_work/bangladesh/about\\_us/bdongoingprojects/?4419/Community-Based-Sustainable-Management-of-Tanguar-Haor-Program](http://www.iucn.org/about/union/secretariat/offices/asia/asia_where_work/bangladesh/about_us/bdongoingprojects/?4419/Community-Based-Sustainable-Management-of-Tanguar-Haor-Program) accessed 13/02/2015

149. The USAID-funded **Climate-Resilient Ecosystems and Livelihoods programme** (CREL) (2013-17) provided technical advice and assistance to government ministries, technical agencies and community-based organizations. The CREL programme aimed to promote responsible, equitable, climate-resilient growth and effective environmental governance. These objectives were supported by promoting: i) alternative climate-resilient livelihood options; ii) biodiversity conservation by co-managing natural resources; and iii) climate change strategy implementation<sup>85</sup>. The LDCF-financed project will link with this USAID-funded project by developing the capacity of national and local government to implement EbA and upscale this approach into national and local policies and plans.

150. The project entitled **Community-based climate resilient fisheries and aquaculture development in Bangladesh** is financed by the GEF/LDCF. This project is implemented by the FAO and executed by the Department of Fisheries. The effects of climate change experienced in Bangladesh including inter alia storms, floods and droughts place severe pressure on the fisheries and aquaculture sectors. These sectors are the source of livelihood for ~15,600,000 people in the country. The FAO-implemented project aims to address the effects of climate change by strengthening the adaptive capacity in the fisheries and aquaculture sectors. In particular, this will be achieved through: i) demonstrating and implementing adaptation techniques; ii) capacity-building of the relevant government stakeholders and local communities to support climate-resilient fisheries; and iii) mainstreaming climate change adaptation in the relevant policies, strategies and plans. The on-the-ground adaptation techniques implemented and demonstrated include the introduction of saline-tolerant and short-cycled fish species, improved shrimp aquaculture farming systems, cage and pen aquaculture, mud crab fattening, and improved hatcheries and satellite hatcheries. In addition, the project's interventions include wetland habitat restoration, swamp forest restoration, critical fishery habitat monitoring and the development of climate-resilient livelihood options for fishery- and aquaculture-dependent communities. The objectives of the FAO-implemented project are aligned with the LDCF-financed project, and these two projects are both implementing on-the-ground initiatives in the Juri upazila in the Haor wetland area. The LDCF-financed project will maintain ongoing communication with the FAO-implemented project through the Regional Project Coordination Committee meetings and through inviting them to participate in the LDCF PSC meetings to promote synergies and avoid duplication of efforts. In particular, interventions related to fish production that will be implemented through the LDCF-financed project to improve livelihoods of communities in the Haor wetland area will be informed by the lessons learned through the FAO-implemented project.

151. The GEF-funded **National Bangladesh Biodiversity Strategic Action Plan** (NBSAP) (2004) had the objective of developing a national Biodiversity Action Plan. The aim of this plan was to fulfil Bangladesh's international commitments under the CBD while incorporating national cultural, historical and geographical priorities. The LDCF-financed projects will support the objective of NBSAP by implementing EbA interventions that increase the adaptive capacity of local communities and restore natural capital. In particular, the LDCF-financed project is well aligned with Strategy 3 and 6 of this action plan, which are aimed at restoring ecosystems and building capacity among different sectors for biodiversity conservation.

152. In Bangladesh, the GEF-funded **National Capacity Self Assessment for Global Environmental Management** process had the goal of identifying priorities and needs for capacity building to protect the global environment. By designing research and knowledge management for appropriate EbA, the LDCF-financed project aligns with the following objectives of this GEF funded process: i) strengthening national procedures to negotiate and implement the global environmental

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<sup>85</sup><http://www.state.gov/documents/organization/200941.pdf> accessed 13/02/2014

conventions; ii) integrating national data collection and reporting for various conventions; and iii) identifying, confirming or reviewing priority issues for action within the areas of biodiversity, climate change and desertification/land degradation.

153. **Integrating Community-Based Adaptation into Afforestation and Reforestation Programs in Bangladesh** is a GEF/LDCF funded project with the objective of reducing the vulnerability of afforestation programmes to climate change in Bangladesh through: i) planting climate resilient mangrove and non-mangrove varieties; ii) implementing new community led climate resilient planting and management techniques; and iii) promoting community participation in the management and long-term protection of new greenbelt structures in partnership with relevant sub-national government entities. The LDCF-financed project will align with these objectives by promoting capacity development for implementing EbA and upscaling EbA into national and local plans.

154. Bangladesh's **Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC)** is a GEF-funded project that promotes appropriate planning, mitigation initiatives and climate change adaptation to be implemented into sustainable development initiatives. The LDCF-financed project aligns with the Second National Communication by strengthening technical capacity of local and national institutions to plan, implement and upscale EbA.

155. The GEF-funded **Assisting Least Developed Countries (LDCs) with country-driven processes to advance National Adaptation Plans (NAPs)** is a UNEP/UNDP support programme that integrates medium- to long-term planning for adaptation for climate change through: i) institutional support; ii) technical support; and iii) knowledge brokering. The LDCF-financed project will align with this programme by strengthening technical capacity of local and national institutions to plan, implement and upscale EbA. The proposed LDCF project will develop the evidence base on the cost effectiveness of investing in ecosystems as an adaptation measure. More broadly, the project will generate lessons learned, and strengthen national and local government coordination mechanisms, implementation partnerships, and awareness and capacity that will be relevant to continuing adaptation planning in the country.

156. The GEF-funded project **Enhancing Capacity, Knowledge and Technology Support to Build Climate Resilience of Vulnerable Developing Countries (2013-2017)** will reduce the vulnerability of LDCs and developing African and Asia-Pacific countries to the effects of climate change. This will be achieved by providing capacity building, and knowledge and technology support on EbA. The LDCF-financed project will align with this project by sharing lessons learned on implementing and maintaining EbA through the web-based platform that has been developed by this project. The proposed LDCF project will generate knowledge, best practices and lessons learned that can be fed into the knowledge portal that has been developed under the above mentioned SCCF project. Supporting countries in the region to implement EbA and enhancing the south-south transfer of knowledge.

157. The **Cooperative for Assistance and Relief Everywhere (CARE)**. Since 1994, CARE has focussed on social justice and decreasing poverty for marginalised groups in Bangladesh. The cooperative has a strong focus on empowering women and will be consulted throughout the LDCF-financed project to ensure integration of gender equality into all activities.

158. The Economics of Land Degradation (ELD) and Land Degradation Neutrality (LDN) in Asia - is a regional project led by UNEP and the Central Asia Regional Economic Cooperation – CAREC

and ELD Initiative. The ELD initiative aims to increase political and public awareness of economic costs and benefits of healthy and productive land. The final objective of this cooperation is to prepare a report on the state of knowledge on land degradation and natural capital for Asian Countries clearly showing the comparison of benefits and costs of action to sustainable land management. The LDCF project sites could be a useful and relevant case study for the ELD initiative, as well as using their methodologies as the basis for building the case for upscaling EbA (in Component 3 of the LDCF project).

159. The UNEP GEF trust fund project entitled National Land Use and Land Degradation Profile toward mainstreaming Sustainable Land Management practices in sector policies will be executed by the Department of Environment and will run from 2016 to 2019. The aim of the project is to establish a knowledge base and enabling policy and institutional environment for SLM consideration in the country's development agenda. The LDCF project can provide useful information and linkages with regard to national land use planning and mapping, as well as on ensuring climate change is integrated into land use policy.

### **SECTION 3: INTERVENTION STRATEGY (ALTERNATIVE)**

#### **3.1. Project rationale, policy conformity and expected global environmental benefits**

##### *Project rationale*

160. The LDCF-financed project aims to decrease the vulnerability of government and local communities living in three upazilas<sup>86</sup> in the Barind Tract and the five upazilas<sup>87</sup> – in which the Hakaluki Haor lies – in the Haor Area to the adverse effects of climate change. To achieve this objective, the project will: i) strengthen the technical and institutional capacity of national and local institutions to address climate change risks through EbA; and ii) implement EbA, and adaptation technologies that conserve water in the Barind Tract and reduce erosion in the Haor Area, and promote additional livelihood options at selected sites in the Barind Tract and Haor Area.

161. EbA interventions in the Barind Tract will focus on the reforestation of dryland forests on khas land<sup>88</sup> – following social forestry rules – using drought-resilient, indigenous tree species that produce benefits for local communities. Once restored, these ecosystems will have enhanced capacity to buffer against the negative effects of climate change including droughts. To support the long-term stability of the EbA interventions, adaptation technologies that conserve water will be constructed. These support measures will include: i) installing rainwater harvesting systems; ii) excavating public and private ponds; and iii) digging canals (for further details see Section 3.3). The EbA and supporting infrastructure measures will: i) improve ground water recharge, ii) increase the storage and supply of surface water; iii) reduce the extraction of groundwater; iv) reduce erosion; and v) improve agricultural productivity. Overall, the implementation of EbA and supporting infrastructure that conserves water in the Barind Tract will enhance ecosystem functioning of dryland forests and contribute to improving livelihoods under conditions of climate change. These interventions will reduce the vulnerability of communities in the Barind Tract.

162. EbA interventions in the Haor Area will include the reforestation of swamp forests using flood-resilient, indigenous tree species that produce benefits for local communities. To support the

<sup>86</sup> The three upazilas are Tanore, Nachole and Pirgani

<sup>87</sup> The five upazilas are; Barlekha, Kulaura, Fenchuganj, Golapganj and Juri.

<sup>88</sup> Khasland or state-owned land is the land which the government is entitled to both lease and give away to citizens of the country who do not own land.

long-term stability of these interventions, adaptation technologies that reduce erosion in the Haor Area will be constructed. These support measures will include: i) excavating community ponds; and ii) digging canals (for further details see Section 3.3). EbA in swamp forests and supporting infrastructure will mitigate against the impacts of flash floods and reduce erosion, which will decrease the rate of siltation of the beels and haors. These interventions will also contribute to improving the habitat quality for economically important indigenous fish species. This will result in an increase in the productivity of local fisheries on which local communities rely. Overall, the implementation of EbA and supporting infrastructure that reduces erosion in the Haor Area will enhance ecosystem functioning of swamp forests and contribute to improving livelihoods under conditions of climate change. These interventions will reduce the vulnerability of communities in the Haor Area.

163. The LDCF-financed project will build on existing initiatives related to ecosystem management and technical capacity building in the Barind Tract and Haor Area. The upazilas in which the LDCF interventions will be implemented were selected based on extensive national and regional workshops and consultations. The particular villages that will be targeted for interventions in these upazilas will be selected at project inception by conducting extensive VIAs at the union level in both areas. Furthermore, the project will improve knowledge – at both a national and local level – on effective EbA to support the long-term sustainability of the project’s interventions.

164. The reforestation of dryland and swamp forests and the implementation of infrastructure that supports the EbA interventions will result in multiple socio-economic and environmental benefits for local communities. Furthermore, the restoration of the wetland and dryland ecosystems will increase the potential for ecotourism in both the Barind Tract and Haor Area, thereby providing local communities with further additional livelihood options that will enhance their resilience to climate change.

165. The project’s activities will include measures to support the sustained generation of socio economic and environmental benefits beyond the project implementation period. For example, the project will develop frameworks that promote the upscaling of EbA in other areas in Bangladesh. Additionally, the lessons learned during the project will be collated and shared with local and national policy- and decision-makers. Furthermore, the project will improve knowledge – at both the national and local levels – on effective EbA to support the long-term sustainability of the project’s interventions. Moreover, the project will build on existing initiatives related to ecosystem management and technical capacity building in the Barind Tract and the Haor Area.

#### *Policy conformity*

166. The LDCF-financed project is aligned with the new GEF VI Focal Area/LDCF strategies. This conformity was taken into account in the design of the project’s components. In particular, the following GEF Focal Area Objectives are addressed by the project.

- *CCA-1, Outcome 1.1: Vulnerability of physical assets and natural systems reduced.* The implementation of EbA and supporting infrastructure that conserves water in the Barind Tract and reduces erosion in the Haor Area (Section 3.3 Component 2) will reduce the vulnerability of natural systems.
- *CCA-2, Outcome 2.3. Institutional and technical capacities and human skills strengthened to identify, prioritize, implement, monitor and evaluate adaptation strategies and measures.* The production of technical guidelines that promote the implementation of EbA (Section 3.3. Component 1), and training of national and local government staff and local community members (Section 3.3 Component 1 and 2) will strengthen the capacity of local and national government to

identify, implement and upscale adaptation in the Barind Tract and Haor Area and in Bangladesh as a whole.

- *CCA-3, Outcome 3.1. Institutional arrangements to lead, coordinate and support the integration of climate change adaptation into relevant policies, plans and associated processes established and strengthened.* While a climate change coordinating mechanism already exists in Bangladesh the project will be strengthening its ability to coordinate specific adaptation actions such as EbA through the revision of its mandate.

#### *LDCF conformity*

167. Bangladesh is party to the UNFCCC and the Kyoto Protocol. Accordingly, the LDCF-financed project is aligned with the guidance and eligibility criteria defined in these documents, as described below.

168. **Participatory approach:** activities and demonstration sites were selected through extensive stakeholder consultations at both local and national levels (Section 2.5).

169. **NAPA priorities:** the LDCF-financed project will address priorities identified in the NAPA. In particular, the project will build on and contribute to priority activities 4, 6, 9, 10, 12 and 13 of the Bangladesh NAPA. Moreover, the project will address priority pillars 1, 3, 4 and 6 of the BCCSAP.

170. **“Learning-by-doing” approach:** the LDCF-financed project will build on the knowledge base on ecosystem management that has been established in Bangladesh. Therefore, lessons learned by other projects have been considered in the design of the project. In addition, tools that have been designed by the DoF will inform the EbA reforestation that will be tailored for particular forests in wetland and dryland ecosystems. Lessons learned throughout the project will be used to apply adaptive management and highlight successes at a national scale to promote EbA across Bangladesh.

171. **Multi-disciplinary approach:** adaptation through ecosystem restoration is relevant to a wide range of sectors including water, agriculture, fisheries and ecosystem conservation. Therefore, the LDCF-financed project has been designed using a multi-sectoral approach. During the implementation phase, this approach will be further promoted by: i) establishing partnerships with relevant line ministries and departments – such as the BMDA and the BWDB– in the execution of relevant activities; and ii) including technical experts from a range of sectors in the design of project activities. In addition, a wide range of stakeholder groups will be engaged throughout project implementation including central government, district officers, academia, NGOs and user groups.

172. **Complementary approach:** the LDCF-financed project will work in conjunction with relevant ongoing and adaptation projects in Bangladesh (Section 2.6). It will build on the activities of the identified baseline projects, increasing their capacity to achieve their objectives under conditions of climate change. It will also exchange information with other EbA and ecosystem management projects. In so doing, valuable lessons will be shared and duplication of efforts will be avoided. The existing knowledge base on EbA will also be enhanced thereby promoting EbA in Bangladesh.

173. **Gender equality:** in Bangladesh, women tend to have lower incomes and fewer opportunities compared to men<sup>89</sup>. The Gender Inequality Index – which measures inequities in different areas of women's and men's everyday lives around the world – ranks Bangladesh at 115 out of 149 countries. The capacity of women to adapt to the effects of climate change is therefore constrained.

174. Women in Bangladesh have historically had a lower level of employment, less participation in the labour market and reduced level of pay. In addition to this, women's level of representation in policy- and decision-making is low, with women only occupying ~19.7% of seats in parliament<sup>90</sup>. This low representation creates an obstacle to reforming policies related to gender equity.

175. Bangladesh has taken significant steps to close the gaps in equity in its education system. The GoB has achieved the MDG goal of gender parity in primary and secondary education at the national level. Despite this, there remains a considerable gap in enrolment literacy as well as a significantly higher proportion of female dropouts from the system, which is still a major concern<sup>91</sup>.

176. LDCF-financed project activities will be informed by socio-economic assessments that will include gender research. Moreover, Bangladesh gender action groups – such as CARE Bangladesh and Ashrai – will be consulted when: i) training materials for local communities on EbA and alternate livelihoods are designed; and ii) information materials are disseminated. These consultations will ensure that information reaches female stakeholders within their networks.

177. Climate-resilient livelihoods will be developed with a focus on including female-headed households. To ensure that the progress of gender mainstreaming can be monitored throughout the project, gender disaggregated targets will be developed and used to monitor indicators.

178. Targets for involving women are included in the Results Framework of the project (see Appendix 4). As such, female representation will be encouraged in: i) training sessions and workshops; and ii) activities for EbA demonstrations. To ensure that the progress of gender mainstreaming can be monitored throughout the project, gender disaggregated targets will be developed and used to monitor indicators.

179. Gender sensitivity will be incorporated into training topics so that: i) female participants are empowered to participate meaningfully in training; and ii) all participants are made aware of their responsibility to respect the views of all of their colleagues during training workshops. Trainers will be required to have the skills and experience necessary to plan and facilitate gender-sensitive training.

180. The PM and M&E Expert will be responsible for monitoring and review of gender sensitivity in all aspects of the project and the application of gender-disaggregated indicators. The project will also create a mechanism in which women will report to the M&E expert on what their experience has been with regard to feeling empowered by project activities, and whether or not they felt that they benefited from project activities. In addition to gender awareness, the LDCF-financed project will promote the requirements of other disadvantaged and more vulnerable groups including the elderly, children and the differently abled.

### *Overall GEF conformity*

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<sup>89</sup>Ferdaush J., K. M. Mustafizur Rahman. 2011. Gender Inequality in Bangladesh, Unnayan Onneshan a centre for research and action on development.

<sup>90</sup>UNDP Bangladesh Human Development Report 2013

<sup>91</sup>Ferdaush J., K. M. Mustafizur Rahman. 2011. Gender Inequality in Bangladesh, Unnayan Onneshan a centre for research and action on development.

181. The LDCF-financed project has been designed to meet GEF requirements in terms of project design and implementation. The following core GEF criteria have been addressed.

182. **Sustainability:** Project priorities include training and capacity building of national and local government, line ministries, Village Conservation Groups (VCGs) and local communities<sup>92</sup>. EbA and supporting adaptation technologies will be implemented in dryland forests and swamp forests – and climate-resilient livelihoods developed – using a country-driven approach that promotes sustainability. In addition, results and best practices will be documented and shared enabling EbA to be upscaled and extend beyond the project’s lifetime. See Section 3.8 for more details on sustainability of the LDCF-financed project.

183. **Replicability:** the project will systematically document the activities, management decisions, strategies, results and lessons learned. Such information will be used to guide the design and implementation of future projects (refer to Section 3.9 for more information on replicability).

184. **Monitoring and evaluation (M&E):** the project design includes an effective M&E framework that will enable ongoing adaptive management. This will support the learning and dissemination of lessons by producing regular progress reports for stakeholders. See Section 6 on M&E for more information.

185. **Stakeholder involvement:** the project design was developed through extensive stakeholder consultations (see Section 2.5). Moreover, the design of the project will ensure that a range of stakeholders is engaged throughout the project implementation phase (see Section 5).

### 3.2. Project goal and objective

186. The overarching goal of the LDCF-financed project is to increase the resilience of local communities living in the Barind Tract and the Haor Area, and economic sectors to climate change. The objective of the project is therefore to decrease the vulnerability of local communities living in the Barind Tract and Haor Area to the negative impacts of climate change, using Ecosystem-based Adaptation (EbA) approaches. This objective will be achieved within three Outcomes (please refer to Section 3.3 for more details).

### 3.3. Project components and expected results

187. The objective of the LDCF-financed project will be achieved through three complementary components. Component 1 will support a policy environment that promotes EbA throughout Bangladesh. Within this component, the technical and institutional capacity of national and local government will be strengthened to plan and implement EbA. Within Component 2, the following on-the-ground interventions will be implemented: i) demonstration of EbA to restore degraded dryland forests in the Barind Tract and degraded swamp forests in the Haor Area; ii) adaptation technology that conserves water in the Barind Tract and reduces erosion in the Haor Area; and iii) demonstration of climate-resilient livelihood options. Local communities and VCGs will be trained on maintaining these interventions. Component 3 will promote knowledge generation, management and dissemination on EbA throughout Bangladesh. Furthermore, funding will be provided to PhD and post-doctorate researchers to conduct long-term research on this approach. Component 3 will also include the development of a framework to upscale and replicate EbA throughout Bangladesh.

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<sup>92</sup> VCGs have already been formed in the Hakaluki haor region (28 VCGs) by the CWBMP and CBA-ECA project. The LDCF-financed project will form new VCGs in the Barind Tract.

The three components of the LDCF-financed project are further detailed below.

### **Adaptation alternative**

*Component 1. Capacity development for implementing EbA and upscaling into national and local plans*

#### **Outcome 1: Strengthened technical capacity of local and national government officials to plan, implement and upscale EbA.**

188. This component will contribute to enabling a policy environment to facilitate EbA throughout Bangladesh. This will be achieved by developing and disseminating: i) policy briefs on proposed revisions to policies and plans related to management of dryland and swamp forests; and ii) technical guidelines for policy- and decision-makers that detail how to move from policy to the implementation of EbA. This component will strengthen the technical and institutional capacity of government to plan and implement EbA, thereby promoting this approach as a means of adapting to climate change throughout Bangladesh. Technical capacity will be strengthened through the training of national and local government officials – from relevant departments including *inter alia* the DoE, DoAE, DoF, BMDA, LGED and BWDB – on the policy briefs, technical guidelines, and implementing EbA.

189. Component 1 of the project will build on work completed by other projects and organisations in Bangladesh. For example, the UNDP Community-based Adaptation to Climate Change through Coastal Afforestation in Bangladesh reviewed national policies and plans related to coastal development and integrated climate change effects into these strategies. In addition, this project integrated climate change effects into community-level strategies. To develop policy briefs on proposed revisions to policies and strategies, the LDCF-financed project will consider lessons learned by these similar projects. In addition, the technical guidelines that will be developed to support the move from policy to implementation will be informed by challenges and successes of this project.

#### **Output 1.1. Policy briefs developed on proposed revisions to policies and strategies related to dryland and wetland ecosystem management to promote EbA.**

190. Within Output 1.1, policy documents from relevant sectors will be collated to identify entry points for climate change and EbA. Following this, policy briefs will be developed on proposed revisions to policies and plans – including budget allocations – related to dryland and wetland management. This output will be informed by lessons learned by similar initiatives such as the UNDP Community-based Adaptation to Climate Change through Coastal Afforestation in Bangladesh project. These proposed revisions to policies and strategies will promote implementation of EbA in relevant sectors, thereby contributing to increased resilience of dryland and wetland ecosystems in Bangladesh. The proposed revisions will be aligned with the gender mainstreaming approach to be adopted by the LDCF-financed project (section 3.1). In addition, national government will be trained to use these policy briefs. In particular, this training will focus on integrating climate change and EbA into policies and plans related to ecosystem management. Representatives from national ministries and departments will be trained within this output using an interactive approach. Importantly, the policy briefs will be disseminated at these trainings and used by these stakeholders as reference material.

The activities to be implemented under Output 1.1 are.

1.1.1. Collate and review existing policies and plans, including budget allocations, related to ecosystem management, national development, and dryland and wetland restoration to identify entry-points for promoting EbA.

1.1.2. Develop policy briefs on proposed revisions to policies and strategies, including budget allocations, to promote the replication and upscaling of EbA throughout Bangladesh.

1.1.3. Conduct technical training workshops with staff from national ministries to present the policy briefs (developed in Activity 1.1.2)

1.1.4. Develop a workplan to deliver policy and strategy revision.

*Output 1.2. Mandate of the Climate Change Cell (CCC) incorporates EbA based on, technical guidelines and training provided to support coordination, planning and implementation of EbA across Bangladesh*

191. The mandate of CCC – which currently acts as the national coordinating body for adaptation-related activities – will be revised to integrate EbA, thereby supporting the move from policy to implementation of this approach. Additionally, technical guidelines and training on moving from EbA policy to implementation will be provided to: i) relevant national stakeholder including the CCC, Climate Change Focal Points (CCFPs) and policy- and decision-makers in climate-vulnerable sectors; and iii) local government at project sites. In particular, this training will focus on: i) selecting appropriate EbA using the UNEP decision-support framework<sup>93</sup>; and ii) writing proposals for accessing national funds for adaptation such as the Bangladesh Climate Change Trust Fund (BCCTF) and the Bangladesh Climate Change Resilience Fund (BCCRF). Representatives from national ministries and departments will be trained within this output using an interactive approach. Importantly, the technical guidelines that are developed under this output will be disseminated at trainings and used by these stakeholders as reference material.

The activities to be implemented under Output 1.2 are.

1.2.1. Identify potential barriers to effective coordination, planning and implementation of EbA. In particular, barriers to the following should be identified: i) effective national dialogue on adaptation; ii) upscaling and replicating EbA, and iii) mobilisation of funds for EbA implementation.

1.2.2. Based on the barriers identified in 1.2.1: i) strengthen the mandate of the CCC to incorporate effective EbA coordination; and ii) develop technical guidelines for national government – including the CCC and policy- and decision-makers from the BMDA, BWDB, BHWDB, DEA, BFD and DLS – on moving from policy to implementation (i.e. how to plan, finance and implement EbA interventions).

1.2.3. Conduct training workshops with national and local government at project sites to present the technical guidelines on moving from EbA policy to implementation (developed in Activity 1.2.2).

*Output 1.3. Training provided to national and local government, and VCG members on planning and implementing EbA interventions.*

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<sup>93</sup>[http://www.unep.org/climatechange/adaptation/Portals/133/documents/Ecosystem-Based%20Adaptation/Decision%20Support%20Framework/EBA%20Guidance\\_WORKING%20DOCUMENT%2030032012.pdf](http://www.unep.org/climatechange/adaptation/Portals/133/documents/Ecosystem-Based%20Adaptation/Decision%20Support%20Framework/EBA%20Guidance_WORKING%20DOCUMENT%2030032012.pdf)

192. National and local government from technical ministries and departments – including the BMDA, BWDB, BHWDB, DEA, BFD and DLS – and VCGs will be trained on: i) planning and implementing EbA; and ii) the benefits of this approach across sectors. International best practice and lessons learned from similar projects in South Asia and ecosystem restoration projects in Bangladesh will inform the development of the training programmes. In addition, this training will build on previous training materials on EbA developed by UNEP such as those developed by the BMU EbA Flagship programme. Training could include workshops, group discussions, lectures and field trips to EbA interventions sites.

The activities to be implemented under Output 1.3 are.

1.3.1. Develop training programmes for national and local government from technical ministries and departments – including the BMDA, BWDB, BHWDB, DEA, BFD and DLS – and VCGs at project sites on: i) selecting EbA for adaptation in Bangladesh using the UNEP EbA decision support framework; and ii) planning and implementing cost-effective EbA for dryland forests and swamp forests.

1.3.2. Train national and local government and VCGs using the programmes developed in Activity

*Component 2: EbA interventions that reduce climate change vulnerability and enhance natural capital.*

Outcome 2: Adaptation technologies – including EbA – transferred to local communities at project intervention sites to restore degraded ecosystems and promote topsoil and water conservation.

193. This component includes the implementation of EbA and adaptation technology that conserves water in the Barind Tract and reduces erosion in the Haor Area, Bangladesh. Initially, comprehensive VIAs will be undertaken to inform the selection of specific target sites and communities. Thereafter, Village Conservation Groups (VCGs) will be established within these communities to implement and maintain EbA interventions. To enable the VCGs to manage the restored areas over the long term – thereby promoting sustainability of LDCF interventions – a Village Conservation Fund (VCF) will be established (for more information on the operation and management of this fund see Appendix 23). The VCF will provide funding options for alternative income generation for the vulnerable people whose livelihoods are dependent on natural resources, ecosystem services and that are likely to be affected by climate change. Technical protocols for the implementation of EbA in specific ecosystems will be developed based on: i) local knowledge on ecosystem restoration; ii) socio-economic and biodiversity expert assessments; iii) predicted climate trends; iv) scientific research on best practice EbA; and v) tools that have been developed by other projects in South and Southeast Asia, such as the UNEP/AF Enhancing Climate Resilience of Rural Communities Living in Protected Areas of Cambodia project. These protocols will be used to restore degraded: i) dryland forests in the Barind Tract (in the Tanore, Nachole and Pirganj upazilas); and ii) swamp forests in the Haor Area (in the Barlekha, Juri, Kulaura, Golapganj, and Fenchuganj upazilas). In particular, climate-resilient, indigenous plant species that provide benefits for local communities will be prioritised for EbA in these areas. Moreover, local government departments – including the DoE, DLS, FD, DAE, WARPO, BMDA, LGED and BWDB – and VCGs will receive: i) EbA protocols developed by the LDCF-financed project; and ii) training on planning and implementing EbA. Consequently, these stakeholders will have increased knowledge on this approach to integrate into local management plans. The use of EbA to restore forests in the selected upazilas in the Barind Tract and Haor Area will increase the resilience of ecosystems in these areas to climate change. As a result, the vulnerability of local communities whose livelihoods are underpinned by these ecosystems will be reduced.

194. To support the reforestation activities, other adaptation technologies that conserve water and reduce erosion – including the excavation of ponds, the digging of canals and installing rainwater harvesting systems – will be implemented in the selected intervention sites. Importantly, infrastructure will be complemented by EbA to increase resilience of these structures, thereby promoting sustainability of these investments. Conserving water in the Barind Tract and reducing erosion in the Hoar Area will improve livelihood production – particularly those related to agriculture, fish production and forestry – under conditions of climate change. This infrastructure will therefore contribute to the overall objective of increasing the capacity of local communities living in these areas to adapt to climate change.

Output 2.1. Vulnerability impact assessments to select target communities in the Barind Tract and Haor Area.

195. Before implementation of the selected interventions, comprehensive Vulnerability Impact Assessments (VIAs) will be undertaken in the selected upazilas in the Barind Tract and Haor Area. The VIAs will follow UNEP-led PROVIA guidance and be in accordance with national legislation. The objective of these VIAs will be to evaluate the vulnerability of local communities to the observed and predicted effects of climate change, in particular: i) increasing annual precipitation and heavier, more erratic rainfall events in the Haor Area; and ii) an increase in air temperature and decrease in annual precipitation in the Barind Tract. The results of the VIAs will inform the selection of specific target sites and communities.

The activities to be implemented under Output 2.1 are as follows.

2.1.1. Conduct comprehensive Vulnerability Impact Assessments (VIAs) including climate change scenario analysis with local authorities and communities in each union<sup>94</sup> of the selected upazilas in the Barind Tract and Haor Area to identify particular sites in which project activities will be implemented.

Output 2.2. Local authorities, communities, committees and user groups in the Barind Tract and Haor Area trained on implementing and maintaining adaptation technologies, and developing additional livelihoods.

196. Within this output, local authorities and communities at interventions sites in the Barind Tract and Haor Area will be trained on planning, implementing, maintaining and monitoring EbA to restore degraded wetlands and drylands. Importantly, this training will prioritise training of women and youth. Through this training, the technical capacity of these stakeholders to develop additional livelihood options will also be strengthened. This training will build on Output 1.3. In addition, training material and content will be informed by: i) biodiversity and socio-economic assessments at these sites; and ii) EbA protocols for each particular ecosystem; iii) international best practice and lessons learned from resource management projects in Bangladesh and EbA projects in South Asia.

The activities to be implemented under Output 2.2 are:

2.2.1. Develop training programmes, based on the protocols developed in Activity 2.3.3, for local authorities, communities, committees and user groups on: i) the benefits of EbA; ii) implementing and maintain EbA interventions; iii) maintaining supporting infrastructure constructed during the project;

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<sup>94</sup>the smallest rural administrative and local government units

iv) additional livelihoods, including spice cultivation, vegetable gardens and fish production; and v) techniques to manage livestock under conditions of climate change.

2.2.2. Conduct training for local authorities, communities, committees and user groups on implementing, maintaining and monitoring EbA and developing alternate livelihoods using the programmes that have been developed in Activity 2.5.1.

Output 2.3. Degraded forests in the Barind Tract and Haor Area rehabilitated using EbA.

197. Under this output, EbA will be implemented to restore degraded forests in the Barind Tract and Haor Area. The upazilas in which EbA will be implemented have been selected based on extensive national and regional workshops and consultations. During project inception, the particular target sites and communities will be selected based on the comprehensive VIAs that will be undertaken under Output 2.1. Thereafter, Village Conservation Groups (VCGs) – including women, youth and other marginalised representatives – will be established within these communities to implement and maintain EbA interventions. Under this outcome, a Village Conservation Fund (VCF) will be established to provide funding options for alternative income generation for the vulnerable community members that are dependent on natural resources, as well as ecosystem services and whose livelihoods are being affected by climate change (for more information on the operation and management of this fund see Appendix 23). The list activities/ projects that will be eligible for funding by the VCF will be validated by the assessments conducted and protocols developed under output 2.3. The VCF will be managed by the VCGs through an executive committee.

198. In the Haor area, swamp forests surrounding beels and haors in valley bases will be restored using flood-resilient forest species. In the Barind Tract, dryland forests will be restored using drought-resilient forest species, thereby improving water penetrability and reducing erosion. Reforestation of all areas will include forest species that provide benefits for local communities and improve overall ecological functioning of ecosystems. Consequently, the vulnerability of local communities that rely strongly on these ecosystems for their livelihoods will be reduced.

199. Initially, information will be collated on: i) forests species preferences of local communities for forest restoration in dryland forests and swamp forests; ii) findings from the biodiversity and socio-economic assessments (including traditional knowledge) for each intervention site; and iii) predicted climate trends for intervention sites. Based on this information, technical protocols for EbA in the Barind Tract and Haor Area will be developed. In particular, these protocols will include information on: i) indigenous plant species that are climate resilient to be used in EbA; ii) best practice for planting these species; and iii) maintaining and monitoring restored areas in the Barind Tract and Haor Area.

200. Indigenous forest species– including *inter alia* hijal (*Barringtonia acutangula*), karach (*Holarrhena antidysenterica*) and barun (*Crataeva nurvula*) – for swamp forest restoration in the Haor Area will be selected that: i) are resilient to flooding; ii) bind soils, thereby reducing erosion; and iii) provide shelter and feed for important fisheries species. The reforestation of swamp forests will reduce erosion and improve bio-physical conditions and ecosystem functioning, thereby increasing the resilience of this ecosystem to the current and predicted effects of climate change. The selection of plant species for reforestation of dryland forests in the Barind Tract include those that: i) grow quickly under conditions of drought; ii) are broad-leaved, thereby reducing rainfall impact on the soil; iii) have deep root systems, thereby increase water infiltration into the soil; and iv) produce natural resources that provide benefits for local communities including NTFPs and medicinal products. The reforestation of dryland forests will increase water infiltration and groundwater recharge. This will increase the amount of water available for agriculture and increase the resilience of dryland ecosystems to the current and predicted effects of climate change. The selection of plant species for

homestead forests will include species that are: i) climate resilient; and ii) produce natural resources that provide benefits for local communities including NTFPs and medicinal products. All reforestation activities will include the planting of both fast- and slow-growing tree species. Furthermore, these reforestation activities will follow social forestry rules, which promote economic, ecological, and social benefits to the local communities.

201. Following the development of the technical protocols, plant nurseries will be built in selected sites in the Barind Tract and Haor Area. These nurseries will be established during the first year of the project and used to grow the saplings that will be used for the EbA activities. As a result of the large distances between local communities in the project area, five nurseries will be established in each upazila in the Haor Area (25 in total), and ten nurseries will be established in each upazila in the Barind Tract (30 in total). After termination of the project, local communities will continue to use these nurseries to propagate climate resilient indigenous species (including swamp forest species) that will be sold to future projects in the area, and to raise funds for the maintenance of EbA interventions and financing other operations for EbA in these areas. Importantly, these nurseries will be run and managed by local communities in collaboration with local government.

202. In both the Barind Tract and Haor Area, EbA will be implemented in degraded forest – including along roadsides, canals, embankments and ponds – and in homestead plantations<sup>95</sup>. Local communities will be included in all reforestation events including planting, monitoring, maintenance and conservation. The DoE and the implementing partners, will work closely with the local communities to ensure that all reforestation activities are in line with local government norms. Importantly, the technical protocols developed by the LDCF-financed project will be disseminated to local government in selected upazilas, thereby promoting the use of EbA in the future. This will facilitate sustainability and upscaling of this approach to other areas. Moreover, the training under Output 2.2 will strengthen the capacity of relevant local government authorities and communities at intervention sites to implement and maintain EbA.

The activities to be implemented under Output 2.3 are:

2.3.1. Establish 25 Village Conservation Groups (VCGs) in the Barind Tract (18 VCGs) and Haor Area (7 VCGs).

2.3.2. Establish a Village Conservation Fund (VCF) to support maintenance of ecosystems at project intervention sites by VCGs as well as to support local livelihood activities. Please refer to draft operational guidelines on how the fund will be managed and administered in the long term (see Appendix 23).

2.3.3. Undertake site-specific socio-economic, biodiversity and climate change assessments in the selected sites in the Barind Tract and Haor Area to inform the development of technical protocols for all on-the-ground interventions in these areas. The results of these assessments and technical protocols will also serve to validate the list of activities that the VCF will fund. The socio-economic assessments should focus on identifying marginalised groups – including women and youth – and ways to empower these groups through on-the-ground interventions.

2.3.4. Undertake a site-specific study to collect traditional knowledge on ecosystem restoration in the Barind Tract and Haor Area to inform the development of technical protocols for all on-the-ground interventions in these areas.

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<sup>95</sup> A homestead plantation is a family-run productive garden or plantation.

2.3.5. Prepare technical protocols based on the site-specific socio-economic, biodiversity and climate change data for EbA in degraded dryland forests in the Barind Tract and swamp forests in the Haor Area.

2.3.6. Establish: i) five nurseries in each of the five Haor upazilas (25 nurseries in total); and ii) ten nurseries in each of the three Barind upazilas (thirty in total).

2.3.7. Reforest the following areas in the Haor Area using the EbA protocols developed in Output 2.3: i) 50 ha of degraded swamp forests on khas land; ii) 50 ha of degraded swamp forests in other areas; and iii) degraded swamp forest along 50 km of roads, embankments, canals and ponds.

2.3.8. Reforest the following areas in the Barind Tract using EbA protocols developed in Output 2.3: i) 80 ha of degraded dryland forest; and ii) degraded dryland forest along 80 km of roads, embankments, canals and ponds.

2.3.9. Establish homestead plantations using the EbA protocols developed under Output 2.3: i) 1000 homestead plantations (200 households per upazila) in the Haor Area; and ii) 900 homestead plantations<sup>96</sup> (300 homestead plantations per upazila) in the Barind Tract.

*Output 2.4. Adaptation technologies implemented – including excavation/re-excavation of ponds, canals and beels, and installation of rainwater harvesting devices – to support EbA by reducing erosion in the Haor Area and conserving water in the Barind Tract.*

203. In the Barind Tract, EbA will reduce erosion and increase water infiltration under current and future conditions of: i) increased rainfall variability; and ii) more frequent and severe droughts. In the Haor Area, EbA will reduce erosion and flooding under the current and future conditions of increased rainfall variability. These interventions will be supported by the construction of adaptation technologies that will: i) improve water conservation in the selected upazilas in the Barind Tract; and ii) reduce erosion in the Haor Area. During the PPG phase, consultations were conducted with local and national government departments, NGOs and academic institutions to select appropriate support measures. These consultations indicated that: i) water conservation ponds, canals and rainwater harvesting systems are the most suitable supporting infrastructure for conserving water in the Barind Tract; and ii) water conservation ponds and canals were the most suitable supporting infrastructure for reducing erosion in the Haor Area. Construction of this infrastructure in the Haor Area will reduce erosion by redirecting, slowing down and/or conserving water runoff. Environmental Impact Assessments (EIA) will be undertaken before such infrastructure is constructed (see Section 2.4)<sup>97</sup>. This infrastructure will be designed and constructed in collaboration with implementing partners including the BMDA in the Barind Tract, and the BWDB in the Haor Area. Therefore, local government departments and relevant technicians from these departments will be consulted. These stakeholders will ensure that construction activities are in line with national and local laws. Importantly, infrastructure will be complemented by EbA to increase resilience of these structures, thereby promoting sustainability of these investments. For example, the edges of these canals will be reforested with flood-resilient swamp forest species in the Haor Area. Training provided in Output 2.2 will include information on how to maintain this infrastructure.

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<sup>96</sup>The size of the homestead plantations will depend on the availability of land.

<sup>97</sup> These EIAs will be in accordance with national legislation and should evaluate the environmental and socio-economic suitability of all of the selected adaptation interventions.

The activities to be implemented under Output 2.4 are:

2.4.1. Undertake feasibility assessments including climate change scenario analysis and comprehensive EIAs for: i) the construction of canals in the Barind Tract and Haor Area; ii) the excavation and re-excavation of ponds in the Haor Area and Barind Tract; and iii) the re-excavation of beels in the Haor Area.

2.4.2. Prepare technical protocols – based on site-specific socio-economic, biodiversity and climate information and feasibility assessments – for the implementation and maintenance of ponds, canals/kahls and rainwater-harvesting systems.

2.4.3. Excavate 16 (30mx30mx4m)<sup>98</sup> ponds. 10 ponds (2 in each of the Fenchuganj, Golapganj, Barlekha, Juri and Kulaura upazilas) in the Haor Area, and 6 ponds (2 ponds in each of the Tanore, Nachole and Pirganj upazilas) in the Barind Tract.

2.4.4. Re-excavate 32 (15mx15mx2m)<sup>99</sup> ponds. 20 ponds (4 in the Fenchuganj, Golapganj, Barlekha, Juri and Kulaura upazilas) in the Haor Area, and 12 ponds (4 in each of the Tanore, Nachole and Pirganj upazilas) in the Barind Tract.

2.4.5. Dig: 6 canals/khals (1000mx4mx3m)<sup>100</sup> (3 canals in 3 selected upazilas from the following list Fenchuganj, Golapganj, Barlekha, Juri and Kulaura upazilas) in the Haor Area and 3 canals/khals (1000mx4mx3m)<sup>101</sup> (1 in each of the Tanore, Nachole and Pirganj upazilas) in the Barind Tract.

2.4.6. Re-excavate three beels (1 beel in 3 of the selected upazilas) in the Haor Area.

2.4.7. Install 9 rainwater harvesting systems for households/agricultural use in the three selected Barind upazilas (27 in total).

*Output 2.5. Additional livelihoods demonstrated to increase the adaptive capacity of local communities to climate change.*

204. The livelihoods of local communities in the Barind Tract and Haor Area are underpinned by functional, intact ecosystems (for further information on the goods and services targeted by the project refer to Appendix 22). Through the implementation of EbA to restore degraded forests at selected intervention sites in the Barind Tract and Haor Area, ecosystem services from dryland forests and swamp forests will be improved. To further increase the adaptive capacity of local communities at intervention sites, additional livelihoods – including fish production in homestead ponds, community-based gardens, community-based floating gardens, and spice cultivation through zero tillage – will be demonstrated. These additional livelihood options were identified during the PPG phase through workshops and consultations with a wide range of national and local government officials – including *inter alia* the BWDB, DLS, BMDA, BFD, DoF, DAE – NGOs and academic institutions. During project inception, research will be undertaken on effective methods to increase the climate-resilience of these options. Interventions under this output will increase the total household income and number of livelihood options for local communities during extreme climate-related events such as droughts. In

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<sup>98</sup> The dimensions for this infrastructure are subject to change based on the outcome of the feasibility assessments that will be undertaken within Activity 2.4.1 during project implementation. The dimensions included in the project document were recommended during PPG, based on in-depth consultations.

<sup>99</sup> IBID

<sup>100</sup> IBID

<sup>101</sup> IBID

addition, the dependency of the communities on forests in the Barind Tract and Haor Area will be reduced, thereby promoting conservation of these ecosystems.

The activities to be implemented under Output 2.5 are:

2.5.1. Conduct research on effective methods to increase the climate-resilience and marketability of livelihoods that will be implemented by the project in the Barind Tract and Haor Area including: i) fish production (i.e. aquaculture) in homestead ponds; ii) community-based gardens; iii) community-based floating gardens; and iv) spice cultivation through zero tillage.

2.5.2. Demonstrate fish production in: i) 75 homestead ponds in the in the five selected Haor upazilas (375 in total); and ii) 100 homestead ponds in the three selected Barind upazilas (300 in total).

2.5.3. Establish 25 community-based floating vegetables gardens in the five selected Haor upazilas (125 in total).

2.5.4. Establish: i) 75 homestead vegetables gardens in the five selected Haor upazilas (375 in total); and ii) 100 homestead farming gardens in the three selected Barind upazilas (300 in total).

2.5.5. Demonstrate ten 20mx20m plots for spice (onion/garlic/ground nut/mustard) cultivation through zero tillage in each of the three selected Barind upazilas (30 in total) and eight 20x20m plots in the 5 Haor upazilas (40 in total).

*Component 3: Research and knowledge management for appropriate EbA design*

Outcome 3: Improved access to scientific and traditional information on EbA to promote upscaling of this approach in Bangladesh.

205. Component 3 will increase national and local knowledge on EbA. To achieve this, a central base will be established to share information on EbA that is collected and generated during and after the project. This central base will be accessible to national and local government ministries and departments. In addition, a new Economics of Land Degradation project is starting up Bangladesh later in 2016 in the context of an Asian regional project that will focus on quantifying the losses associated with land degradation and the benefits of sustainable land management. This LDCF project will link to this project to adopt good practice methodologies in quantifying the cost effectiveness of the proposed adaptation measures. Additionally, financial support will be provided to post-graduate and post-doctorate students to conduct research focused on: i) specific climate change risks in the Barind Tract and Haor Area; and ii) the effectiveness of EbA interventions that are implemented within Bangladesh. Furthermore, a plan will be developed to manage information and knowledge – including collation, storage and dissemination – on climate change and EbA during and after project implementation. This knowledge management plan will facilitate sustainability and upscaling of this approach in Bangladesh. Moreover, a strategy will be developed to further promote upscaling of EbA. The activities implemented within this component of the project will increase knowledge on best-practice EbA for Bangladesh including in the long term. In particular, access to information on EbA – including scientific reports and lessons learned through implementation of the EbA approach – will be improved.

Output 3.1. A central information database – for information on EbA lessons learned and cost-effectiveness from the Haor Area, Barind Tract and other regions across Bangladesh – established or strengthened in MoEF within an appropriate entity.

206. Within this output, a central information database will be designed, established, and maintained – or strengthened if an existing database is identified as appropriate – to enable the sharing of EbA information products. These products will include *inter alia* scientific reports, EbA protocols and research dissertations produced during and after the project. This central information database will be housed within the MoEF within an appropriate entity e.g. the Climate Change Cell.

The activities to be implemented under Output 3.1 are:

3.1.1. Review existing information databases for ecosystem restoration and/or climate change – including government department websites (such as the climate change website hosted by the MoEF at <http://www.climatechange.gov.bd>) – to identify an appropriate portal for the central EbA information database.

3.1.2. If an appropriate portal is identified in Activity 3.1.1, strengthen this portal to include the central EbA information database. If no appropriate existing portals are identified, establish a new portal<sup>102</sup>.

3.1.3. Collate data and information from relevant departments and institutions to share on the central EbA information database including: i) lessons learned through implementing the LDCF-financed project; ii) results of research and assessments undertaken within the project; and iii) cost-effectiveness of EbA.

*Output 3.2. Financial support provided to post-graduate and post-doctorate researchers to conduct research focused on specific climate change risks and the EbA interventions that are implemented by the project.*

207. The LDCF-financed project will provide financial support to students from local universities to assess the effectiveness of EbA interventions that will be implemented under Outcome 2. Post-graduate and post-doctorate students will be selected from local universities that: i) have experience in the research area; ii) own the necessary equipment and technical expertise to produce scientific reports for publication in peer-reviewed journals; and iii) are willing to continue focussing research on the effectiveness of EbA interventions after the lifespan of the LDCF-financed project. In particular, selected students will be funded to: i) develop new hypotheses and studies that are particular to EbA; and ii) design and initiate long-term research projects on the interventions that will be implemented in the Barind Tract and Haor Area. The PhD research will include an exchange programme between international academic institutions – such as the Chinese Academy of Sciences. Importantly, PhD students will carry out their research and studies in their home country and in the country that they visit. Findings from this research will be used to build the knowledge base on EbA in Bangladesh. Importantly, these findings will be communicated to the project team, policy- and decision-makers and the international scientific community. These information-sharing activities will promote the integration of research into EbA planning.

The activities to be implemented under Output 3.2 are:

3.2.1. Identify research institutions that will be able to assess and research the impact of EbA interventions in the Barind Tract and Haor Area in the long term.

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<sup>102</sup> This portal should be linked to relevant portals/websites established by relevant project such as the GEF/SCCF-funded **Enhancing capacity, knowledge and technology support to build climate resilience of vulnerable developing countries**. The website for this portal is <http://www.ebasouth.org/>.

3.2.2. Identify post-graduate and post-doctorate students from local research institutions to conduct research on risks from climate change and the effectiveness of EbA interventions implemented by the LDCF-financed project.

3.2.3. Develop research questions with selected students to measure the effectiveness of EbA interventions implemented in the Haor Area and Barind Tract.

3.2.4. Provide financial support to post-graduate and post-doctorate researchers to scientifically assess the biological, physical and socio-economic impacts of the implemented EbA interventions.

Output 3.3. A knowledge management plan developed to capture and share information on climate change impacts and EbA.

208. A plan will be developed to manage information and knowledge on climate change and EbA in Bangladesh. This plan will include mechanisms to store and disseminate relevant information collected from the LDCF-financed, baseline and aligned projects. Importantly, this plan will include other related outputs of the LDCF-financed project including: i) long-term research that will be undertaken under Output 3.2 (for generating knowledge); and ii) the central EbA information base that will be established under Output 3.1 (for storing and disseminating knowledge). The information and knowledge that is managed through this output will provide an evidence base for EbA, thereby promoting the wide-scale implementation of this approach across Bangladesh including in dryland and swamp forests.

The activities to be implemented under Output 3.3 are:

3.3.1. Design and implement a knowledge management plan and communication strategy to capture, store and disseminate knowledge products generated by the LDCF-financed, baseline and aligned projects in Bangladesh.

Output 3.4. Frameworks that support replicating and upscaling of EbA in Bangladesh developed and presented to relevant national institutions.

209. To promote the sustainability and replication of EbA in Bangladesh, a strategy for nation-wide upscaling of EbA will be developed. This strategy will build on: i) the technical guidelines and training provided under Output 1.2 and 2.2.; and ii) consultations with a broad spectrum of relevant stakeholders, including local communities. The upscaling strategy will include sections on: i) the benefits of EbA; ii) multi-sectoral research to inform EbA; iii) a coordinated approach to upscaling; iv) cost-effectiveness of EbA relative to other approaches for adapting to climate change; v) recommendations for mainstreaming EbA into development planning (including recommendations to revisions of national budgets); vi) the role of stakeholders in the upscaling strategy; and vii) research required to further support upscaling of EbA. This upscaling strategy will be informed by lessons learned through implementing EbA in the Barind Tract and Haor Area and will be validated by local and national government officials. Furthermore, business case models – for both the public and private sector – will be developed and integrated into the upscaling strategy to promote private sector investment in EbA in Bangladesh.

The activities to be implemented under Output 3.4 are as follows:

3.4.1. Identify good practices for, and barriers to, the effective upscaling of EbA interventions.

3.4.2. Develop a nation-wide EbA upscaling strategy through consultation with stakeholders at all levels (including local communities), led by Department of Environment, to sustain and replicate climate-resilient development using EbA.

3.4.3. Develop two business-case models<sup>103</sup> to support the nation-wide upscaling strategy including *inter alia* details on: i) the benefits of EbA relevant to the costs; ii) implementation arrangements at all levels (including within local communities) to promote this approach; and ii) potential funding mechanisms.

3.4.4. Host a workshop to validate the upscaling strategy and business-case models developed under this output with relevant local and national government officials including *inter alia* the MoF, MoA, MoP, MoEF, MoL and MoWR and all relevant departments under these ministries.

### **3.4. Intervention logic and key assumptions**

210. The activities of the LDCF-financed project will strengthen the technical and institutional capacity of stakeholders at a local and national level to address climate change risks through the implementation of EbA to restore degraded dryland and swamp forests. This approach will improve the capacity of local communities whose livelihoods are underpinned by functional, intact ecosystems. This will be achieved by: i) enabling a policy environment that promotes EbA; ii) enabling an environment that promotes the discussion about and use of EbA; iii) demonstrating adaptation interventions including EbA, technology that conserves water in the Barind Tract and reduces erosion in the Haor Area, and additional livelihood options; and iv) enhancing knowledge of the general public – including local communities and policy- and decision makers – on the effectiveness of EbA. These project interventions represent a multi-disciplinary approach to climate change adaptation. UNEP advocates this approach and the project interventions therefore align with: i) UNEP’s Programme of Work; and ii) the priorities identified in Bangladesh’s NAPA and Climate Change Strategy and Action Plan 2009.

211. The project was designed in consultation with multiple national and local stakeholders and the selection of interventions and project sites used a participatory approach. This participation of local communities and government institutions (Section 2.5) will promote buy-in and ownership of the project stakeholders at a national and local level. This local support will enhance the long-term sustainability of the project.

212. The LDCF-financed project interventions are considered “low regret” or “no regret” options. This is because they will benefit government and local communities regardless of the severity of climate change. For example, activities that focus on strengthening the technical capacity of the government and local communities (Outcome 1 and 2) will support improved planning and management, particularly with respect to natural resources and ecosystems. In addition, activities that focus on funding post-graduate and post doctorate research (Outcome 3) will increase the human resources capacity of Bangladesh. Finally, activities to restore dryland forests in the Barind Tract and swamp forests in the Haor Area, and improve management of these ecosystems (Outcome 2) will benefit biodiversity and generate multiple ecosystem goods and services.

213. The following assumptions underlie the project design.

- Project activities are unlikely to be undermined by extreme climate events during implementation.
- Local communities at intervention sites will take ownership of activities on the ground.

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<sup>103</sup>This will be done by following the Targeted Scenario Analysis (TSA) approach.

- Infrastructure constructed will be safe from theft and vandalism.
- Local communities participating in developing and implementing the project interventions will accept additional livelihoods and land-uses proposed by the project.
- There is sufficient surface water and groundwater available, with appropriate management, to meet local demand.
- Governmental institutions will have sufficient capacity to support the project’s activities.
- Sufficient national financial resources will be available to maintain the project’s interventions in the long term.
- There is sufficient technical capacity to undertake the preliminary studies and to design the implementation of activities.
- Baseline project activities will be implemented as planned.
- Adaptation priorities for climate change are unlikely to be undermined by national emergencies or civil unrest.
- Large-scale infrastructural developments – that would disrupt project activities – will not take place within the project areas during project implementation.
- Forests in the Barind Tract and wetland ecosystems in the Haor Area – in which EbA will be implemented – are not completely degraded.

### 3.5. Risk analysis and risk management measures

214. A participatory approach was adopted during the PPG phase of the project to assess and identify all potential risks to successful implementation of the project. Through annual PSC meetings, this approach will be continued throughout project implementation. Therefore, the project will have strong support from local communities and government. Risks to successful project implementation were identified and assessed and appropriate countermeasures and management responses to minimise the negative effect posed by the potential risk will be taken into consideration during project implementation. Monitoring, re-assessing and updating these project risks will be an important task of the TA throughout project implementation. Table 2 below describes the risks that have been identified, their associated impacts and countermeasures.

**Table 2.** Risk matrix

#	Description	Potential consequence	Countermeasures	Risk category	Probability & impact (1–5)
National-level risks					
1	Political instability at the national level.	Project inventions delayed because of uncertain role allocation at the central level.	<ul style="list-style-type: none"> <li>• The project manager and ITA will keep abreast of developments in the country and have contingency plans if necessary.</li> </ul>	Organisational	P = 1 I = 3
2	Disagreement between stakeholders on the allocation of roles in the project.	Project inventions delayed because of uncertain role allocation. Effectiveness of project management is reduced.	<ul style="list-style-type: none"> <li>• Institutional representatives at the validation workshop will agree upon the roles and responsibilities of each participating stakeholder.</li> <li>• During project implementation, the project will include relevant ministries and</li> </ul>	Organisational	P = 1 I = 4

			departments as partners to implement project activities. The coordination and reporting arrangements between ministries and departments will be clearly defined at project inception.		
3	The central information database established in the MoEF is not utilised or maintained over time leading to limited inter-institutional data sharing or collaboration.	Limited transfer of relevant project information amongst role players and end-users resulting in delayed or ineffective implementation of interventions.	<ul style="list-style-type: none"> <li>Awareness will be raised among stakeholders on the availability of information on the central information database and importance of using the portal to share information on climate change and EbA.</li> <li>Stakeholder consultations will be held to identify expectations of sharing information and to clarify responsibilities.</li> <li>An IT technician – based in the MoEF – will control content upload and ensure that the information database is maintained during and after the project.</li> </ul>	Organisational	P = 1 I = 4
4	The long-term nature of adaptation, in particular EbA, may lead to limited government support for project activities in the selected area.	Loss of government support may result in lack of prioritisation of project activities.	<ul style="list-style-type: none"> <li>Regular stakeholder consultations will be undertaken with all government staff. Provide training and raise awareness of government authorities on the nature of EbA, and benefits from this approach that will accrue. This will also include active involvement in sharing information and lessons learned.</li> </ul>	Organisational	P = 2 I = 4
5	High turnover of staff members in implementing agencies (in particular MoEF, DoE and CCU).	Changes in project-related government priorities and poor institutional memory result in disruptions or delays in project implementation and	<ul style="list-style-type: none"> <li>Alternative representatives within the involved institutions will be recommended at inception and involved in training to ensure continuity.</li> </ul>	Organisational	P = 2 I = 3

		coordination.	<ul style="list-style-type: none"> <li>• Technical guidelines will be developed in English and Bengali. These guidelines will guide new staff that become involved in the project.</li> </ul>		
6	Increasing Overseas Development Assistance increases demands on time/capacity	Increasing Overseas Development Assistance results in increased demands on time for implementing agency officials, which in turn results in disruptions or delays in project implementation and coordination.	<ul style="list-style-type: none"> <li>• Stakeholders from the LDCF-financed project will collaborate with other related development projects/ programmes/ activities/ initiatives to ensure that capacity is built according to the required in-country needs.</li> </ul>	Organisational	P = 3 I = 3
<b>Local level risks</b>					
7	Limited acceptance of stakeholders to accept change i.e. the adaptation alternative over the business-as-usual. This has a potential to affect the scaling up of project activities.	Communities may not adopt ecosystem restoration for adaptation activities during or after the project resulting in continued unsustainable use of resources.	<ul style="list-style-type: none"> <li>• Training will be provided and awareness raised among local communities on the benefits of EbA.</li> <li>• Share lessons learned – including success of – the LDCF-financed project.</li> <li>• VCGs will promote sustainable management of restored ecosystems.</li> </ul>	Social	P = 1 I = 4
8	Disagreement over allocation of land for implementation of project activities.	Disagreement among stakeholders about site selection.	<ul style="list-style-type: none"> <li>• Target upazilas were selected through national and local workshops, and consultations to promote a transparent, logical and equitable site-selection process.</li> <li>• During selection of particular sites, existing land user rights and ownership will be considered.</li> </ul>	Social	P = 1 I = 3
9	Under-developed land tenure system of property rights undermines project interventions.	Insecure/unsure land tenure system decreases buy-in to EbA interventions by local communities.	<ul style="list-style-type: none"> <li>• EbA protocols will be informed by socio-economic assessments at project sites. These assessments will include information on land tenure to ensure the interventions will be sustained in the long</li> </ul>	Organisational and social	P = 1 I = 4

			term.		
10	Unfavourable climate conditions including current climate and seasonal variability and/or extreme weather events.	Current climate and seasonal variability and/or hazard events result in poor restoration results.	<ul style="list-style-type: none"> <li>• Climatic variability will be taken into account in the selection of species for EbA.</li> <li>• Adaptation technology infrastructure will support implementation of EbA by providing water and reducing erosion.</li> </ul>	Environmental	P = 2 I = 4
11	Limited local technical capacity hinders project interventions.	Capacity constraints of local institutions and experts may limit the ability to undertake the research and demonstration activities.	<ul style="list-style-type: none"> <li>• Human resources capacity will be identified and developed as required.</li> <li>• Collaboration and exchange of information between local institutions and international research institutes will be initiated and sustained.</li> <li>• A Technical Advisor will work closely with the project Manager, and Bangladeshi experts will work closely with the LTAs to ensure timely delivery of project outputs.</li> </ul>	Technical	P = 1 I = 3
12	Limited commitment/buy-in from local communities.	Lack of commitment/buy-in from local communities may result in failure of demonstration projects.	<ul style="list-style-type: none"> <li>• See stakeholder engagement plan in Sections 4 and 5 of this document. This plan will be elaborated on during project inception.</li> <li>• During project implementation, local communities will be actively engaged and trained to ensure their buy-in into the project.</li> </ul>	Social, Environmental	P = 1 I = 4
13	Unsustainable land and natural resource use.	Unsustainable use of natural resources continues, leading to further degradation of ecosystems.	<ul style="list-style-type: none"> <li>• Training of local communities on the benefits of EbA and alternate livelihoods will be undertaken.</li> <li>• Local communities will be actively engaged during implementation.</li> </ul>	Social, Environmental	P = 3 I = 4
14	Implemented interventions are not cost-effective.	Priority interventions are not cost-effective which results in limited demonstration and will hamper the	<ul style="list-style-type: none"> <li>• Cost-effectiveness has been considered in the design of the project interventions.</li> <li>• The mix of EbA and</li> </ul>	Technical	P = 1 I = 2

		success of the interventions. Economic loss and budget allocation to other activities is reduced.	other adaptation technology infrastructure is a cost-effective approach to climate change adaptation (See Section 7.3 of the Project Document).		
15	Local communities cannot access sufficient support to implement EbA interventions successfully.	Lack of sufficient support to implement EbA for local communities may result in failure of demonstration projects.	<ul style="list-style-type: none"> <li>• Training will be provided for local communities on planning and implementing EbA.</li> </ul>	Social, Environmental	P = 1 I = 4

### 3.6. Consistency with national priorities or plans

215. The LDCF-financed project is aligned with the main development strategies and rural development programmes of Bangladesh. These national priorities and plans are described below.

216. Bangladesh National Environmental Management Action Plan (NEMAP) was developed in 1996 by government agencies to identify the most notable environmental problems in Bangladesh. The LDCF-financed project contributes to realising improvements in the environment as described in the Action Plan. In particular, the project is aligned with NEMAP’s objectives to reduce the rate of environmental degradation and improve the natural environment.

217. United Nations Development Assistance Framework (UNDAF) for Bangladesh was updated for the period 2012–2016. The LDCF-financed project will promote outcomes under three pillars of the framework. In particular, the project is well aligned with Outcome 5.1.1 under Pillar 5 “By 2016, populations vulnerable to climate change and natural disaster have become more resilient to adapt with the risk”.

218. Bangladesh Forestry Master Plan (BFMP) was formulated in 1994 to provide guidelines and recommendations for developing protected areas in Bangladesh. In particular, the BFMP aims to increase the extent of protected areas in Bangladesh by 10% of the reserved forest area by 2015<sup>104</sup>. The LDCF-financed project will identify entry points for EbA in relevant policies, thereby contributing to conservation objectives that underpin this plan

219. The National Biodiversity Strategy and Action Plan (NBSAP) was formulated in 2004 and provides a framework for biodiversity conservation, ecosystem services, sustainable resource use and benefit sharing. In addition, the NBSAP aligns with the Poverty Reduction Strategy Paper (PRSP) and Bangladesh’s Sixth Five Year Plan (2011–2015) by promoting sustainable livelihoods from ecosystem goods and services, thereby contributing to poverty reduction. The LDCF-financed project will support these objectives by developing livelihoods for local communities in the Barind Tract and Haor Area.

<sup>104</sup><http://www.slideshare.net/hafizes07ku/present-status-policy-and-management-of-biodiversity-in-bangladesh>

220. The National Water Management Plan (NWMP) was formulated in 2004 to implement socio-economic development strategies that were established by the National Water Policy (NWP). In particular, the NWMP supports implementation of these strategies by promoting Integrated Water Resource Management (IWRM). Effective management of water resources in Bangladesh contributes to: i) improved living standards; ii) reduced poverty; and iii) disaster prevention. The LDCF-financed project will have a positive effect on water resource management in the Barind Tract and Haor Area by: i) restoring degraded ecosystems; and ii) implementing techniques that reduce erosion and promote groundwater recharge.

221. The Haor Master Plan (HMP) was developed in 2012 with the goal of planning and implementing activities related to the optimum utilisation of water resources, and reduction of poverty. The particular objectives of the HMP are to: i) develop integrated programmes that promote sustainable management of natural resources; ii) increase crop production; iii) protect vulnerable homesteads and infrastructure; iv) preserve natural water bodies; and v) maintain wetlands along the lengths of natural canals, thereby mitigating flood risk and damage<sup>105</sup>. The LDCF-financed project will contribute to achieving these objectives by restoring degraded wetlands in the Haor Area. This will increase freshwater ecosystem goods/services – including the provision of fish and fibre, water purification and supply, flood regulation, and sediment/nutrient retention and export – under heavier and more erratic rainfall during the monsoon season.

222. The objective of Gob's Sixth Five Year Plan (2011–2015) is to accelerate economic growth and reduce poverty by developing relevant strategies, policies and institutions<sup>106</sup>. In particular, this plan prioritises adaptation to climate change for vulnerable communities and degraded ecosystems. The LDCF-financed project will support these priorities by strengthening Bangladesh's institutional and technical capacity to plan and implement EbA. Thereby providing ecosystems and local communities with a means of adapting to climate change.

223. The Social Forestry Rules (SFR) were developed in 2004 – amended in 2010 and 2011 – to provide legal support to communities partaking in participatory forestry and to promote sustainability of the programme. In particular, these rules define the following for social forestry in Bangladesh: i) process of beneficiary selection; ii) roles and responsibilities of different stakeholders; iii) best-practice management of forests; iv) capacity-building requirements; and v) distribution of earnings from social afforestation. In addition, these rules summarise the priorities to promote income generation from natural resources including fuel wood, timber and fodder. The LDCF-financed project will align with the SFR by training local authorities, communities, committees and user groups – with an emphasis on women and youth – on adapting community livelihoods to climate change by using specific techniques for restoring degraded drylands and wetlands in the Barind Tract and Haor Area respectively.

224. The National Adaptation Program for Action (NAPA) was approved by the GoB in 2005 and revised in 2009. The NAPA identified 15 projects to address urgent and immediate national adaptation priorities. The Barind Tract and Haor Area are described in the NAPA as two of the most vulnerable areas in Bangladesh. The LDCF-financed project is aligned with the projects described below.

- Project 6: “Mainstreaming adaptation to climate change into policies and programmes in different sectors (focusing on disaster management, water, agriculture, health and industry)”.
- Project 10: “Promotion of research on drought, flood and saline tolerant varieties of crops to facilitate adaptation in future”.

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<sup>105</sup><http://fpd-bd.com/wp-content/uploads/2013/04/Haor-Master-Plan-Brief-Outline.pdf>

<sup>106</sup><http://www.unicef.org/bangladesh/Six-Five-Year-Plan-2012-Final.pdf>

- Project 12: “Adaptation to agriculture systems in areas prone to enhanced flash flooding–North East and Central Region”.

225. By developing capacity for implementing EbA and upscaling into national and local plans under Component 1, the LDCF-financed project is aligned with Project 6. Projects 10 and 12 will also be addressed by implementing on-the-ground EbA in degraded drylands in the Barind Tract and degraded wetlands in the Haor Area. These ecosystems will buffer local communities from natural disasters related to climate change such as flooding and droughts.

226. In Bangladesh, considerable economic losses have been experienced as a result of: i) land degradation from aridity; and ii) reduced crop production from droughts. To address these problems, the GoB adopted the National Action Programme for Combating Desertification (NAP) in 2005. The NAP identifies factors contributing to the process of desertification in Bangladesh. This programme uses an integrated, bottom-up approach to combat desertification and mitigate the effects of droughts<sup>107</sup>. The LDCF-financed project will align with the NAP by building the climate resilience of communities in the Barind Tract that are exposed to increasingly frequent and severe seasonal droughts and intermittent dry spells.

227. While the LDCF-financed project is focussed on increasing technical capacity for EbA, restored forests will promote the sequestration of carbon and contribute to the mitigation of climate change globally. The project is therefore aligned with – and will support – the Intended Nationally Determined Contributions (INDC) process. This process is currently being initiated in Bangladesh.

228. The GoB has made considerable progress in planning to achieve the Sustainable Development Goals (SDGs). Through implementation of EbA, the LDCF-financed project will contribute to: i) promoting “climate action” (SDG 13); and ii) improving “life on land” (SDG 15).

### 3.7. Additional cost reasoning

A summary of the adaptation alternative and the business-as-usual scenario – overall and per outcome – is presented in the tables below.

<b>Business-as-usual</b>	<b>Adaptation alternative scenario</b>
<p>Growing population pressure, poverty and unsustainable agricultural practices will continue to result in the degradation of dryland forests in the Barind Tract and swamp forests in the Haor Area. This degradation will reduce the capacity of ecosystems in these areas to provide valuable goods and services that underpin the livelihoods of local communities, such as nutrient cycling, water purification and flood regulation. Several ongoing initiatives are being implemented to address the problems associated with environmental degradation and its underlying causes. The current and predicted effects of climate change – including <i>inter alia</i> increasing temperatures and rainfall variability – will continue to reduce the effectiveness of these initiatives to address the baseline problems. Without</p>	<p>LDCF resources will be used to increase the adaptive capacity of government and local communities in Bangladesh through the cost-effective, low-risk EbA approach. These stakeholders will be trained on implementing EbA to restore degraded dryland forests in the Barind Tract and swamp forests in the Haor Area so that they are: i) more resilient to climate variability; and ii) more beneficial to the local community than the degraded ecosystem, and iii) combining EbA methods with small scale infrastructure investments. Demonstrations of EbA in selected intervention sites using LDCF resources will provide local communities with enhanced ecosystem services which will reduce their vulnerability to climate change as well as provide alternative sources of</p>

<sup>107</sup>[http://www.doe.gov.bd/publication\\_images/5\\_nap\\_2006.pdf](http://www.doe.gov.bd/publication_images/5_nap_2006.pdf)

LDCF resources, stakeholders involved in these projects will not have adequate capacity to plan and implement EbA to adapt to climate change.	income and increased food security under conditions of climate change.
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Business-as-usual	Adaptation alternative scenario
<p><b>Outcome 1</b></p> <ul style="list-style-type: none"> <li>• Policy- and decision-makers in Bangladesh will remain unaware of the considerable benefits of EbA and this will remain an under-explored adaptation strategy.</li> <li>• Technical knowledge on the implementation of EbA interventions will remain limited.</li> <li>• The national approach to ecosystem restoration will continue to be <i>ad hoc</i>, with various ecosystem restoration-related activities taking place in isolation, and with minimal communication between ministries.</li> <li>• Line ministries will continue to have limited technical and institutional capacity for developing the full suite of adaptation benefits that can arise from restoring degraded ecosystems using EbA.</li> </ul>	<p><b>Outcome 1</b></p> <p>LDCF resources will be used to increase the technical and institutional capacity of stakeholders in Bangladesh to adapt to climate change using EbA. The interventions under this outcome will promote the inclusion of EbA in national policies and strategies thereby creating a platform for promoting large-scale EbA in Bangladesh. This will be done through the activities listed below.</p> <ul style="list-style-type: none"> <li>• Developing policy briefs to propose revisions to existing policies and plans that are particularly relevant to ecosystem management.</li> <li>• Conducting technical training with staff from national ministries to present the policy briefs.</li> <li>• Developing technical guidelines for policy- and decision-makers on how to plan and finance EbA interventions that will increase the resilience of communities whose livelihoods are underpinned by functional, intact ecosystems.</li> <li>• Strengthening the mandate of the CCC to include EbA coordination, and strengthening capacity to move from policy to implementation.</li> <li>• Conducting technical training workshops with national and local government staff to: i) present technical guidelines; and ii) train technical staff on moving from policy to implementation.</li> <li>• Promoting improved communication between relevant ministries by including multiple implementing partners in the execution of project activities.</li> <li>• Assisting in overcoming barriers to national dialogue by promoting an integrated approach for EbA, in multiple climate-vulnerable sectors.</li> <li>• Conducting introductory training of national and local government on EbA.</li> <li>• Ultimately, creating an enabling policy environment that strongly promotes large-scale EbA implementation.</li> </ul>

**Outcome 2**

- Degradation of climate-vulnerable dryland forests in the Barind Tract will continue to result in negative effects such as: i) increased soil erosion, which reduces agricultural and forest productivity; ii) reduced water infiltration and subsequent water availability with impacts on ground water and stream flow; iii) flood events from river bank erosion and catchment degradation iv) increased sedimentation of rivers, haors and beels resulting in decreased water quality; v) degraded habitat destruction impacting on fish production and vi) reduced agricultural yields.
- Livelihood improvement initiatives – such as the Irrigation Project in the Barind Tract and the SRCWP in the Haor Area – will continue to focus on the construction of supporting infrastructure rather than combinations of infrastructure and EbA to maximise adaptation benefits for local communities.
- Government projects and NGOs will continue to undertake restoration of degraded ecosystems with limited consideration of climate change trajectories.
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**Outcome 2**

LDCF finances will be used to demonstrate technologies – including EbA – to increase the adaptive capacity of local communities in the Barind Tract and Haor Area. This will be achieved through the activities listed below.

- Conducting comprehensive Vulnerability Impact Assessments (VIAs) to: i) identify the most vulnerable communities; and ii) select specific sites for the implantation of project activities in the Barind Tract and Haor Area.
- Establishing VCGs in the Barind Tract and Haor Area.
- Collecting scientific research and traditional knowledge.
- Preparing technical protocols and methodologies for the implementation of EbA, and supporting infrastructure that supports EbA in dryland and swamp forests in Bangladesh.
- Implementing tailored EbA to restore dryland forests and swamp forests in the selected upazilas in the Barind Tract and Haor Area.
- Constructing supporting infrastructure to support the selected EbA interventions.
- Developing , demonstrating and funding climate-resilient additional livelihoods with local communities in selected upazilas to: i) promote conservation of dryland forests and swamp forests; and ii) adaptation to climate change.
- Conducting training of local communities (focusing in particular on women and youth) on: i) EbA; ii) supporting infrastructure that conserves water in the Barind Tract and reduces erosion in the Haor Area; iii) additional livelihoods; and iv) techniques to manage livestock under conditions of climate change.

<p><b>Outcome 3</b> Policy- and decision-makers, and the general public in Bangladesh will remain largely unaware of the considerable benefits of EbA as a means of adapting to climate change.</p> <ul style="list-style-type: none"> <li>• Impacts of EbA will not be measured in the long-term.</li> <li>• Knowledge of EbA will remain limited among the general public including policy- and decision-makers, national stakeholders and local communities.</li> <li>• The evidence-base for adaptation technologies in Bangladesh – including EbA – will not be adequate to prioritise effective interventions.</li> <li>• Scientific knowledge on EbA will remain limited and will not inform the design of restoration activities.</li> </ul>	<p><b>Outcome 3</b> LDCF resources will be used to increase knowledge on the benefits and application of EbA, by:</p> <ul style="list-style-type: none"> <li>• Designing, creating and maintaining a central information database that will allow sharing of and access to <i>inter alia</i>, technical guidelines, technical reports, handbooks and scientific reports in a user-friendly manner.</li> <li>• Providing financial support to PhD and post-doctorate researchers – including international exchange programmes – to conduct research on specific climate change risks and the long term impacts of EbA in the Barind Tract and Haor Area.</li> <li>• Promoting short-, medium-, and long-term scientific research within institutions in Bangladesh on EbA –including scientific studies and research into local knowledge – for maximising the benefits of EbA in different ecosystems.</li> <li>• Designing and implementing a knowledge management plan – including a strategy for monitoring the biophysical and socio-economic benefits of these interventions over the long-term – and communication strategy to capture, store and disseminate knowledge products generated by the LDCF-financed project and other ecosystem restoration projects in Bangladesh.</li> <li>• Developing frameworks that support the replication and upscaling of EbA in Bangladesh.</li> <li>• Training policy- and decision-makers on the use of the frameworks that support the upscaling of EbA in Bangladesh.</li> </ul>
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### 3.8. Sustainability

229. The LDCF-financed project was developed by consulting a wide range of stakeholders, including: i) central government representatives; ii) local government representatives in the Barind Tract and the Haor Area; iii) NGO's; iv) implementing agencies; v) national academic institutions; and vi) local communities (Section 2.5 of the UNEP Project Document). This participatory approach has promoted ownership of the project by all stakeholders. As a result, project interventions will be sustained beyond the project implementation period. A participatory approach will also be used during the implementation of the project to further promote: i) stakeholder ownership; and ii) sustainability of project interventions.

230. To promote sustainability, the LDCF-financed project will include activities additional to those described in the paragraph above. Firstly, national and local government members will be trained on accessing national funding for EbA from the National Climate Funds. Improved access to funding for EbA will promote sustainability and replication of this approach throughout the country. Additionally, training on planning and implementing tailored EbA in dryland forests in the Barind Tract and swamp forests in the Haor Area will be provided to local government involved in ongoing initiatives such as the Irrigation Project, Agri-Products Project, FMP and SRCWP. This training – including technical details of selected species, planting protocols as well as monitoring and

conservation plans – will promote replication and sustainability of EbA through these initiatives. Revisions to national policies and plans – including budget allocations – to include EbA will also promote the upscaling and sustainability of EbA. Furthermore, the demonstration and monitoring of adaptation technologies – including EbA and infrastructure that conserves water in the Barind Tract and reduces erosion in the Haor Area – will increase the evidence base for this approach. Dissemination of this evidence to the general public – including policy- and decision-makers, government and local communities – through the knowledge platform and awareness campaigns will support implementation of EbA in the future.

The long-term sustainability of the adaptation interventions will be promoted by establishing/strengthening Village Conservation Groups (VCGs) at intervention sites. In the Haor Area, this activity will build on the VCGs that were established by the CWBMP project. In the Barind Tract, VCGs do not currently exist, and will therefore be established through the LDCF-financed project, based on lessons learned through the CWBMP project. These VCGs will include members from the targeted communities including a representation of women and youth. These committees will: i) participate in all project activities at the selected communities; and ii) manage and protect restored ecosystems, planning and undertaking maintenance events – including replanting certain areas when necessary and maintaining infrastructure – throughout the project lifespan. The technical capacity of these stakeholders to plan, implement and monitor EbA will be strengthened through the LDCF-financed project. A Village Conservation Fund (VCF) will also be established to maintain the various project interventions in the long term. Refer to Appendix 23 for draft operational and management guidelines for the fund. The VCF will provide options for alternative income generation for vulnerable communities whose livelihoods are dependent on ecosystem services. In addition the VCF will also be used to maintain project interventions past the end of the project – e.g. funding for the management of nurseries, maintenance of restoration activities, re-excavating canals etc. – thereby promoting sustainability of the interventions. The sustainability of demonstrations will also be promoted by strengthening or establishing links between local communities at project interventions sites and markets for products from livelihoods that are demonstrated through the LDCF-financed project.

231. With regard to the sustainability of various pond and canal excavation activities, EbA will be implemented to complement these re-excavation activities by reducing erosion in watersheds surrounding beels and ponds, which will decrease the rate of sedimentation. Implementation of EbA will consequently enhance ecosystem functioning of natural beels and ponds in the long term. These relatively small canals will be maintained by local communities after the project lifespan through manual labour, and using finances from the VCF. EbA will also be implemented alongside new canals that will be constructed through the LDCF-financed project. This will reduce erosion of topsoils into the canals, thereby increasing the sustainability of the infrastructure. Furthermore, the protocols that will be developed within Output 2.4 will detail ways to maintain the infrastructure that will be constructed through the LDCF-financed project, and will guide targeted communities after the lifespan of the project.

232. The LDCF-financed project will prioritise the appointment of national consultants. Consequently, international consultants will only be appointed when local expertise is limited. In such cases, national and international consultants will collaborate to develop national expertise on EbA and promote the sustainability of project activities.

233. The LDCF-financed project will fund PhD and post-doctorate researchers to measure the effectiveness of EbA in the long-term. This funding will be provided to students from selected local and national institutions. Knowledge gained through such long-term research will grow the evidence-

base for EbA, and inform the design of this approach in the future. In addition, the project will implement a knowledge management plan, which will enable the dissemination of information on EbA after the project is finished.

234. The project design aligns with the National Adaptation Programme of Action (NAPA), the National Action Programme for combatting Desertification (NAP), and the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) priorities. This alignment increases the likelihood of the project interventions being upscaled to other areas. In addition, the cost-effectiveness of the proposed interventions as well as the buy-in of local communities will encourage the government to include EbA in national development planning.

235. Proposing revisions to policies and plans to incorporate EbA will create an enabling environment for implementation and upscaling of this approach. This will contribute to the sustainability of the project interventions and upscaling EbA across Bangladesh.

236. Finally, the LDCF-financed project will benefit from the UN's previous experiences in Bangladesh, particularly the UNDP Comprehensive Disaster Management Programme. The project will, therefore, build on the lessons learned from this project – and other initiatives for ecosystem restoration and management – to avoid pitfalls that have been experienced.

### **3.9. Replication**

237. The LDCF-financed project will implement interventions in drylands in the Barind Tract and swamp forests in the Haor Area in Bangladesh. Within the project, technical protocols and tools for adaptation interventions will be tailored to dryland and wetland ecosystems – which cover a large portion of Bangladesh's land area. Therefore, EbA interventions can be replicated in other degraded drylands and swamp forests using the protocols and tools developed within this project. Furthermore, policy briefs that propose revisions to national policies and plans to include EbA, and technical guidelines on how to plan, finance and implement EbA and supporting infrastructure – that conserves water in the Barind Tract and reduces erosion in the Haor Area – will be produced and distributed to policy- and decision-makers in Bangladesh. The policy briefs will ultimately create an enabling policy environment that strongly promotes large-scale EbA implementation. In addition, the technical guidelines will further promote the replication of on-the-ground adaptation interventions across Bangladesh.

238. To facilitate effective replication of EbA, lessons learned during implementation will be documented and disseminated by means of: i) workshops with policy- and decision-makers, project managers and other relevant stakeholders, and ii) an online platform that will be developed within the project to share information on climate change adaptation (see Activity 3.1.2). In addition, the upscaling of the project activities will be promoted by the strengthened institutional and technical capacity of government agencies such as the MoEF and DoE.

### **3.10. Public awareness, communications and mainstreaming strategy**

239. Local communities have limited knowledge of EbA. To address this limitation, the LDCF-financed project will include national and regional training activities on EbA. This training will focus on: i) the definition and meaning of EbA; ii) the benefits of this approach; iii) current ecosystem restoration projects in Bangladesh; iv) EbA best practices; and v) basic tools and guidelines to promote implementation and maintenance of EbA. Moreover, lessons learned and information generated during the project will be integrated into these trainings. These training programmes will be gender-sensitive and include representation from gender action groups in the project areas.

240. At selected sites, experience-sharing days with communities from outside the pilot areas to share information on lessons learned on EbA and associated additional livelihood options will facilitate learning and dialogue among policy-makers, implementers and local communities. Representatives from neighbouring communities will be invited to these events, thereby promoting upscaling of this approach.

241. The LDCF-financed project will facilitate the internalization and mainstreaming of the EbA approach by: i) recommending revisions to existing policies and strategies; ii) producing technical guidelines to promote adaptation to climate change using EbA; iii) increasing knowledge on EbA; iv) strengthening the capacity of local and national government to plan and implement EbA; v) implementing EbA, constructing supporting infrastructure that conserves water in the Barind Tract and reduces erosion in the Haor Area, and demonstrating additional livelihood options; and vi) developing a strategy to upscale and sustain dryland and wetland development using EbA. The technical guidelines and upscaling strategy will be presented to policy- and decision-makers through training sessions and workshops.

### **3.11. Environmental and social safeguards**

242. The interventions to be implemented by the LDCF-financed project will have positive environmental impacts. This is because these interventions are aimed at: i) restoring degraded drylands and swamp forests; and ii) enhancing the capacity of local and national stakeholders to plan for and implement EbA in these ecosystems. It is expected that the project will result in benefits such as: i) reduced erosion; ii) increased water infiltration; iii) increased NTFPs and natural resources; and iv) improved livelihoods that are climate-resilient. As such, these project activities can be considered as ‘no regrets’ interventions because they will improve upon the baseline conditions regardless of the severity of anticipated climate change effects.

243. The UNEP checklist for Environment and Social Safeguards (Appendix 16) reflects the positive environmental and social impacts of the LDCF-financed project. The Project Manager (PM), International Technical Advisor (ITA), UNEP Task Manager (TM), and the focal points from the implementing partners will be responsible for overseeing adherence to these guidelines throughout the implementation of the project. This checklist will be reviewed and updated annually by the PM in conjunction with the UNEP TM. Following national regulations, EIAs will be undertaken to inform the implementation of hard infrastructure activities within Component 2 of the LDCF-financed project. In addition, feasibility and vulnerability assessments will be undertaken to inform the design of project interventions.

244. To meet the objectives of the LDCF-financed project, EbA will be complemented by techniques for water conservation in the Barind Tract and soil conservation in the Haor Area. Such techniques includes: i) excavating ponds; and ii) digging canals in the selected upazilas in the Barind Tract and Haor Area. In addition, rainwater harvesting systems for households/agricultural use will be installed in the selected upazilas in the Barind Tract. This combination of EbA and supporting infrastructure will conserve water and topsoil under predicted conditions of climate change including reduced water availability in the Barind Tract and increased flooding in the Haor Area. The perceptions of local communities and government will be considered when designing such techniques or infrastructure.

245. The LDCF-financed project will adopt an approach that supports gender equality (Section 3.1). As such, gender equality, women’s rights and the empowerment of women will be promoted. Therefore, the project will support Bangladesh’s moral and legal obligations as described in the

Constitution. Article 28 of the Constitution recognises the principle of equality between men and women in all spheres of the State and public life. In addition, several of the GoB's Five Year Plans recognise the importance of gender mainstreaming and women's empowerment. For example, one of the goals of the National Policy for Women's Advancement (NPWA) is to ensure that adequate measures are taken for women's education, health and nutrition. In addition, Bangladesh has committed to a number of international conventions that have strong gender policies. These include: i) the United Nations Millennium Declaration; ii) the Cairo Program for Action; iii) the Beijing Platform for Action; and iv) the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW). Accordingly, gender equity – defined here as the equal participation of men and women in project activities – will be addressed in the development of EbA protocols. Stakeholder decisions relating to project activities will only be made with a sufficient representation of women in attendance. Furthermore, women and youth will be a focus of technical capacity strengthening for implementing EbA in degraded dryland and wetland ecosystems.

#### **SECTION 4: INSTITUTIONAL FRAMEWORK AND IMPLEMENTATION ARRANGEMENTS**

246. The LDCF-financed project will be implemented over a four-year period<sup>108</sup>. Implementation will be informed by lessons learned from other restoration projects in Bangladesh and EbA projects in South Asia. For example, lessons learned during the implementation of the UNEP Coastal and Wetland Biodiversity Management at Cox's Bazar and Hakakuki Haor project will be used to inform the implementation of this LDCF-financed project. Lessons learned will be shared through: i) working with implementing partners in the Barind Tract and the Haor Area; ii) meetings with a wide range of government departments during the implementation of the LDCF-financed project; and iii) meetings with members of the Regional Project Coordination Committees that will be established by the LDCF-financed project.

247. UNEP will be the Implementing Agency (IA) for the project. The IA will oversee the project, and provide the technical assistance required to meet the project goals<sup>109</sup>. As such, UNEP will be responsible for project supervision to ensure consistency with GEF and UNEP policies and procedures. A task manager (TM) will be appointed for this role. The TM will be based in UNEP Department of Environmental Policy Implementation (DEPI/GEF) Climate Change Adaptation Unit (CCAU). The TM will participate in the: i) mid-term review and terminal evaluation; ii) clearance of half-yearly and annual reports; and iii) technical review of project outputs.

248. This project is in line with UNEP's Programme of Work 2014–2015, in particular with Subprogramme 1 – Climate Change. The project will be building capacity, undertaking pilot initiatives through Ecosystem-based approaches to Adaptation, fostering climate change outreach and awareness-raising – all of which are areas of work under Subprogramme 1 under the current UNEP Programme of Work (PoW 2014–15). Under the Climate Change Subprogramme the project will be contributing to PoW Output 2 (*Technical support provided to countries to implement ecosystem-based adaptation demonstrations and supporting adaptation approaches, and to scale these up through partnerships at the regional and national levels*) and Output 4 (*Technical support provided to countries to address adaptation planning and reporting requirements under the Framework Convention on Climate Change*), under expected accomplishment A (*Ecosystem-based and supporting adaptation approaches are implemented and integrated into key sectoral and national development strategies to reduce vulnerability and strengthen resilience to climate change impacts*).

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<sup>108</sup>according to the workplan in Appendix 4

<sup>109</sup>see Appendix 14 for information on UNEP's comparative advantage

## Management structure

249. As a result of the large distances between project sites and difficulties in travelling between sites, the management structure will include a centralised Project Management Unit and two regional management units. The management structure of the LDCF-financed project is presented in Figure 5. This will comprise:

- **Project Steering Committee (PSC)** to provide project oversight and advisory support, particularly for the Monitoring and Evaluation (M&E) plan.
- **Project Implementation Committee (PIC)** to provide guidance for project implementation.
- **Project Management Unit (PMU)** to execute the project at the national level, this structure will include: i) a Project Director (PD); ii) a Project Manager (PM); iii) an International Technical Advisor (ITA); iv) an Administrative and Finance Officer (AFO); and v) an Office Assistant.
- **Regional Technical Units (RTUs)** to execute the project at the regional level (one RTU in Rajshahi town and one RTU in Kulaura/Juri of Moulvibazar). This structure will include :i) a Regional Coordinator (RC); ii) a Local Technical Advisors (LTAs); iii) a Climate Change and Natural Resource Management Expert (CC&NRME); iv) an Administrative and Finance Officer (AFO); and v) an Office Assistant.
- **Regional Project Coordination Committee (RPCC)** to facilitate enhanced collaboration, coordination and synergy by providing necessary guidance and insight during implementation of activities in pilot areas at the regional level. One RPCC will be established in both the Barind Tract and Haor Area. The RPCC will consist of focal points from the implementing partners, representatives of academia and civil society. The committee will be headed by the Regional Coordinator (RC) who will be an officer of the DoE.
- **Implementing Partners (IPs)** to execute/implement the delivery of project outputs and activities in the two pilot areas at the regional level.
- **National and International Experts** to provide technical support for project implementation. This will include an International Technical Advisor (ITA) who will work closely with the PM in consultation with PD.

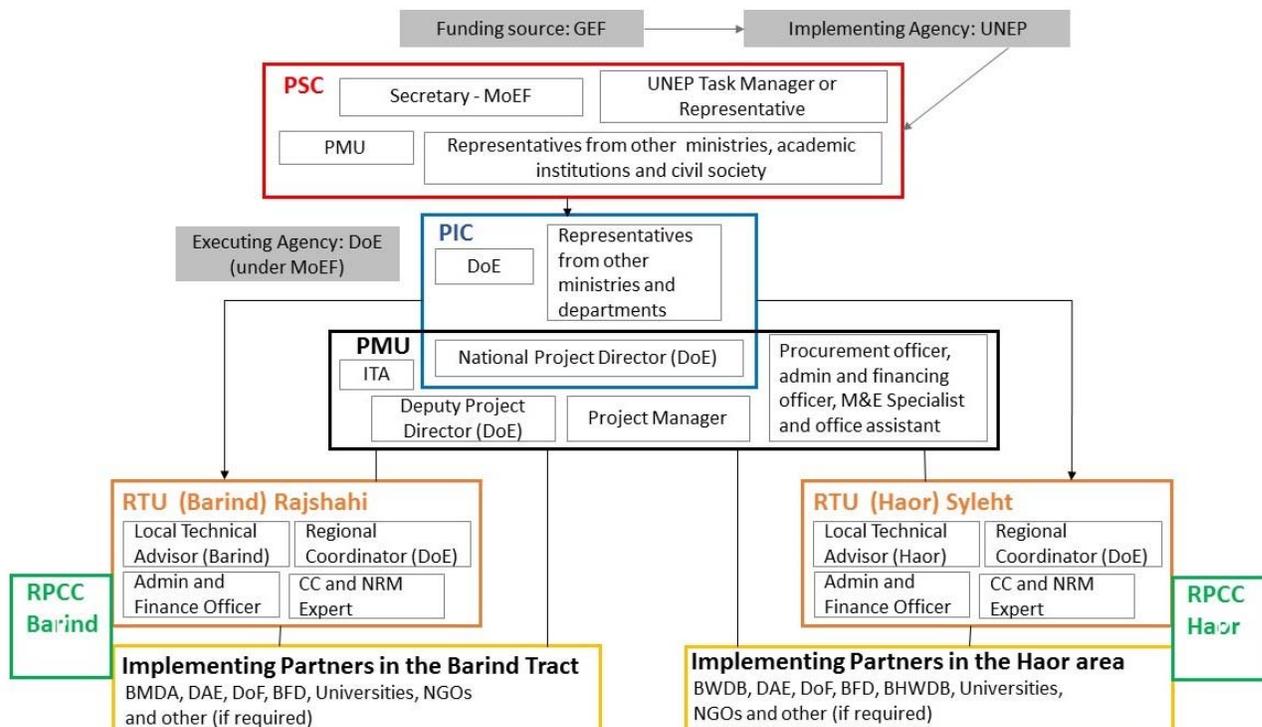


Figure 6. LDCF-financed project management structure.

250. The mandate of the **PSC** will include: i) overseeing project implementation; and ii) reviewing annual workplans, project reports including any changes in Results-Based Framework (RBF) or timeline of project activities. The Member Secretary will communicate all decisions taken by the PSC to the concerned parties. The PSC will meet twice a year to discuss performance indicators and provide strategic guidance. The Secretary of the MoEF (GEF Operational Focal Point) will play the role of the Chairman of the PSC, while the one officer from MoEF will play the role of Member Secretary for the PSC. The PSC will consist of the PD and representatives of relevant ministries, departments/agencies, academia and civil society.

251. A **Project Implementation Committee (PIC)** will be established under the DoE. The Director General of the DoE will chair this committee. The PIC will meet quarterly – or more frequently if necessary – to oversee project implementation and coordination among the IPs. The PIC will provide guidance for project implementation and progress as per the approved workplan.

252. The DoE will be the **Executing Agency (EA) of this project**. PMU will be established under this government department. This unit will support day-to-day project execution and will ensure:

- the quality of outcomes delivered by the LDCF-financed project;
- the effective use of resources;
- appropriate procurement of equipment and consultation services;
- availability of financing to support project implementation; and
- efficient coordination between project stakeholders, particularly national stakeholders and IPs.

253. As the Executing Agency, the DoE will retain overall responsibility for project outcomes and strategic guidance. One of the Officers of the DoE will be the **Project Director (PD)**. The PD will have complementary and mutually supporting roles associated with overseeing project

implementation, project management, and technical and operational support services. The PD will be accountable to the PSC and PIC for project implementation. The PD will have overall responsibility for the PMU. Additional responsibilities of the PD include ensuring: i) overall project implementation; ii) day-to-day project execution; iii) quality of outcomes delivered; iv) effective use of resources; v) appropriate procurement of equipment and consultation services; vi) availability of financing to support project implementation; vii) efficient coordination between project stakeholders, particularly national stakeholders and IPs; viii) hiring of project staff/personnel; ix) preparing the MoU with Implementing Partners; x) project progress report to PSC; and xi) guide the RTU in the implementation of project activities.

254. MoEF who will be an officer of DoE will appoint a **Deputy Project Director** (DPD). The DPD will have complementary and mutually supporting role associated with overseeing implementation, project management, and technical and operational support services under the guidance of PD.

255. A full-time PM will be hired for the PMU to coordinate and execute the day-to-day activities of the project. The PM will: i) report to the PD; and ii) manage the project in line with budget, work plans and procurement plans, and in accordance with GEF and UNEP guidelines. In addition, the PM will deliver progress reports on a monthly basis to the PD, TM and the ITA. These reports will include information on the: i) status of activities; and ii) challenges encountered on the ground during project execution. In particular, the PM will: i) provide on-the-ground information for UNEP progress reports; ii) engage with stakeholders; iii) facilitate in organising the PSC, PIC and other meetings; iv) provide technical support to the project, including measures to address challenges to project implementation; and v) participate in training activities, report writing and facilitation of expert activities that are relevant to the PM's area of expertise. Moreover, the PM will serve as a liaison among the PMU, the technical experts, IPs and the government staff involved in project activities.

256. Two Regional Coordinators (RC) will be appointed by the DoE and based in the RTU offices (one in each regional office). RC will head the RTU and he/she will be the Convenor of RPCC. The RCs will: i) coordinate meetings of the RPCC and other meetings related to EbA project at regional level; ii) promote the timely execution of activities through IPs and the achievement of expected outcome of the project at the regional level; iii) promote dialogue between the DoE and the implementing partners particularly at regional and local level; iv) meet with the focal points from the implementing partners and discuss project progress as per the agreed workplan; v) visit and monitor the intervention sites regularly; vi) work in close collaboration and guidance of the PD.

257. Two **Local Technical Advisors** (LTAs) will be hired on a full-time basis to support the RC and PM. The responsibility of the LTAs will be to: i) promote the timely execution of activities and achievement of expected deliverables at the project sites; ii) facilitate and coordinate meetings of the RPCC and other meetings. The LTAs will visit/monitor the intervention sites regularly. LTAs will be based in the RTU offices and work under the guidance RC and PM.

258. At the regional level, the project activities will be executed by **Implementing Partners** (IPs) including: i) the BMDA, DAE, DoF, DLS, BFD, and NGOs in the Barind Tract; and ii) the BWDB, DAE, BFD, DoF, BHWDB, DLS, and NGOs in the Haor Area. The IPs will work within the overall framework of the project and will be responsible for: i) the timely execution of activities and achievement of expected deliverables at the project sites; ii) the procurement of equipment and consultation services; and iii) the participation of VCGs and local communities in the LDCF-financed project activities. Each IP will designate a Focal Point with day-to-day responsibility for the project and act as a key point of contact for project management purposes. The IPs Focal Points will report to the RC. Each Focal Point will be responsible for preparing annual work plans in coordination with the

RTU under the overall direction of the PMU and in line with the overall guidance of the RPCC. Furthermore, all IPs will: i) have a signed Letter of Agreement (LoA) – or if needed, official legal instruments (contract/MoU) –with the DoE outlining the particular roles and responsibilities of the IPs and the DoE; ii) be assigned financial and material resources based on the agreed objectives and work plans set out in the LoA/MoU; and iii) be accountable for the use of funds, for progress on agreed work plans and for achieving expected outputs. Both the PMU and the IPs may engage contractors or sub-contractors to carry out specific tasks relating to project delivery as long as these are stipulated within annual or quarterly work plans.

259. An Administrative and Finance Officer (AFO) will be based in the PMU and each of the RTUs (three AFOs in total) and will assist in administrative and financial matters. These officers will: i) prepare quarterly financial reports to track internal expenditures; ii) drawing up a procurement plan; iii) track project procurement; iv) track legal instruments, v) report on expendable equipment, and vi) other activities.

260. A team of Experts will be employed for the implementation of the project activities. They will provide technical support for specialised tasks that cannot be undertaken by DoE staff or the staff of the implementing partner organisations. Descriptions of the Experts' responsibilities are included in the project's budget notes (see Appendix 1). To address challenges in the implementation of specialised EbA interventions at a national level, an ITA with EbA expertise will be hired to provide technical advice. This individual (ITA) should have experience in other GEF adaptation projects. Responsibilities of the ITA will include *inter alia*: i) advising on suitable technical methodologies; ii) technical advice and guidance to national Experts' work; iii) providing quality assurance and technical review of outputs; iv) assisting with knowledge management and communications for awareness-raising at a national level; and v) providing specialised technical and capacity building support to the PMU. The ITA will travel to Bangladesh as per workplan to interact with national and regional staff and implementing partners. In year 1, the ITA will spend two months in country to assist the PM in setting up and initiating the project and thereafter provide 1-month remote technical assistance. In year 2, the ITA will spend 1 month in country to provide technical assistance and oversee project implementation, thereafter providing 1-month remote technical assistance. In year 3, ITA will spend 1 month in country to provide technical assistance. As the project progresses, the technical capacity of PMU, PM, RCs, LTAs and experts will be enhanced through the support of the ITA.

## **SECTION 5: STAKEHOLDER PARTICIPATION**

261. Stakeholder participation will be coordinated to enable effective implementation of the LDCF-financed project. A stakeholder engagement plan to be used during the implementation phase will be developed during the project inception workshop. Stakeholders will be consulted throughout the implementation phase to: i) promote community understanding of the project's outcomes; ii) promote local community ownership of the project through engaging in planning, implementing and monitoring of the interventions; iii) communicate to the public in a consistent, supportive and effective manner; and iv) maximise coordination with other ongoing projects.

262. The mechanisms for stakeholders consultations will include: i) initial meetings with local government and national government ministries during the project inception workshop (see Section 2.5); ii) consultation meetings with the coordinators of the baseline projects and co-financing institutions (see Section 2.6); iii) consultation meetings with aligned projects (See Section 2.7); iv) consultation meetings with local NGOs; and v) consultation meetings with local communities, indigenous communities and with the beneficiaries of the LDCF-financed project.

263. Importantly, project interventions will be designed to promote gender equality. To achieve this, Bangladesh gender action groups – such as CARE Bangladesh – will be thoroughly consulted during the project inception phase and throughout implementation.

264. The stakeholders and partners for each outcome are described in the table below. Memorandums of Understanding (MoUs) will be signed between the different government institutions participating in the implementation of LDCF-financed project. The corresponding budget for the activity will then be transferred to the implementing partners in charge. Details of stakeholder participation will be finalised during project inception.

**Table 3.** Stakeholder participation per outcome

<b>Outcome</b>	<b>Output</b>	<b>Lead or coordinating institution/s</b>	<b>Important Stakeholders/ partners</b>	<b>Key responsibilities</b>
<b>Outcome 1. Strengthened technical capacity of local and national government to plan, implement and upscale EbA.</b>	Output 1.1 Policy briefs developed on proposed revisions to policies and strategies related to dryland and wetland ecosystem management to promote EbA.	DoE	<ul style="list-style-type: none"> <li>• DoE</li> <li>• NPE</li> <li>• International Policy Expert</li> </ul>	Overseeing: <ul style="list-style-type: none"> <li>• meetings between national experts and projects already conducting research on revisions to existing policies and strategies related to dryland and wetland ecosystem management; and</li> <li>• providing support to develop policy briefs that propose revisions to policies and plans related to ecosystem management.</li> </ul>
	Output 1.2 Mandate of the Climate Change Cell (CCC) incorporates EbA based on technical guidelines and training provided to support coordination, planning and implementation of EbA across Bangladesh.	DoE	<ul style="list-style-type: none"> <li>• CCC</li> <li>• NPE</li> <li>• International Policy Expert</li> <li>• International EbA expert</li> <li>• NAE</li> <li>• ITA</li> </ul>	Overseeing: <ul style="list-style-type: none"> <li>• meetings between national experts and projects already conducting research on policies and strategies for producing technical guidelines that promote EbA;</li> <li>• review of relevant strategies and</li> </ul>

				<p>policies to identify where technical guidelines on EbA are needed; and</p> <ul style="list-style-type: none"> <li>development of technical guidelines that promote adaptation to climate change using EbA.</li> </ul>
	<p>Output 1.3 Training provided to national and local government and VCG members on planning and implementing EbA interventions.</p>	DoE	<ul style="list-style-type: none"> <li>DoE</li> <li>National Experts</li> <li>CARE</li> </ul>	<p>Overseeing:</p> <ul style="list-style-type: none"> <li>developing training materials for national and local government departments on planning and financing EbA; and</li> <li>training on planning and financing EbA.</li> </ul>
<p><b>Outcome 2 Adaptation technologies – including EbA– demonstrated in the Barind Tract and Haor Area to restore degraded ecosystems and promote topsoil and water conservation.</b></p>	<p>Output 2.1 Vulnerability impact assessments undertaken to select target communities in the Barind Tract and Haor Area.</p>	DoE	<ul style="list-style-type: none"> <li>National Vulnerability Assessment Expert.</li> <li>CARE</li> </ul>	<p>Overseeing the undertaking of comprehensive VIA undertaken in the Barind Tract and Haor Area.</p>
	<p>Output 2.2 Local authorities, communities, committees and user groups in the Barind Tract and Haor Area trained on implementing and maintaining adaptation technologies, and developing additional livelihoods.</p>	DoE	<ul style="list-style-type: none"> <li>DoE</li> <li>BWDB</li> <li>LGED</li> <li>National Adaptation Specialist</li> <li>NGOs</li> <li>VCGs and local communities</li> <li>Santal community representatives</li> <li>CARE</li> </ul>	<p>Overseeing:</p> <ul style="list-style-type: none"> <li>Developing training materials for local authorities, communities, committees and user groups in the Barind Tract and Haor Area on planning and implementing EbA; and</li> <li>training on EbA.</li> </ul>
	<p>Output 2.3 EbA demonstrated in degraded forests in the Haor Area and Barind Tract.</p>	DoE	<ul style="list-style-type: none"> <li>BMDA</li> <li>BWDB</li> <li>FD</li> <li>DoE</li> <li>LGED</li> <li>International EbA</li> </ul>	<p>Implementing:</p> <ul style="list-style-type: none"> <li>reforestation of degraded dryland forests in the Barind Tract and degraded swamp</li> </ul>

			<p>Expert.</p> <ul style="list-style-type: none"> <li>• National Biodiversity and Ecology Expert</li> <li>• National Adaptation Specialist</li> <li>• National Climate Change and Socio-economic Expert</li> <li>• National indigenous species in Bangladesh Expert</li> <li>• NGOs</li> <li>• VCGs and local communities</li> <li>• Santal community representatives</li> <li>• CARE</li> <li>• Upazila Development Coordination Committee (UDCC) and District Development Coordinating Committees (DDCC)</li> </ul>	<p>forests in the Haor Area and;</p> <ul style="list-style-type: none"> <li>• reforestation of degraded dryland forest along road side strips in the Barind Tract and swamp forest along road sides in the Haor Area; and</li> <li>• establishment of homestead plantations in the Barind Tract and Haor Area;</li> <li>• Set up of VCF</li> </ul> <p>Overseeing:</p> <ul style="list-style-type: none"> <li>• construction of nurseries in the Barind Tract and Haor Area.</li> <li>• Setting up and management of the VCF</li> </ul>
	Output 2.4 Adaptation technologies demonstrated – including excavation/re-excavation of ponds, canals and beels, and installation of rainwater harvesting devices – to support EbA by reducing erosion in the Haor Area and conserving water in the Barind Tract	DoE	<ul style="list-style-type: none"> <li>• BWDB</li> <li>• LGED</li> <li>• BMDA</li> <li>• National Biodiversity and Ecology Expert</li> <li>• National Adaptation Specialist</li> <li>• National Climate Change and Socio-economic Expert</li> <li>• NGOs</li> <li>• VCGs and local communities</li> </ul>	<p>Implementing:</p> <ul style="list-style-type: none"> <li>• excavation of ponds in the Barind Tract and Haor Area;</li> <li>• digging canals in the Barind Tract and Haor Area; and</li> <li>• instillation of rainwater harvesting systems in the Barind Tract.</li> </ul>

			<ul style="list-style-type: none"> <li>• Santal community representatives</li> <li>• CARE</li> </ul>	
	<p>Output 2.5 Additional livelihoods demonstrated to enhance the adaptive capacity of local communities to climate change.</p>	DoE	<ul style="list-style-type: none"> <li>• BWDB</li> <li>• LGED</li> <li>• BMDA</li> <li>• National Biodiversity and Ecology Expert</li> <li>• National Adaptation Specialist</li> <li>• National Climate Change and Socio-economic Expert</li> <li>• National indigenous species in Bangladesh Expert</li> <li>• NGOs</li> <li>• VCGs and local communities</li> <li>• Santal community representatives</li> <li>• CARE</li> </ul>	<p>Implementing:</p> <ul style="list-style-type: none"> <li>• demonstration of fish production in homestead ponds in the Barind Tract and Haor Area;</li> <li>• establishment of community homestead farming in the Barind Tract and Haor Area;</li> <li>• establishment of community-based floating gardens in the Haor Area; and</li> <li>• demonstration of spice cultivation through zero tillage in the Barind Tract.</li> </ul>
<p><b>Outcome 3: Improved access to scientific and traditional information on EbA to promote upscaling of this approach in Bangladesh.</b></p>	<p>Output 3.1 A central information database – for information on EbA lessons learned and cost-effectiveness from the Haor Area, Barind Tract and other regions across Bangladesh – established or strengthened.</p>	DoE	<ul style="list-style-type: none"> <li>• Consultant contract for an Information database/Web-design Company</li> </ul>	<p>Coordinating:</p> <ul style="list-style-type: none"> <li>• the design and implementation of a central information database for sharing information collated and generated by the project; and</li> <li>• Overseeing the development of the central information database.</li> </ul>
	<p>Output 3.2 Financial support provided to post-graduate and post-doctorate researchers</p>	DoE	<ul style="list-style-type: none"> <li>• National Academic</li> <li>• ICCCAD</li> <li>• BARRI</li> </ul>	<ul style="list-style-type: none"> <li>• Choosing – in coordination with baseline projects – topics on EbA for PhD theses and</li> </ul>

	to conduct research on specific climate change risks and the EbA interventions that are implemented by the project.		<ul style="list-style-type: none"> <li>• Local academic institutions</li> <li>• International academic institutions</li> <li>• Bangladesh Haor and Development Department</li> </ul>	<p>post-doctorate research.</p> <ul style="list-style-type: none"> <li>• Selecting and funding students.</li> <li>• Ensuring that students communicate the findings of their research.</li> <li>• Coordinating workshops to communicate findings and suggestions to DoE and other relevant ministries.</li> </ul>
	Output 3.3 A knowledge management plan developed to capture and share information on climate change impacts.	DoE	<ul style="list-style-type: none"> <li>• BMDA</li> <li>• HWDB</li> <li>• LGED</li> <li>• NIE</li> <li>• ICCCAD</li> <li>• Other tertiary institutions</li> </ul>	<ul style="list-style-type: none"> <li>• Overseeing development of a knowledge management plan.</li> <li>• Coordinating the capturing and sharing of impacts and lessons learned.</li> <li>• Implementing the use of the knowledge management plan.</li> </ul>
	Output 3.4 Frameworks that support replicating and upscaling of EbA in Bangladesh developed.	DoE	<ul style="list-style-type: none"> <li>• MoF</li> <li>• National and International Experts</li> <li>• BMDA</li> <li>• HWDB</li> <li>• LGED</li> </ul>	<p>Overseeing:</p> <ul style="list-style-type: none"> <li>• workshops/meetings between experts, and MoF; and</li> <li>• the development of frameworks that support the upscaling of EbA in Bangladesh.</li> <li>• Coordinating workshops to communicate findings and strategies to policy- and decision-makers on the following topics: i) entry points for EbA; and ii) an</li> </ul>

				upscaling strategy.
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**SECTION 6: MONITORING AND EVALUATION PLAN**

265. UNEP will be responsible for managing the mid-term review/evaluation and the terminal evaluation. The Project Manager and partners will participate actively in the process.

266. The project will be reviewed or evaluated at mid-term (tentatively in 2018 as indicated in the project milestones). The purpose of the Mid-Term Review (MTR) or Mid-Term Evaluation (MTE) is to provide an independent assessment of project performance at mid-term, to analyse whether the project is on track, what problems and challenges the project is encountering, and which corrective actions are required so that the project can achieve its intended outcomes by project completion in the most efficient and sustainable way. In addition, it will verify information gathered through the GEF tracking tools.

267. The Project Steering Committee will participate in the MTR or MTE and develop a management response to the evaluation recommendations along with an implementation plan. It is the responsibility of the UNEP Task Manager to monitor whether the agreed recommendations are being implemented. An MTR is managed by the UNEP Task Manager. An MTE is managed by the Evaluation Office (EO) of UNEP. The EO will determine whether an MTE is required or an MTR is sufficient.

268. An independent terminal evaluation (TE) will take place at the end of project implementation. The EO will be responsible for the TE and liaise with the UNEP Task Manager throughout the process. The TE will provide an independent assessment of project performance (in terms of relevance, effectiveness and efficiency), and determine the likelihood of impact and sustainability. It will have two primary purposes:

- (i) to provide evidence of results to meet accountability requirements, and
- (ii) to promote learning, feedback, and knowledge sharing through results and lessons learned among UNEP and executing partners.

269. While a TE should review use of project funds against budget, it would be the role of a financial audit to assess probity (i.e. correctness, integrity etc.) of expenditure and transactions.

270. The TE report will be sent to project stakeholders for comments. The EO will share formal comments on the report in an open and transparent manner. The project performance will be assessed against standard evaluation criteria using a six point rating scheme. The EO will make the final determination of project ratings when the report is finalised. The evaluation report will be publically disclosed and will be followed by a recommendation compliance process.

271. The direct costs of reviews and evaluations will be charged against the project evaluation budget.

**SECTION 7: PROJECT FINANCING AND BUDGET**

**7.1. Overall project budget**

**Table 4.** Breakdown of total project financing.

	LDCF Funds	Co-Financing	Total Costs
Total project cost	5,200,000	55,032,617	60,232,617

(US\$)			
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## 7.2. Project co-financing

**Table 5.** Breakdown of project financing by funder.

	US\$	%
LDCF Funds	5,200,000	8.6
<b>Co-financing</b>		
The Barind Rain Water Conservation and Irrigation Project	5,850,000	9.7
The Marketing of Agricultural Products through Development of Rural Agri-products Project	15,812,000	26.3
The Haor Flood Management and Livelihood Improvement Project	25,830,000	42.9
Strengthening Regional Co-operation for Wildlife Protection (SRCWP) Project	7,300,000	12.1
Ministry of Environment and Forests, Government of Bangladesh	240,617	0.4
<b>Total</b>	<b>60,232,617</b>	<b>100</b>

## 7.3. Project cost-effectiveness

272. The LDCF-financed project is based on the NAPA priorities identified by the GoB in 2005 and the priority pillars identified in the BCSAP 2009. One of the guiding elements that were considered during the development of Bangladesh's NAPA was cost-effectiveness. Consequently, this principle has guided the development of the LDCF-financed project.

273. The project will adopt an approach of additionality and will build on two existing projects in the Barind Tract – the Irrigation Project and the Agri-products Project – and two projects in the Haor Area – the Flood Management Project and the SRCWP project. Furthermore, it will complement and align with a number of current initiatives. For example, technical capacity of government stakeholders that will be strengthened through Component 1 will build on the knowledge and capacity that has been developed by similar initiatives. This is a cost-effective approach to building technical capacity that will facilitate planning and implementation of EbA.

274. The project interventions will be implemented by partners in the Barind Tract and the Haor Area. This will enable the sharing of lessons learned from: i) similar initiatives for ecosystem restoration and management; and ii) on-the-ground interventions that will be implemented through Component 2 of the LDCF-financed project. These lessons will also be communicated to the public by means of: i) scientific reports; and ii) a central information database to share information on EbA. Therefore, this approach will be promoted and upscaled in a cost-effective way.

275. Globally, there is an urgent requirement to find tractable, sustainable, flexible and cost-effective interventions for local communities to adapt under conditions of climate change<sup>110</sup>. In some instances, initiatives have focused on constructing supporting infrastructure<sup>111</sup> to protect local communities from climate-related hazards. However, it is acknowledged that healthy ecosystems also

<sup>110</sup>Jones et al. 2012. Harnessing nature to help people adapt to climate change. *Nature*. Published online: 26 June 2012. DOI: 10.1038/nclimate1463

<sup>111</sup>including sea walls, irrigation infrastructure and dams

facilitate adaptation to climate change by acting as buffers and providing services<sup>112</sup>. Furthermore, ecosystems that are enhanced through EbA are less likely to reach their tipping points, after which ecosystem degradation becomes irreversible under conditions of climate change<sup>113</sup>. Therefore, EbA is a ‘soft’ proactive rather than reactive approach for addressing climate change. Moreover, a growing body of scientific research indicates that increasing numbers of EbA projects will deliver favourable cost-benefit ratios in comparison with projects that use only hard interventions for adaptation to climate change. For example, the restoration and rehabilitation of grasslands and woodlands reportedly have internal rates of return of 20-60% and benefit-cost ratios of up to 35:1<sup>114</sup>. As another example, an economic analysis of watershed management and engineering interventions was undertaken in Lami, Fiji<sup>115</sup>. This study included assessments of the costs and benefits of measures based on watershed management options for disaster risk management, engineering options and a hybrid approach combining both ‘hard’ engineering and ‘soft’ watershed management interventions. The analyses demonstrated that watershed management options are at least twice as cost-effective as hard engineering options (benefit cost ratio of US \$10.50 compared to US \$4.80). Moreover, it investigated hybrid approaches using complementary watershed management and engineering measures. Irrespective of the proportional emphasis on watershed management for disaster risk management relative to engineering, strategies that combined both watershed management and engineering options were likely to reduce damages by ~25% with a benefit cost ratio of US \$4.30–8.00. See Table 6 below for further examples of successful EbA compared to hard infrastructure to address climate change.

**Table 6.** Examples of the cost of successful EbA compared with hard infrastructure for addressing climate change<sup>116</sup>.

EbA for adaptation to climate change	Hard infrastructure for adaptation to climate change
<i>Sustainable water management</i>	
Approximately 9 million New York City residents receive 1.3 billion gallons of water per day – 90% of their water requirement – from the Catskill-Delaware watershed. Protection of the watershed has cost the city US\$ 150 million per annum over the past 10 years.	To address the water needs of New Yorkers without this type of natural watershed, a water filtration plant would need to be built. A water filtration plant capable of processing 1.3 billion gallons of water for New York City would cost between US\$ 6–8 billion. In addition, the plant would have operating costs of US\$ 300 million per annum.
<i>Disaster risk reduction</i>	
Coral reefs are natural buffers that provide protection against erosion and wave damage. In the Turks and Caicos Islands this protection is valued at US\$16.9 million per year.	The cost of using hard-engineering options (dykes and levees) for coastal protection in the Turks and Caicos Islands has been estimated at 8% of its gross domestic product, or US\$223 million.
Wetlands of the Mississippi Delta are valuable ecosystems providing services worth US\$12 billion–47 billion per year. If the wetlands of New Orleans were to be restored and used as part of the coastal defence system, the estimated cost would be: for marshland stabilization US\$2 per square metre; for marshland creation US\$4.30 per square metre; and for freshwater diversion US\$14.3 million.	The cost of engineering solutions for coastal defence in New Orleans is high. To heighten a dyke by 1 metre costs between US\$7 million and US\$8 million per kilometre. To heighten concrete floodwalls costs between US\$5.3 million and 6.4 million per kilometre length. To heighten closure dams (in water) 1 m costs US\$5.3 million per kilometre. The cost to armour levees for each square metre is

<sup>112</sup>Ibid

<sup>113</sup>Jones et al. 2012. Harnessing nature to help people adapt to climate change. *Nature*. Published online: 26 June 2012. DOI: 10.1038/nclimate1463

<sup>114</sup>De Groot et al. 2013. Benefits of investing in ecosystem restoration. *Conservation Biology* 27: 1286-1293.

<sup>115</sup>Rao et al. 2013. *An economic analysis of ecosystem-based adaptation and engineering options for climate change adaptation in Lami Town, Republic of the Fiji Islands*. A technical report by the Secretariat of the Pacific Regional Environment Programme. Apia, Samoa.

<sup>116</sup>Jones et al. 2012. Harnessing nature to help people adapt to climate change. *Nature*. Published online: 26 June 2012. DOI: 10.1038/nclimate1463

	between US\$21 and US\$28.
<i>Food security</i>	
The use of sustainable land-management practices such as agroforestry (using trees and shrubs in pastures and croplands) can increase farmers' resilience to climate change through sustaining or increasing food production. By intercropping maize with a nitrogen-fixing tree, <i>Gliricidia sepium</i> , Malawi farmers increased average yields fourfold, at minimal cost.	To increase average yields fourfold by using nitrogen-based inorganic fertilizers would cost Malawi farmers US\$11.6 million annually.

276. Within Outcome 2 of the LDCF-financed project, the reforestation of dryland forests in the Barind Tract and swamp forests in the Haor Area will be complemented by infrastructure for reducing erosion in the Haor Area and improving water retention in the Barind Tract. This combination is effective because: i) soft, ecosystem-based interventions are more flexible in the long-term; and ii) infrastructure has benefits that are more direct in the short- to medium-term<sup>117</sup>. Therefore, this complementary approach to climate change promotes cost-effectiveness<sup>118</sup>.

277. The project interventions were selected during the PPG phase through consultations – both at the national and regional level – with a wide range of stakeholders including: i) national and local government members; ii) community members; iii) local experts; and iv) NGOs. Through these consultations, interventions were selected to address the main climate-related problems, namely droughts and a limited supply of surface water in the Barind Tract, and increased sedimentation and flash flooding in the Haor Area. Additionally, cost-benefit analyses were carried out for selected interventions (see Appendix 24). According to these analyses, positive economic net benefits will be achieved for all interventions.

278. Through the project, knowledge on ecosystem restoration and management under conditions of climate change will be transferred to local communities. Importantly, the principles of EbA are grounded in ecosystem restoration and management. By adopting EbA, “no-regrets” activities will be implemented. Therefore, local communities will benefit from enhanced ecosystem services regardless of the severity of the negative effects of climate change.

279. While the EbA approach reduces vulnerability, it simultaneously provides a range of co-benefits such as carbon sequestration and storage, biodiversity conservation, additional livelihoods and poverty reduction. As a result, EbA has benefits that will contribute towards mitigation commitments and other development goals of the GoB.

<sup>117</sup>Hallegate, S. and Dumas, P. 2009. Adaptation to climate change: soft vs. hard adaptation. C.I.R.E.D. Available at: <http://www.oecd.org/env/cc/40899422.pdf>. Accessed on 1 April 2014.

<sup>118</sup>CARE. 2011. Policy brief: climate change – why community based adaptation makes economic sense. Available at: [http://www.careclimatechange.org/files/adaptation/PolicyBrief\\_Why\\_CBA\\_Makes\\_Economic\\_Sense\\_July12.pdf](http://www.careclimatechange.org/files/adaptation/PolicyBrief_Why_CBA_Makes_Economic_Sense_July12.pdf). Accessed on 1 April 2014.