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Collaborative Adaptation Research Initiative in Africa and Asia

Review of Current and Planned Adaptation Action in Bangladesh

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Titles in this series are intended to share initial findings and lessons from research and background studies commissioned by the program. Papers are intended to foster exchange and dialogue within science and policy circles concerned with climate change adaptation in vulnerability hotspots. As an interim output of the CARIAA program, they have not undergone an external review process. Opinions stated are those of the author(s) and do not necessarily reflect the policies or opinions of IDRC, DFID, or partners. Feedback is welcomed as a means to strengthen these works: some may later be revised for peer-reviewed publication.

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Abstract

Bangladesh is ranked among the most vulnerable countries to climate change. About two-thirds of its land area is prone to river and rainwater flooding, and its coastlines are exposed to storm surges and tidal flooding. These factors make the country particularly vulnerable to sea level rise, greater precipitation during the monsoon season, and glacial retreat. Recognizing its vulnerability, Bangladesh was one of the first countries to prepare a National Adaptation Programme of Action and establish dedicated climate change-focused institutions and funds. The government has also established climate change cells in each ministry to incentivize climate mainstreaming across sectors, policies, and plans. As well, climate risks have been fully or partially integrated into national development plans and some sectoral policies; climate change remains to be mainstreamed into sectoral policies related to forestry, fisheries, health, and gender. Bangladesh has also seen many projects and initiatives implemented to prepare for current and future climate change impacts. The majority of these initiatives are large infrastructure projects aimed at reducing the impacts of floods, saline water intrusion, sea storm surges, and sea level rise, predominantly in the urban coastal areas of the south. Other sectors and vulnerable regions of the country are still relatively neglected, such as the livestock sector, which is key to vulnerable communities affected by frequent droughts. This report provides an overview of these and other adaptation action in Bangladesh. It is one in a series of country reviews prepared for the Collaborative Adaptation Research Initiative in Africa and Asia.

Résumé

Examen des mesures d'adaptation actuelles et prévues au Bangladesh

Le Bangladesh est considéré comme l'un des pays les plus vulnérables aux changements climatiques. Environ les deux tiers de sa superficie terrestre sont exposés aux crues des rivières et aux inondations liées aux eaux de pluie, et son littoral est exposé aux ondes de tempête et aux inondations causées par les marées. Ces facteurs rendent le pays particulièrement vulnérable à la montée du niveau de la mer, à l'accroissement des précipitations pendant la saison de la mousson et au recul glaciaire. Conscient de sa vulnérabilité, le Bangladesh a été l'un des premiers pays à élaborer un plan d'action d'adaptation national et à mettre en place des institutions et des fonds consacrés aux changements climatiques. Le gouvernement a également mis en place des groupes dédiés aux changements climatiques dans chaque ministère afin de prendre en compte systématiquement les changements climatiques quels que soient les secteurs, les politiques et les plans. Par ailleurs, le risque climatique a été partiellement ou totalement intégré aux plans de développement nationaux et à certaines politiques sectorielles. Les changements climatiques doivent encore être intégrés aux politiques sectorielles concernant la forêt, les pêches, la santé et l'égalité des genres. Le Bangladesh a également mis en œuvre de nombreux projets et initiatives visant à se préparer aux effets actuels et futurs des changements climatiques. La plupart de ces initiatives sont des projets d'infrastructure importants visant à réduire les effets des inondations, des intrusions d'eau salée, des ondes de tempête maritime et de la montée du niveau de la mer, principalement dans les zones urbaines côtières du sud. D'autres secteurs et régions vulnérables du pays sont encore relativement négligés, comme le secteur de l'élevage, dont dépendent des communautés vulnérables touchées par des sécheresses fréquentes. Le présent rapport fournit un aperçu de ces actions et d'autres mesures d'adaptation au Bangladesh. Cet examen fait partie d'une série d'examens des pays préparés dans le cadre de l'Initiative de recherche concertée sur l'adaptation en Afrique et en Asie.

Acronyms

ADB	Asian Development Bank
BCCRF	Bangladesh Climate Change Resilience Fund
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCCT	Bangladesh Climate Change Trust
BCCTF	Bangladesh Climate Change Trust Fund
CARIAA	Collaborative Adaptation Research Initiative in Africa and Asia
CBO	community-based organization
CCCP	Community Climate Change Project
CCU	Climate Change Unit
CDKN	Climate and Development Knowledge Network
CDMP	Comprehensive Disaster Management Programme
CIF	Climate Investment Funds
CPD	Centre for Policy Dialogue
DAE	Department of Agriculture Extension
FAO	Food and Agriculture Organization of the United Nations
GOB	Government of Bangladesh
ICIMOD	International Centre for Integrated Mountain Development
IDRC	International Development Research Centre
IFC	International Finance Corporation
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
LGED	Local Government Engineering Department
MOA	Ministry of Agriculture
MOEF	Ministry of Environment and Forests

MOFL	Ministry of Fisheries and Livestock
NAPA	National Adaptation Programme of Action
ND-GAIN	University of Notre Dame Global Adaptation Index
NWMP	National Water Management Plan
ODA	official development assistance
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
PPCR	Pilot Program for Climate Resilience
RCP	Representative Concentration Pathway
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

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Contents

Synopsis

Climate risks	• Greater inter-annual rainfall variability, more extreme rainfall events, and greater exposure to floods • Earlier onset and later retreat of the Indian summer monsoon • Continued glacier retreat • Rising sea levels and associated increase in frequency of storm surges, intensity of cyclonic events, and rate of salinity intrusion • Higher mean annual temperatures • Increases in the occurrence of drought in the northwest and southwest regions	**Key sources of vulnerability**	• Exposure to a large number of extreme climate events due to its geographical location, including a vast coastline susceptible to sea level rise, storms, and cyclones and low-lying areas susceptible to floods • High dependency on an agricultural sector (employs half of the population) that is vulnerable to inundation and drought • Nearly half of the population lives in multi-dimensional poverty • Lack of availability of safe freshwater sources in the coastal zone • Lack of availability and access to adequate sanitation infrastructure • Important gender inequalities remain

Vulnerable sectors	Illustrative potential impacts on vulnerable sector	Illustrative adaptation priority adaptation measures in each sector as identified in Bangladesh Climate Change Strategy and Action Plan and the National Adaptation Programme of Action	Projects in sector[1]
Freshwater resources	• Decreased availability of safe drinking water due to saline intrusion	• Improve water and sanitation programs for climate vulnerable areas	34%
Coastal areas	• Increased flooded areas • Displacement of coastline population • Destruction of infrastructure	• Improve flood forecasting and early warning, and cyclone and storm surge warning • Repair and maintain existing flood embankments, cyclone shelters, and coastal polders • Carry out preparatory studies for adaptation against sea level rise • Monitor and support internal and external migration of adversely impacted population	21%
Food, fibre, and forests	• Reduced main crop production • Reduced in milk production	• Increase institutional capacity for research on climate-resilient cultivars and their dissemination	31%

[1] Percentage of total identified discrete adaptation projects and programs based upon research undertaken as part of this review. Note that individual projects may address more than one sector.

	• Loss of suitable land for agriculture and livestock • Increased cattle mortality • Reduced aquaculture • Reduced habitat for freshwater fish • Loss of forests (e.g., Sundarbans mangrove forests)	• Develop climate-resilient cropping systems and production technologies (e.g., agricultural research for crops tolerant to floods, droughts. and salinity) • Improve coastal afforestation	
Health	• Increased water and air-borne diseases such as malaria, cholera, and diarrhea • Changes in spatial distribution of diseases and increased incidence zones (e.g., malaria)	• Improve water and sanitation programs for climate-vulnerable areas • Introduce adaptation measures in the health sector (e.g., implement surveillance systems for existing and new disease risks; implement drinking water and sanitation programs in areas at risk from climate change)	3%
Urban areas	• Increased urban floods and drainage congestions • Increased flash floods and landslides due to urban development (e.g., on hills)	• Introduce risk management against loss of income and property • Improve urban drainage • Plan, design, and implement resuscitation of rivers and khals through dredging and de-siltation work	21%
Gender	• Greater exposure to health risks	• Increase integration of gender consideration in climate change management	17%
Governance	• Macroeconomic and sectoral economic impacts of climate change	• Revise sectoral policies for climate resilience • Strengthen institutional capacity for climate change management • Mainstream climate change in national, sectoral, and spatial development programs	41%

Particularly vulnerable regions	**Particularly vulnerable groups**	**Status of climate governance**
• Coastal areas vulnerable to sea level rise and salinity intrusion as well as cyclones and storm surges • Central regions and northeast of the country along rivers (Ganges-Brahmaputra-Meghna system) vulnerable to floods • Northwest region of the country is more prone to droughts • Northeast region is vulnerable to flash flood	• Women and children • Population living in coastal area	• *National Adaptation Programme of Action* completed in 2005 and revised in 2009 • Revised version of *Bangladesh Climate Change Strategy and Action Plan* released in 2009 • Bangladesh Climate Change Trust Fund and the Bangladesh Climate Change Resilience Fund established in 2010 • Climate change cells established within each ministry since 2010

Introduction

The low-lying riparian country of Bangladesh is located between India to the east, Myanmar to the west, the Bay of Bengal in the south, and the Himalayas in the north. With the exception of hilly regions in the country's northeast and southeast, most of Bangladesh is less than 10 metres above sea level. The country contains one of the largest deltas in the world, formed by a dense network of tributaries of the country's three major rivers—the Ganges, the Brahmaputra, and the Meghna—which flow from the Himalayas in India and discharge into the Bay of Bengal through a single outfall (Ministry of Environment and Forests [MOEF], 2015, 2012). Home to over a 150 million inhabitants, Bangladesh is one of the most densely populated countries in the world, with approximately 1,203 people per square kilometre (World Bank, 2015a, 2015c).

In the past decade Bangladesh's economy has grown an average of nearly 6% per year, driven in part by remittances and exports, mostly of ready-made garments and knitwear, which have significantly increased since 2010 (World Bank, 2015a). This level of economic growth has enabled poverty to drop by nearly a third, with more than 15 million people moving out of poverty since 1992 (World Bank, 2015b). Life expectancy, literacy, and per capita food intake have also increased. The country has also made considerable progress in the health sector by, for example, increasing access to safe drinking water and reducing mortality rates. However, despite these improvements, around 47 million people still live below the poverty line (MOEF, 2012; World Bank, 2015b).

If Bangladesh is to continue its economic growth and become a middle-income country by 2021, as it aspires to do, it will need to effectively address the significant risk it faces from climate change. The country is already severely impacted by climate events, with approximately 20 to 25% of its total land area normally being flooded each year and around 80% of its land being located in the country's floodplain. It also experiences tropical cyclones, storm surges, droughts, and other extreme climate events (MOEF, 2012). Consequently, over the past two decades Bangladesh has been among the top 10 countries most affected by extreme weather events, experiencing an average loss of 1.2% per unit of GDP per year (Kreft, Eckstein, Junghans, Kerestan, & Hagen, 2014). Its exposure to these risks will grow in the future as the global climate changes. Already Bangladesh is being affected by sea level rise, with its associated impacts of river bank erosion, saline intrusion, and higher storm surges.

The Government of Bangladesh (GOB) has recognized the risk posed by climate change and responded through a range of policy and program measures at the national, district, and community levels. This paper provides a snapshot of Bangladesh's current and planned efforts to support adaptation to climate change. Drawing upon available literature and key informant interviews, it has been prepared to support the work of the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA). Jointly funded by the UK

Department for International Development (DFID) and the International Development Research Centre (IDRC), CARIAA aims to help build the resilience of poor people to climate change in three hot spots in Africa and Asia: semi-arid areas, deltas in Africa and South Asia, and glacier- and snow-fed river basins in the Himalayas. To achieve this goal, CARIAA is supporting four consortia to conduct high-calibre research and policy engagement activities that will inform national and subnational planning processes in 17 countries, including Bangladesh.

The paper begins by summarizing current understanding of existing and projected climate risks in Bangladesh. To further set the context for the remainder of the paper, Section 3 discusses Bangladesh's vulnerability to climate variability and change given its existing development challenges and identifies vulnerable sectors, regions, and groups. Section 4 provides an overview of the critical policies and plans shaping Bangladesh's efforts to address climate change adaptation at the national and subnational levels. To assess the extent to which efforts to address the country's critical adaptation priorities are presently under way, Section 5 paints a general picture of the scale, type, and focus of current and planned adaptation-focused programs and projects in Bangladesh as well as the level of adaptation finance flowing into the country. Section 6 provides a profile of in-country efforts to advance adaptation learning and knowledge sharing, as reflected in the presence of networks and communities of practice active in this field. The paper concludes with an assessment of the general status of adaptation planning at the national and subnational levels in Bangladesh.

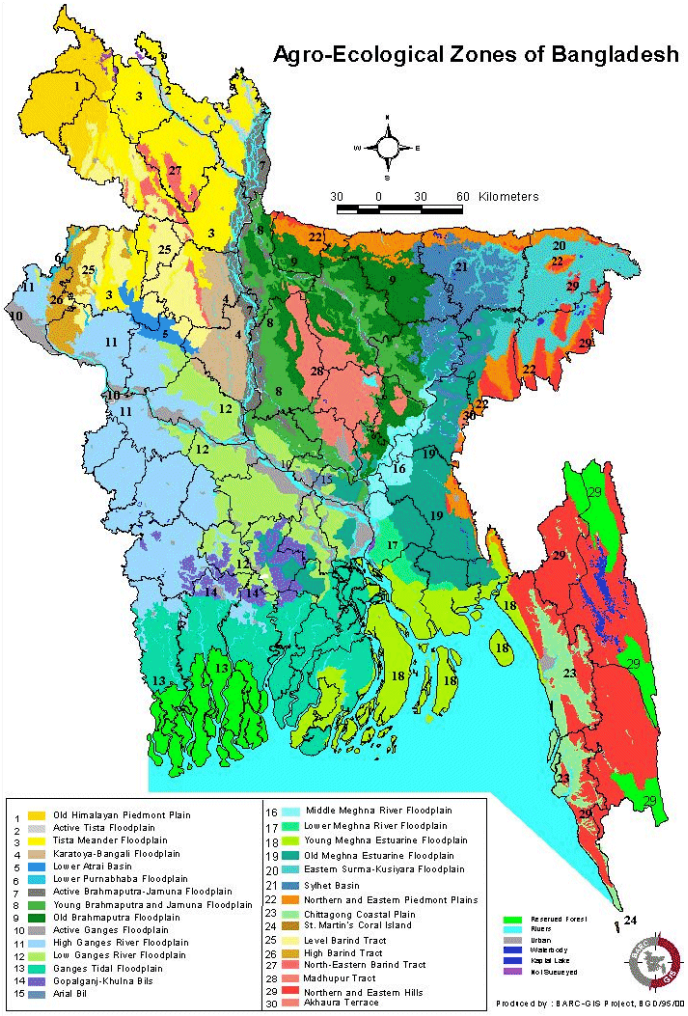


Figure 1 – Agro-ecological zone map (Food and Agriculture Organization of the United Nations [FAO], n.d.)

1. Current climate and projected changes

Bangladesh experiences a tropical monsoon-type climate that is marked by inter- and intra-seasonal variations (MOEF, 2012). A hot and extremely humid summer occurs from March to June, a cooler monsoon season from June to September, and a dry winter from October to March (Karmalkar, McSweeney, New, & Lizcano, n.d.). Average annual temperature is about 25°C, with warmest temperatures between April and May of around 30°C; temperatures at times rise above 40°C, especially in the northwestern part of the country (MOEF, 2012). Average annual rainfall is about 2,200 mm, with 80% of rainfall occurring during the monsoon season (Karmalkar et al., n.d.; MOEF, 2012). Precipitation is also caused by western depressions, mainly from the end of January to the end of February, and northwesters (early summer thunderstorms) in early May (MOEF, 2012). The northeastern

part of the country receives the greatest amount of precipitation, exceeding an average of 5,500 mm near the border with India.

As previously noted, Bangladesh is significantly affected by extreme weather events. The northwestern region is commonly affected by droughts, and about two-thirds of Bangladesh's land area is prone to river and rainwater flooding, while its coastlines are exposed to storm surges and tidal flooding (MOEF, 2009). At present, roughly three to seven cyclones affect its coastline each decade (MOEF, 2012). These events have the potential to cause significant loss of life, population displacement, and damage to property. Most dramatically, tropical cyclones in 1970 and 1991 are estimated to have killed 500,000 and 140,000 people respectively (MOEF, 2012). Additionally, between 1984 and 2007, severe floods killed over 6,500 people, rendered more than 80 million people homeless, and provoked damage of about US$8.4 billion (MOEF, 2009). Additionally, in 2007, Cyclone Sidr killed over 3,000 people and provoked an economic loss of US$1.7 billion (Rai & Smith 2013). Given the frequency and size of these events, it is not surprising that Bangladesh was ranked sixth on GermanWatch's 2015 Global Climate Risk Index (Kreft et al., 2014). Bangladesh also spends more of its budget on disaster relief than all other South Asian countries (The Economist Intelligence Unit Limited, 2014).

1.1 Observed climate trends

Bangladeshis have begun to witness changes in their climate due to human-caused climate change. Since 1960, the country's mean annual surface air temperature has increased between 0.3°C and 0.5°C, or an average of 0.12°C per decade. The most significant increase has been in the months of September, October, and November. Other figures show that mean annual temperature rose by 0.016°C per year from 1977 to 2008 and that mean maximum temperatures and mean minimum temperatures have risen by 0.02°C per year and 0.012°C per year, respectively (MOEF, 2012). Between 1960 and 2003, the average number of hot days per year increased by 26, particularly during the months of June, July, and August (Karmalkar et al., n.d.). Similarly, the average number of hot nights per year increased by 15. Average temperature during cold spells has decreased, mostly affecting the northern part of Bangladesh located closest to the Himalayas, which is one of the poorest regions of the country (MOEF, 2012).

Changes in rainfall patterns have also been observed. Although not statistically significant, mean rainfall decreased by 0.5% per decade between 1960 and 2003. This overall figure hides seasonal variations, as rainfall increased by 3.4% during the months of March, April, and May and decreased by 1.7% during June, July, and August. The proportion of intense rainfall events decreased by 1.1% during this same time period (Karmalkar et al., n.d.). Sea levels increased between 1947 and 2003 by 1.4 mm per year in the southeast of Bangladesh, and by up to 3.9 mm per year in the south-central region (MOEF, 2012).

1.2 Climate change projections

Global circulation models indicate that mean annual temperatures in Bangladesh will continue to rise in the decades to come, although the rate of change varies under different model simulations. For South Asia as a whole, the Intergovernmental Panel on Climate Change (IPCC) projects an overall rise in annual mean temperatures with a median projection of 0.9°C (0.4°C to 1.4°C) by 2035, 2.2°C (1.5°C to 3.1°C) by 2065, and 4.1°C (3.1°C to 6.0°C) by 2100 (Christensen et al., 2013).[2] Warming is projected to be greater than the mean rise during the months of December, January, and February, and less than the mean during the months of June, July, and August (Christensen et al., 2013). Analysis completed specifically for Bangladesh projects that mean annual temperatures will increase by 1.6°C by 2050 (MOEF, 2012).

Greater uncertainty remains regarding how rainfall patterns will alter in the future across South Asia and within Bangladesh, due to factors such as a lack of consistency between models regarding changes in monsoon patterns. Regional analysis for South Asia suggests that mean annual precipitation will increase over the remainder of this century, rising by a median projection of 3% by 2035, 8% by 2065, and 18% by 2100.[3] A greater proportion of this increase is expected to occur during the months of June, July, and August (Christensen et al., 2013), and at higher latitudes (Overseas Development Institute [ODI] and Climate and Development Knowledge Network [CDKN], 2014). At the same time, greater inter-annual variability is anticipated, along with an increase in the occurrence of extreme rainfall events, particularly at higher Representative Concentration Pathways (RCPs) (Christensen et al., 2013). Current analysis suggests that changes in patterns of the Indian summer monsoon will lead to increases in both mean and extreme precipitation levels, and to earlier onset and later retreat (Christensen et al., 2013).

Studies completed specifically for Bangladesh using the IPCC's previous set of climate scenarios projected that precipitation would increase by nearly 5% by the 2030s and 8% by the 2050s under an A2 (higher emission) scenario and slightly more under a B1 (lower emission) scenario (MOEF, 2012). Seasonal variations, however, are expected, with reductions in rainfall projected to occur in December, January, and February, equal to about 28% by the 2030s and 38% by the 2050s under an A2 scenario (MOEF, 2012). An increase in precipitation during the monsoon season could generate additional volumes of runoff in the Ganges, Brahmaputra, and Meghna river basins, which could lead to floods. However, with appropriate storage, the greater runoff volumes may alleviate water stress in the Ganges basin (Chaturvedi et al., 2015). In contrast, lower levels of precipitation during the winter months could reduce river flow, particularly when combined with higher surface evaporation, creating concerns about water availability at this time of year (MOEF, 2012).

[2] These projections represent a 50% likelihood of occurrence, using 39 global models and the RCP 8.5 scenario for the time periods 2016–2035, 2046–2065, and 2081–2100, and against a baseline period of 1986–2005.
[3] These projections represent a 50% likelihood of occurrence, using 39 global models and the RCP 8.5 scenario for the time periods 2016–2035, 2046–2065, and 2081–2100, and against a baseline period of 1986–2005.

Along with changes in rainfall patterns, river flows in Bangladesh are expected to be affected by changes in the rate and timing of melting of the Himalayan glaciers (MOEF, 2009). These glaciers have already been observed to be retreating, with the exception of some in the Karakorum region, influenced by factors such as rising temperatures, more frequent and intense extreme rains, and black carbon. The continued loss of ice and snow in the mountain regions has significant implications for downstream water flows in the Brahmaputra basin and, to a moderate extent, in the Ganges (Kilroy, 2015).

Potential changes in cyclone patterns are of particular interest to Bangladesh. However, there is uncertainty regarding the pattern, frequency, and intensity of these events. At a global level, there is a medium level of confidence that the number of tropical cyclones will increase in the future (Christensen et al., 2013). Tropical cyclones that make landfall in South Asia are expected to have more extreme rainfall toward their centres (ODI & CDKN, 2014).

Other projected changes in extreme events are increased occurrence of drought in the northwestern region of Bangladesh (MOEF, 2009) and increased frequency of storm surges, leading to further penetration of water inland and more areas deemed to be at high risk of flooding (MOEF, 2012). The rise in storm surges is connected to the projected continuation of sea level rise along Bangladesh's extensive coastal areas. Globally, by the 2080s, sea levels are projected to rise by 26 cm to 55 cm under a low-emissions scenario, and 45 cm to 82 cm under the RCP8.5 emission scenario (IPCC, 2013)—potentially reaching 98 cm by 2100 (ODI & CDKN, 2014). Sea level rise in South Asia is expected to be higher than the global mean (Global Facility for Disaster Reduction and Recovery, 2011). Sea level rise projections for Bangladesh indicate that it could reach 27 cm by 2050 (MOEF, 2012). These changes are expected to increase saline intrusion into aquifers and rivers across a wide belt in the south of the country (MOEF, 2009, 2012), reducing freshwater availability and affecting the agricultural sector.

2. Vulnerability to climate change

In light of the growing risk that climate change poses to Bangladesh, this section discusses the country's vulnerability to climate change given its existing development context. It provides an overview of key development challenges that represent drivers of Bangladesh's vulnerability, followed by a review of actual and potential climate impacts on Bangladesh's most vulnerable sectors, regions, and groups.

2.1 Current drivers of vulnerability

Bangladesh is still officially classified as a least developed country. However, as its indicators of human well-being have progressed in recent years, it is now considered to fall within the lower end of the "medium" human development category of the Human Development Index (see Table 1). This transition reflects the 6% annual economic growth

the country has experienced since 1996 (Central Intelligence Agency [CIA], 2015; United Nations Development Programme [UNDP], 2014). However, despite this positive progress, nearly half of Bangladeshis still live in multi-dimensional poverty (UNDP, 2014).

Agriculture remains an important economic sector, employing almost half of Bangladeshis, mainly in rice production. As 70% of the territory's land is used for agriculture, and approximately one-quarter of the country is inundated on average each year, this sector is highly vulnerable to climate risk (MOEF, 2009, 2012). Bangladesh's economic reliance on agriculture has declined in recent decades, as more than half of its GDP is now derived from the service sector, while the industrial sector makes up around 26% of GDP (CIA, 2015). Exports of garments are key to the country's industrial sector and together with remittances are responsible for the country's economic growth rate.

Looking at the country's social indicators, significant progress has been made in reducing the mortality rate of children under five years (from 151 deaths per 1,000 births in 1991 to 41 deaths per 1,000 births in 2013). Life expectancy has also been extended, with women today living an average of 71.5 years and men 69.9 years (MOEF, 2012; UNDP, 2014). Bangladesh has also achieved significant rates of improved water access in rural areas, but still lags behind in terms of availability and access to adequate sanitation infrastructure; only 57% of the total population has access to improved sanitation (World Bank, 2015). In terms of health expenditure, Bangladesh dedicates a lower share of its GDP to health—3.7% in 2011—compared to the region's average share of 4.2% (CIA, 2015; UNDP, 2014).

Challenges remain with respect to advancing gender equity in Bangladesh. Overall, the country is ranked 142nd on the Gender Inequality Index. Factors contributing to this situation are mean years of schooling still being higher for men than women, with overall literacy rates being 7.4% lower for women compared to men (UNDP, 2014).

The country's average population growth rate has remained constant, with a small decrease from 1.3% in 2005 to 1.2% in 2013, while the proportion of Bangladeshis living in urban areas has increased from around 27% in 2005 to nearly 33% in 2013—equivalent to an annual urbanization rate of 3.55%, which is faster than all other South Asian countries (CIA, 2015; World Bank, 2015). A large share of the population is young, with 30% of the population being under 15 years of age in 2013 (International Organization for Migration [IOM], 2014). In terms of migration, the IOM estimates that over 5 million Bangladeshis are currently working overseas, contributing to their families and to Bangladesh's economy through remittances. Official remittances reached a record high level of US$11 billion in 2010 and are estimated to have represented 10.78% of the country's GDP in 2011 (IOM, 2014; UNDP, 2014). Migration is starting to be recognized as a viable livelihood option (IOM, 2014). Displacement within the country is frequent due to floods, cyclones, storm surges, erosion, and salinity intrusion in land and water resources, with sea level rise threatening to displace an important part of the coastal population.

Table 1 – Key indicators of development progress for Bangladesh

Category	Indicator	Year	Value	Source
Human Development	Human Development Index (score[d]/rank[d] out of 187 countries)	2013	0.558 / 142	UNDP (2014)
	Population in multi-dimensional poverty (%)	2013	49.5%	
	Under-five mortality rate (per 1,000 live births)	2013	41	
	Adult literacy rate (15 years of age and above)	2013	57.7[c]	
	Improved water source, rural (% of population with access)	2012	84%	World Bank (2015)
	Improved sanitation facilities (% of population with access)	2012	57%	
	Access to electricity (% of population)	2010	55.2%	
Gender	Gender Inequality Index (value[e]/rank[d] out of 187 countries)	2013	0.529 / 142	UNDP (2014)
Demographics	Total population (in millions)	2013	156,595.0[a]	UNDP (2014)
	Average annual population growth rate	2010	1.1%	
	Population, urban (% of population)	2011	29.4% [b]	
Economic development	GDP (in current $US, millions)	2013	149,990.45	World Bank (2015)
	GDP growth (annual %) (average of period of 2010 to 2013)		6.2%	
	Agricultural land (% of land area)	2012	70.1%	
Governance	Corruption Perceptions Index (score[f] out of 100)	2014	25	Transparency International (2014)
	Corruption Perceptions Index (rank[d] out of 174 countries)	2014	145	
	Fragile States Index (score out of 120[g])	2014	92.8	Fund For Peace (2014)
	Fragile States Index (status)	2014	Alert	
	Expenditure on education, Public (% of GDP)	2012	2.2%[c]	UNDP (2014)
	Expenditure on health (% of GDP)	2011	3.7%	
Environment	Population living on degraded land (%)	2010	11.3%	UNDP (2014)
	Change in forest area, 1990/2011	2013	-3.7%	

[a] Projections based on medium-fertility variant
[b] Because data are based on national definitions of what constitutes a city or metropolitan area, cross-country comparison should be made with caution

[c] Data refer to the most recent year available during the period specified
[d] Where 1 or first is best
[e] Where 0 is best
[f] Where 0 is highly corrupt and 100 is very clean
[g] Where 120 is very high alert, and 0 very sustainable

2.2 Vulnerability to climate change

Bangladesh is considered to be highly vulnerable to future climate change, as measured by its ranking on the University of Notre Dame Global Adaptation Index (ND-GAIN, 2015) as presented in Table 2. Bangladesh's vulnerability stems in part from the range of natural disasters to which the country is exposed and existing gaps in its response capacity or readiness. According to the ND-GAIN Readiness Index, Bangladesh is among the countries in the region least ready to respond to climate change. The country's vulnerability stems from difficulties related to factors such as access to reliable drinking water, insufficient dam capacity, insufficient sanitation infrastructure (e.g., drainage) and service delivery, insufficient medical staff, growing urbanization, and inadequate transport infrastructure such as paved roads (The Economist Intelligence Unit Limited, 2014; ND-GAIN, 2015).

From a complementary perspective, the South Asia Women's Resilience Index assesses countries' capacities for disaster risk reduction and recovery and the extent to which the needs of women are considered in national resilience-building efforts. On this index, Bangladesh received a score of 40 out of 100 (where 100 is highest), which is slightly lower than the scores received by the Maldives, India, Nepal, Sri Lanka, and Bhutan; Pakistan ranked lowest at 27.8. Notably, Bangladesh's national plan for disaster management explicitly recognizes the particular vulnerabilities of women (The Economist Intelligence Unit Limited, 2014).

Table 2 – Bangladesh position in ND-GAIN Index (ND-GAIN, 2015)

Country	Vulnerability*			Readiness**			Overall		
	World rank	Score	Trend	World rank	Score	Trend	World rank	Score	Trend
Bangladesh	142	0.539	↓	140	0.347	↑	139	40.4	↑
Bhutan	118	0.482	↓	103	0.432	↑	109	47.5	↑
India	113	0.468	↓	116	0.389	↑	120	46.1	↑
Maldives	124	0.492	↓	85	0.467	↓	99	48.7	↓
Nepal	129	0.505	↓	124	0.370	↑	125	43.2	↑
Pakistan	112	0.467	↓	139	0.349	↓	123	44.1	↑
Sri Lanka	87	0.423	=	97	0.444	↑	89	51.0	↑

*Lower score indicates lower vulnerability. The vulnerability score is determined based on indicators of exposure, sensitivity, and adaptive capacity, taking into consideration indicators related to six life-supporting sectors: food, water, health, ecosystem service, human habitat, and infrastructure.
**Higher score indicates higher degree of preparedness. The readiness score takes into account measures of economic readiness, governance readiness, and social readiness to pursue adaptation actions.

In its Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), the GOB described the vulnerability of the following sectors to climate change: water, agriculture, fisheries, livestock, human health, ecosystems and forests, infrastructure, and urban areas (MOEF, 2012). Likely impacts from climate change on these sectors are presented in Table 3 and described below.

Table 3 – Climate change impacts on key vulnerable sectors in Bangladesh (MOEF, 2009; MOEF, 2012)

Sector	Likely impacts of climate change
Water	• Sea level rise • Increased flooded areas due to both sea and river flooding • Reduced water availability for purposes such as drinking water due to saline water intrusion • Increased water shortages, particularly in the northwest and southwest regions • Increased number of droughts, mostly in the western parts of the country • Displacement of coastline population
Agriculture	• Reduced main crop production by 13.9% in 2050, except for Boro rice production • Loss of productive agricultural land due to saline intrusion, coastal erosion, and inundation
Fisheries	• Reduced aquaculture production due to floods • Reduced habitat for freshwater fish due to saline water intrusion
Livestock	• Reduced milk production • Losses in suitable land for livestock • Increased cattle mortality due to extreme climate events
Human health	• Increased water- and air-borne diseases such as malaria, cholera, and diarrhea • Changes in the spatial distribution of diseases and increased incidence zones for diseases such as malaria • Heightened risks to vulnerable groups such as women and children, due to saline water
Ecosystems and forests	• Endangerment of species in the Sundarbans mangrove and wetlands due to climate change–induced natural hazards • Loss of forest species and ecosystems in coastal areas due to sea level rise and inland due to greater moisture stress during dry periods
Infrastructure	• Damage to highways and railways due to flooding

Urban centres	• Increased urban floods and drainage congestion • Increased flash floods and landslides due to urban development (e.g., on hills) • Reduced water quality due to cyclones, storm surges, and floods causing saline intrusion

Bangladesh's coastal areas and water resources are probably most likely to be adversely affected by climate change due to the country's large exposed coastline, low-lying land areas, and many river basins. Higher sea levels, river bank erosion, and saline water intrusion are likely to displace hundreds of thousands of people from coastal areas toward big cities such as Dhaka. Already, about 100,000 people become homeless every year due to river erosion and saline intrusion (MOEF, 2012). By 2050, these processes could displace 8 million people if sea level rise is greater than the expected rise of 27 cm and coastal protection is not strong enough (MOEF, 2009, 2012). Sea level rise might increase areas being flooded by up to 3% by the 2030s and by 6% by the 2050s (MOEF, 2012). Coastal flooding can also be provoked by cyclones and storm surges. These may penetrate further inland in the future and increase the size of areas at high risk by 35% in the 2020s and by 40% in the 2050s (MOEF, 2012). Moreover, sea level rise could lead to the destruction of almost all of the Sundarbans mangroves (UNESCO World Heritage Centre, 2009).

A related concern is the vulnerability of Bangladesh's water resources. The drought-prone northwest and the coastal belt areas are expected to be most affected, especially during the dry season (MOEF, 2009, 2012). In coastal regions, water availability is expected to decrease due to saline intrusion into coastal rivers and groundwater aquifers and reduced river flows; an additional 7.6 million people are expected to be exposed to high salinity (MOEF, 2012). Reduced access to drinking water will increase the burden on women and children responsible for its collection and will have adverse health consequences. Pregnant women, for example, are cited as being at particular risk from increasingly saline drinking water (MOEF, 2009). The coastal districts most affected by saline intrusion are Bagerhat, Khulna, Satkhira, Barisal, Patualkhaki, and Bhola (MOEF, 2012).

These changes in the availability of water resources, combined with temperature increases, has implications for Bangladesh's agriculture sector. Although agriculture accounts for only about 17% of GDP, over 60% of Bangladeshis depend on it directly or indirectly to sustain their livelihoods (CIA, 2013; MOEF, 2009). Crop production is expected to be negatively affected by increased water salinity, flash floods transporting sediments into riverbeds, and lack of water availability due to factors such as drought (MOEF, 2012). On a crop-by-crop basis, rice production could decline by 8% by 2050, compared to a 1990 baseline (MOEF, 2009). Only one type of rice (Boro) could see its production increase with climate change (MOEF, 2012). Wheat production is also projected to decline by 32% against a 1990 baseline year (MOEF, 2009).

Fish represent 80% of total animal protein intake in the country, and thus the fisheries sector is important to Bangladesh's overall food security (MOEF, 2012). Fishing families

living along the coastline, which are among the poorest in the country, are expected to be seriously affected by river erosion and saline intrusion further into the Ganges-Brahmaputra-Meghna delta and extreme climate events such as cyclones, which all affect fisheries habitats and aquaculture infrastructure (MOEF, 2009, 2012).

Livestock represents less than 3% of GDP, but 20% of Bangladeshis directly depend on this sector and 50% are partially dependent. Animal protein from milk and meat is especially important for rural communities. Milk production is projected to decrease by 5% by the 2050s due to heat stress, while suitable land area for livestock is expected to decrease by about 20% in the 2050s due to sea level rise (MOEF, 2012). Additionally, individual cyclones and floods can kill several thousands of cattle. For example, Cyclone Sidr in 2007 killed 1.8 million head of cattle (MOEF, 2012). Lastly, diseases remain the major cause of cattle death and could be aggravated by climate change.

The health consequences of climate change, including a likely increase in the incidence and distribution of water- and air-borne diseases along with extreme climate events, could be significant. Climate change could compound existing health concerns in the country, such as poor drainage and sanitation capacities. Of concern is the potential increase in the risk of malaria, which is currently a major public health issue in Bangladesh. The country's 13 border districts in the east and northeast of the country are declared high-risk malaria zones, and 14.7 million people are at high risk from malaria. These at-risk areas are projected to increase (except in the northwestern regions), and malaria is anticipated to become a concern in previously unaffected areas. Diarrhea occurrence could also increase. At present, diarrhea is one of the major causes of mortality and morbidity in the country, especially of children. Furthermore, cholera incidence depends on flooded areas, salinity intrusion, and sea surface temperature. Since all three factors are set to increase due to climate change, research indicates that cholera could become a regular disease rather than a seasonal one as it is at present (MOEF, 2012).

Bangladesh's growing urban centres are also vulnerable to climate change. The country is one of the most densely populated globally, with about 33% of all Bangladeshis living in urban areas, including more than 15 million people living in Dhaka (CIA, 213; World Bank, 2015a). Megacities such as Dhaka, where drainage is already inefficient, are expected to encounter serious sanitation issues due to more intense rainfalls. The poorest people living in slums and informal settlements, often located in low-lying parts of the cities, will be the worst affected. These risks are expected to be compounded by migration toward cities by displaced coastline populations (MOEF, 2009).

The GOB has also identified the transport sector as vulnerable due to the damage that floods can cause to the country's road and railway infrastructure. The country's forests and ecosystems are also at risk, and economic products such as timber are projected to drastically decline with sea level rise (MOEF, 2012).

3. Adaptation planning context

Bangladesh has a relatively long history of engagement in planning for the impacts of climate change compared to other countries, and as such has developed a number of specific climate change adaptation plans, strategies, and institutions. As well, it has established systems to support the integration of climate risks into its development programs and policies (Ayers, Huq, Wright, Faisal, & Hussain, 2014). The government has pushed to establish climate change cells in each ministry to help mainstream climate change as well as build capacity across the ministries. This effort is being coordinated by the Climate Change Unit (CCU), now known as the Bangladesh Climate Change Trust (BCCT), as well as by the inter-ministerial National Steering Committee on Climate Change, among others. The government is also thinking about establishing a separate Department of Climate Change under the Ministry of Environment and Forests (MOEF), which is now in charge of coordinating all decisions regarding climate change. However, the country still has no national climate change policy, and some important sectoral policies have yet to mainstream climate change issues (MOEF, 2012). Overall, as noted in Table 4, Bangladesh has made significant progress in establishing an institutional structure for advancing adaptation action. An overview of these policies, plans, and strategies in Bangladesh is provided in the pages that follow.

Table 4 – National adaptation planning context: An assessment of progress as of May 2015

Indicator	Progress
Climate change recognized in country's guiding development vision/plan	Yes, in *Bangladesh Vision 2021*, the *Perspective Plan of Bangladesh 2010–2021* and the *Sixth Five-Year Plan*
National-level coordinating entity for climate change established and active	Yes, the Ministry of Environment and Forestry
Climate change policy and/or law in place	Not present, but recently updated *National Environmental Policy* now incorporates climate change issues
Climate change strategy published	Yes, the *Bangladesh Climate Change Strategy and Action Plan, 2009*
Climate change action plan published	Yes, the *Bangladesh Climate Change Strategy and Action Plan, 2009*
Adaptation plan published	Yes, the *National Adaptation Programme of Action, 2009*
Climate change fund or national adaptation fund operational	Yes, the Bangladesh Climate Change Trust Fund and the Bangladesh Climate Change Resilience Fund, established in 2010
Climate change units established in key ministries	Yes, climate change cells established within each ministry since 2010

Degree to which climate change integrated into national sectoral policies	Partially; integrated in policies focused on agriculture and water

3.1 National-level development policy context

Bangladesh's long-term development vision is outlined in Bangladesh Vision 2021 (Centre for Policy Dialogue [CPD], 2007) and in the national Perspective Plan of Bangladesh 2010-2021: Making Vision 2021 a Reality (GOB, 2012). As stated in this latter document:

> "Vision 2021 lays down a development scenario where citizens will have a higher standard of living, will be better educated, will face better social justice, will have a more equitable socio-economic environment and the sustainability of development will be ensured through better protection from climate change and natural disasters. The associated political environment will be based on democratic principles…" (GOB, 2012, p. 2).

Vision 2021 is built around eight goals identified through consultation processes: 1) "to become a participatory democracy"; 2) "to have an efficient, accountable, transparent and decentralized system of governance"; 3) "to become a poverty-free middle-income country"; 4) "to have a nation of healthy citizens"; 5) "to have a skilled and creative human resource"; 6) "to become a globally integrated regional economic and commercial hub"; 7i) "to be environmentally sustainable"; and 8) "to be a more inclusive and equitable society" (CPD, 2007, vii–viii).

The first of two medium-term development plans, the Sixth Five-Year Plan (2011–2015), has been developed to help implement Vision 2021; it is the latest in a series of development plans prepared by Bangladesh since 1973 (General Economics Division, 2011). Each of Vision 2021, the Perspective Plan and the Sixth Five-Year Plan have chapters on climate change (Ayers et al., 2014). Within Vision 2021, goal seven focuses on being "environmentally sustainable" and explicitly addresses the need for effective natural disaster management due to climate change. Plans are outlined to strengthen warning and evacuation mechanisms, natural disaster insurance schemes, and other measures to mitigate seasonal floods and droughts. Also described are long-term investments in flood control and water management through the establishment of a greenbelt and more efficient use of water resources, such as through water storage systems (CPD, 2007). The Perspective Plan refers throughout the document to climate change as an additional threat to achievement of the country's development goals. In fact, "mitigating the impacts of climate change" is part of its nine articulated development priorities, and includes promoting adaptation to climate change as well as other supportive measures. More explicit measures are identified in chapter 13 of the Perspective Plan (GOB, 2012). Finally, the Sixth Five-Year Plan contains a chapter on environmental management and climate change. Among the range of actions outlined in this plan, the GOB has prioritized repair and maintenance of coastal polders and defences damaged by cyclones Sidr and Aila, as well as

development of a comprehensive plan addressing the implications of climate change for the country's coastal belt. It has also prioritized mainstreaming climate adaptation and mitigation concerns and capacity building (General Economics Division, 2011; Nachmany et al., 2014).

The Planning Commission is playing a significant role in mainstreaming climate change in Bangladesh by incorporating the issue in its 10-year, 5-year, and annual development plans and projects (Pervin, 2013). The Commission is also reviewing existing plans and policies to assess whether they conflict with climate change issues. If conflicts are identified, changing policies or adopting new policies are to be advocated, thereby mainstreaming climate issues into development planning (Ayers et al., 2014; Pervin, 2013).

The government has also integrated climate change into national-level planning through initiatives such as the Poverty-Environment initiative led by the UNDP, and the Poverty, Environment and Climate Mainstreaming project from the United Nations Environment Programme (UNEP). Both of these initiatives are supported by the Planning Commission (Pervin, 2013).

3.2 National-level climate policy context

The two key national plans to address climate change in Bangladesh are the National Adaptation Programme of Action (NAPA), developed in 2005 and subsequently revised in 2009, and the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), released in 2009. Bangladesh also completed its Initial National Communication under the UNFCCC in 2002 and elaborated its second one in 2012; a third National Communication is presently under preparation. The GOB, with the support of the UNDP, has also initiated development of guidelines to support preparations of a National Adaptation Plan for the country (Rabbani, 2015). Bangladesh released its Intended Nationally Determined Contribution in April 2015, showing clear leadership as one of the first Least Developed Countries to submit its document to the UNFCCC (CDKN, 2015).

Bangladesh was also one of the first countries to develop a NAPA. The country's first NAPA was prepared in 2005 under the leadership of the MOEF. It identified 15 priority adaptation activities, of which one project, Coastal Community-Based Adaptation to Climate Change through Coastal Afforestation in Bangladesh, received funding for implementation through the Least Developed Countries Fund (Ayers et al., 2014; MOEF, 2005; Nachmany et al., 2014).

The NAPA was updated in 2009 following criticism from several stakeholders who deemed it insufficient to tackle climate impacts in the country (Nachmany et al., 2014). The 2009 NAPA aims to "incorporate potential adaptation measures into overall development planning processes, make development resilient to climate change, and promote sustainable development of Bangladesh" (MOEF, 2009, p. iii). It identifies priority projects under eight

thematic areas: research and knowledge management; agriculture, fisheries, and livestock; health; building climate-resilient infrastructure; disaster management; livelihoods; biodiversity; and policy and institutional capacity building (MOEF, 2009). Although well regarded, Bangladesh's revised NAPA has been criticized for adopting a stand-alone, project-based approach to adaptation and for being developed in response to international policy and financial incentives as opposed to domestic political will (Ayers et al., 2014).

Building on the revised NAPA, in 2009 the government developed a revised version of its BCCSAP, which is now the main national planning document for dealing with climate change. The BCCSAP is a 10-year program that aims to build the capacity and resilience of the country to deal with climate change and achieve its Vision 2021 goals (MOEF, 2009). It is a "pro-poor Climate Change Management Strategy, which prioritizes adaptation and disaster risk reduction, and also addresses low carbon development, mitigation, technology transfer and the mobilization and international provision of adequate finance" (MOEF, 2009, p. xvii). It recommends 44 medium- to long-term programs of action built around six pillars (MOEF, 2009). Table 5 provides an overview of the programs of action most relevant to climate adaptation along all the BCCSAP pillars except its "mitigation and low carbon development" pillar. However, the BCCSAP does not provide any detailed costing or prioritization of actions aside from noting an initial infrastructural budget of US$500 million in years 1 and 2, and a total of US$5 billion over the 2009 to 2013 period (MOEF, 2012).

Table 5 – Priority adaptation programs of actions identified in the BCCSAP

Pillar	Programs of actions
1. Food security, social protection, and health It aims to increase the resilience of vulnerable groups, including women and children. It focuses on the needs of this group for food security, safe housing, employment, and access to basic services, including health.	P1. Institutional capacity for research on climate-resilient cultivars and their dissemination P2. Development of climate-resilient cropping systems and production technologies (e.g., agricultural research for crops tolerant to floods, droughts, and salinity) P3. Adaptation against drought, salinity submergence, and heat P4. Adaptation in fisheries sector P5. Adaptation in livestock sector P6. Adaptation in health sector (e.g., implement surveillance systems for existing and new disease risks; implement drinking water and sanitation programs in areas at risk from climate change) P7. Water and sanitation programs for climate-vulnerable areas P8. Livelihood protection in ecologically fragile areas P9. Livelihood protection of vulnerable socio-economic groups (including women)
2. Comprehensive disaster management	P1. Improvement of flood forecasting and early warning P2. Improvement of cyclone and storm surge warning

It aims to further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural catastrophes as a result of climate change.	P3. Awareness raising and public education toward climate resilience (e.g., strengthen the capacities of government, civil society partners, and communities to manage disasters and ensure appropriate policies, laws, and regulations are in place) P4. Risk management against loss of income and property
3. Infrastructure It aims to ensure that existing infrastructure (e.g., coastal and river embankments) are well-maintained and fit for purpose, and that needed infrastructure (e.g., cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change.	P1. Repair and maintenance of existing flood embankments P2. Repair and maintenance of cyclone shelters P3. Repair and maintenance of existing coastal polders P4. Improvement of urban drainage P5. Adaptation against floods P6. Adaptation against tropical cyclones and storm surges P7. Planning and design of river-training works (e.g., river embankments, river erosion control) P8. Planning, design, and implementation of resuscitation of rivers and khals through dredging and de-siltation work
4. Research and knowledge management It aims to understand and project scale and timing of climate change impacts on different sectors of the economy to inform planning of future investment strategies.	P1. Establishment of a centre for knowledge management and training on climate change P2. Climate change modelling at national and sub-national levels P3. Preparatory studies for adaptation against sea level rise (e.g., model hydrological impacts on the Ganges-Brahmaputra-Meghna system) P4. Monitoring of ecosystem and biodiversity changes and their impacts P5. Researching of macroeconomic and sectoral economic impacts of climate change (e.g., research the likely impacts of climate change on macro economy and key sectors to contribute to a climate-proof national development plan) P6. Monitoring of internal and external migration of adversely impacted population and providing support to them through capacity building for their rehabilitation in new environment P7. Monitoring of impact on various issues related to management of tourism in Bangladesh and implementation in priority action plan
6. Capacity building and institutional strengthening It aims to strengthen capacity of government ministries and agencies, civil society, and the private sectors to manage climate change.	P1. Revision of sectoral policies for climate resilience P2. Mainstreaming climate change in national, sectoral, and spatial development programs (including in national government, local government, private sector, civil society, and communities to ensure that impacts on vulnerable groups and women are prioritized in plans) P3. Strengthening human resource capacity P4. Strengthening gender consideration in climate change

	management P5. Strengthening institutional capacity for climate change management P6. Mainstreaming climate change in the media

Source: GOB (2009).

More recently, the GOB's adaptation priorities were articulated in its Second National Communication to the UNFCCC, published in 2012 (MOEF, 2012). The document provides an overview of Bangladesh's national climate and development contexts, updates the country's emissions inventory, reviews its vulnerability to climate change by sector, discusses key adaptation and mitigation issues, and elaborates adaptation and mitigation options. Particular adaptation concerns are identified in regards to water resources, agriculture and livestock, marine and freshwater fisheries, human health, ecosystems and forests, infrastructure, and urban areas (MOEF, 2012). Identified adaptation measures for these sectors are presented in Table 6.

Other adaptation-relevant policies include the development of the Bangladesh Green Development Plan, which aims to promote private sector investment in areas such as the environment, energy, and climate change. Its aim is to help address the needs of the poorest with respect to climate change adaptation and mitigation (Nachmany et al., 2014). In addition, while the country does not yet have a climate policy per se, it has recently updated its National Environmental Policy so that it now includes climate change issues (Mallick, personal communication, June 29, 2015).

Table 6 – Priority adaptation actions by sector identified in Bangladesh's Second National Communication to the UNFCCC

Sector	Priority adaptation measures
Water	• Strengthen embankment systems along coastal zones • Implement tidal river management and remove siltation to avoid water logging and allow greater passage for draining • Maintain and construct cyclone shelters and climate-proof housing • Strengthen local disaster committees and use indigenous knowledge for water management • Promote research on water-related hazards • Promote early warning and preparedness for all hazards (flood, cyclone, drought, river erosion)
Agriculture	• Research salt- and drought-tolerant crops • Develop efficient water irrigation and water management systems • Promote diversified crop production

Fisheries	• Protect floodplains, capture fisheries habitat through excavation of silt, establish sanctuaries, and improve connectivity • Enhance aquaculture fisheries by retaining water through pond deepening, removal of sludge, dyke tree planting, harvesting of runoff water, etc. • Raise dyke heights to reduce pond over-filling during floods • Screen for and develop shallow water and temperature-tolerant fish species • Develop salt-tolerant species in coastal areas • Promote paddy-cum-fish polyculture • Promote alternative livelihoods during fish breeding periods
Livestock	• Manage feeding and drinking water to minimize heat stress effects • Improve housing facilities such as shade, cooling, and ventilation • Raise platform level of housing for livestock in coastal and flood-prone areas • Build capacity for veterinary services • Raise awareness of farmers on climatic disasters
Human health	• Enhance capacity of existing health infrastructure and build new health facilities • Increase manpower for health services during climate change impacts • Build capacity of health professionals to deal with future climate change impacts • Raise awareness to reduce diseases related to floods, cyclones, heatwaves, cold spells, etc. • Raise levels of hand-tube well and sanitary latrines to reduce water contamination threats • Research vectors, parasites, and virus mutation and adaptation to changing climate
Ecosystems and forests	• Develop national strategy for integrated water resource management to protect aquatic plants and animals • Maintain critical ecological zones • Conserve threatened species • Create buffer zones or migration corridors (allowing plant and animal migration following pole-ward shifts in habitat distributions due to changes in temperature and precipitation) • Conserve and protect habitats • Conserve and carry out afforestation in reserve forests, coastal areas, and swamp forests in wetlands
Infrastructure	• Redesign and improve road, rail line, embankment, and other infrastructure to keep them functional during floods • Increase number of openings (in bridges) to improve drainage congestion • Maintain and improve existing shelters and construct additional ones • Research and implement climate-smart and cheap housing • Dredge navigation routes and canals
Urban centres	• Implement existing policies and plans for development of built areas, and redesign urban planning to account for climate change impacts (elevations, drainage congestions, etc.)

	• Mainstream adaptation into urban development policies and programs (into disaster management, water, health, and industry sectors) • Ensure that city authority monitors, guides, and controls the city's development activities • Revise and implement building codes, considering climate change • Introduce urban greening program, including rooftop gardening • Preserve and maintain drainage areas • Create awareness-building programs on climate change at community level • Strengthen capacity building of concerned ministries and agencies on climate change

Source: MOEF (2012).

The main funding instruments for implementing the BCCSAP are two trust funds: the Bangladesh Climate Change Trust Fund (BCCTF), established and completely funded by the GOB, and the Bangladesh Climate Change Resilience Fund (BCCRF), created to attract additional funding from development partners. The BCCRF was formerly called the Multi-Donor Trust Fund, and its initial contributors included Australia, Denmark, the European Union, Sweden, Switzerland, the United Kingdom, and the United States (Ayers et al., 2014; MOEF, 2014; Nachmany et al., 2014).

Establishment of the BCCTF was enabled by the Climate Change Trust Fund Act (2010), which establishes the rules under which the Fund can be used and managed. The Act stipulates that 66% of the fund's budget will be spent on implementing projects prioritized in the BCCSAP, while the other 34% will be kept as a deposit for emergencies (Nachmany et al., 2014). It also established two guiding entities: a technical committee that reviews and recommends the projects submitted to the Fund, which is chaired by the Secretary of MOEF and comprised in part of members from civil society, and a board of trustees that ultimately decides which adaptation project are selected, which includes members from several ministries (Ayers et al., 2014; Huq & Rabbani, 2011). Additionally, the CCU under the MOEF serves as the BCCTF Secretariat and is responsible for overseeing implementation of the activities financed by the Fund (Khan, Huq, & Shamsuddoha, n.d).

Between 2009 and 2012, the government allocated US$350 million to the BCCTF; as of April 2013, 282 projects had been undertaken worth 1,997 crore (19.97 billion) taka (or US$251.6 million) (BCCT, 2014a; Pervin, 2013). Of the money allocated, 44.24% funded infrastructure projects, while only 1.93% was used to fund capacity building and institutional strengthening projects (Pervin, 2013). Projects undertaken included construction of embankments, river bank protections, cyclone-resilient houses, and water control, waste management, and drainage infrastructure; excavation of canals; introduction and dissemination of stress-tolerant crop and seed varieties; afforestation; and installation of solar panels (BCCT, 2014b). Figure 2 shows the distribution of the funding that went to

these different projects, organized by BCCSAP themes. The BCCTF can allocate funds to NGOs to implement community-driven climate resilience measures through its Community Climate Change Project (CCCP). Neither fund seems to have focused on financing projects that target the most vulnerable regions and peoples of Bangladesh (Khan, Haque, & Rouf, 2013).

The second fund, the BCCRF, has received over US$170 million in contributions and was planned to be further replenished to reach an expected total of US$274 million by mid-2013 (Ayers et al., 2014; Khan et al., n.d.; Swiss Development and Cooperation, 2015). The BCCRF has two streams of funding. The larger stream funds public sector projects and the second (representing 10% of total funding) funds civil society and private sector projects (Khan et al., n.d.). The government designated the Palli Karma-Sahayak Foundation as the administrative entity for the fund's second stream or "off-budget window," while the World Bank operated the overall BCCRF before handing this role to the MOEF (Khan et al., n.d.; Pervin, 2015). Projects submitted to either fund must align with the priorities identified in the BCCSAP (Ayers et al., 2014).

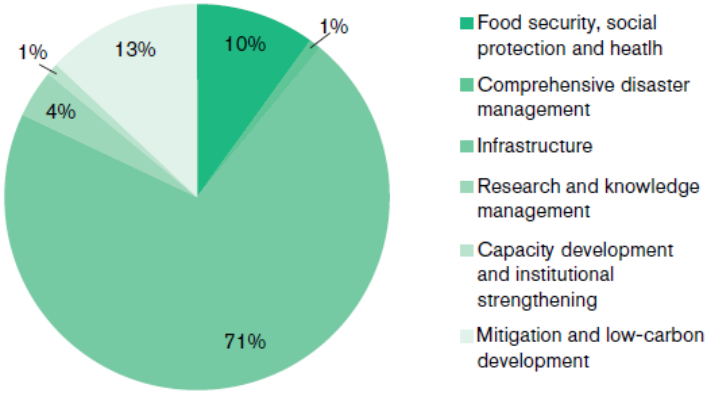


Figure 1 – BCCTF spending per BCCSAP theme (Pervin & Moin, 2014)

3.3 Institutional structure for climate governance

The MOEF is the leading institution in charge of managing climate change in Bangladesh. It leads the discussions, planning, policy, and programs development on climate change issues and takes the issue forward at the international level by acting as the operational focal point to the UNFCCC and the Global Environment Facility (Huq & Rabbani, 2011). It is responsible for preparing Bangladesh's National Communications to the UNFCCC, NAPA, and BCCSAP, approving Clean Development Mechanism projects, and mainstreaming climate change at the sectoral level. Figure 3 describes the country's overall policy and institutional framework.

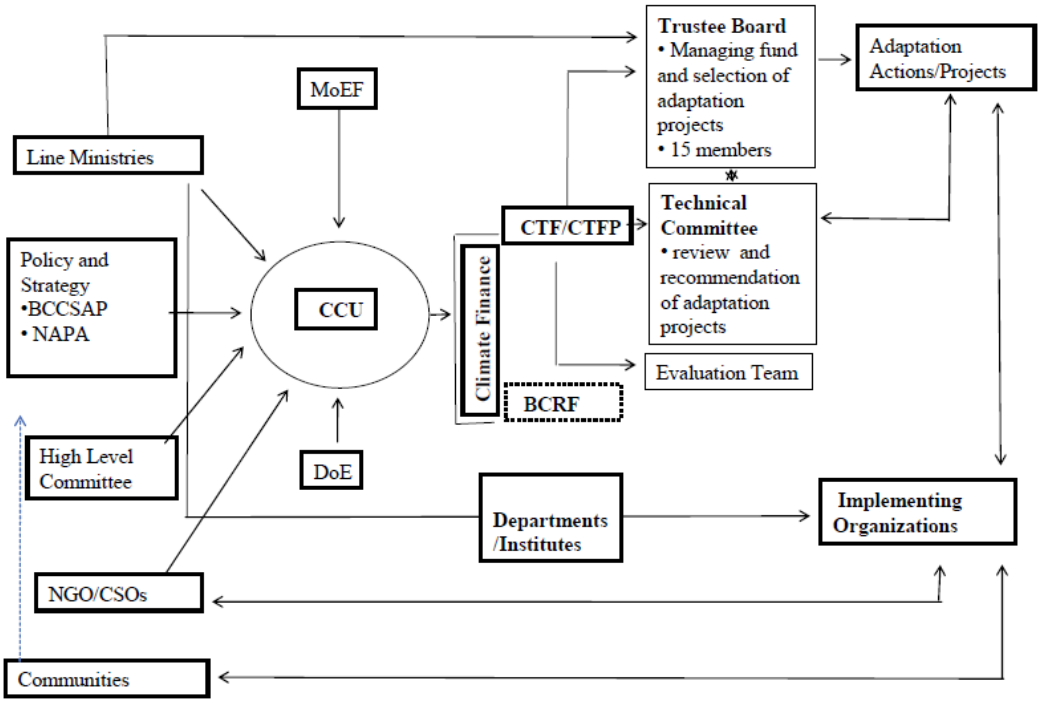


Figure 2 – Policy and institutional climate change framework in Bangladesh (from Huq & Rabbani, 2011)

In 2010 the MOEF established the CCU, which is in charge of coordinating the various climate change cells established within each ministry to help mainstream climate change across sectors as well as build capacity across government (Ayers et al., 2014). The CCU has now been replaced by the BCCT, which helps to manage the BBCCRF and the BCCTF.

In addition to the entities established under the Climate Change Trust Fund Act to manage the BCCTF, the Inter-Ministerial National Steering Committee on Climate Change was set up in 1994 to support planning and implementation processes. The committee provides guidance on international climate change negotiations, including bilateral, multilateral, and regional collaboration programs, and reports to the National Environment Committee, which is chaired by the prime minister (MOEF, 2009). As well, a Standing Committee on Environment and Climate Change has been proposed for establishment within the current 10th Parliament (Pervin, personal communication, 2015).

The institutional arrangements for climate change at the national level bypass the national government's traditional institutional structure, in which the Planning Commission approves projects that are then implemented by executing agencies. For climate change projects under US$250 million, the MOEF directly submits them to either the BCCTF or the BCCRF for increased flexibility. Projects over this amount need to be approved by the Planning Commission. There is room to improve Bangladesh's institutional arrangements by integrating the management of funds with other ministries and by clarifying the role of local bodies and NGOs in adaptation processes (Pervin, 2013).

Regarding information systems and data sharing, each ministry has its own system for collecting and using data and information. Systems to generate and disseminate this information remain weak at the sectoral and local levels. Information tends to be too general and vague to appropriately guide decision-makers in their investment decisions (Pervin, 2013). In terms of monitoring and evaluation systems for adaptation, there is at present no common framework for either adaptation or mitigation activities. However, the General Economics Division has been developing an indicator framework that should cover all adaptation activities and be monitored by the monitoring cell (Pervin, 2013). At present, the GOB's Implementation, Monitoring and Evaluation Division has the mandate to monitor all projects being implemented by the different ministries.

3.4 National-level sectoral policies

As part of its mainstreaming efforts, the Planning Commission is reviewing sectoral policies published before climate change issues appeared on the political agenda to see where changes may be required. As updating these policies, such as those for exports and industry, is a long and complex process and creating new policies is easier (Pervin, 2013), some sector-specific policies do not integrate climate issues at the moment.

Policies that integrate climate change issues include the National Agricultural Policy (2010), which recognizes climate change as one of the agricultural sector's challenges and aims to establish "self-reliant and sustainable agriculture adaptive to climate change and responsive to farmers' needs" as its fourth specific objective (Ministry of Agriculture [MOA], 2010). The policy includes a commitment to climate change–related research, including research on weather and crop forecasting, climate change and disaster management, and drought and saline-tolerant rice crops (MOA, 2010).

Several policies and strategies have been put in place in the water sector, including the National Water Policy and Policies for Safe Water Supply and Sanitation in 1998, a National Water Management Plan (NWMP) in 2001 to implement the Water Policy, and a National Sanitation Strategy in 2005. While the water and sanitation policies do not take climate change into account, the 2001 NWMP identifies impacts of climate change for the sector, such as higher irrigation water requirements and increased competition over water access and use. It recommends several measures under its disaster management program, such as cyclone shelters and flood- and drought-proofing measures for railway networks, roads, and water basins (Ministry of Water Resources, 2001). Other national policies, such as the Water Act (2013), prioritize improved water management and other measures to solve existing regional freshwater scarcity issues that are expected to be compounded by climate change. These measures, although they are not specifically referred to as adaptation strategies, could help build climate resilience (MOEF, 2012; Nachmany et al., 2014).

Related to the water sector, the Bangladesh Coastal Zone Policy of 2005 also recognizes climate change as a threat for most households and agriculture. It identifies reducing vulnerability to natural disasters as an integral aspect of the national strategy for poverty

reduction, as well as other measures such as cyclone shelters, multi-purpose embankments, disaster warning systems, sea dykes, and afforestation measures. It states that adaptive measures for addressing climate change will be gradually implemented in the coastal zone. However, being a policy and not a strategy or action plan, no detailed measures are articulated in it.

The National Fisheries Policy was adopted in 1988 with the primary objective of increasing fish production and making aquaculture and fisheries management activities environmentally friendly and sustainable. In 2006, the National Fisheries Strategy was developed and approved by the Ministry of Fisheries and Livestock (MOFL). Neither the policy nor the strategy identify climate change as an issue for this sector.

The National Livestock Development Policy was developed and adopted in 2007 by the MOFL and also does not recognize climate risks, despite its main objective being "to provide the enabling environment, opening up opportunities, and reducing risks and vulnerability…" (MOFL, 2007, p.4). Additionally, a national Livestock Policy and Action Plan was drafted in 2005 (MOFL, 2005) and the National Livestock Extension Policy was drafted in 2013. The former does not mention climate risks but does identify risks from natural disasters, such as livestock diseases, as a constraint to the sector. The latter identifies extreme climate events (calling them "natural disasters" and referencing heavy rainfall, floods, droughts, cyclones, intrusion of saline water, etc.) as an emerging issue for the sector given their potential negative impacts on the transportation of feed and fodder, freshwater availability for livestock and the spread of diseases. It points to the Disaster Management Policy from 2008 for guidance, but does not identify specific climate change–related measures.

The National Plan for Disaster Management 2010–2015 (GOB, 2010) acknowledges that climate change could increase the frequency and intensity of existing climatic events such as floods, droughts, and cyclones and alter the timing of their incidence. It has a specific chapter on climate change describing observed changes and future climate change scenarios and identifies disaster risk reduction that takes climate change adaptation into account as a "win-win opportunity." It includes climate variability and change as defining elements of the risk environment in the plan's disaster management conceptual model. It also calls for inclusion of these risks in national and district disaster management plans and for their consideration when implementing specific actions (e.g., mainstreaming climate change adaptation and risk-reduction principles in all development programs and policies).

Gender-related policies, including the National Women Development Policy 2011 and the Bangladesh National Strategy for Maternal Health 2001, do not acknowledge climate change impacts, aside from the former stating the need to ensure that facilities and measures are in place for the security of women in the event of natural disasters (Ministry of Women and Children Affairs, 2011; Shabib & Khan, 2014). On the other hand, it seems that the climate change policies recognize women as being particularly vulnerable to the impacts of climate

change, but do not identify or implement any specific measures targeting women (Shabib & Khan, 2014).

Other policies that do not take into account climate risks include those focused on health (National Health Policy adopted in 2011 by the Ministry of Health and Family Welfare) and the forestry sector (National Forest Policy in 1994 and Forestry Sector Master Plan in 1993). The absence of reference to this concern in the latter two documents may be attributed to their development prior to climate change emerged as a national priority.

Overall, the country has started to integrate climate change adaptation in national and sectoral development policies and plans, as shown by the sectoral policies that already fully or partially integrate climate risks (Ayers et al., 2014; see also Table 7). Moreover, Bangladesh seems on track to continue this mainstreaming across sectors incentivized by national development strategies' mandates, which are themselves already integrating climate risks.

Table 7 – Integration of climate change into national sectoral strategies, policies, and plans: An assessment of progress

	Absent	Climate change mentioned as potential risk	Possible actions for reducing risk identified	Targets identified for specific adaptation measures
National Agricultural Policy (2010)		✓	✓	—
National Water Management Plan (2001)		✓	✓	—
National Coastal Zone Policy (2005)		✓	✓	—
National Fisheries Policy (1998) and *National Fisheries Strategy* (2006)	X	—	—	—
National Livestock Policy (2007)	X	—	—	—
National gender-related policies	X	—	—	—
National Disaster Management Plan 2010-2015		✓	✓	✓

4. Current and planned adaptation programs and projects

To assess the extent to which adaptation actions are under way in Bangladesh, this section first provides an overview of the adaptation projects and programs being implemented in the country. It then provides analysis of the flow of finance from domestic and international sources that specifically aim to enhance Bangladesh's capacity to adapt to climate change.

4.1 Adaptation projects and programs

This section provides an overview of adaptation programs and projects in Bangladesh, including those that have recently been completed, are under way, and are planned for implementation in the near term. We identified projects with a specific focus on supporting climate change adaptation, as reflected in their title and/or objectives, through a web-based review, then captured them in a database and classified them by their type and area of focus. For details on the methodology used to identify and classify the programs and projects included in this review, please refer to Annex A.

The review found 29 ongoing or recently completed projects: 8 are of regional scope, 2 of global scope, and the remaining 19 are being implemented only in Bangladesh. All of these projects are presented in Annex B, and Table 8 provides a summary of their sectors of focus. We recognize that the projects identified through this review do not capture the much larger array of projects and initiatives being implemented in Bangladesh that are helping to build its capacity to adapt to climate change. For example, there are many disaster risk reduction project being implemented in the country that were not included because they do not refer to climate adaptation as one of their objectives or part of their intended outcomes.

Table 8: Sector of focus of current adaptation projects and programs identified in Bangladesh

Sector of focus		Priority sectors for adaptation	Number of projects*	Percentage of total projects	Geographical scale	
Food, fibre, and forest	Agriculture and livestock	✓	3	10%	National projects	19
	Forestry	✓	5	17%	Regional projects	8
	Aquaculture		1	3%	Global projects	2
Freshwater resources	Watershed management	✓	4	14%	Total	29

	Freshwater supply	✓	6	21%
Oceans and coastal areas	Coastal zone management	✓	6	21%
	Marine fisheries	✓	1	3%
Infrastructure	Energy	✓	1	3%
	Transportation	✓	3	10%
	Waste management	✓	3	10%
	Buildings	✓	4	14%
Governance	Government	✓	11	38%
	Civil society	✓	1	3%
Urban areas		✓	6	21%
Disaster risk management		✓	12	41%
Migration			2	7%
Human health		✓	1	3%
Gender		✓	5	17%
Climate information			5	17%
Multi-sectoral or other			3	10%

*Individual projects may address one or more sectors.

The majority of adaptation initiatives reviewed include capacity-building components, aim to guide policy formulation and integration of climate risks into national development processes and policies, or focus on enhancing understanding and communicating the impacts of climate change or sharing experiences. Many of the adaptation projects reviewed focus on improving governance at various levels, particularly in relation to built infrastructure (e.g., for transportation, waste management, or buildings), risk reduction, freshwater supply and sanitation, coastal zone management, and urban centres close to the coast. Fewer activities focus on agricultural crops, livestock, forestry, and climate-resilient livelihoods more generally. Most of the projects focus on reducing vulnerabilities to floods, droughts, and saline intrusion. The majority of the projects and programs implemented in Bangladesh have to align with the government's priorities and priority adaptation actions as laid down in the BCCSAP and NAPA, especially those funded through the BCCRF and BCCTF.

Many of the large-scale adaptation projects under way in Bangladesh funded by the World Bank, the Asian Development Bank (ADB), and a number of bilateral donors focus on large-

scale infrastructure projects, particularly in the southern and coastal districts of Bangladesh. They aim to reduce vulnerabilities to floods, wave impacts, or saline intrusion, and to improve water management and drainage. The following are examples of these projects:

- Coastal Towns Infrastructure Improvement Project, part of the Bangladesh Pilot Program for Climate Resilience (PPCR; see below).
- Coastal Embankments Improvement and Afforestation project led by the World Bank.
- Urban Flooding of the Greater Dhaka Area in a Changing Climate: Vulnerability, Adaptation and Potential Costs project, also led by the World Bank.

Initial phases of these often multi-phase projects typically strictly focus on physical infrastructure, such as reconstructing or building cyclone shelters. Current phases continue to include these elements as well as the climate-proofing of roads, bridges, and other infrastructure, but now sometimes include capacity building of local governance and institutions, as well as knowledge management. For example, the Coastal Embankments Improvement and Afforestation project specifically focuses on establishing green infrastructure such as greenbelts while considering and dealing with climate change. Some have managed to go further by including elements focusing on formulating adaptation policy options and priorities for decision-makers, such as the project Urban Flooding of the Greater Dhaka Area in a Changing Climate: Vulnerability, Adaptation and Potential Costs. Moreover, other large projects aim to institutionalize risk reduction approaches more broadly across key ministries and agencies within the multi-donor-funded Comprehensive Disaster Management Programme (CDMP).

Smaller-scale projects involving implementation by or in collaboration with local partners are often focused on strengthening livelihoods of the poorest and of women through community-based adaptation or ecosystem-based adaptation approaches. Examples of these projects include the Adaptation to Climate Change and Rehabilitation of Livelihoods in Selected Districts of South Bangladesh project, led by Deutsche Gesellschaft für Internationale Zusammenarbeit and several Bangladeshi organizations, and the CCCP, implemented by the Palli Karma-Sahayak Foundation. The latter project established community climate change funds that can be used to finance several community-based adaptations proposed by NGOs.

Over and above these projects being implemented exclusively in Bangladesh, the country is also benefiting from involvement in several projects that are also being implemented in other countries. Among the most significant is the PPCR. Bangladesh was the first country to receive funding for adaptation and resilience building under the PPCR, which is financed through the Climate Investment Funds (CIF) Strategic Climate Fund program. The PPCR is being piloted in 17 other countries aside from Bangladesh and aims to integrate climate

resilience and adaptation into core development planning and implementation in participating countries. In Bangladesh, the PPCR was built around the NAPA and the BCCSAP. Bangladesh leapfrogged phase one of the program, which aims to plan and prepare for receiving and using the funds, directly into phase two of implementation, since it already had a "well-established policy and institutional framework for addressing climate change" and was at an advanced stage in the adaptation planning exercise through its two key adaptation planning documents (Rai & Smith, 2013, p.11).

Three investment projects and two technical assistance projects were selected to be funded through the PPCR, with a total of US$110 million accepted in October 2010, US$50 million in the form of grants and US$60 million in the form of concessional loans (CIF, 2010). The national implementing agency is the MOEF, while the ADB is leading its operationalization along with the World Bank and the International Finance Corporation (IFC). The expected outcomes from the PPCR in Bangladesh are increased resilience of coastal infrastructure, reduced water and soil salinity, improved agricultural and fisheries production, and improved and strengthened capacities of the MOEF to manage and coordinate climate resilient initiatives and investments (CIF, 2015a). Table 9 documents the projects being implemented as part of the PPCR.

Table 9 – Bangladesh PPCR summary projects

Project/program	Objectives	Total budget[a]	Implementing agencies	Project status/ duration
Investment project 1: Promoting Climate Resilient Agriculture and Food Security	Improve access to sustainable agricultural practices and products of coastal zones, ensuring food security and livelihoods for the most vulnerable (irrigation, stress-tolerant/adaptive varieties, capacity building of farmers in adaptive water management techniques) (CIF, 2015a).	US$325m	IFC, Department of Agriculture Extension of the Ministry of Agriculture (MOE), and Bangladesh Meteorological Department	Completed in 2012
Investment project 2: Coastal Embankments Improvement and Afforestation	Strengthen coastal embankments to withstand daily, seasonal, and erratic climate-induced disasters, including floods and cyclonic storms (rehabilitating	US$400m[4]	World Bank, Bangladesh Water Development Board, the Forest Department, and Bangladesh Forestry	June 2013 – December 2020[5]

[4] See World Bank (n.d.)
[5] See World Bank (n.d.)

	embankments, reforesting to establish greenbelts) as well as improve agricultural production by reducing saline water intrusion and improve the GOB's capacity to respond promptly and effectively to an eligible crisis or emergency (CIF, 2015a, 2015b).		Research Institute	
Investment project 3: Coastal Climate Resilient Water Supply, Sanitation, and Infrastructure Improvement. Project 3a: Climate Resilient Infrastructure Improvement in Coastal Zone Project Project 3b: Coastal Towns Infrastructure Improvement Project	Improve water supply, sanitation, and connectivity; improve their resiliency as well as access to these services through construction and rehabilitation of all-weather access roads that can withstand severe flooding, thereby reducing poverty and raising incomes in the coastal districts (CIF, 2015a).	3a: US$90m 3b: US$120.4m	ADB, Local Government Engineering Department (LGED), Department of Public Health and Engineering, Ministry of Food and Disaster Management, and Water Supply and Sewerage Authority	3a: November 2011 – unknown (completed) 3b: Was divided into two coastal town infrastructure improvement projects, of which one was completed in October 2014 and the second is ongoing.[6]
Technical assistance 1: Climate Change Capacity Building and Knowledge Management	Strengthen MOEF capacities in terms of requisite human resources and technology for managing and coordinating investments in and knowledge on climate resilient initiatives (CIF, 2015a; ADB, 2015).	US$0.5m	ADB, MOEF, and Economic Relations Division	August 201 – December 2014 (completed)
Technical	Gather the needed	US$0.4m	IFC, Ministry of Food	Unknown

[6] There is an additional project following from this PPCR investment project called the Coastal Towns Environmental Infrastructure Project, which started in 2014, led by the ADB.

assistance 2: Feasibility Study for a PPCR Housing in the Coastal region	information base for making investment decisions on low-cost, storm- and cyclone-proof individual housing for coastal populations and their livestock that are economically, environmentally, and socially sustainable (CIF, 2015a).		and Disaster Management/LGED

[a] Budget figures reflect information presented on the indicated web sources. Discrepancies have been observed between the figures presented in different sources.

Source: Adapted from Rai and Smith (2013).

Bangladesh has also been selected as one of the five target countries for the International Fund for Agriculture Development's Adaptation for Smallholder Agriculture Programme. The funds will be used to scale up best practice and test new adaptation interventions in the Haor Infrastructure and Livelihood Improvement Project in five eastern districts. Activities include building climate-resilient community infrastructure, promoting alternative livelihoods and new farming technologies, and establishing early-warning and weather information systems.

It is worth mentioning that two adaptation projects identified through the NAPA process have already been implemented in Bangladesh: Community-Based Adaptation to Climate Change through Coastal Afforestation, and Integrating Community-Based Adaptation in Afforestation and Reforestation Programmes in Bangladesh. A third project has been planned: Community-Based Climate Resilient Fisheries and Aquaculture Development in Bangladesh (UNFCCC, 2014). The Community-Based Adaptation to Climate Change through Coastal Afforestation in Bangladesh project was very successful. Led by the UNDP and implemented by the MOEF from 2009 until 2014, and funded by the Least Developed Countries Fund, it aimed to reduce the vulnerability of coastal communities to climate impacts in four areas. The project promoted the diversification of livelihoods and income generation, for example, through the rational use of coastal land to produce forest, fruit, and fish resources to incorporate short- and long-term resource and income generation, protection against climate hazards, and climate change mitigation. This project received three awards: the Earth Care Award in 2012; an award in the knowledge competition of the Fifth International Conference on Community Based Adaptation, held in Bangladesh in 2011; and the Solution Search's Adaptation to a Changing Climate contest award, sponsored by Rare and The Nature Conservancy (UNDP, n.d.).

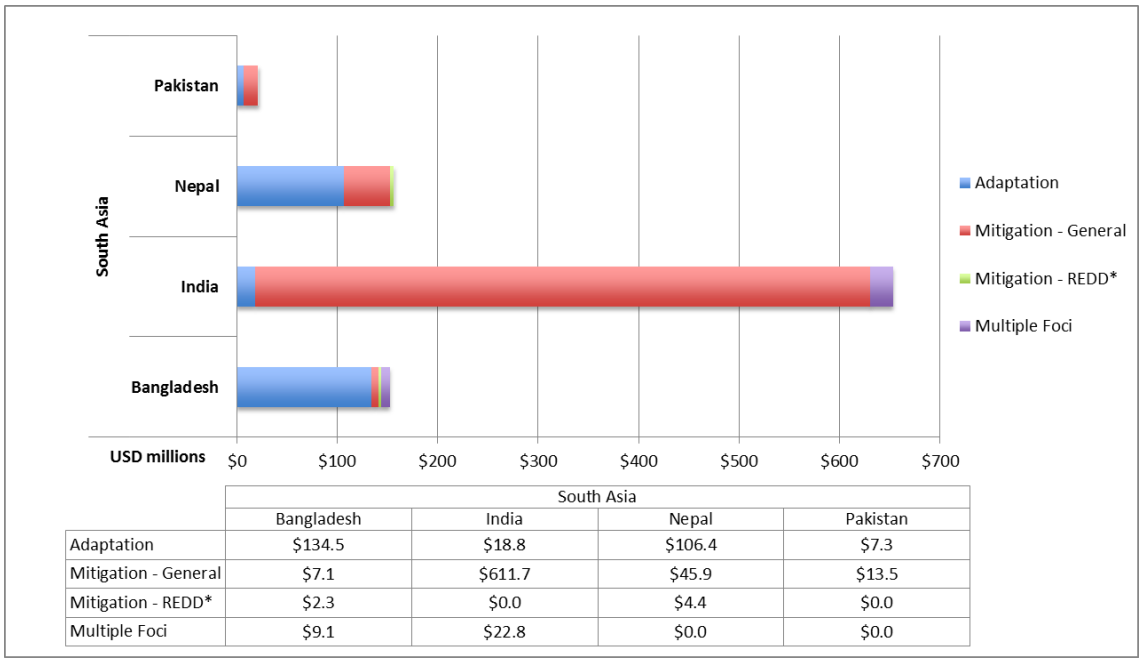
4.2 Climate finance

Financing of the adaptation activities under way in Bangladesh is derived from a combination of domestic and international sources. As previously described, the country has the BCCTF, funded by the government, and the BCCRF, funded by international donors. In addition, the government supports adaptation action through financial mechanisms not exclusively aimed at addressing climate change concerns, namely the following (Pervin, 2013):

- Through the annual development program led by the Planning Commission, which funds climate-related activities to a value of up to 4% of GDP, most of which are infrastructure projects.
- Through the non-developmental budget led by the finance ministry, which has funded social protection measures.

It is estimated that between 20 and 25% of government expenditures are spent on programs containing a climate change angle (Pervin, 2013). Others have calculated that three-quarters of the money spent on climate change in Bangladesh comes from domestic sources, as the country spends between 6 and 7% (US$1 billion a year) of its annual budget on climate change adaptation; one-quarter of climate change financing comes from international donors (UNEP, 2014).

Bangladesh also is a significant recipient of international climate finance. According to the Climate Funds Update, which tracks climate finance flowing through discrete multilateral and bilateral climate funds, Bangladesh is one of the largest recipients of international financing. As presented in Figure 4, since 2003 Bangladesh has been approved to receive US$153.04 million (in current dollars) from dedicated climate funds such as the Least Developed Countries Fund, the World Bank's PPCR, and the Global Climate Change Alliance (Climate Fund Update, 2015). The majority of this financing has been allocated to supporting adaptation projects and programs. When only funding for adaptation is considered, Bangladesh is the world's third-largest recipient of financing from dedicated multilateral climate funds, having been approved to receive a total of US$134.5 million in current dollars. It is behind Mozambique and Niger, and followed by Cambodia and Nepal (Climate Fund Update, 2015).



	South Asia			
	Bangladesh	India	Nepal	Pakistan
Adaptation	$134.5	$18.8	$106.4	$7.3
Mitigation - General	$7.1	$611.7	$45.9	$13.5
Mitigation - REDD*	$2.3	$0.0	$4.4	$0.0
Multiple Foci	$9.1	$22.8	$0.0	$0.0

*Reducing emissions from deforestation and forest degradation

Figure 3 – Comparison of approved funding from designated multilateral and bilateral climate funds to countries in South Asia since 2003, in US$ millions, as of 30 April 2015 (based on Climate Funds Update, 2015)

The Rio Markers data collected by the Organisation for Economic Co-operation and Development (OECD) provides a different perspective, as it tracks climate financing provided through official development assistance (ODA) and other official flows. Based on OECD data, in 2013 Bangladesh was the third-largest recipient of climate-oriented development assistance from both multilateral and bilateral sources, behind India and Turkey. In that year it was approved to receive a total of US$1,817.96 million (in constant 2012 prices) in funding from multilateral and bilateral sources for projects that contributed to climate mitigation, adaptation, or both mitigation and adaptation.

In contrast to the pattern of financing tracked through the Climate Funds Update, ODA from both multilateral and bilateral sources received by Bangladesh in 2013 was primarily allocated to supporting climate mitigation activities. Of the US$1,817.96 million committed to Bangladesh, US$1,462.35 million (or 80.4%) was oriented toward climate mitigation. The majority of this funding was focused on the energy sector, followed by transportation and storage. Only US$342.64 million (or 18.8% of total funding) was committed to addressing climate adaptation (OECD, 2015).

Focusing specifically on funding received from bilateral aid between 2010 and 2013, half of the climate-related financing approved for Bangladesh supported climate mitigation projects and programming, while 40% supported adaptation. The prevalence of mitigation funding stems in part from a significant commitment by Japan to the country for mitigation-focused programming in 2013. The majority of bilaterally supported projects were in the

transportation and storage sectors, followed by water supply and sanitation, multisectoral initiatives, general environment protection, and disaster prevention and preparedness.

Looking more closely at the adaptation financing received by Bangladesh during this time period, as illustrated in Figure 5, the majority of financing has been for projects for which adaptation was the principal objective.[7] The balance between projects in which adaptation has been the principal versus the significant objective has varied over the years—ranging from 90% of bilateral development aid received for climate change adaptation in 2013 to only 30% in 2010.

Since 2010, the bilateral donor providing the greatest amount of climate-related financing to Bangladesh has been Japan; it provided nearly three-quarters of all funding received. In part this stems from Japan's significant contribution in 2013, in which it approved US$1,166.5 million in funding (US$798.7 million for mitigation and US$367.8 million for adaptation). Over the period of 2010 to 2013, the second-largest bilateral donor was the Netherlands (US$115.07 million), followed closely by Germany (US$111.13 million) (based on OECD, 2015).

Finally, it appears that despite a strong institutional climate arrangement, Bangladesh only leveraged a little over US$1 billion from major funds to implement the BCCSAP, instead of the estimated US$5 billion expected for the period 2009 to 2013 (Pervin & Moin, 2014). Therefore, despite Bangladesh being a large recipient of aid, disbursement remains fragmented and inadequate to implement the range of activities that the government designed to respond to climate change.

A different perspective on climate financing in India is provided through a review of the findings of the Climate Funds Update, which tracks financing allocated from dedicated multilateral and bilateral climate funds since 2003. Based on their data, as presented in Figure 4, India has been the top recipient of financing through climate funds in comparison to its neighbours in South Asia. The vast majority of these funds, however, have been directed toward mitigation-focused activities (US$611.7 million) as opposed to adaptation (US$18.8 million) (as of April 2015). When funding for adaptation only is considered, India receives significantly less support from dedicated climate funds compared to Bangladesh and Nepal. Adaptation initiatives in India have not received adequate financing through these bilateral and multilateral climate funds, and adaptation remains an underfunded domain.

[7] Based on the definitions used by the OECD Rio Markers system, activities are considered to have supporting adaptation as their "principal" objective "when promoting the objectives of the UNFCCC is stated in the activity documentation to be one of the principal reasons for undertaking the activity. In other words, the activity would not have been funded but for that objective. Activities marked "significant" have other prime objectives, but have been formulated or adjusted to help meet climate concerns" (OECD, 2011, p.3).

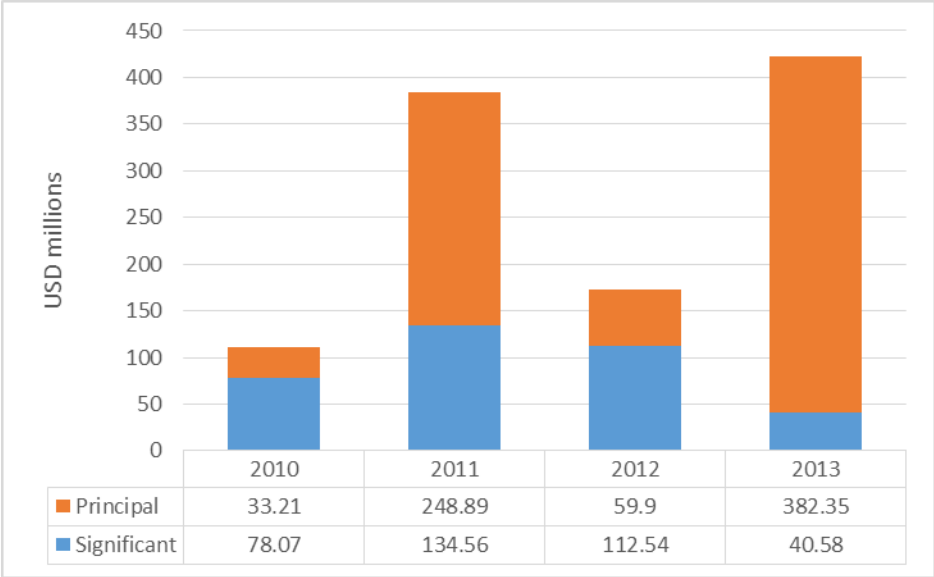


Figure 5 – Bilateral development aid to all sectors marked identified as having as its principal or significant objective support adaptation in Bangladesh, 2010 to 2013, constant 2012 prices (based on OECD, 2015)

5. Networks and communities of practice

Reflecting the level of concern about climate change in Bangladesh, a number of networks and communities of practice are active in the country. Many engage NGOs and community-based organizations (CBOs) and advocate for measures that will reduce vulnerability to the impacts of climate change and alleviate poverty. Several focus on the linkages between climate change and disaster risk reduction. Others focus on linking research organizations within and outside of Bangladesh to increase understanding of specific issues. Geographically, many of the identified networks are focused on adaptation issues related to the coastal areas of Bangladesh as opposed to its highland areas.

Among the more prominent networks in the country that local NGOs have initiated is the Climate Change Development Forum Bangladesh, which was started in 2005 by the Bangladesh Centre for Advanced Studies. The network involves about 30 development NGOs working on climate change issues in the country. Another alliance of NGOs and CBOs is the Equity and Justice Working Group Bangladesh (EquityBD). Established in 2007, it works from the grassroots to national and international levels on a range of issues, including climate justice. Similarly, the Network on Climate Change, Bangladesh (NCC,B) was established in 2005 to address climate challenges. Consisting of small local community organizations and faith groups, the network's objectives focus on information dissemination to partner organizations, modelling different mechanisms of adaptation, campaigning for technical support toward adaptation and for other climate change–related issues, and advocacy to replicate successful adaptation initiatives modelled by the network members at local, national, regional, and international levels.

Working in Bangladesh's coastal zone, the Coastal Livelihood and Environment Action Network, founded in 2010, is a regional network-based organization focused on promoting climate resilience, good governance, and disaster risk reduction with a focus on small producer rights, ecosystem-based adaptation, and sustainable biodiversity management. Similarly, the Coastal Development Partnership was established in 1997 to act as the coordinating secretariat for NGOs and CBOs working to assist people living in the waterlogged southwest coastal region of Bangladesh. It is actively engaged in reducing vulnerability to the impacts of climate change.

Another prominent network is the Local Consultative Group on Climate Change and Environment, a semi-formal group of government bodies, international development partners, and NGOs that aims to identify shared environmental concerns and maintain a constructive dialogue with the GOB and development partners. It aims to support implementation of the BCCSAP through policy dialogue, coordination, and sharing of experience and knowledge. Priorities for the network include adaptation to climate change, identification and coordination of climate finance schemes, involvement in the UNFCCC process, and support for the protection/conservation of water, soil, and air.

6. Conclusions

Bangladesh is one of the most vulnerable countries in the world to climate change impacts. About two-thirds of its land area is prone to river and rainwater flooding, and its coastlines are exposed to storm surges and tidal flooding, while its northwestern region is commonly affected by droughts (MOEF, 2009). Bangladesh has become the symbol when talking about climate change impacts in low-lying countries at international negotiations.

Thus, it is perhaps not surprising that Bangladesh was also one of the first Least Developed Countries to start to seriously tackle climate change. It was one of the first countries to draft its NAPA and now has a strongly built national climate change strategy relying on its revised NAPA (2009) and its BCCSAP (2010). A third National Communication is also being planned. Adaptation will likely continue to be the primary focus of this next National Communication, reflecting Bangladesh's emphasis on this issue relative to climate mitigation in the BCCSAP and other national policy documents. Additionally, it has made considerable efforts to incorporate climate change into national-level planning through Vision 2021, the Perspective Plan and the Sixth Five-Year Plan.

The GOB has also established dedicated institutions to deal with climate change, such as the Climate Change Trust, climate change cells within each ministry, and specific financial mechanisms with the BCCTF and the BCCRF. The climate change cells established within each ministry are expected to help mainstream climate change across sectors as well as build capacity across the ministries. Nevertheless, some of these institutional arrangements still seem to function too much in parallel with traditional, more standard development planning processes. Improvements could be made, such as integrating the management of

the climate change funds in line with other ministries as well as clarifying the roles of other actors in adaptation processes, such as local bodies, NGOs, and the private sector. Moreover, institutional capacities still need to be strengthened, and very few government-financed projects focus on these aspects.

Bangladesh has also seen an impressive amount of projects and initiatives implemented to deal with climate change impacts. The majority of these projects have and are still focused on large infrastructural projects aimed at reducing the impacts of floods, saline water intrusion, sea storm surges, and sea level rise, predominantly in the urban coastal areas of the south of the country, particularly Dhaka, the Greater Dhaka area, and secondary cities. For example, as of April 2013, 44.24% of the funding allocated by the BCCTF financed infrastructure projects, while only 1.93% was used to fund capacity building and institutional strengthening (Pervin, 2013). While focusing on the water sector and on these hazards is understandable considering the country's vulnerabilities and its geographic characteristics, other sectors and regions of the country also vulnerable to climate change have been relatively neglected. For example, the livestock sector might represent less than 3% of GDP, but many rural communities are dependent on animal protein from milk and meat. This becomes worrying in light of projections for this sector, as milk production is estimated to decrease by 5% by the 2050s due to heat stress, while suitable land area for livestock is expected to decrease by about 20% by 2050 due to sea level rise (MOEF, 2012). Additionally, many communities located in the northwestern region of the country are vulnerable to frequent droughts. And while Bangladesh is a pioneer country in research and innovation in areas such as the development of stress-tolerant rice seeds, its vulnerability to droughts highlights a need for projects and programs to focus more on ensuring livelihoods in these rural communities. This does not mean that trying to improve the water supply and sanitation situations in urban centres such as Dhaka should stop, but rather that a broader range of activities should be considered in the way forward.

There is also a significant level of engagement within the Bangladeshi population on the issue of climate change, as reflected in the number of networks and communities of practice active in the country. Many of these networks engage those active on development and social justice issues, particularly in the coastal regions. The extent to which iterative learning and experience building is taking place through knowledge sharing in other contexts, such as between private sector actors, municipal government officials, and the engineering community, remains unclear.

Nevertheless, challenges to fully integrate climate adaptation into national and subnational planning remain, including the following: establishing or using more learning mechanisms, including adaptation monitoring and evaluation systems, to inform policies and actions over time; further focusing on capacity building across sectors and ministries; reducing the gap between climate institutional arrangements and other national planning processes; increasing synergies and coherence between plans and programs to ensure that the country

can be a climate-resilient middle income country by 2021; and clarifying the roles of all stakeholders, including the private sector, which has not been very engaged up until now.

The country is well positioned to address these challenges, as there is political will to deal with climate adaptation, and progress is being made. For example, in information systems and data sharing, the General Economics Division is developing an indicator framework that should cover all adaptation activities. Additionally, an increasing number of initiatives seem to prioritize the most vulnerable, including the poorest and women, slowly ensuring that adaptation action is becoming pro-poor and gender-sensitive, which is key to achieving the country's development goals.

7. Annexes

Annex A: Methodology

This section presents the research parameters established to guide development of the standardized reviews of current adaptation action in the CARIAA program's countries of engagement. It sets forward definitions used in this study, particularly with respect to the identification, selection, and classification of programs and projects considered in the review. This methodology was previously developed by the International Institute for Sustainable Development to support a review of current and planned adaptation action in 12 regions, which was completed in 2011 for the Adaptation Partnership. Modest updates to this original methodology were made to support the current review undertaken for the CARIAA program. For more information, see Adaptation Partnership (2015).

A.1 Adaptation actions included in the review

Within the review, adaptation action was defined as "policies, programs, and projects designed and implemented specifically to address the current and projected impacts of climate change." Therefore, the review focused on examining policies, programs, and projects in which specific reference has been made to supporting adaptation to climate change or climate risk reduction.

Consistent with this definition, the review gave attention to discrete, time-bounded programs and projects designed and implemented specifically to support preparation for or implementation of practical adaptation actions within the broader context of achieving development objectives. Therefore, at least one of the following terms appeared in the title, goals statement, or objectives statement of each program or project included in the review: "adaptation," "climate change adaptation (CCA)," "climate risk management," or "climate vulnerability reduction."

Based upon these parameters, the following types of programs and projects were not included in the review: disaster risk reduction, prevention, or management projects, unless they specifically reference that this activity is being undertaken in support of CCA; primary scientific research studies (for example agrology, botany, or meteorology) on the potential impacts of climate change (for example on changes in crop production, glacial melt rates, or typhoon patterns); long-term monitoring efforts (whether climatic or socioeconomic) needed to inform decision-making; stand-alone workshops, conferences, and training programs; and capacity building to support participation in processes related to the UNFCCC (such as training for negotiators, enabling activities to prepare reports).

The following additional parameters were established to guide the selection of programs and projects incorporated in the study:

- *Official start date.* To ensure that only "current" projects were included in review, selected projects needed to have begun on or after January 1, 2012, with the exception of projects that began before this date but were still ongoing as of January 1, 2015.
- *Official end date*. Ongoing projects are those who official completion day is on or after January 1, 2015. Projects completed after January 1, 2012, were classified as completed.
- *Funding characteristics*. Projects with a value of US$100,000 or more were included in the study. However, reflecting the greater level of adaptation action underway in Bangladesh and India, the minimum value of projects included in the reviews for these two countries was raised to US$250,000. Projects financed by international and domestic sources of funding were considered.

Additionally, identified projects were classified by geographical scale in accordance with the following definitions:

- Global: Projects involving countries throughout the world, including the profiled country.
- Regional: Multi-country projects within a particular subregion, be it a continent or subcontinental area (such as South Asia or West Africa), that includes the profiled country.
- National: Projects occurring within one country.

A.2 Type of project being undertaken

To better understand the orientation of the projects underway in the countries examined as part of the review, projects were classified by type using the following definitions:

- *Research*. Encompassing efforts to develop new knowledge or organize existing information so as to increase understanding of the links among climate change, human society, and ecosystems and inform adaptation decision-making.
- *Assessment*. Encompassing risk, impact, and vulnerability assessments, as well as monitoring of ecological and societal trends.
- *Capacity building*. Encompassing the provision of technical training, technical assistance, institutional strengthening, and education.
- *Knowledge communication*. Encompassing efforts to share information, knowledge, and practices related to CCA, including awareness raising and engagement of media.
- *Policy formation and integration*. Encompassing efforts to inform, develop, and implement CCA plans, strategies, frameworks, and policies at the local, subnational, national, and international levels.
- *Field implementation*. Encompassing physical measures to reduce vulnerability to the impacts of climate change, including the implementation of pilot projects, construction of infrastructure, development and modification of technologies, and management of physical resources.

- *Community-based adaptation*. Encompassing actions that directly engage community members in efforts to understand, plan for, and respond to the impacts of climate change.

A.3 Sector or area of focus

To further inform analysis of the range of adaptation action taking place in each country reviewed, programs and projects examined in the study were classified by sector using the following definitions:

1. **Food, fibre, and forests**. Defined as the management and use of terrestrial natural resources to directly improve human well-being. Its subcategories are:
   - *Agriculture*. Encompassing subsistence agriculture, commercial agriculture, and the rearing of confined domestic animals.
   - *Pastoralism*. Encompassing the use of domestic animals as a primary means for obtaining resources from habitats (UNEP, 2007), particularly in nomadic and semi-nomadic communities.
   - *Forestry*. Encompassing afforestation, reforestation, agroforestry, commercial forestry, community-based forest management, and woodland management.
   - *Fire management*. Encompassing monitoring, planning, and management to address the impact of fires on settlements and ecosystems, including forested and grassland ecosystems.
   - *Aquaculture.* Food production through the rearing of aquatic animals, such as fish, crustaceans, and molluscs, or the cultivation of aquatic plants in natural or controlled marine or freshwater environments.

2. **Ecosystems**. Defined as a system of living organisms interacting together and with their physical environment, the boundaries of which may range from very small spatial scales to, ultimately, the entire Earth (IPCC, 2001). Its subcategories are:
   - *Biodiversity protection*. Encompassing activities related to the maintenance of living organisms at various spatial scales, including the establishment and protection of parks and bioreserves.
   - *Ecosystem conservation*. Encompassing efforts to *maintain* the health of particular ecosystems, such as wetlands, grasslands, forests, mangroves, and coral reefs.
   - *Ecosystem restoration*. Encompassing efforts to *restore* the health of particular ecosystems, such as wetlands, grasslands, forests, mangroves, and coral reefs.

3. **Freshwater resources**. Defined as the management and use of freshwater contained in terrestrial ponds, lakes, rivers, and watersheds, among others. Its subcategories are:
   - *Freshwater fisheries*. Encompassing the catching, packing, and selling of fish and shellfish derived from lakes, rivers, and ponds, as well as through freshwater aquaculture.

- *Watershed management*. Encompassing management of the basins that supply water to different streams, rivers, lakes, and reservoirs, including integrated watershed management.
- *Freshwater supply*. Encompassing efforts to access and preserve freshwater for human consumption and use, including drinking water sources, groundwater resources, rainwater harvesting, and water infrastructure such as wells, dams, and dikes.

4. **Oceans and coastal areas**. Defined as the management and use of coastal areas and oceans. Its subcategories are:
   - *Coastal zone management*. Encompassing the management of land and water resources in coastal areas, including through integrated coastal zone management and the establishment and maintenance of coastal infrastructure.
   - *Marine management*. Encompassing the management and use of offshore ocean and sea resources.
   - *Marine fisheries*. Encompassing the catching, packing, and selling of fish, shellfish, and other aquatic resources found in the oceans and seas, including through marine and coastal aquaculture.

5. **Disaster risk management**. Defined by the United Nations International Strategy for Disaster Reduction (2009) as the "systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster" (p. 10). It includes emergency response measures, preparation for extreme events and early warning systems. No sub-categories were established in relation to this macro project category.

6. **Migration and security**. Defined as efforts to support the movement of people and maintain their personal security in the face of incremental climate changes or climate shocks.
   - *Migration*. Encompassing preparations for and responses to the potential movement of people from one location to another due to climate change impacts.
   - *Security*. Relating to personal security and freedom from violence, crime, and war due to natural and human-induced disasters (UNEP, 2007) and encompassing peace building, conflict reduction, and conflict avoidance.

7. **Gender**. Defined as the social attributes and opportunities associated with being male and female and the relationships between women and men, and girls and boys, as well as the relations among women and among men. These attributes, opportunities, and relationships are socially constructed and are learned through socialization processes (United Nations Entity for Gender Equality and the Empowerment of Women, n.d.). This category includes efforts to understand the vulnerability of women to the impacts of climate change, gender-sensitive adaptation strategies, and measures to improve the

situation of women at the local and policy level, including through gender mainstreaming. No subcategories were established in relation to this macro project category.

8. **Business**. Defined as the purchase and sale of goods and services with the objective of earning a profit. Its subcategories are:
   - *Tourism*. Encompassing the adjustment and development of tourist facilities and operations to account for current and future vulnerabilities, including these actions in relation to ecotourism.
   - *Private sector*. Encompassing potential impacts of climate change and potential adaptation strategies on the diverse activities underway in the portion of the economy in which goods and services are produced by individuals and companies including industry, mining, and other economic sectors.
   - *Trade*. Encompassing the exchange of goods and services within and between countries.
   - *Insurance*. Encompassing the development, testing, and adjusting of insurance and risk-management schemes, including weather-based index systems.

9. **Infrastructure**. Defined as the basic equipment, utilities, productive enterprises, installations, institutions, and services essential for the development, operation and growth of an organization, city or nation (IPCC, 2001). Its sub-categories are:
   - *Energy*. Encompassing energy-related systems and infrastructure, including small-scale and large-scale energy generation through hydroelectric power generation, wind, solar, and other forms of traditional and new energy sources, as well as transmission networks.
   - *Transportation*. Encompassing the components of the system required to move people and goods, including roads, bridges, railway lines, shipping corridors, and ports.
   - *Waste management*. Encompassing sanitation, sewage systems, drainage systems, and landfills.
   - *Buildings*. Encompassing actions related to built structures such as houses, schools, and offices, including changes to building codes, building practices, and green ways of construction.

10. **Human settlements**. Defined as a place or area occupied by settlers (IPCC, 2001). Its subcategories are:
    - *Peri-urban areas*. Encompassing the outskirts of urban centres and the transition zones between rural and urban areas.
    - *Urban areas*. Encompassing municipalities, towns, and cities, as well as areas in these centres (such as slums).
    - *Rural areas*. Encompassing villages and other small settlements, as well as rural landscapes and integrated rural development.

11. **Human health**. Defined as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (WHO, n.d.). It includes efforts to assess vulnerabilities to and the impacts of climate change on human health directly and indirectly, and the development and implementation of appropriate adaptation strategies at the local, regional, and national levels. No subcategories were established in relation to this macro project category.

12. **Climate information services**. Defined as the production and delivery of authoritative, timely, and usable information about climate change, climate variability, climate trends, and impacts to different users at the local, subnational, national, regional, and global levels. It includes efforts to develop, adjust, and provide short- and long-term climate forecasts, including climate change projections, to different audiences. No subcategories were established in relation to this macro project category.

13. **Governance**. Defined as the institutions (laws, property rights systems, and forms of social organization) through which societies define and exercise control over resources (UNEP, 2007). Its subcategories are:
    - *Government*. Encompassing efforts to build the capacity of government officials, either at the national or subnational level, to prepare for and facilitate adaptation to climate change, including through the development of policies, plans, frameworks, and strategies, as well as the establishment and operation of climate change trust funds.
    - *Civil society*. Encompassing efforts to build the capacity of the public, including NGOs, to understand, prepare for, and respond to climate change.

14. **Social protection**. Based on DFID's definition of social protection, projects within this category focus on three sets of instruments to address chronic poverty and vulnerability:
    - *Social insurance*. Referring to "the pooling of contributions by individuals in state or private organizations so that, if they suffer a shock or change in circumstances, they receive financial support."
    - *Social assistance*. Encompasses "non-contributory transfers that are given to those deemed vulnerable by society on the basis of their vulnerability or poverty."
    - *Workplace safety*. Involves the "setting and enforcing of minimum standards to protect citizens within the workplace" (DFID, 2006, p. 1).

    Adaptation projects that focus on labour market interventions and social assistance would be included in this category. No subcategories were established in relation to this macro project category.

15. **Multisectoral**. Defined as actions that simultaneously address more than one sector in one or multiple locations. It includes efforts that address more than one sector, which are challenging to tease apart, and in the context of this review includes large, multi-

country projects in which the specific sector of focus is nationally determined and, therefore, varies from country to country. No subcategories were established in relation to this macro project category.

16. **Other**. To capture areas of focus not clearly identified in the previous categories.

Annex B: Projects and programs

Projects working to address vulnerability to the impacts of climate change in Bangladesh are presented alphabetically in the table below.

Name of project	Objectives	Funder(s) and budget	Implementing agencies	Type of project	Sector	Duration	Scale and location(s)
Adaptation to Climate Change and Rehabilitation of Livelihoods in Selected Districts of South Bangladesh	Selected vulnerable communities have become more resilient to natural disasters and the impacts of climate change. Farmers have adopted appropriate farming methods, while communities, schools, and households have an increased level of awareness and preparedness. There are three project components: 1. Promote agricultural technologies for climate change adaptation by providing capacity building and start-up support for farmers. 2. Promote alternative livelihoods (off-farm) through in-kind and financial start-up support, skills training, value-chain development, and the formation of community interest groups. 3. Improve disaster preparedness in communities and schools by supporting groups to develop their disaster preparedness action plans for their communities, by providing training, first aid, and rescue equipment and supporting the reinforcement of school buildings.	Deutsche Gesellschaft für Internationale Zusammenarbeit	Development Foundation; Wave Foundation; Gonoshastha Kendra; INCIDIN Bangladesh; Association for Disaster Mitigation and Development	Capacity building; policy formation and integration; field implementation; community-based adaptation	Agriculture; disaster risk management; gender; infrastructure (buildings); government; social protection	2011–2016	National Vulnerable communities in Barguna, Patuakhali, and Bhola districts

Agricultural Adaptation in Climate Risk Prone Areas of Bangladesh	This project seeks to enhance the resilience of communities and households to future disasters through introducing technologies and practices that improve land use during the dry season; strengthening the capacities of the Department of Agriculture Extension (DAE) and other stakeholders in climate change adaptation; developing community-based rural early warning systems in drought-, flood- and salinity-prone areas; and improving awareness raising, knowledge sharing, and communications in agricultural climate change adaptation.	BCCRF; World Bank US$22.8 million	DAE; FAO	Capacity building; knowledge communication; field implementation	Agriculture; government	2012–unknown	National
Building Adaptation to Climate Change in Health in Least Developed Countries through Resilient Water, Sanitation and Hygiene	The primary goal of this pilot project is to reduce disease risk and improve health in four countries. The project focuses on integrating climate change considerations into health care. Once the project is complete, its outcomes will be used to reduce the risk of climate-related diseases in other low- and middle-income countries.	DFID through the International Climate Fund £8.5 million	World Health Organization	Policy formation and integration; field Implementation	Freshwater supply; human health	2013–2016	Global Bangladesh, Nepal, Ethiopia, Tanzania
Building Climate Change Awareness in the South Asian Media	This initiative aims to improve media coverage and public debate around climate and development in South Asia by strengthening the capacity and understanding of journalists and other members of	DFID and the Netherlands through CDKN £250,000	International Centre for Integrated Mountain Development (ICIMOD);	Capacity building	Communications and media	May 2012–Mar 2014	Regional Bangladesh, India, Nepal, Pakistan, Bhutan, Sri

	the media.		PANOS				Lanka
Climate Adaptation and Livelihood Protection–Scaling up best practice and testing new adaptation interventions in the Haor Infrastructure and Livelihoods Improvement Project	This project aims to strengthen the community and ecological resilience to climate change in the Haor region. It has three components: 1. Community infrastructure: protection of village roads and market infrastructure against waves, reforestation for natural wave barriers, vegetation to stabilize slopes, emergency flash flood platforms for food storage, weather and flash flood forecasts, income diversification. 2. Livelihood protection: promoting new farming technologies and capacity building. 3. Capacity and knowledge for building resilience: awareness raising among public and private institutions, establishment of flash flood early warning system and a weather information system, and support for climate-sensitive pro-poor policy dialogue.	International Fund for Agricultural Development through Adaptation for Smallholder Agriculture Programme; Spanish Food Security Co-financing Facility Trust Fund; GOB US$133 million	LGED (Ministry of Local Government, Rural Development and Cooperatives)	Research; capacity building; knowledge communication; field implementation; community-based adaptation	Forestry; disaster risk management; rural areas; climate information	2012–2020	National Five districts: Netrakona, Sunamganj, Kishorganj, Habiganj, Brahmanbaria
Climate Change Programme–Jolobayoo-O-Jibon	This project aims to implement climate change adaptation and risk reduction measures to protect and improve the lives and livelihoods of 15 million poor and vulnerable people by 2017. It also supports Bangladesh in achieving its Millennium Development Goals by adapting to climate change.	DFID £74,349,075	International Bank for Reconstruction and Development; International Institute for Environment; UNDP; universities; research	Capacity building; knowledge communication; policy formation and integration	Disaster risk management; government	Sep 2008–Dec 2017	National

			institutes				
Climate Proofing Growth and Development in South Asia	This project aims to integrate climate change (adaptation and mitigation) into development planning, budgeting, and delivery in national and subnational governments in Afghanistan, Bangladesh, India, Nepal, and Pakistan by strengthening planning, budgeting and delivery mechanisms, building awareness and capacity of stakeholders, providing technical and some implementation support, helping leverage domestic finance and actively sharing knowledge.	UK DFID £28.5 million	UNDP and Oxford Policy Management	Capacity building; knowledge communication; policy formation and integration	Government	Oct 2012–2019	Regional Bangladesh, India, Nepal, Pakistan, Afghanistan
Climate Resilient Ecosystems and Livelihoods	The project aims to achieve responsible, equitable, climate-resilient growth and good environmental governance by promoting climate-resilient livelihood activities, scaling up and adapting successful natural resource co-management models, establishing policies that institutionalize community-based natural resource management, and implementing Bangladesh's climate change strategy.	USAID US$8 million	Winrock International	Capacity building; community-based adaptation	Forestry; biodiversity protection; watershed management	2012–2017	National
Climate Resilient Participatory Afforestation and Reforestation Project	The objective of the project is to reduce forest degradation and improve forest coverage through participatory planning and monitoring in nine coastal and hilly districts and targeting the most vulnerable. The project is divided	World Bank through the BCCRF; GOB; Arannayk Foundation US$35 million	Bangladesh Forest Department under MOEF; Arannayk Foundation	Capacity building; policy formation and integration; field implementation; community-based	Forestry; government	Feb 2013–Dec 2016	National Nine coastal and hilly districts of Bangladesh: Cox's Bazar,

	into three components: 1: Afforestation and reforestation 2: Alternative livelihoods to support forest communities 3: Capacity development for forest resource planning and management			adaptation			Chittagong, Noakhali, Lakshmipur, Barisal, Patuakhali, Barguna, Bhola, Feni
Coastal Climate-Resilient Infrastructure Project	The main objective of the project is to reduce poverty and raise incomes in the rural coastal districts of Bangladesh through fostering rural connectivity (rural roads, bridges, culverts, cyclone shelters, and markets) in a sustainable and "climate-proof" way. The project will enhance the accessibility of rural people in the coastal districts to social services, such as health, education, and economic opportunities. Widening all-weather access to markets and livelihood activity will result in improved earnings for the rural poor, including poor women. There are three project outputs: 1. Improved road connectivity 2. Improved market services 3. Enhanced climate change adaptation capacity	ADB, under the CIF US$81.2 million	N/A	Capacity building; field implementation	Coastal zone management; gender; transportation	2012–n/a	National
Coastal Embankments Improvement and Afforestation	The project's goal is to strengthen coastal embankments to withstand daily, seasonal, and erratic climate-induced disasters, including floods and cyclonic storms (rehabilitating embankments, reforesting to establish greenbelts) as well as	World Bank through CIF and the International Development Association	World Bank and the Bangladesh Water Development Board; Others include the	Capacity building; field implementation	Forestry; coastal zone management; disaster risk management; waste management;	Jun 2013–Dec 2020	National Six coastal districts: Satkhira, Khulna, Bagerhat,

	improve agricultural production by reducing saline water intrusion and improve the GOB's capacity to respond promptly and effectively to an eligible crisis or emergency. Project components include (i) reconstruct and modernize the coastal embankments system to make it climate resilient; (ii) rehabilitate, build, or improve all water management–related structures within the embankments for improved drainage and reduced flooding and water logging, and improve agriculture and fish productivity; (iii) improve the coastal greenbelt along the embankments and reduce the impact of tidal surges and strong winds by implementing a systematic program of afforestation/reforestation measures. The project is part of Bangladesh PPCR, investment project 2.	US$400 million	Forest Department and the Bangladesh Forestry Research Institute		urban areas; government		Pirojpur, Barguna, Patuakhali Districts
Coastal Towns Environmental Infrastructure Project (44212-013)	This project's overarching aim is to increase climate and disaster resiliency in coastal towns, improving well-being and in particular benefitting the poor and women. Its objectives are to (1) improve climate-resilient municipal infrastructure and (2) strengthen institutional capacity, governance, and public awareness for improved urban planning and service delivery considering climate change and	Asian Development Fund; Strategic Climate Fund; Sanitation Financing Partnership Trust Fund; GOB US$117.1 million	Department of Public Health Engineering; Ministry of Local Government, Rural Development and Cooperatives; LGED, with the ADB	Capacity building; field implementation	Freshwater supply; coastal zone management; disaster risk management; gender; transportation; waste management; buildings; urban areas;	Jun 2014–unknown	National In eight vulnerable coastal pourashavas (secondary towns) of Bangladesh

	disaster risks. Key infrastructure investments include (i) drainage; (ii) water supply; (iii) sanitation; (iv) cyclone shelters; and (v) other municipal infrastructure, including emergency access roads and bridges, solid waste management, bus terminals, slum improvements, boat landings, and markets. This project is part of the Bangladesh PPCR.				government		
Coastal Towns Infrastructure Improvement Project (44212-012)	This project aims to strengthen climate resilience and disaster preparedness in eight vulnerable coastal towns. It is part of the Bangladesh PPCR, investment project 3. The project takes a holistic and integrated approach to urban development and will (i) provide climate-resilient municipal infrastructure, (ii) strengthen institutional capacity, local governance, and public awareness for improved urban planning and service delivery considering climate change and disaster risks; iii) strengthen project management and administration support.	ADB through the Japan Fund for Poverty Reduction; the Bill and Melinda Gates Foundation; GOB US$117.1 million	The LGED will be the executing agency and the Department of Public Health and Engineering a co-executing agency. The participating coastal towns will be the implementing agencies.	Capacity building; field implementation	Freshwater supply; coastal zone management; disaster risk management; transportation; waste management; buildings; urban areas	Mar 2013–unknown	National Eight vulnerable coastal towns: Bhola, Daulat Khan, Galachipa, Kalapara, Amtali, Barguna, Mathbaria, Pirojpur
Coastal Towns Infrastructure Improvement Project (44212-023)	The project aims to improve access to more reliable and climate-resilient municipal services in vulnerable coastal towns (that suffer deficits in basic urban services and are severely at risk to climate change) to ultimately improve the health of their	ADB Special Funds and GOB US$3.5 million	LGED, supported by ADB	Assessment; capacity building	Freshwater supply; coastal zone management; disaster risk management; waste management;	Aug 2012–Oct 2014	National

	inhabitants. The project will provide climate-resilient municipal infrastructure with investments in water supply, sanitation, drainage, urban roads and bridges, solid waste management, slum improvement, and transport facilities. The project will strengthen local governance and capacity for sustainable service delivery and urban planning as well as improve natural disaster preparedness. It is part of the Bangladesh PPCR, investment project 3.				urban areas; government		
CCCP for Bangladesh	The CCCP is a funding mechanism that will finance community-based adaptation sub-projects. The aim is to enhance the capacity of selected communities to increase their resilience to the impacts of climate change. The project has three components: 1. Community climate change fund 2: Knowledge management, monitoring and evaluation, and capacity building 3: Project management	BCCRF; World Bank US$12.5 million	Palli Karma-Sahayak Foundation	Capacity building; knowledge communication; community-based adaptation	Disaster risk reduction; water; multi-sectoral	Dec 2012–Dec 2016	National
Community-based Climate Resilient Fisheries and Aquaculture Development in Bangladesh	This project aims to build the climate change–adaptive capacity of vulnerable fisheries and aquaculture communities in Bangladesh. Activities include building climate-resilient fisheries through relevant national capacity development; strengthening	Least Developed Countries Fund US$20,725,114	FAO in collaboration with the Department of Fisheries	Capacity building; knowledge communication	Aquaculture; freshwater fisheries; marine fisheries	Jul 2014–unknown	National

	knowledge and awareness of fisheries- and/or aquaculture-dependent communities facing the adverse impacts of climate change; enhancing local adaptive capacity to support climate-resilient fisheries and aquaculture management and alternative livelihood in the face of climate change; disseminating best practices, and monitoring and evaluating the lessons learned.						
CDMP II	The project aims to further reduce Bangladesh's vulnerability to adverse natural and anthropogenic hazards and extreme events, including the devastating potential impacts of climate change. It will do so through risk management and mainstreaming. It builds on CDMP I and aims to institutionalize the adoption of risk reduction approaches, not just in its host, the Ministry of Food and Disaster Management, but more broadly across 13 key ministries and agencies.	Norwegian Agency for Development Cooperation; AustralianAID; the EU; the UK Agency for International Development; Swedish International Development Agency US$78.3 million	UNDP is the managing agency, in collaboration with the Ministry of Disaster Management and Relief	Assessment; capacity building,; knowledge communication; policy formation and integration	Disaster risk management; migration; climate information; government; civil society	2010–2014	National
Deltas, Vulnerability and Climate Change: Migration and Adaptation	This project aims to understand adaptation choices in delta regions, with a strong focus on the role of migration as an adaptation strategy, including temporary, periodic, or permanent migration. Working with stakeholders and key decision-makers, and taking gender into account, the project will integrate climate and socio-economic data	DFID and IDRC through CARIAA CAD$13.5 million	University of Southampton: Bangladesh: Institute of Water and Flood Management; Bangladesh University of Technology	Research; capacity building; knowledge communication	Migration; multi-sectoral	Feb 2014 – Nov 2018	Global Bangladesh, India, Ghana, Egypt

	for each delta to assess when migration might be appropriate for the most vulnerable, compared with other adaptation options.		and Engineering; India: Jadavpur University; Egypt: National Authority for Remote Sensing and Space Sciences; Ghana: University of Ghana				
Eco-Engineering, Climate Adaptation and Innovations in Flood Risk Mitigation	The project's main objective is to develop recommendations to the government for integrated flood risk management in Greater Dhaka that takes into account innovative eco-engineering approaches for flood risk mitigation and climate adaptation. It also aims to identify, prioritize, and design pilot activities using eco-engineering approaches to be potentially implemented after the study.	BCCRF US$0.3 million	Bangladesh Water Development Board and the World Bank	Research	Climate information	2013–2015	National Dhaka city
Ecosystem-based Approaches to Adaptation in the Drought-prone Barind Tract and Haor "Wetland" Area	The goal of this project is to reduce the vulnerability of communities to climate change impacts in the Barind Tract and Haor area using ecosystem-based adaptation.	LDC Trust Fund US$5.3 million	UNEP in collaboration with the MOEF	Community-based adaptation	Other: Ecosystem-based adaptation	2013–unknown	National

Himalayan Adaptation, Water and Resilience	The project's main goal is to "contribute to enhanced climate resilience and adaptive capacities of the poor and vulnerable women, men, and children living in these river basins by leveraging research and pilot outcomes to influence policy and practice to improve their livelihoods" (ICIMOD, n.d.).	DFID and IDRC through CARIAA CAD$13.5 million	ICIMOD; Bangladesh Centre for Advanced Studies; The Energy and Resources Institute; Climate Change, Alternate Energy and Water Resources Institute of the Pakistan Agricultural Research Council; and Alterra at Wageningen University and Research Centre	Research; capacity building; knowledge communication	Watershed management; multi-sectoral	Feb 2014– Nov 2018	Regional Bangladesh, India, Nepal, Pakistan
Himalayan Climate Change Adaptation Programme	The program aims: to (1) to increase understanding of the uncertainties influencing climate change scenarios and water availability and demand projections for parts of major river basins in the region, and to encourage use of the knowledge thus created; (2) enhance capacities to assess, monitor, communicate, prepare for, and undertake actions to respond to challenges and opportunities from impacts of climate change and	Norwegian Ministry of Foreign Affairs and the Swedish International Development Cooperation Agency	Led by: Center for International Climate and Environmental Research-Oslo; ICIMOD; GRID-Arendal	Research; assessment; knowledge communication; community-based adaptation	Agriculture; watershed management; climate information	Sep 2011 – Dec 2017	Regional Bangladesh, India, Pakistan, China

	other drivers of change; and (3) make concrete and actionable proposals on strategies and policies (with particular reference to women and the poor) for uptake by stakeholders, including policy makers.						
Increasing Resilience and Reducing Risk of Coastal Communities to Climate Change and Natural Hazards in the Bay of Bengal	The overall objective of the project is to contribute to poverty alleviation amongst the poor communities of coastal areas of the Bay of Bengal, with a focus on reducing their risk to the impacts of hazards and climate change.	European Union	Concern Worldwide, Jagrat Juba Sangha and Sushilan (Bangladesh), and Regional Centre for Development Cooperation (India)	Capacity building; knowledge communication; community-based adaptation	Coastal zone management; disaster risk management; government	Feb 2011 – Jan 2016	Regional Bangladesh, India
Managing Climate Risk for Urban Poor	This project helps cities plan for and invest in reducing the impacts of weather-related changes and extreme events on 2 million urban poor and vulnerable people in 25 medium-sized cities in 6 Asian countries (initially Pakistan, Bangladesh, India, Vietnam, Indonesia, and the Philippines).	UK DFID; ADB; Rockefeller Foundation US$140 million (UK DFID: GBP 85.0 million; Rockefeller Foundation: US$5 million)		Research; capacity building; knowledge communication; policy formation and integration; field implementation	Urban areas	Sep 2013– Dec 2017	Regional Bangladesh, India, Indonesia, Pakistan, Vietnam
Multipurpose Cyclone Shelter Construction Project	This project aims to help protect the population against cyclones. Its objective is to construct 61 new multi-purpose shelters and 11.5 km of connecting roads in five coastal districts.	World Bank through the BCCRF US$25 million	LGED	Field implementation	Disaster risk management; gender; infrastructure (buildings)	Nov 2013– unknown	National
South Asia	This project aims to help several	United Kingdom	World Bank	Research;	Watershed	2013–	Regional

Water Initiative	Asian countries integrate climate change adaptation into integrated water resource management as part of a broader focus on improving transboundary water management and collaboration, improving the knowledge base related to basin and water resources, strengthening water institutions, and supporting investments that promote sustainable development.	through the South Asia Water Governance Programme (£11.5 million); Australian Department of Foreign Affairs and Trade, South Asia Sustainable Development Investment Strategy; Norway		capacity building; knowledge communication; policy formation and integration	management; energy	2017	Bangladesh, India, Nepal, Afghanistan, China, Bhutan
Strengthening the Environment, Forestry and Climate Change Capacities of the MOEF and its Agencies	This initiative seeks to strengthen human and organizational capacity in the country to deliver more effective, coordinated, sustainable, and country-driven investment programs in environmental protection, sustainable forest management, and climate change adaptation and mitigation.	USAID US$4.5 million	FAO in collaboration with the MOEF	Capacity building	Gender; government	Sep 2013–Aug 2016	National
Supporting Implementation of the BCCSAP	The aim of the project is to enhance capacity of the MOEF and other ministries in order to be able to plan and implement BCCSAP projects and therefore strengthen climate-resilient development and low-carbon growth in Bangladesh. Components include (i) preparation of country-specific climate-proofing guidelines for key prioritized sectors in line with the BCCSAP; (ii) formulation of sector-specific programs and projects and national climate change policy; (iii)	ADB US$850,000	ADB with the MOEF (consultations of relevant ministries, line agencies, civil society organizations, private sectors, and research organization)	Capacity building; policy formation and integration	Government	May 2012–Oct 2014	National

	preparation of the program for clean development mechanism and Nationally Appropriate Mitigation Action; (iv) capacity building and knowledge management for enhancement of operational effectiveness.						
Urban Flooding of Greater Dhaka Area in a Changing Climate: Vulnerability, Adaptation and Potential Costs (Analytical Advisory Assistance)	This project aims to fill a knowledge gap on better understanding the impacts of climate change on other urban centres (other than Dhaka), especially implications for the marginalized segments of the society from economic, social, and environmental viewpoints. It also seeks to identify adaptation options and define key policy priorities for decision-makers on dealing with these impacts.	BCCRF US$0.5 million	World Bank	Research; assessment	Urban areas; climate information	Jan 2012–unknown	National Greater Dhaka area

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