

Bangladesh Poverty Watch Report 2024



Institute for Inclusive Finance and Development (InM)
and



Center for Inclusive Development Dialogue (CIDD)

BANGLADESH

Poverty Watch Report 2024

Climate Change and Poverty Nexus

Ending poverty is a political choice

“When I feed the poor, they call me a saint. When I ask why so many people are poor, they call me a communist”. – Dom Hélder Câmara, Brazil’s ‘Archbishop of the poor’



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The Bangladesh Poverty Watch Report 2024 is the third in the series of this Report prepared jointly by the Institute for Inclusive Finance and Development (InM) and Center for Inclusive Development Dialogue (CIDD).

These Reports aim to ensure that grassroots voices of the 'left behind' and disadvantaged and excluded communities are heard, and their voices are reflected in policies. More specifically, Poverty Watch Report 2024 examines the nature, extent and seriousness of climate change-poverty interactions in Bangladesh – one of the most climate change vulnerable countries of the world. In the process, the Report brings out the testimonies, reflections and 'stories' of individuals from selected climate change vulnerable locations experiencing poverty and deprivations in Bangladesh.

The central part of the Report consists of the voices and opinions drawn from face-to-face meetings with individuals from these climate vulnerable locations who participated in the discussion meetings organised during September-December 2024 as part of the research undertaken for preparing this Report. In their 'stories', the participants shared their experience of climate change related hazards that led to their deeper poverty and exclusion; putting them into extremely difficult conditions re-inforced by systemic failures and structural inequalities.

During the discussions, these participants 'wrote' their own life stories; the biggest value added of which is the insights into the 'process of deepening of poverty and deprivation due to climate change related transformations' in their communities. This has been the first step in framing of recommendations for adaptation to climate change related challenges as well as empowerment, inclusion and recognition of their voices in designing policies and measures for their wellbeing and socioeconomic inclusion in fighting climate change challenges.

The Report begins with challenges of global climate change and impacts of climate change especially on rural populations and rural resources impacting the long term development prospects of Bangladesh. The climate change-poverty interactions are analysed in terms of potential transmission channels and their impacts on human livelihoods, rural resources and future sustainability. The Report also highlights the poverty impacts of climate change in selected climate vulnerable areas of Bangladesh using field level data and information, discussion meetings, and case studies, identifying the priority policy agenda for Bangladesh.

The analysis brings out emerging priorities for policies as well as recommendations for policy makers which are intertwined throughout the Report. The key value addition emerges from testimonies, reflections, proposals and 'stories' of persons who are victims of climate change hazards and exclusion.

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Acronyms

4IR	Fourth Industrial Revolution
ADM	Adaptive Delta Management
BBS	Bangladesh Bureau of Statistics
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCCT	Bangladesh Climate Change Trust
BDP	Bangladesh Delta Plan
BINA	Bangladesh Institute for Nuclear Agriculture
BMD	Bangladesh Meteorological Department
BMDA	Barind Multipurpose Development Authority
BWDB	Bangladesh Water Development Board
CCCP	Community Climate Change Project
CFF	Climate Fiscal Framework
CHT	Chittagong Hill Tracts
COP	Conference of the Parties
CSOs	Civil Society Organisations
CVF	Climate Vulnerable Forum
DHS	Demographic and Health Survey
DTWs	Deep Tube Wells
ECAs	Ecologically Critical Areas
EMF	Environmental Management Framework
FCCC	Framework Convention on Climate Change
FGDs	Focus Group Discussions
GBM	Ganges, Brahmaputra and Meghna
GCF	Green Climate Fund
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GNI	Gross National Income
HCR	Headcount Ratio
HDI	Human Development Index
HIES	Household Income and Expenditure Survey
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
IWRM	Integrated Water Resources Management
LDCs	Least Developed Countries
MDGs	Millennium Development Goals
MFS	Mobile Financial Services
MICS	Multiple Indicator Cluster Survey
MPI	Multidimensional Poverty Index
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action Plan
NREL	National Renewable Energy Laboratory
PKSF	Palli Karma-Sahayak Foundation
PRECIS	Providing Regional Effects of Climates for Impact Studies
RMGs	Readymade Garments
SDGs	Sustainable Development Goals
SHSs	Solar Home Systems
SMF	Social Management Framework
SREDA	Sustainable and Renewable Energy Development Authority
STWs	Shallow Tube Wells
UN	United Nations
UNCBD	UN Convention on Biological Diversity
UNDP	United Nations Development Programme
UNFCCC	UN Framework Convention on Climate Change

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Overview

“We need an exit ramp off the highway to climate hell, and the truth is we have control of the wheel.”

UN Secretary-General António Guterres, June 2024

Tackling global climate change and its severe consequences have now become the urgent priority for survival of human beings and our mother planet, the Earth. Climate change refers to long-term shifts in global temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas. Burning fossil fuels generates greenhouse gas (GHG) emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.

Scientific analysis by climate experts shows that humans are responsible for virtually all global heating over the last 200 years. Human activities like the ones mentioned above are causing GHG emissions that are warming the world faster than at any time in at least the last two thousand years. The average temperature of the Earth's surface is now about 1.2°C warmer than it was in the late 1800s (before the industrial revolution) and warmer than at any time in the last 100,000 years. The last decade (2011-2020) was the warmest on record, and each of the last four decades has been warmer than any previous decade since 1850.

Moreover, climate change does not mean warmer temperatures alone. Rising temperature is only the beginning of the story. Because the Earth is a complex system, where everything is connected, changes in one aspect influences changes in all other dimensions as well.

The main GHGs that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving cars or coal for generating electricity, for example. Clearing land and cutting down forests can also release carbon dioxide. Agriculture, oil and gas operations are major sources of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the main sectors causing GHGs. At present, the level of GHG emissions is being rigorously monitored – which are produced by human interventions in the earth's natural system as well as in the living environment including production activities and their value chains. No doubt, the urgency surrounding climate change mitigation is greater than ever; nevertheless, the understanding and awareness for generating such urgency took centuries to materialise. It is only since the late 1970s that climate science started to impact global public policy resulting from the mounting evidence about the significance and severity of climate change for sustenance of human activities and the earth's carrying capacities.

Climate Change: Global Perspectives

The root of climate change is the phenomenon known as the 'greenhouse effect...

The root of climate change is the phenomenon known as the 'greenhouse effect' -- the way that certain atmospheric gases 'trap' heat that would otherwise radiate upward, from the planet's surface, into outer space. On the one hand, greenhouse effect causes the presence of life on earth; without it, the planet would be cold and unlivable. But human activities in recent centuries began to push the greenhouse effect to new levels. As a consequence, the planet Earth is warmer at present than at any point of time in human history, and getting ever warmer day-by-day. This global warming has, in turn, dramatically

¹Global temperatures are rising at the fastest rate since the Industrial Revolution. Swedish scientist Arrhenius first described it in 1896. According to him, the amount of carbon in the atmosphere is constantly increasing due to the burning of fossil fuels. Carbon absorbs heat from the sun and heat scattered from the earth.



altered natural cycles and weather patterns, with impacts that include extreme heat, protracted drought, increased flooding, more intense storms, and rising sea levels. Taken together, these deadly effects are what have come to be known as climate change. Some degree of climate change may be attributed to natural phenomena such as volcanic eruptions, fluctuations in solar radiation, tectonic shifts, and even small changes in earth's orbit. These are, however, very small and without noticeable consequences.

The GHGs produced by humans are the primary cause of the world's fastest rate of warming

The atmosphere contains various gaseous elements such as nitrogen, oxygen, carbon dioxide, argon, and water vapor. However, a variety of gases added as a result of different human activities are destroying this natural balance. As a result, temperature of the earth is gradually increasing. Coal, peat, petroleum, natural gas, and other fossil fuels are extensively used by humans in manufacturing, transportation, power generation and other activities. Due to increasing consumption of energy and ongoing industrialisation, carbon dioxide gas has been emitted to the atmosphere in increasing amounts during the past 200 years and the process has become more extensive in recent decades.

According to the scientists, carbon dioxide in the atmosphere has increased three times over the last 200 years due to massive deforestation and the use of mineral oil as fuel. More than three-quarters of the world's carbon dioxide is produced by the production and use of fossil fuels.

Climate change is caused not only by excessive carbon emissions, but also because of persistent destruction of carbon sinks by indiscriminate deforestation of the extensive forest cover of the earth including the rainforests around the world, valuable resources for carbon sequestration. The world is facing significant threats due to various environmental issues as well, such as deforestation, river pollution, dam construction, biodiversity loss, air pollution, and ecosystem destruction. Additionally, industrialisation causes billions of tons of hazardous sulfur fumes from factories to combine with atmospheric water each year to create sulfuric acid, also referred to as acid rain.

The Earth's solar radiation, crust formation, and volcanic eruptions are all factors that contribute to its climate change but these are minor events contributing little to climate change. It is important to realise that, from the social, political, economic, and globalisation perspectives, climate change is by and large caused by human activities throughout the world, which greatly contribute to the transformation of global warming. Although there is a natural balance between various gases, water vapor, and other elements in the earth's atmosphere, the Arctic ozone layer located in the stratosphere has been depleted since the beginning of the 19th century due to addition of excessive ozone gas, chlorofluorocarbons (CFCs), to the atmosphere. As a result, the ultraviolet rays of the sun passing through the thin gas layer of ozone are creating a serious negative impact on the environment. It is this ozone layer that protects the balance of the environment by carefully filtering the ultraviolet rays like a filter. This ozone depletion is more visible in the Northern Hemisphere. Ultraviolet rays damage the human skin and cause serious diseases, including cancer in the body. It also has harmful effects on animals and plants. Although the ice of the northern and southern hemispheres and the snow cover of the South Pole are going on naturally, the warming of the earth's surface is increasing due to the influence of the industrial revolution and other human activities. As a result, the polar ice is melting rapidly. 'Sea inflation' is observed due to this melting water. And this is likely to cause an environmental disaster. As a result, many island countries, coastal and low-lying countries may be completely or partially submerged in the sea.



The amount of carbon dioxide in that will be stored in the atmosphere by the middle of 2150 will be more than twice the level before the industrial revolution...

According to the Intergovernmental Panel on Climate Change (IPCC), even if there is a positive change in the course of development, the amount of carbon dioxide that will be stored in the atmosphere by the middle of 2150 will be more than twice the level before the industrial revolution. If the amount of carbon dioxide in the atmosphere doubles, the average temperature of the earth will increase by 1.5 to 4.5 degrees Celsius. Current global emissions will not achieve a steady state of carbon dioxide in the atmosphere by 2100. For this, the carbon dioxide emission rate should be lower than the emission of 1990. If the current emission rate does not increase, by the year 2100, the amount of carbon dioxide in the atmosphere will increase by 40 per cent of the current level, and it will continue to increase. Due to environmental pollution, environmental degradation, natural disasters, etc., the massive damage to the earth at local, regional, and continental levels will not only bring disaster for a particular country, but it will have an adverse effect on more or less all countries. Bangladesh has already become one of the most endangered and vulnerable countries in the world due to climate change.

Sea level may rise by up to 1.1 meters by 2100. Weather will behave dangerously due to an increase in sea temperature ...

By 2100, sea level may rise by up to 1.1 meters. Weather will behave dangerously due to an increase in sea temperature. Sea storms and tides will increase. Scientists predict large-scale floods worldwide by 2050, with damage increasing by 2 to 3 times due to the steady warming of seas and oceans since the 1970s. The ocean absorbs 90 percent of the excess heat generated in the environment. Since 1993, this level of absorption has increased by two times. As a result, the ice in Greenland and Antarctica is melting. From 2007 to 2016, the rate at which Antarctic ice is melting is three times that of the previous 10 years. Glaciers in the Andes, Central Europe, and Northern Asia are likely to melt up to 80 percent by 2100. Rising sea temperatures will affect fisheries, aquatic plants and ecosystems. The level of mercury in the body of the fish will increase. Aquatic animals will change their habitat.

The surface temperature is increasing to such an extent that the goal of limiting the global temperature announced in the Copenhagen and Paris agreements is no longer working...

The surface temperature is increasing to such an extent that the goal of limiting the global temperature announced in the Copenhagen and Paris agreements is no longer working. The United Nations Climate Change Conference held in Paris in 2015 (COP 21) pledged to limit global warming to below 2°C by 2030 and reduce GHG emissions to below 1.5°C by 2050. Apart from this, initiatives were taken to create a climate fund to deal with the damage. Rich and industrialised countries pledged \$100 million in aid. But many developed countries are still behind in depositing money. According to the agreement, there is a reduction in GHG emissions, but the industrialised countries are not complying with it.

The Montreal Protocol of 1987 mandated that countries around the world phase out the use of substances found to deplete the ozone layer of the Earth's atmosphere. The United Nations (UN) established the Intergovernmental Panel on Climate Change (IPCC) in 1988 to advance scientific knowledge about climate change caused by human activities. In 1997, the Kyoto Protocol became the first international treaty to set legally binding targets for developed countries to cut GHG emissions. The Paris Agreement in 2015 brought developing nations into the fold, with emissions targets for nearly 200 signatories. The new agreement aimed to prevent the global average temperature from rising more than 2 degrees Celsius above preindustrial levels. In the same year, UN adopted 17 Sustainable Development Goals (SDGs), which included emphasis on adopting sustainable energy systems, sustainable forest management and lowering emissions.



In its sixth assessment report, issued in 2023, IPCC predicted that significant and timely mitigation and adaptation efforts would reduce the adverse impacts of climate change on humans and ecosystems. The Panel noted that since its fifth assessment report, issued in 2014, policies and laws on climate change mitigation have expanded.

Limiting global temperature rise to no more than 1.5°C would help avoid the worst climate impacts...

Although every increase in global warming matters, there has been a broad agreement in the 2015 Paris Agreement that limiting global temperature rise to no more than 1.5°C would help the earth to avoid the worst climate impacts and maintain a livable climate. Yet policies and mitigation measures currently in place point to up to 3.5°C of warming by the end of the century.

Ongoing mitigation efforts have not as yet generated tangible impact on climate change, including changing weather patterns and extreme weather events...

However, ongoing mitigation efforts have not as yet generated tangible impact on climate change, including changing weather patterns and extreme weather events. In recent years, an increase in droughts, heat waves, wildfires and intense precipitation have been attributed to climate change, as well as to sea level rises and declines in Arctic sea ice.

These alarming trends point out the urgency to redouble global efforts to reduce GHG emissions and fight climate change. Such efforts include improving energy efficiency, transitioning to renewable energy sources and other measures to achieve net zero or carbon neutral outcomes.

In recent times, the high-level participation at the COP26 in Glasgow in 2021 and COP27 in Sharm-el-Sheikh in 2022 have brought out the grave concerns of world leaders as well as the scientists and policymakers regarding the disastrous consequences of climate change on human civilisation and the Earth itself.

The COP28, held in Dubai in 2023, adopted an ambitious response to transition away from fossil fuels to reach net zero along with encouraging all countries to submit economy-wide nationally determined contributions (NDCs). It also covered a new specific target to triple renewables and double energy efficiency by 2030, and build momentum behind a new architecture for climate finance.

The Action Agenda of COP28 spans the four pillars of the Paris Agreement: (i) fast tracking a just and orderly energy transition; (ii) fixing climate finance to make it more available, affordable, and accessible; (iii) focusing on people, nature, lives and livelihoods; and (iv) fostering full inclusivity in climate action. It also reached an agreement on loss and damage, and advanced the Global Goal on Adaptation (GGA) especially on energy transition. The most critical challenge of the agreement reached at COP28 is to start transitioning away from oil, coal and gas during this decade, to reaching net zero by 2050.

Box 1.1: Climate catastrophe and big polluter

The fact is that the world is way off track for preventing a 'climate catastrophe'. Climate activists and scientists are raising alarm that time is running out to reduce GHG emissions and slash fossil fuels. Available estimates show that 50 billion metric tons of planet-heating gases were released to the earth's atmosphere in 2022. Most of the world's planet-heating pollution comes from just a few countries. The top 20 global climate polluters — dominated by China, India, United States and European Union — were responsible for 83 percent of emissions in 2022. What these countries do to respond to the climate crisis has a tremendous impact on the rest of the world. By contrast, 47 least developed countries (LDCs) accounted for only 3 percent of global GHG emissions.

A different picture emerges when we look at per capita emissions, which represent the climate pollution



produced by the average person in each country. China is the biggest emitter overall, but the average American is responsible for nearly twice as much climate pollution as an average Chinese. And in densely populated India, one of the world's biggest climate polluters, per capita emissions are significantly below the global average. The world is heading towards nearly 3 degrees of global warming, even if current climate policies are met, the UN has warned.

Under the 2015 Paris Agreement, countries pledged to keep global warming below 2 degrees Celsius, with the ambition of limiting it to 1.5 degrees Celsius. Years of international climate actions have been helping to put the world on the right path. But the pace is still far too slow. This, however, doesn't mean there's any less urgency. "Every fraction of a degree makes a very big difference in impacts on the ground". The difference between 1.5 and 2 degrees means hundreds of millions more lives will be at risk from extreme weather events. And for some ecosystems, it's a death sentence.

For the big polluters, there's a long way to go. These countries are starting from such high levels of emissions, that there is still a considerable distance to reach net zero by 2050 — the plan to reduce planet-heating pollution as close to zero as possible, and remove from the atmosphere whatever remains. Furthermore, 'what causes climate change today is not just the amount of emissions that occurred this year; it's all emissions that have occurred at least since the industrial revolution'. Not only do developed countries bear a greater historical responsibility for climate change, they have built their economies — and their wealth — on it. This means wealthy countries have a responsibility to slash emissions faster and reach net zero goals sooner.

The concept of fairness when it comes to climate action has long been a debated topic. At the COP28 climate summit in Dubai, countries formally adopted a fund to help nations hit hardest by the climate crisis, and pledged more than \$700 million dollars. But the amount is much too little to reduce planet-heating pollution to meet their 'fair share' of emissions reductions by 2030 to put them on course to meet the 1.5-degree target. Despite the Summit's final agreement noting trillions of dollars are needed every year to help them cope with climate change, it included no requirements for rich countries to give more.

It reflects the reality that every country needs to act on climate change, but not all at the same pace. The fact is that the developed countries have emitted so much over the last nearly 200 years that they are now ethically and morally responsible for climate action. "There is no one single answer" to the question of who should do what when it comes to climate change. "It's not about physics. It's not about math. It's not about climate science. It's about decision and policy and diplomacy".

Source: Climate Action Tracker

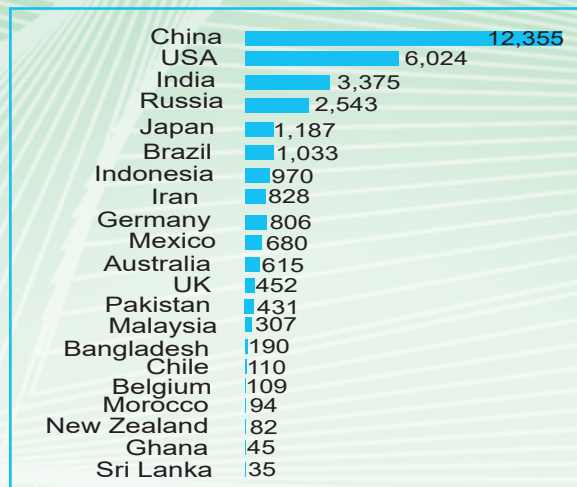
Over time, human activity is the primary driver of what is being observed at present worldwide. This climate change is referred to as 'anthropogenic', meaning 'caused by human beings'...

The present global warming is much faster than ever before. Over time, human activity is the primary driver of what is being observed at present worldwide. This climate change is referred to as 'anthropogenic', meaning 'caused by human beings'. The unchecked burning of fossil fuels has drastically increased the presence of atmospheric GHGs, most notably carbon dioxide. At the same time, logging and development have led to widespread destruction of forests, wetlands, and other carbon sinks—natural resources that store carbon dioxide and prevent it from being released into the atmosphere. Presently, atmospheric concentrations of GHGs like carbon dioxide, methane, and nitrous oxide are the highest since human history. Due to continuous release of these gases into the air, the earth's average temperature has risen by about 1.9 degrees Fahrenheit during the 20th century—which has created the current era of deadly and increasingly routine weather extremes. It is also significant that, while climate change affects everyone in some way, it does not affect everyone and all countries equally: across the world, ecologically vulnerable and more climate change affected countries and poor people living in economically disadvantaged or marginalised communities bear a much larger burden, despite the fact that these communities play a much smaller role in warming the planet.



Figure 1.1: GHG Emitters, 2018 (selected countries)

Emissions in tonnes of carbon dioxide equivalent

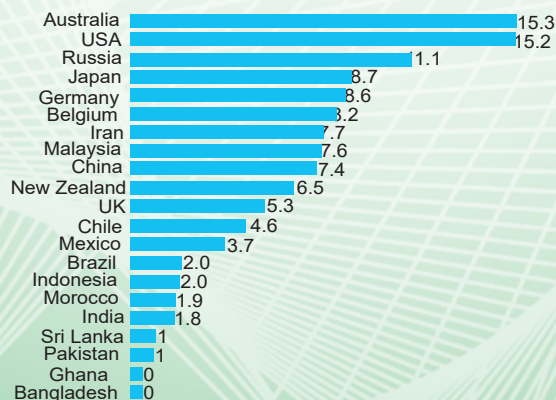


Source: WRI (2018).

In fact, ways in which power for electricity, heat and transportation are generated; built environment and industries; ways of interacting with the land; consumption habits; and other activities of human beings together serve as primary drivers of climate change. Although major changes are occurring as renewable energy sources like wind and solar become cheaper and easier to develop that are replacing fossil fuel sources, but these are not moving fast enough.

The present compulsion is to keep the earth's average temperature from rising not more than 1.5 degrees Celsius, which is needed in order to avoid the very worst impacts of climate change. This means every available opportunity needs to be availed to speed up the shift from fossil fuels to renewables in the electricity sector. Similarly, factories and facilities that produce goods and services for human consumption are significant sources of GHGs. One way to reduce industrial sector's carbon footprint is to increase efficiency through improved technology and stronger enforcement of pollution regulations. Another way is to rethink attitudes towards consumption (e.g. plastics), recycling, and reuse—so that production levels can be minimised. And, since infrastructure developments rely heavily on industries like cement manufacturing, policy initiatives are needed to grow markets for cleaner alternatives and adopt more sustainably produced materials.

Figure 1.2: Per Capita GHG Emissions (in tonnes), 2018



Source: World Bank (2021).



In agriculture, advent of modern input-intensive production has significantly altered the vital but delicate relationship between soil and the climate—so much so that agriculture has now emerged as a major source of GHG emissions. Agriculture releases large amounts of nitrous oxide and methane, powerful gases that are highly effective in trapping heat. The widespread adoption of chemical fertilisers, combined with certain crop-management practices that prioritise high yields over soil health, makes agriculture as the major contributor of nitrous oxide in the atmosphere. Meanwhile, large-scale livestock production continues to be a significant source of atmospheric methane, which is emitted as a function of the digestive processes of cattle and other ruminants. The use of land according to sustainable principles— for example, adopting methods associated with regenerative agriculture – emissions can be reduced while boosting the soil's capacity for sequestering carbon from the atmosphere and producing healthier foods.

Box 1.2: Challenge for biggest emitters in line with 1.5°C pathways

On the climate change front, getting the world on track will necessarily have to start with the biggest emitters. The recommended 2035 targets -- that would be in line with domestic pathways towards 1.5°C -- for seven of the world's biggest emitters: **China, USA, India, EU, Indonesia, Japan, and Australia.** **Together, these seven large emitters are responsible for 60 per cent of global GHG emissions in 2022. As such, they need to show international leadership to drive climate action. The Troika countries (UAE, Azerbaijan and Brazil), who have released roadmap to 1.5°C, but all plan to extract more fossil fuels: a massive mismatch between words and action. The ten countries together produce a total of 63 percent of global emissions.**

Additionally, the developed countries need to continue to supplement their domestic action with significant financial and other support for developing countries to constitute an equitable contribution to the 1.5°C limit. The reality is that most developing countries can only implement required climate action with significant financial, technical and other commitments and support. The high ambition in line with 1.5°C for these countries can be summarised as follows:

What is needed for 1.5°C aligned NDC targets					
Targets aligned with 1.5°C MODELLED DOMESTIC PATHWAYS	Change from BASE YEAR	2030		2035	
		INCLUDING land use & forests	EXCLUDING land use & forests	INCLUDING land use & forests	EXCLUDING land use & forests
MAJOR EMITTERS					
China	below 2023 levels	66%	55%	78%	66%
United States	below 2005 levels	65%	58%	80%	
India Conditional NDC	above 2005 levels	25%	50%	5%	18%
European Union	below 1990 levels	at least 68%	at least 62%	at least 78%	at least 74%
Indonesia Conditional NDC	below 2019 levels	28%	7%	51%	22%
Japan	below 2013 levels	69%	66%	81%	78%
Australia	below 2005 levels	62%	44%	77%	59%
TROIKA COUNTRIS					
Brazil	below 2005 levels	75%	13%	85%	25%
UAE UAE	below 2019 levels	21%	17%	43%	39%
Azerbaijan	below 1990 levels	64%	60%	77%	73%

** Nov 2024 update

Source: Climate Action Tracker



Fossil fuel is a major source of methane; while methane is a less prevalent GHG than carbon dioxide, it is much more potent at trapping heat especially during the first twenty years of its release into the atmosphere...

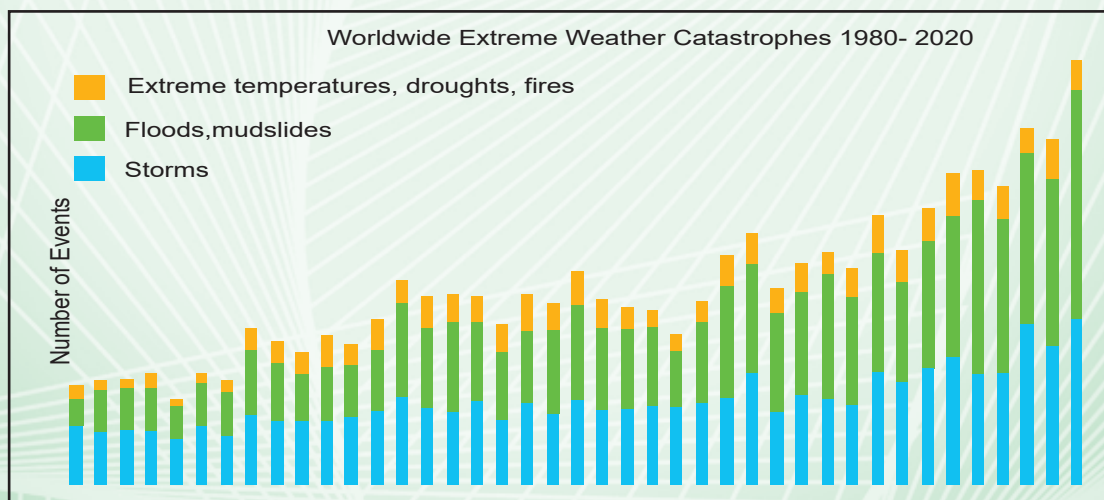
From the climate change perspective, oil and gas lead to emissions at every stage of their production and consumption—not only when these are burned as fuel, but as soon as a hole is drilled in the ground to begin extracting them. Fossil fuel is a major source of methane; while methane is a less prevalent GHG than carbon dioxide, it is much more potent at trapping heat especially during the first twenty years of its release into the atmosphere.

Even buildings—both residential and commercial—emit a lot of GHGs. These come from heating, cooling, cooking, running appliances, and maintaining other building-wide systems. The key is to ensure energy efficiency, allowing achieving the same (even better) results with less energy expended -- by employing highest efficiency standards and using most appropriate technologies to reduce emissions while ensuring quality standards of housing facilities and environmental justice.

Another path of injecting more GHG into the atmosphere is through deforestation and degradation of wetlands. Vegetation and soil store carbon by keeping it at ground level or underground. Through logging and other forms of ecosystem changes, vegetative biomass is transformed releasing stored carbon into the air. Policies that emphasise sustainable practices -- combined with shifts in consumer behaviour -- are needed to offset this and restore the planet's carbon sinks.

Further, individual decisions in everyday life -- products to purchase, food habits, food waste, life style and others -- add up to humanity's collective carbon footprint. The first step in reducing it is to acknowledge the uneven distribution of climate change's causes and effects, and for those who bear the greatest responsibility for global GHG emissions to reduce them without bringing further harm to those who are least responsible.

Figure 1.3: Worldwide extreme weather catastrophies, 1980-2020



People are experiencing climate change in diverse ways...

Climate change can affect human health, ability to grow food, housing, safety and work. Some are already more vulnerable to climate impacts, such as people living in small island nations and other developing countries. Conditions like sea-level rise and saltwater intrusion have advanced to the point where whole communities have had to relocate, and protracted droughts are putting people at risk of famine. In the future, the number of people displaced by weather-related events is expected to rise.



The consequences of climate change cover a wide range of impacts on physical environments, human beings and living creatures...

The consequences of climate change include, among others, heat waves, intense droughts, irregular rainfall patterns, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms, salinity intrusion, and declining biodiversity. Humans experience climate change effects in diverse ways. For instance, climate change can affect the health status, food production, housing, human safety, ability to work and labour productivity. Conditions like sea-level rise, saltwater intrusion and river erosions force communities to relocate, and protracted droughts put people at risk of food deficiency and malnutrition.

Global community faces a huge challenge but already many solutions are known....

Adapting to climate consequences protects people, homes, businesses, livelihoods, infrastructure and natural ecosystems. It covers current impacts and those likely in the future. Adaptation will be required everywhere, but must be prioritised now for the most vulnerable people with the fewest resources to cope with climate hazards. The rate of return can be high. Early warning systems for disasters, for instance, save lives and property, and can deliver benefits up to ten times the initial cost.

Many climate change solutions can deliver economic benefits while improving human lives and protecting the environment...

Many climate change solutions can deliver economic benefits while improving human lives and protecting the environment. Global frameworks and agreements are available to guide progress, such as the Sustainable Development Goals (SDGs), UN Framework Convention on Climate Change (FCCC) and the Paris Agreement. Three broad categories of action are available: (i) reduce emissions; (ii) adapt to climate impacts; and (iii) finance required adjustments.

Switching energy systems from fossil fuels to renewables like solar or wind reduce the emissions driving climate change. While a growing number of countries is committing to net zero emissions by 2050, emissions must be cut in half by 2030 to keep warming below 1.5°C. Achieving this means huge declines in the use of coal, oil and gas: production and consumption of all fossil fuels need to be cut by at least 30 percent by 2030 in order to prevent catastrophic levels of climate change.

Adapting to climate consequences protects people, homes, businesses, livelihoods, infrastructure and natural ecosystems...

Adapting to climate consequences protects people, homes, businesses, livelihoods, infrastructure and natural ecosystems. It covers current impacts and those likely in the future. Adaptation is needed everywhere, but the key is to prioritise now for the most vulnerable people with the fewest resources to cope with climate hazards. With the right priority, the social rate of return will be very high. Early warning systems for disasters, for instance, save lives and property, and can deliver benefits up to 10 times the initial costs.

Climate action requires significant financial investments by the governments, businesses and households. On the other hand, climate inaction can be vastly more expensive. The critical step is for developed countries to support developing countries so that they can adapt and move towards greener environment.

Thus, the major climate-affecting decisions are shaped, at the end, by humans – their needs, demands and priorities. Winning the fight against climate change requires a rethinking of these needs, limiting the demands and resetting the priorities. The need is to move swiftly to collective action—fueled by human ability to change the world for the better.



The humanity is on a highway to climate hell and the need is to avail an exit ramp off the highway...

As the UN Secretary-General António Guterres has observed in June 2024, the humanity is on a highway to climate hell and the need is to avail an exit ramp off the highway; and he is hopeful that the humans have the control of the wheel. But, the fact is that the drivers, particularly the lead drivers (big GHG polluters) responsible for the climate debacle that humanity now faces, are not yet working together in taking the exit. Science clearly exemplifies how fast climate change is intensifying and why and how the worsening consequences are playing havoc with the planet Earth and its inhabitants.

As noted above, global climate change is caused by global warming which, in turn, is the outcome of concentration in the atmosphere of GHGs emitted by different types of human activities. Despite global commitments on declining GHG emissions by mid-2010s, it has continued to increase every year till now. Global atmospheric concentration of most GHGs together in terms of carbon dioxide crossed 400 PPM in 2015. Since then, the increase was an average of 2.2 PPM per year up to 2023, when the total concentration crossed 421 PPM (Ahmad, 2025). After 2023, there has in fact been acceleration in GHG emissions, with the total concentration rising by 3.53 PPM in 2024 compared with 2023 and by a projected 4.99 PPM in May 2025 compared with 2024. The projected total concentration of 429.60 in May 2025 is the highest in over 2 million years (Ahmad, 2025).

The 2015 Paris Agreement on climate change set the goal of global warming by end of this century at 1.5°C or well below 2°C above the pre-industrial levels for the earth to remain livable. Global efforts in this regard are pledged by countries of the world in their nationally determined contributions (NDCs). Even if the latest NDCs are fully implemented by all countries, the efforts will fall well short of the needful in the context of the Paris target of 1.5°C. In fact, given the actions outlined in the existing NDCs, the increase in global warming will likely be a catastrophic 2.5-2.9°C by the end of this century (Ahmad, 2025). According to Inter-governmental Panel on Climate Change (IPCC), in order to remain on course for the target of 1.5°C global warming, all GHG emissions must be cut by 43 per cent and CO₂ emissions by 48 per cent by 2030, 60 per cent and 65 per cent respectively by 2035, and 84 per cent and 99 per cent respectively by 2050 compared with 2019 (Ahmad, 2025). Thus, while science shows the way to exit the expressway to climate hell, the global emitters, particularly the major GHG emitting countries, have been failing to come together to act to reduce GHG emissions in terms of the dictates of science. Hence, the march towards climate hell continues and, in fact, it is accelerating as global GHG emissions have been increasing, despite ever increasing impacts of more frequent and devastating natural disasters of various types caused by the fast worsening climate change impacts on natural and human systems as well as in terms of human health all around the world.

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted by the Earth Summit in Rio de Janeiro, Brazil in 1992. Currently, the number of parties to the convention (member countries) is 198. The first Conference of the Parties (COP) held in 1995 focused on mitigation and that focus continued up to 2007. In COP13 held at Bali, Indonesia in 2007, the scope of debates and negotiations was extended to include adaptation, shared vision, finance and technology. Since then, the so called negotiations on all the above-mentioned fronts and related issues have been taking place annually in COPs, as well as in other forums. And, of course, altogether a huge amount of money is spent for organising and attending these meetings which cause substantial amount of GHGs to be



emitted as well. But, regardless of what has been happening in COPs, the issue in combatting climate change is mitigation; in fact, drastic reduction in global GHG emissions as per IPCC findings is crucial in this regard. But, the issue of fossil fuels, the most important source of GHGs, was not even discussed until in COP26 in 2021, where a phasing down of the use of fossil fuels was agreed instead of the originally proposed phasing out (Ahmad, 2025). However, no progress in respect of accelerating the mitigation process was reported at COP29 in 2024, despite the fact that global GHG emissions have been increasing continuously expediting the intensification of climate change.

In addition, the adverse impacts of climate change are exacerbated by wide-scale biodiversity loss and vice-versa. UN Convention on Biological Diversity (UNCBD), which became operational in 1993 and currently has 196 states as parties, has also been of little avail. The 16th CBD COP was held in 2024. But, the convention has failed to generate effective global cooperation to make an impression on the continued bio-diversity decline.

On climate finance, which is vital especially for developing countries, a core annual financing of \$300 billion by 2035 was agreed in COP29. In fact, the delivery was promised after 11 years from the time of commitment. It may be recalled that when climate finance of \$100 billion was pledged in 2009 that was also to be implemented after 11 years, in 2020. If the similarity extends to delivery, then the climate finance pledge may not also be properly delivered ((Ahmad, 2025). Moreover, the amount is too little as the requirement runs into trillions of dollars. It may also be noted that the developed countries are now very lukewarm regarding public sector climate finance. They emphasise that private sector must be tapped for climate finance more and more. But, the private sector remains limited in this regard up to now and is very unlikely, it would appear, to come forward meaningfully in foreseeable future. Further, a very recent setback is the withdrawal of USA from the Paris Agreement once again.

The year 2024 was the hottest on record and 2025 may surpass 2024 in this regard. It may also be noted that the outcome of the latest UN Climate Change Conference (COP29), held in November 2024 at Baku, Azerbaijan has, by and large, been less enthusiastic.

The Green Climate Fund (GCF), which was created as the leading multilateral funding mechanism for climate actions, has not been able to make much of an impact in terms of actually funding climate actions in developing countries because of fund replenishment issues limiting its capacity and its lengthy decision making process (3 to 4 years) on projects submitted (Ahmad, 2025). Thus, the reality shows that the climate vulnerable resource-poor countries (such as Bangladesh) will continue to suffer the ever increasing adverse impacts of climate change. The losses and damages due to climate change suffered by the developed countries are also increasing immensely.

Therefore, while an exit from the expressway to climate hell exists and it is known how to go about taking advantage of it, all countries of the world are not moving together to act urgently on the basis of the principle of common but differentiated responsibilities and respective capabilities (CBDR & RC). This brings out the stark reality: the fast track journey of the world towards a climatic catastrophe, as of now, remains on course. suffered by the developed countries are also increasing immensely.

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Climate Change and Bangladesh

Bangladesh's low level of development, combined with factors such as its geography and climate, makes the country extremely vulnerable to climate change. Bangladesh belongs to one of the largest deltas in the world which is highly vulnerable to natural disasters due to its geographical location, flat and low-lying landscape, population density, poverty, and other socioeconomic characteristics.

The reality is that Bangladesh, in effect, makes no contribution to climate change and its worsening. The country's contribution to global GHG emission is an insignificant 0.4 per cent of the annual global total. As such, mitigation is not a priority for Bangladesh...

Bangladesh is one of most climate vulnerable countries of the world mainly due to its location, geographical characteristics and the size of population. The country is deltaic, low-lying and is located at the bottom of three major river systems – the Ganges, Brahmaputra and Meghna (GBM). Bangladesh has a coastline of 710 km along the Bay of Bengal; and about one-fourth is less than 7 feet and two-thirds of the country are less than 15 feet above the sea level. The country is also criss-crossed by a large number of rivers.

With a population of nearly 176 million in 2025 and an area of 148,460 km², the density of population is about 1,300 people per sq. km, which is highest in the world except for a few city states such as Singapore. The geographic reality of Bangladesh makes it particularly prone to natural disasters while the country's high population density means that a similar natural disaster harms a much larger number of people in Bangladesh than in any other country. The country is also resource-poor so that its ability to combat the climate change impacts is very limited.

The reality is that the country, in effect, makes no contribution to climate change and its worsening. The country's contribution to global GHG emission is an insignificant 0.4 per cent of the annual global total. Natural disasters are not uncommon in Bangladesh since the past; but the occurrences were few and far between. In recent decades, with intensifying climate change, both frequency and intensity of different kinds of natural disasters have increased, causing more losses and damages. These natural disasters include erratic rainfall, flood, cyclone, sea level rise, storm surges, coastal inundation, salinity intrusion, river erosion and disaster-induced displacement of people. The burgeoning adverse impacts fall on various socioeconomic and infrastructure sectors and human health, undermining both economic and social development prospects of the country. Even poverty, unemployment and food security issues have become increasingly difficult to address with the increasing adverse impacts of climate change. Thus, the fast worsening climate change constitutes a severe obstacle to Bangladesh's sustainable development.

Bangladesh's location at the tail end of the fragile delta formed by the Ganges, Brahmaputra and Meghna Rivers makes it more exposed to tropical cyclones than any other country; it also experiences about two-fifths of the world's storm surges every year...

Its location at the tail end of the fragile delta formed by the Ganges, Brahmaputra and Meghna Rivers makes it more exposed to tropical cyclones than any other country; it also experiences about two-fifths of the world's storm surges every year². The total land area consists mostly of floodplains (almost 80 percent) leaving the country (with the exception of north-western highlands) prone to flooding during the rainy season. Moreover, the adverse effects of climate change -- especially high temperature, sea-level rise, cyclones and storm surges, salinity intrusion, heavy monsoon downpours -- significantly aggravate the country's development challenges.



According to the World Bank, per capita gross national income (GNI) of Bangladesh is \$2,880 (using Atlas method) in 2023 which is nearly 21 per cent above the average South Asian per capita income of \$2,388.³ In 2022, nearly one-fifth (18.5 per cent) of the country's population is reported to be living in poverty; and poverty is higher in rural areas compared with urban areas. Less than 15 per cent of the country's GDP comes from agriculture that is critical for food security and nutrition; and this makes the country's economy sensitive to climate variability and change. Bangladesh is widely recognised as one of the most climate vulnerable countries in the world. It experiences frequent natural disasters, which cause loss of life, damage to infrastructure and economic assets, and create adverse impacts on lives and livelihoods, especially of the poor people.

The geographical location and geo-morphological conditions of Bangladesh have made the country one of the most vulnerable ones to climate change...

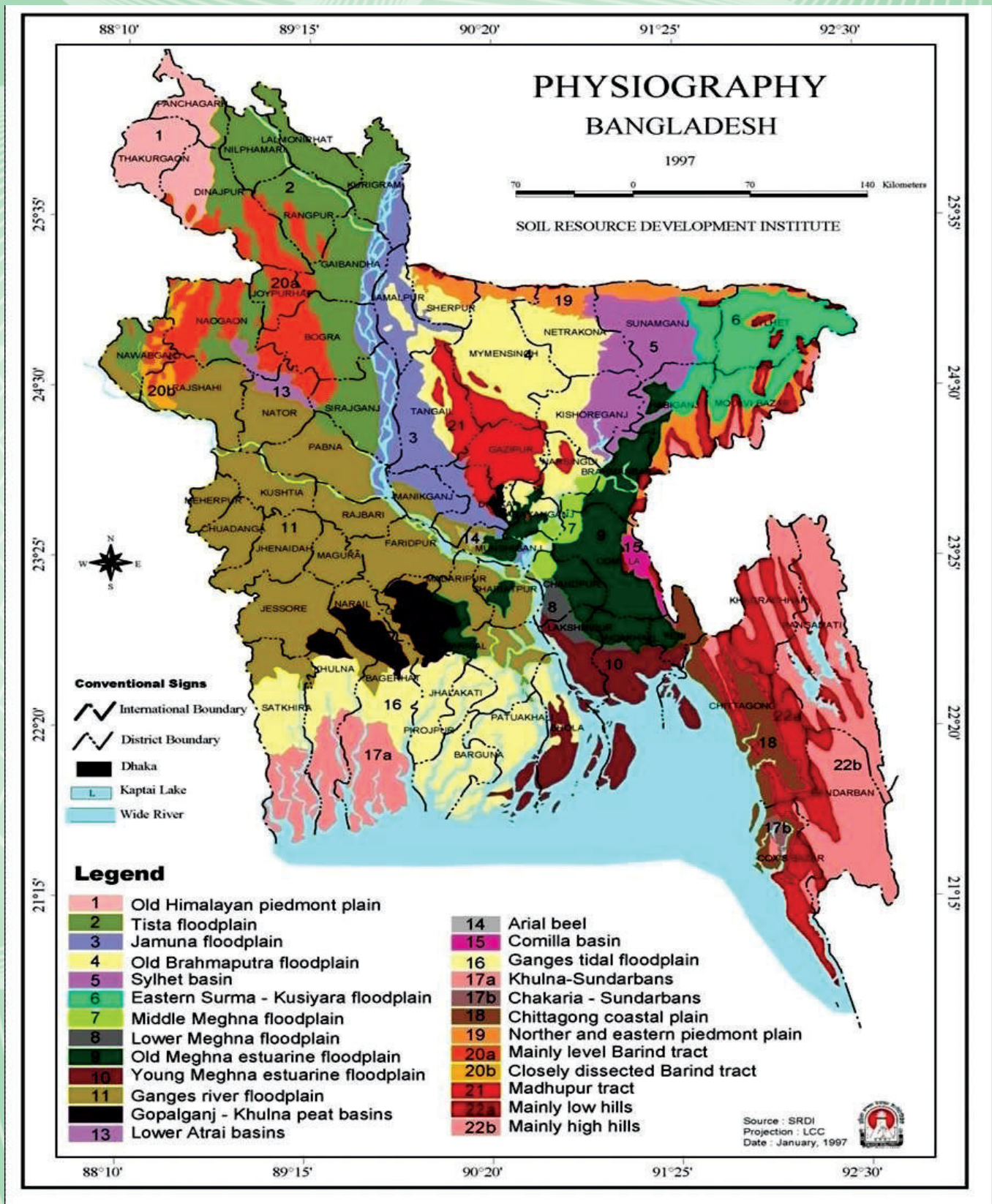
Most of the climate change impacts in Bangladesh come from the south—that is, the Bay of Bengal and the adjoining North Indian Ocean (Figure 1.4). These waters are the sources of tropical cyclones and storm surges, coastal erosion, monsoon wind, evaporation for monsoon rainfall, floods, and droughts. The geographical location and geo-morphological conditions of Bangladesh have made the country one of the most vulnerable ones to climate change. The country has a very low and flat topography, except the northeast and southeast regions. About 10 per cent of the country is hardly 1 meter above the mean sea level (MSL), and one-third is under tidal excursions. About two-thirds of the country are less than five meters above sea level, and floods increasingly inundate homes, destroy farm production, close businesses, and shut down public infrastructure. Erosion leads to an annual loss of about 10,000 hectares of land and weakens natural coastal defenses and aquatic ecosystems. Fresh water has become scarcer in Bangladesh's drought-prone northwest and in southwest coastal areas where about 2 million poor residents regularly suffer from shortages of drinking water and water for irrigation. Further, their coastal aquatic ecosystems have been severely compromised. Salt water intrusion from sea level rise in low-lying plains has also intensified the risk of food insecurity, the disappearance of employment opportunities for agricultural workers, and the spread of water-related diseases.

² According to the 2015 Climate Change Vulnerability Index, Bangladesh's economy is more at risk to climate change than any other country in the world. The World Bank estimates that economic losses in Bangladesh over the past 40 years stand at an estimated \$12 billion, depressing GDP annually by 0.5 to 1 percent. Especially devastating storms that come along every few years have an enormous impact – such as the 2007 cyclone Sidr, which wrought an estimated \$1.7 billion in damages, or about 2.6 percent of GDP on top of \$1.1 billion losses due to monsoon flooding in the previous 12 months. In May 2009, 3.9 million Bangladeshis directly suffered from the impact of Cyclone Aila, which caused an estimated \$270 million in asset damage.

³ See, World Development Indicators 2023, World Bank, Washington DC, 2023



Figure 1.4: Map of Bangladesh



Bangladesh. With regard to precipitation, whether there is an increase or decrease under climate change is a critical factor in estimating how climate change will affect Bangladesh given the country's extreme vulnerability to water related disasters. The key is what happens during the monsoon. More than 80 per cent of the 2,300 mm of annual precipitation that falls on Bangladesh comes during the monsoon period (April-August) and the prediction is that precipitation will increase during the summer monsoon. Moreover, with higher temperatures increasing evapo-transpiration combined with a small decrease in precipitation, dry winter conditions, even drought, are likely to be made worse.

Bangladesh currently has extreme vulnerability to cyclones, both on account of its somewhat unique location and topography (that creates an inverted funnel effect), and because of the low (though growing) capacity of its society and institutions to cope with such extreme events. A partial listing of major cyclones and accompanying surge heights is given in Table 1.1. Given that over two-thirds of the country is less than 5 metres above the sea-level and densely populated, storm surges contribute to flooding and loss of life and livelihoods far beyond the coast. Although, during the recent years, greater success in disaster management has significantly reduced the loss of human lives, the potential for economic and infrastructural damage remains very significant. Given the current vulnerability, a critical question is whether (and how) climate change might affect cyclone patterns and their intensity in the Bay of Bengal.

While some tentative assessments are available, there is no reason to assume that cyclone tracks will shift under climate change – meaning that Bangladesh is likely to continue to be hit with cyclones and storm surges. The possibility that peak intensities may increase has potentially serious implications for the country which is already very vulnerable to storm surges driven by strong winds. A potential implication would be that future storm surges might be even higher than those observed currently. And a projected increase of 20-30 per cent in the associated precipitation could only make the concerns more serious given that Bangladesh is also prone to inland flooding because of its topography and lying as it does at the mouth of three major river systems (the Ganges, Brahmaputra, and Meghna).

Another critical variable that determines the vulnerability of Bangladesh to climate change is the magnitude of sea level rise. There is no specific regional scenario for net sea level rise; in part because the Ganges-Brahmaputra delta is still active and the morphology is highly dynamic. Evidence suggests that the coastal lands are receiving additional sediments due to tidal influence, while there are parts where land is subsiding due to tectonic activities (Huq et al. 1996). Since the landform is constituted by sediment decomposition, compaction of sediment may also play a role in defining net change in sea level along the coastal zone.

A review of the literature and of expert opinion suggests that sediment loading may cancel out the effect of compaction and subsidence, so that a net sea level rise is plausible. The Bangladesh country study put the range at 30-100 cm. by 2100, while the IPCC Third Assessment gives a global average range with slightly lower values of 9 to 88 cm. In any event, increases in mean sea level need to be viewed in conjunction with the expected higher intensity of cyclones. Higher mean sea levels are likely to compound the enhanced storm surges expected to result from cyclones with higher intensity. Even in non-cyclone situations, higher mean sea levels are likely to increase the problems of coastal inundation and salinisation in the low lying deltaic coast.



Table 1.1: Listing of Some Major Cyclones along Coastal Bangladesh

Cyclone event	Season	Storm surge height (meter)	Max. Wind Speed (km/hour)	References
November 1876	Post-monsoon	3.0~10.0	...	
May 1941	Pre-monsoon	4.0	...	
May 1960	Pre-monsoon	3.2	...	
October 1960 (first event)	Post-monsoon	5.1	...	
October 1960 (second event)	Post-monsoon	6.6	...	
May 1961 (first event)	Pre-monsoon	3.0	...	
May 1961 (second event)	Pre-monsoon	6.0~8.0	...	
May 1965	Pre-monsoon	7.6	161	
December 1965	Post-monsoon/winter	8.8	217	
October 1967	Post-monsoon	7.6	139	
May 1970	Pre-monsoon	5.0	...	
October 1970	Post-monsoon	4.7	...	
November 1970	Post-monsoon	9.0	224	
September 1971	Monsoon	5.0	...	
December 1973	Post-monsoon/winter	4.5	...	
August 1974	Monsoon	6.7	...	
November 1975	Post-monsoon	3.1	...	
May 1985	Pre-monsoon	4.3	154	
November 1988	Post-monsoon	4.4	...	
April 1991	Pre-monsoon	4.0~8.0	225	
May 1997	Pre-monsoon	3.1-4.6	232	
November 2007 (SIDR)	Post-monsoon	3.0	223	World Meteorological Organization (WMO) report on SIDR WMO, 2008
May 2009 (AILA)	Pre-monsoon	2.5	92	Bangladesh Meteorological Department
May 2010 (Laila)	Pre-monsoon			India Meteorological Department
May 2013 (Mahasen)	Pre-monsoon	2.5	100	Bangladesh Meteorological Department
November 2014 (Helen)	Post-monsoon	2.0	110	Bangladesh Meteorological Department
July 2015 (Komen)			65	Bangladesh Meteorological Department
May 2016 (Roanu)	Pre-monsoon	2.5	128	Bangladesh Meteorological Department
May 2017 (Mora)			146	Bangladesh Meteorological Department
May 2019 (Fani)	Pre-monsoon	2.5	160	India Meteorological Department
May 2020 (Amphan)	Pre-monsoon	4.0~6.0	240	India Meteorological Department
May 2021 (Yaas)	Pre-monsoon	3.5~5.0	125	India Meteorological Department
May 2022 (Asani)	Pre-monsoon	2.0	100	India Meteorological Department
October 2022 (Sitrang)	Post-monsoon	2.0~3.0	120	India Meteorological Department
May 2023 (Mocha)	Pre-monsoon	2.5~3.5	180	India Meteorological Department
October 2023 (Hamoon)	Post-monsoon	2.0	120	India Meteorological Department

Note: Surge height varies based on location.

Source: Ali 2003, DMB, various years.



The key for Bangladesh is to adapt itself to these changing circumstances...

Although Bangladesh is a virtually zero contributor to GHG emissions that affect global climate change, it is ironic that it suffers so disastrously from the effects of climate change. The key for Bangladesh is to adapt itself to these changing circumstances. However, meaningful adaptation requires assessment of vulnerability across different disciplines, which obviously requires an integrated approach.

In principle, three adaptive options may be conceived for Bangladesh: (i) retreat; (ii) accommodation; and (iii) protection. Considering high population density, future population projections, and shortage of land and other realities, retreat is not a feasible option for Bangladesh. This leaves two relevant options for the country -- accommodation and protection. Moreover, Bangladesh also needs to adopt all feasible measures to recover additional land from the sea through reclamation.

Climate Change Impact: Major Pathways for Bangladesh

The impact of climate change in Bangladesh is manifested through a range of effects that include: rising average weather temperatures including more extreme hot and cold spells; higher variability of rainfall with less when it is needed most for agriculture yet more during the monsoon causing intense flooding; altering hydrological cycles of the rivers due to melting of glaciers in the Himalayas and other changes; more powerful tornados and cyclones; and sea level rise displacing communities, turning freshwater saline and facilitating more powerful storm surges.

Bangladesh is among the most disaster prone countries in the world and it experiences climate change through a range of effects...

Bangladesh is among the most disaster prone countries in the world and it has suffered more than 200 large scale disasters between 1970 and 2024. The frequency of flooding episodes has also been growing, with catastrophic 'once in a generation' floods occurring more regularly. Even without serious climate change effects, a natural disaster survey records 137 cyclones and 64 floods between 1907 and 2004 with an estimated loss of \$30 billion (Ahammad and Baten, 2008). All predictions point out that these disasters will increase both in frequency and severity in future.

Changing temperatures

The impact of changing temperature resulting from climate change on health may exacerbate mortality and morbidity due to hotter weather and changing rainfall patterns. In Bangladesh, increased temperature due to climate change in the already high rainfall area of Chittagong Hill Tracts (CHT) is reported to have increased the incidence of malaria. It is apprehended that the pattern will be replicated in other areas especially in the north and east of Bangladesh. Climate change is also likely to produce congenial conditions for spread of dengue fever in many areas of Bangladesh. Moreover, the warmer sea-surface temperatures along the coast of the country would support higher phytoplankton growth which provides habitats for the survival and spread of infectious bacterial diseases such as cholera.

The effect of changing temperature on agriculture is somewhat complex due to a number of interplaying factors. While higher carbon dioxide levels and solar radiation may increase food production, other changes such as heat stress, shorter growing seasons and higher evapo-transpiration resulting in lower soil moisture levels may counteract the former influences leading to overall lower production of many food crops such as most varieties of rice, wheat and potato. Reductions in yield could potentially be as high as a 17-28 per cent decline for rice and 31-68 per cent decline for wheat production (Karim et al, 1999). Evapo-transpiration and moisture loss from soils as a result of hotter weather will be more severe during the post-monsoon and pre-monsoon seasons especially considering the already diminishing



rainfall in winter and erratic rainfall patterns, particularly in the north-west of the country (Ahmed, 2006). Most affected will be the rabi/pre-kharif growing season (December-March) when evaporation already exceeds the unpredictable rainfall during the time.

Increased temperature in the water bodies may also have impact on fisheries, such as by advancing the sexual maturation process of hilsa ilisha fish and the timing of their spawning leading to a decline in hilsa production (Ali, 1999). In terms of impact on livelihoods and the economy, the coastal shrimp farming industry of Bangladesh is likely to be most affected by a rise in surface water temperatures. For example, if the temperature goes above 32°C, the small shrimp fries would suffer high mortality rates. Warmer water would also encourage algal bloom which reduces shrimp growth (Ahmed, 2006). Increased sea temperature and changing sea currents as well as increased water acidity due to more dissolved carbon dioxide may additionally affect the marine fishing industry of Bangladesh. It is well known that greater acidity makes it harder for fish and other sea creatures to develop skeletons and shells and may stop the growth of corals which provide nurseries for commercial fish thereby reducing the numbers of important fish foods such as plankton and snails.

Variability in rainfall

The summer is dominated by southwest monsoon in Bangladesh which occurs from June to September and influences the seasonal cycles. However, climate change is likely to weaken the monsoonal flows and the large scale tropical circulation which could change the rainfall pattern such as its timing. A warmer, moister atmosphere is also likely to lead to heavier rainfall during the monsoon. Various studies point out that the average rainfall is rising in Bangladesh during the summer monsoon; and the increase will be by about 1 per cent to 4 per cent in the 2020s which may increase by 2 per cent to 7 per cent in the 2050s (Tanner et al, 2007). Moreover, the studies also predict slightly less rainfall in the winter months.

In the Ganges-Brahmaputra-Meghna basin, the combined total catchments of the rivers from where rainfall drains into these rivers totals about 1.74 million km² and the volume of water entering into Bangladesh varies from less than 5,000 cubic metres per second (m³/s) in the driest period (March-April) to 80,000--140,000 m³/s in late August to early September. Therefore, higher rainfall outside Bangladesh during the monsoon is likely to lead to more frequent and severe floods from swollen rivers, while less rain in the winter will mean less water in rivers in the dry season affecting river-fed irrigation, industry, fisheries, travel by launch/ferries and increased salinity around the coast (Alam, 2004).

As only about 7 per cent of the catchment area of the major rivers lies inside Bangladesh, the country is also vulnerable to extraction for irrigation and hydroelectric schemes in the upstream. The Ganges/Padma River is particularly affected. In India, barrages control all the tributaries to the Ganges and divert more than 60 per cent of the river flows to large scale irrigation. India also controls the flow of the Ganges into Bangladesh through over 30 upstream water diversions and the 5th largest dam in the world—the Farakka Barrage—which is located only 18 km from the Bangladeshi border. India plans to build a large number of dams and canals to interlink the major rivers like the Ganges and Brahmaputra and divert water from these rivers to its drier southern states. Despite the 1996 Ganges Water Sharing Treaty between Bangladesh and India, the amount of water entering into Bangladesh is already dwindling and this is likely to be reduced further due to climate change induced adverse developments and accentuated by India's future irrigation and electricity generation plans (Wong et al, 2007). Similar developments with the Teesta and many other rivers entering into Bangladesh from India are also major causes of concern for the future.



Changes in flooding

As noted earlier, Bangladesh is located on a low-lying flood plain made up of the lower reaches of the Ganges, Brahmaputra and Megna Rivers. As about 60 per cent of the country is lower than 6 metres above the sea level with an average river gradient of only 6cm/km in the delta, Bangladesh is extremely vulnerable to large volumes of water flowing down these rivers and other types of flooding. Annually around 20 per cent of the country is temporarily flooded but, in extreme cases, this may rise to as high as 70 per cent of the country's land area (Mirza, 2002). The seasonal floods, despite bringing fertility in the form of deposited silt on the farmlands, bring significant damages to livelihoods and properties especially of the poor and disadvantaged sections in society since these groups mostly live in low lying and flood prone areas due to population pressure and other factors. Over time, environmental damage makes floods more severe and increases the damages manifold.

Floods in Bangladesh are categorised into four different types: flash floods, river floods, rain floods and coastal storm-surge floods. Flash floods occur in the eastern and northern rivers along the borders of Bangladesh and are characterised by quick rises in water level and high speed of water flow resulting from exceptionally heavy rainfall occurring over neighbouring hills and mountains in India. Such floods tend to occur between April-May and September-November. One possible impact of increased rainfall in the monsoon due to climate change is likely to be more flash flooding as heavy rainfall leads to a rapid rise and fall in river levels as it flows down quickly from the hills.

River floods from the spilling of major rivers and their tributaries and distributaries generally rise and fall slowly over 10–20 days or more and can cause extensive damage to property and loss of life. The depth and extent of floods and associated damage are extensive when the major rivers reach their peaks simultaneously usually during June to September when high volumes of water flow down in two or all three major rivers (Ganges/Padma, Brahmaputra/Jamuna and Meghna) at around the same time (NAPA, 2005). The effects of climate change could mean that about 18 per cent of current low flooded areas will be susceptible to higher levels of flooding, and about 12-16 per cent of new areas will be at risk of flooding at various levels. As a result, flood prone areas may increase from 25 per cent to 39 per cent during an average year (Ahmed, 2006).

Rain floods are caused by high-intensity local rainfall of long duration during the monsoon season. The extent and depth of rain water flooding varies with the monsoon, depending on the amount and intensity of local precipitation and current water levels in the major rivers that control drainage from the land (Mirza, 2002). The warmer wetter monsoon as a result of climate change is likely to increase floods caused by rainfall runoff because the rain may fall in more intense bursts. Cities like Dhaka and Chittagong are particularly at risk due to poor drainage systems and blockage of most former canals and open spaces. A health crisis may also occur as sewage mixed with floodwater would result in high risk from water-borne diseases such as acute respiratory infections, diarrhoea, dysentery, jaundice, typhoid and scabies (Alam and Rabbani, 2007).

Storm surge floods, on the other hand, occur mostly in the coastal areas which consist of large estuaries, extensive tidal flats, and low-lying islands. Storm surges generated by tropical cyclones cause widespread damage to property and loss of life in the coastal areas. Extensive floods particularly affect the poor who lose the meagre assets they possess along with their livelihood activities. Floods also contribute to concentration of landownership due to distress sales by the poor in the post-flood situation to the richer people in the community (Chowdhury, 2002). Thus, increasing floods due to climate change are likely to have adverse impacts on the poor including on transient poverty in Bangladesh.



In Bangladesh, extreme floods are usually considered as 50-100 year events (Ahmed, 2006). But they are likely to become more frequent in future due to global warming and climate change and it is apprehended that they may occur every 4-20 years by 2050 (Mirza, 2002). Such changes in flooding will have significant effect on food production especially on the production of the major crop, rice. It may be mentioned here that the reduction of agricultural production due to 1998 flood is estimated at 45 per cent (Ahmed, 2006). In particular, high-yielding aman rice varieties are easily destroyed by floods as these rice varieties cannot withstand flood water for long, including monsoon vegetables (Karim et al, 1999).

On the other hand, boro rice which is cultivated in the dry winter season usually gives a good harvest after a high flood in the previous year due to a better supply of moisture and the growth of blue-green algae. However, other climatic changes resulting from global warming such as temperature rise and carbon dioxide levels may reduce boro rice harvests by about 4 per cent by 2050 (Karim et al, 1999). In addition, flood waters now increasingly carry sands from the bare deforested hillsides upriver rather than depositing silts that boost soil fertility and threaten crop production including the bumper harvests of boro rice (Chowdhury, 2002).

River bank erosion

Higher volumes of water flowing down the rivers due to climate related changes are also likely to increase land erosion beside the rivers in Bangladesh. As most of the country is made up of soft silt soils, riverbanks are washed away by river currents and wave action. Further, river bank erosion includes channel shifting, creation of new channels during floods, bank slumping due to undercutting and local scour from turbulence caused by obstruction (Ahmed, 2006). The Bangladesh Water Development Board (BWDB) estimates that 1,200 km of riverbanks are actively eroded and more than 500 km are facing severe problems related to erosion every year; and despite some deposition of silt, a net land area of 8,700 hectares are being lost due to erosion (Ahmed, 2006). About a million people are pushed off their lands by river erosion and they turn into destitute and it is apprehended that increased river erosion due to climate change will displace more people from their homes and farms.

Incidence of drought

Bangladesh experiences a dry period for about seven months (November to May) when there is practically no or very low rainfall. During the period, about 2.7 million hectares of land become vulnerable to drought; and there is about a 10 per cent probability that 41-50 per cent of the country would experience drought in a given year (Tanner et al, 2007).

Drought impact, associated with late arrival of monsoon rains or complete failure of monsoon spreads over a much larger geographical area than areas affected by other natural hazards in Bangladesh. The production of rice, jute, vegetables and other crops are highly affected and livestock population also suffers. Drought can affect the rice crop in three different seasons. First, pre-kharif drought (in March and April) prevents timely land preparation and plowing thus delaying the planting of crops during the monsoon season. Second, kharif drought (in July and August) delays the transplantation of aman rice in high and medium high areas while kharif drought in September and October reduces yields of both broadcast and transplant aman rice and delays sowing of pulses and potatoes especially in the northern region. Meanwhile, rabi drought in the winter months affect boro rice, wheat, vegetables and other crops grown in the dry season (Selvaraju et al, 2006).

Already climate change is increasing the frequency of droughts and the area affected during droughts. For example, the area severely affected by rabi droughts could increase from 4,000 km² to 12,000 km² as global warming increases (Huq et al, 1996). Over the last few decades, progressive development of groundwater for both water supplies and agriculture has meant that dry season water availability has



been less of a problem and has even allowed dry season agriculture to become the main source of increased food production. Groundwater supplies have allowed large areas to become irrigated which have played the key role in transforming agriculture in Bangladesh. However, higher and more severe incidence of droughts, in addition to having a direct impact on agricultural production in the dry season, will also reduce the annual refilling of groundwater storing aquifers. This has huge implications for groundwater based irrigation which is already experiencing difficulties in different parts of the country in sustaining supply due to over-extraction of water and insufficient refill in the monsoon. It is reported that already 46 per cent of the country's cropland irrigated through shallow tube wells (STWs) are unable to draw enough water to irrigate farms during the dry season because of lowering of groundwater levels (Roy, 2008). While deep tube wells (DTWs) may help in ensuring irrigation in the short run, this will progressively become harder along with escalating costs and forcing the access to irrigation difficult for the poor farmers.

Rising vulnerability of coastal ecosystems

According to the Intergovernmental Panel on Climate Change (IPCC), future tropical cyclones will become stronger along with faster wind speeds (Alley et al, 2007). These massive storm events combine the effects of heavy rainfall, high winds, and storm surge and sea-level rise. Since most of the country is less than 10 meters above the sea level and almost 10 per cent of the country's population lives below 1 meter elevation, the entire coastal area is highly vulnerable to high tides and storm surges. Moreover, the Bay of Bengal is located at the tip of the north Indian Ocean, where severe cyclonic storms as well as long tidal waves are frequently generated and hit the coast line with severe impacts because of the shallow as well as conical shape of the Bay near Bangladesh.

Nearly one-fourth of the total population of Bangladesh live in the coastal areas, where majority of the population are somehow affected (directly or indirectly) by coastal floods, tidal surges, river bank erosion, salinity, tropical cyclones and other natural disasters. It is apprehended that with the rise of sea-level up to one meter only, Bangladesh could lose nearly 15 per cent of its land area under sea water affecting around 30 million people living in the coastal areas turning them into 'climate refugees'. Agriculture, industry, infrastructure (e.g. educational institutions, hospitals, roads, bridges and culverts and other structures), livelihoods, marine resources, forestry, biodiversity, human health and other utility services will suffer greatly because of these disasters. Salinity intrusion from the Bay of Bengal is reported to have penetrated more than 100 kilometers inside the country during the dry season and the situation is likely to deteriorate fast due to climate change impacts.

Due to different natural processes such as water flow between oceans, continental plate movement, and raising or lowering of land surfaces, the rise in sea level varies geographically (Cruz et al, 2007). Several processes, although not directly related to global warming, are actively at work to cause the sea level to rise. These include: 'tectonic subsidence' which means that coastal Bangladesh is gradually sinking due to the weight of the silt being deposited by its rivers and the continued rise of the Himalayas that is slightly tipping Bangladesh seawards; 'compaction of peat layers' which are soft layers of organic dead plant and animal materials that are gradually being squeezed tightly together by the weight of the land above; and 'human activities' such as removal of water from the ground for irrigation which speeds up compaction and the building of dams, dykes, embankments and other structures to prevent floods -- since these prevent new layers of silt raising the land level as older layers compact and sink (Mohal and Hossain 2007).

It is therefore difficult to predict how these natural processes will interact to result the sea level rise in the coast of Bangladesh. Some predictions maintain that the net sea level rise would be between 18 cm and 59 cm by the year 2100 while others hold that lowering of the coastal zone through subsidence could alone lead to relative sea level rises of 70 cm by 2050 and 1.2 metres by 2100 (Alley et al, 2007,



Broadus, 1993). The assessment by BWDB indicates that the combined effect of global warming and subsidence will result in a net sea level rise of 30 cm by 2030 and 50 cm by 2100 (Jenkins, 2006). Likewise, how sea level rise will affect Bangladesh is open to varied interpretation, with more recent reports using newer and better research data, showing a slightly smaller rise of sea level rise than previously predicted. These estimates suggest that land permanently lost to the sea may amount to 3 per cent and 6 per cent of Bangladesh by the 2030s and 2050s respectively (Tanner et al, 2007). Currently, about 40 million people live in the coastal areas of Bangladesh but depending on the rate of population growth, it could be between 51-97 million by 2080 when the situation begins to get more serious. In the year 2050, assuming a sea level rise of 27 cm, around 26 million people will be at a low risk and almost 7 million will be at medium risk of flooding (Mohal and Hossain, 2007).

Another related problem is 'drainage congestion' meaning that water flowing down the rivers towards the sea is slowed down by different natural and other factors and the problem is likely to be made worse by climate change (Tanner et al, 2007). Climate change causes drainage congestion through a number of factors. Higher sea water level means the rivers' gradients are reduced which lead to higher river levels due to 'backwater effects', subsidence of earlier deposits of sediment slowing the river flows, blocking of channels by siltation of estuary branches making water flow more difficult, reduced capacity to quickly flow as much water as needed due to higher riverbed levels resulting in higher water levels in rivers, and reduced sedimentation in flood-protected areas indicating that they do not rise in height to match the sinking effect of silt subsidence. Generally all these factors are linked to climate change and will make drainage more difficult and gradually increase water logging problems. The water logging will harm agriculture, make flooding worse and increase water borne diseases (NAPA, 2005).

Currently, about 6 million people are exposed to high salinity (>5 ppt), but due to climate change the size of affected population is expected to increase to nearly 14 million in the year 2050 and 15 million in 2080 (Mohal and Hossain, 2007). This will be mainly due to the boundary to the area of high salinity, 'the salinity front', moving to the north by 40 km to 60 km inland from the coast by 2100 (NAPA, 2005). Along with making household water supply problematic, salinity negatively affects agricultural production and a study in the southwest region of Bangladesh finds that suitable area for transplant aman rice cultivation will reduce from 88 per cent to 60 per cent with 32 cm rise in sea level and by 12 per cent with an 88 cm rise in sea level (CEGIS, 2005).

Water resources and hydrology

Climate change is likely to alter the patterns of water availability by intensifying the water cycle. Droughts and floods will become more severe in many areas. In Bangladesh, the effects of climate change on both surface and ground water resources will be very severe and alarming. Changes to water resources and hydrology will have a significant impact on the country's economy, where people mostly depend on the surface water for irrigation, fisheries, industrial production, navigation and similar other activities. The ground water table is also affected with consequent adverse impacts on livelihood and other activities. The practice of burning the stubble/stalks after rice or wheat harvest contributes to climate change in several ways. It releases GHGs notably methane, troposphere ozone and aerosols; fire reduces reflectivity of the earth's surface for several weeks causing warming; and burning may destroy trees and bushes beside the farms that take the GHG (carbon dioxide) from the air during photosynthesis. A more environment-friendly practice would be to collect, compost or plough back the rice stalks into the soil. This will improve the quality and fertility of the soil as well.

Agro-forestry combines forestry and farming on the same piece of land. It includes shelter belts of trees or buffer strips such as woody species beside roads and ponds. The standing stock of carbon above the ground is usually higher than the same land without trees, and planting trees increase soil carbon sequestration and the trees reduce atmospheric warming by absorbing carbon dioxide. The cultivation



of bamboo which is the fastest growing canopy for re-greening of forest lands can also mitigate warming in the context of Bangladesh. Bamboos can be grown in small plots or on field edges; and the plants give out 35 per cent more oxygen than wood trees. Some bamboo species may even absorb up to 12 tons of carbon dioxide per hectare from the air. Bamboo trees, a variety of giant grass, send out extra shoots as they grow so that even after removing the weaker ones, more bamboos will grow by the time the main plant is ready to be cut. Bamboos also enrich soil fertility through their fallen leaves.

Trees and forests

Forests play an important role in the climate system. They are a major reservoir of carbon, containing around 80 per cent of all carbon stored in land vegetation, and about 40 per cent of the carbon residing in soils. Large quantities of carbon are emitted into the atmosphere when forest land is cleared. But regeneration and growth reabsorbs it. Forests also directly affect climate through influencing ground temperature, evapo-transpiration, surface roughness, albedo (or reflectivity), cloud formation, and precipitation. Although the area that covers Bangladesh was once densely forested, most of the land has been cleared for timber and firewood, and converted into lands for agriculture and other uses and at present only around 15 per cent of the total land areas are now considered as forest lands.

A tropical or subtropical forest absorbs significantly more carbon dioxide into its leaves than a temperate one, typically from 100 to 600 tons per year for every square kilometer. Therefore preserving forests in Bangladesh can make a huge difference in preventing adverse impacts of climate change. There also exists a huge potential for tree planting, forest protection and agro-forestry development in Bangladesh. Roadside plantation is also a way to increase tree cover in the densely populated country like Bangladesh where natural woodlands are in danger of extinction. The promotion of fruit orchards and tree nurseries including trees for timber are good for carbon stored in buildings; wood fuel reduces the use of GHG emitting fossil fuels, while gases from wood fuel are re-absorbed by new seedlings planted.

Biodiversity

Bangladesh enjoys a wide diversity of ecosystems including mangrove forests called that Sundarbans at the extreme south of the country. The Sundarbans is a world heritage and constitute the largest mangrove forest in the world, comprising 577,00 ha of land area along the Bay of Bengal. A total of 425 species have been identified in the forest, the most significant of which is the famous Royal Bengal Tiger. The climate change impacts will have negative effects on the ecosystems of the coastal areas and the Sundarbans is likely to suffer the most among all systems especially due to its vulnerable location.

Furthermore, the composition and geographic distribution of ecosystems will change as individual species respond to new conditions created by climate change. At the same time, habitats will degrade and fragment in response to other human pressures. Moreover, species that cannot adapt quickly will become extinct creating an irreversible loss.

Biodiversity and ecosystems are valuable natural economic resources; for example, the Sundarbans mangrove forest is important for tourism, timber, and honey collection. In Bangladesh, the honey harvest from the nests of the giant honey bee *apis dorsata* is estimated to be between 130 and 185 tons per year, while the wax harvest is estimated at between 42 and 45 tons (FAO, 2001). There is also traditionally a great reliance on non-timber forest products for food such as wild tree fruits, fish, and roots and tubers, during seasonal nutrition gaps occurring during lean periods and disasters (FAO, 1989). Natural habitats such as mangroves have mostly been protected as an adaptation measure for coastal communities from storms and cyclones; they have also benefited the local economy by protecting it from climate change losses.



Bangladesh needs to establish 'wildlife corridors' which are belts of natural habitat such as trees or rivers that connect different areas of high biodiversity and adopt community level initiatives by planting native species of trees along roadsides or by allowing wild plants and wildlife to flourish along river banks. Adaptation measures that may benefit both wildlife and communities by expanding areas of suitable habitat include: mangroves that reduce coastal erosion, native sal forest plantations for timber, reed sanctuaries to prevent erosion and benefit the nature, and fish sanctuaries to allow source areas for fish to safely breed to raise fishing yields, protect fish species and other wildlife such as wetland birds from extinction.

Community based tree plantation is seen to benefit communities in the short term with fuel, fodder for livestock, reduced erosion, flood prevention, storm wind control, more medicinal plants, and creation of job opportunities, such as for those growing seedlings in nurseries. In the long term, timber would be available for sale. Biodiversity also benefits through swamp grove and wetland restoration, enhancement of tree cover, an increase in numbers of birds and wild life and the conservation of rare tree species.

The adaptation strategy of tolerance of crop, fish or livestock losses is not realistic in the context of Bangladesh as most farmers are poor having little capacity to survive disasters or adverse climate change consequences. Sharing losses is a good potential adaptation strategy, sometimes taking place informally especially within extended families or closely knit communities. But these are not sustainable especially in the long term for the poor, while micro-insurance is mostly not available. Likewise, change of location as a strategy is also not practical in a land scarce country like Bangladesh. Despite the limited scope, some adaptation is possible along these lines by being creative with the little space that is owned such as growing vegetables on house roofs and fencing fish ponds and growing vegetables on their margins.

Climate Change and Poverty

Climate change impacts are increasing at an alarming rate, altering the natural calendar of the natural environment. Crops cannot be planted and harvested at the right time; water salinity and sea levels are rising. Heavy rains, non-rainfalls at the right time, flash floods, and untimely intense fires are the most common causes of poverty.

In rich countries, climate change does not affect their socioeconomic conditions as much as it affects in the poor countries, for example, the South Asian countries. Wealthier countries tend to have the resources and networks to adapt to a changing climate and more resilient infrastructure (e.g., water systems and housing) to deal with erratic weather events and disasters.

Poor countries, on the other hand, are more vulnerable to the consequences of climate change as they usually have inadequate infrastructure and fewer resources. Extreme weather patterns, natural hazards, and food and water shortages threaten the lives of people living in poverty, and poor people find it harder to recover from failed crops, destroyed homes, and health crises. The impact is especially noticeable in Bangladesh since the country depends on agriculture for food as well as for livelihoods and income for a large number of rural population. Higher temperatures, altered rainfall patterns, and a shortage of water are making huge areas of land unusable for food production, and poor land management practices and unsustainable development are contributing to land degradation, including soil erosion and desertification, which is hastening the adverse effects of climate change.

People with fewer resources and less influence are always those who suffer the most when a disaster occurs. But they exacerbate poverty because those most affected by drought or flood must sell their



land or livestock at low prices, effectively transferring wealth from the poor to the rich, leading to rising poverty levels.

The integrated view of climate change covers both longer-term processes (e.g. global warming, sea level rise, deepening water scarcity, ocean acidification) as well as climate variability (such as increasing frequency and intensity of extreme weather events including cyclones/storms, floods, droughts, and changing seasonality e.g. variability in rainfall and temperature). Climate change impacts may therefore arise as: (i) shorter-term shocks, disasters and/or climate extremes; and (ii) longer-term stresses including sea level rise, water scarcity, increased seasonal variability and overall changes in rainfall and temperature patterns. These impacts on people, communities and countries can be both direct and indirect. For example, impacts can be immediate resulting from climate-related disaster, or indirect as a potential risk for displacement and forced relocation. Some of these impacts (e.g. rising sea level, cyclones and ocean acidification) may be specific to coastal ecosystems and communities while others may affect broader regions and communities.

Overall, climate change impacts mostly contribute to negative effects on ecosystems, human communities and countries. The changes affect the climate-vulnerable countries (e.g. Bangladesh) the most; and rural, natural resource-dependent areas in particular since these locations are highly sensitive to a variety of climate-related drivers impacting these systems. The people who live and work in these communities often experience high levels of climate-related vulnerability, through a combination of high exposure and sensitivity and low adaptive capacity to climate change hazards. In effect, they face multiple climate-related concerns that threaten particularly farming and other land-based livelihoods.

There are complex interactions between poverty and climate change. Reduction of poverty usually allows people, especially the poor, to better respond to disasters and reduce vulnerability to climate change impacts. On the other hand, climate change responses that treat poverty as ‘maladaptive’, potentially make poverty worse and climate change responses less effective.

In countries like Bangladesh, relatively high incidence of poverty in its multiple dimensions -- not only in terms of socioeconomic characteristics but also access to resources and livelihood patterns, political and cultural dimensions -- increase vulnerability to, and thereby exacerbate, climate change impacts on poverty. No doubt, poverty refers to a state of multiple deprivations and lack of capabilities and empowerment; while climate change is a driver that affects households, communities and the country. As such, poverty and climate change neither refer to the same aspects nor to any opposing forces; rather these have more complex interactions.

These interactions, particularly the effects of poverty on climate, occur through a variety of channels. The economic growth path of a country may also significantly increase GHG emissions and exacerbate climate impacts. Other policies may increase climate risk and vulnerability, negatively affect adaptive capacity, and potentially limit options and abilities to implement desired climate responses. Indeed, maladaptive climate responses can worsen poverty and, as a result, contribute to negative environmental and climate-related impacts.

In practice, poverty exacerbates vulnerability to climate impacts, due to two major reasons: (i) a higher dependence on natural resources and associated productive sectors that are more climate-sensitive (e.g. agricultural and resource-based livelihoods including fishing, forestry, farming, livestock rearing and use of other renewable natural resources); and (ii) geographic location in marginal areas, where poverty is more concentrated, and which are affected by increased frequency and intensity of climate change induced extreme events, such as cyclones, flooding and drought.



With increased exposure, poor and vulnerable populations are more susceptible to damages. Further, with fewer resources, the relative ability to cope and recover is more limited, and relative costs of recovery are also higher, further exacerbating vulnerability and inequality. Moreover, vulnerable populations have limited capacities to engage or invest in risk reduction measures that would help them to prevent, adapt and/or prepare in the face of climate change shocks.

In addition, social inequality, and a lack of social protection and inadequate safety nets and risk management strategies, can also generate: (i) risk-averse behaviour among the poor due to limited social protection; (ii) subsistence-oriented consumption and production decisions resulting in limited productivity; and (iii) negative coping strategies after climate shocks, resulting in permanent loss of limited assets and falling into deeper poverty. Other such consequences include taking off children out of school, consuming inadequate and less nutritional diets, poverty-induced forced migration, high cost borrowing and possibility of falling into debt trap, and similar other consequences.

Furthermore, GHG emissions associated with poverty can emerge as a significant concern. While the bulk of emissions contributing to climate change do not come from those experiencing poverty, or from their livelihood practices, a lack of options can, in some cases, lead to unsustainable livelihood activities with negative consequences for climate change (e.g. dependence on fuel wood and charcoal for cooking, harvesting of mangroves in coastal areas) which could be significantly reduced through improved management and technology.

Considering the interactions among responses to climate change and poverty, the key is to identify the strategic elements that provide a path for an improved approach to addressing the nexus of climate change and poverty, one that involves more integrated climate and poverty responses. This would help to achieve greater coherence and coordination between poverty reduction considerations and the climate agenda. The approach needs to be applied from the local to national and finally to the global levels.

These also need to reflect the demands for context-sensitive perspectives on the socioeconomic, cultural, biophysical and governance landscapes in which the approach has to be implemented. The challenge in implementation is to generate complementarity and cohesiveness among poverty reduction and climate adaptation responses.

One of the worst forms of manifestation of poverty is malnutrition. The effects of climate change, especially the increasing number of extreme weather events, play a negative role on malnutrition, particularly among children and women, in the climate change vulnerable areas of Bangladesh. The correlation between weather-related crises and declining quantity and quality of food, especially amongst the poor households, is a stark reality in the country.

As the frequency of extreme weather events increases, poor households are hit by storms, floods, severe drought or other natural calamities. As a result, they have less time to recover from the crisis before the next disaster hits. The poor households displaced by flooding may not be able to replant in severely eroded small plots, and may be compelled to seek alternative livelihoods. Moreover, these shocks are usually accompanied by food scarcity and increased prices.

During all crises, it is natural that the poor and disadvantaged households suffer the most under the existing socioeconomic reality in Bangladesh; that is highly unequal, both vertically and horizontally. As a result, children, women, disadvantaged and marginalised communities are most at risk of malnutrition in areas where climate-driven extreme weather disrupts food production and supply chains and, as a consequence, malnutrition increases.



Objectives and Report Outline

The Poverty Watch Report 2024 explores the climate change and poverty nexus in Bangladesh adopting an integrated framework. The primary aim is to ensure that grassroots voices of the 'left behind and poor climate vulnerable communities and population groups are heard, and their voices are reflected in relevant policies. In the process, the Report highlights several issues:

- ★ Interactions between climate change and poverty especially in the climate vulnerable regions of the country.
- ★ Impact of climate change, particularly of extreme temperature and drought, cyclone, floods, riverbank erosion, salinity intrusion and sea level rise, on livelihoods and poverty status of the residents in the climate vulnerable areas of the country.
- ★ Poverty updates at both national and subnational levels based on most recently available data.
- ★ Emerging priorities for policies and actions as well as challenges faced by individuals/communities experiencing poverty in the context of climate change adversities in Bangladesh.

The underlying assessment of the Report adopts an analytical approach that utilises both qualitative and quantitative research using both primary and secondary data and information. In order to collect primary data and gather grassroots voices, household surveys have been conducted in purposively selected climate-prone rural locations from different regions in Bangladesh. Finally, conclusions and policy actions have been drawn using the survey findings as well as the 'voices of the climate vulnerable poor' collected through focus group discussions (FGDs) and case studies.



2

Climate Change and Poverty

Interaction Channels and Poverty Updates

“... while the eyes of the world have been riveted on polar bears, Antarctic penguins, and other endangered inhabitants of the Earth’s shrinking ice caps, relatively few researchers have turned serious attention – until recent years – to quantify the prospective long-term effects of climate change on human welfare”.

--- Skoufias, 2012, p. 2.

Climate change has already emerged as an immediate concern for the global community -- reshaping ecosystems, economies, and societies across the globe. While its environmental impacts are widely acknowledged, its profound and often insidious influence on human poverty and inequalities still remains underexplored. In reality, the interplay between climate change and poverty reveals a complex web of interactions where the poor and vulnerable populations bear the disproportionate burden of climate change induced disasters, despite contributing the least to their causes. The fact, however, is that climate change and poverty are intertwined through the complex dynamics of various social, economic, political, and cultural channels. These dynamics create a vicious cycle: climate change exacerbates poverty by undermining livelihoods, increasing inequalities, and eroding resilience; while poverty limits the capacity of individuals and communities to adapt to and overcome the impacts of climate change. Recognising and addressing the nexus is critical to achieving sustainable development and ensuring equity in global climate action.

Since the beginning of realisation of the danger of climate change, global concerns were focused mostly on its physical impact, with relatively less effort devoted to its implications for the livelihoods, wellbeing, poverty, inequality and other social dimensions of the affected people. Nevertheless, broader social impacts of climate change and their feedback effects started to receive more attention during the recent decades. Moreover, as is expected, the analysis of the climate change and poverty nexus has often been extended to its impact on inequalities as well. It has been highlighted that “socially and economically disadvantaged and marginalised people are disproportionately affected by climate change” (IPCC, 2014: 796). It is further observed that “climate change impacts tend to be regressive, falling more heavily on the poor than the rich” (Skoufias, 2012: 6). This happens mostly through disproportionate erosion of the limited availability of physical, human, and social assets at the disposal of the affected poor and disadvantaged households and communities. Further, there is significant regional variation, such that the poor regions are much more affected than the relatively better off regions.

Overall, it is now widely recognised that climate change exacerbates both poverty and inequalities. Further, research findings generally agree that socially and geographically disadvantaged people – including people facing discrimination based on gender, age, race, class, caste, indigeneity and disability – are particularly affected negatively by climate hazards.

While it is critical for Bangladesh, using variations of the general analytical framework, to design the specificities of the nature and relative magnitude of relevant interactions and their regional variations for proper assessment of climate change-poverty nexus for guidance in adopting effective policies, the following analysis delves into the multifaceted relationship between climate change and poverty, organised under several key dimensions. The social dimensions of this relationship explore how poor and vulnerable groups—especially women, children, and marginalised communities—experience disproportionate climate change impacts. The economic interactions assess how climate change disrupts livelihoods, intensifies resource scarcity, and influences the labour markets. On the other hand, political and cultural fallouts are expected to shed light on how governance structures, societal norms, and cultural practices shape and are shaped by interactions of climate change and poverty. By unpacking these interconnected dimensions, the expectation is to provide a comprehensive understanding of how climate change and poverty are not only interlinked but also reinforce one another in ways that demand integrated, inclusive, and urgent action.

⁴This analytical framework has been adapted from several earlier studies. Some of these studies have used the term ‘vulnerability’ and accordingly these have often been described as the ‘vulnerability’ frameworks. For example, AR5 considers the impact of climate hazards with respect to ‘vulnerability’ and ‘exposure’ (see IPCC 2014, Summary for policymakers, p. 3). The term vulnerability, however, includes both ‘susceptibility’ and ‘ability to cope and recover’. Many others define ‘vulnerability’ to include ‘exposure’ as well as ‘ability to cope and recover’.

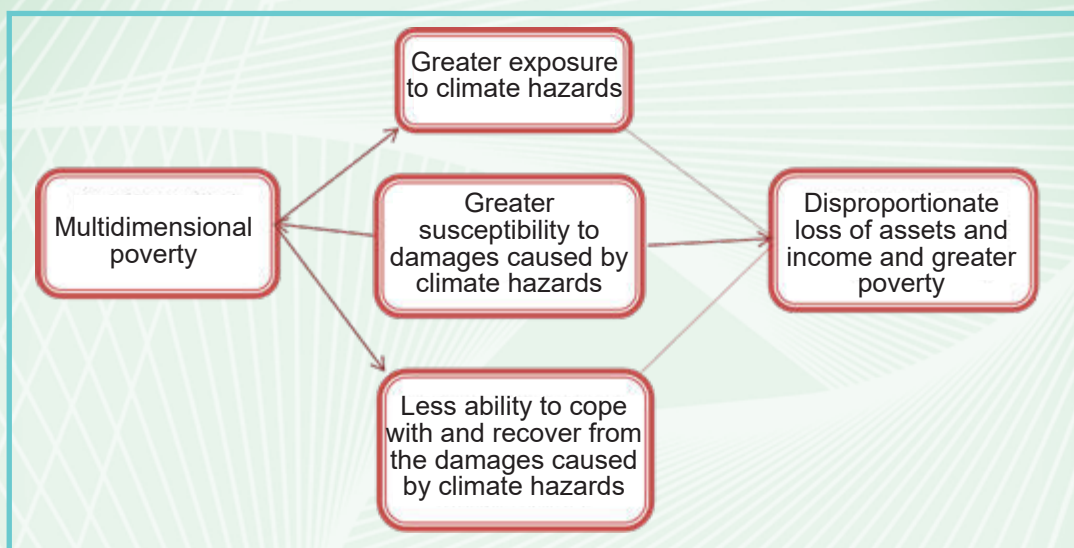


Climate Change and Poverty: Channels of Interaction

Climate change-poverty nexus: An analytical framework

It is useful to begin the analysis of the nexus between climate change and poverty by using an analytical framework.⁴ In this context, three major channels may be identified through which poverty status of the poor and disadvantaged populations are aggravated by the impact of climate change (Figure 2.1). These are: (i) increase in the exposure to climate hazards; (ii) increase in susceptibility to damage caused by climate hazards; and (iii) decrease in the ability to cope with and recover from the damages due to climate hazards.

Figure 2.1: Major channels of climate change-poverty nexus



These channels work in different ways for specific types of climate change hazards. Consider, for example, the specific consequence of increased flooding due to climate change. Evidence shows that poverty often compels the poor and disadvantaged populations to live in areas that are more prone to flooding, thus increasing their exposure to flooding caused by climate change. Further, among all populations living in the flood zone, the poor and disadvantaged groups are more susceptible to the damages caused by flooding. For instance, their dwellings are completely washed away or are severely damaged, because these are often kutcha houses. By contrast, the houses of the well-off suffer the least damage because these are generally pucca houses made of brick and concrete. Finally, the poor has less ability to cope with and recover from the damages caused by floods. The richer people may buy housing insurance and thus get compensated for the damages. By contrast, the poor are not generally able to afford such insurance and thus have to absorb the entire loss, leading to greater loss of their meagre accumulated asset.

Moreover, as a consequence of the combined effects of these channels, climate change and poverty may become locked in a vicious cycle, such that climate change hazards end up aggravating both poverty and inequality. The cycle begins with multidimensional poverty, which causes greater exposure of the poor to climate hazards, increases their susceptibility to damage caused by the hazards, and decreases their ability to cope with and recover from the damages. As a consequence, when different climate hazards repeatedly occur, the poor suffer disproportionate loss of income and all types of assets (e.g. physical, financial, human, and social). Climate change thus makes poverty worse, thus perpetuating the climate change-poverty vicious cycle.



However, the above scenario of transmission channels and consequent impacts treat climate change effects as exogenous. But in reality, there are feedback effects of poverty on climate change, making the above vicious cycle stronger with more destructive impacts.

This may take place in several ways. Usually, poverty and inequality aggravates climate change and environmental impacts on the poor and vulnerable communities, including further worsening of climate change hazards (Islam, 2015). Usually, countries with lower poverty and inequalities tend to have higher per capita levels of waste generation, water use, and meat and fish consumption. These imply that such countries will tend to have higher levels of per capita GHG emissions. Thus, when climate change is treated as endogenous such that feedback effects of poverty on climate change are taken into account, breaking the vicious cycle between climate change and poverty becomes more important and urgent.

Socioeconomic dimensions of climate change-poverty interactions

Bangladesh, being one of the most climate-vulnerable nations in the world, provides varied illustrations on how climate change exacerbates social inequalities and entrenches poverty. Its geographical location, low-lying topography, high population density, and dependence on climate-sensitive livelihoods make it particularly susceptible to adverse effects of climate change. Examining the social dimensions of climate change-poverty nexus in Bangladesh reveals critical insights into how poor and vulnerable populations are disproportionately affected.

Displacement and urban vulnerabilities: Climate-induced displacement ('climate refugees') is a pressing issue in Bangladesh. Rising sea levels, riverbank erosion, and increasing frequency and devastation of cyclones compel millions of people to leave their homes, particularly in the coastal and riverine regions. This migration often leads to a significant influx into urban areas, such as Dhaka and Chittagong, which are ill-equipped to handle such unexpected population explosion. Slum dwellers in these cities face poor housing, inadequate access to clean water and sanitation, and heightened exposure to health risks. Women and children are particularly vulnerable in these precarious living conditions, with limited access to education and healthcare services further compounding their poverty.

Gender inequality and climate impacts: Climate change intensifies existing gender inequalities significantly. Women, especially in rural areas, are more dependent on natural resources for their livelihoods, such as water for household needs and agriculture-related activities. As climate change exacerbates resource scarcity, women must travel longer distances to fetch water or collect fuel, increasing their workload and reducing their time for education or income-generating activities. Additionally, during natural disasters, women and children face higher mortality rates due to cultural norms that limit their mobility and access to timely assistance. Post-disaster scenarios often witness a surge in gender-based violence, further marginalising women and hindering their ability to recover from social and economic distresses.

Health implications for poor and vulnerable populations: Climate change has significant health implications, particularly for poor and marginalised communities in Bangladesh. Rising temperatures, flooding, and stagnant water contribute to the spread of waterborne diseases, such as diarrhea and cholera. Children, women and the elderly are most affected by malnutrition and diseases during and after extreme weather events. Moreover, air pollution from urban congestion, exacerbated by climate migration, increases respiratory illnesses among the urban poor. The lack of access to affordable healthcare systems further deepens their vulnerability, creating a vicious cycle of poverty and ill-health.



Disruptions in education: Frequent climate disasters, including floods and cyclones, disrupt educational opportunities for children of poor households especially in rural areas of Bangladesh. Schools in affected areas are often used as shelters, and infrastructure damage delays the resumption of classes. Poor families, already struggling to recover from climate shocks, are often forced to pull their children out of school permanently to reduce expenses or increase household income by engaging them in child labour. Such disruptions perpetuate intergenerational cycles of poverty by limiting children's future opportunities for upward economic and social mobility.

Poor and marginalised communities and inequitable adaptation: In Bangladesh, marginalised communities, including the poor, indigenous peoples and landless labourers, face unique vulnerabilities to climate change. These groups often reside in ecologically fragile or disaster-prone areas where they lack secure land tenure and access to state resources. Adaptation programmes, while essential, sometimes fail to consider the needs of these groups, leading to inequitable outcomes. For instance, large-scale infrastructure projects, such as embankments or flood control measures, may benefit wealthier landowners while displacing or neglecting the survival needs of the landless poor.

In fact, the social dimensions of climate change in Bangladesh highlight the multifaceted and deeply entrenched challenges faced by the poor and vulnerable populations. Addressing these issues requires a multi-pronged approach that integrates social protection, gender-sensitive policies, and inclusive disaster management systems. By focusing on equity and the needs of the marginalised groups, Bangladesh can better navigate the social impacts of climate change and build a more resilient society.

On the other hand, the economic implications of climate change are profound in Bangladesh, with far-reaching consequences for livelihoods, productivity, and economic stability. As a country that is highly dependent on agriculture, fisheries, and other natural resource-based activities, Bangladesh faces severe economic disruptions due to the increasing frequency and intensity of climate-related events. The economic interactions between climate change and poverty manifest in several interconnected ways that exacerbate the vulnerabilities of marginalised and low-income populations.

Agricultural livelihoods and food security: Agriculture is the backbone of Bangladesh's economy, employing more than 40 per cent of the workforce and contributing significantly to rural livelihoods. However, climate change poses a direct threat to this sector. Erratic rainfall patterns, prolonged droughts, increased salinity from rising sea levels, and frequent flooding have led to declining crop yields, especially for staple crops like rice, maize and wheat. Farmers often incur significant losses due to destruction of standing crops in the field, which, in turn, reduces household income and increases food insecurity. Small and marginal farmers, who constitute more than 85 per cent of the agricultural producers, are particularly vulnerable due to their limited access to capital, technology, and traditional farming practices. The economic instability caused by these challenges forces many to take on high-interest loans or sell assets, further entrenching them in poverty cycle.

Impact on fisheries and the coastal economy: Bangladesh's coastal and riverine communities depend heavily on fisheries for their livelihoods. Rising sea temperatures and changes in salinity levels have disrupted fish migration patterns and reduced the availability of key species, such as hilsa, which is, both economically and culturally, one of the most significant fish species of the country. Additionally, frequent cyclones and storm surges damage fishing equipment, boats, and infrastructure, imposing heavy economic burdens on the fisher folk. The loss of income in these communities often leads to increased rural-to-urban migration, placing further pressure on urban labour market and exacerbating poverty in the destination areas.

Labour market disruptions: Climate-induced displacement and migration significantly affect labour markets in Bangladesh. Rural-to-urban migration, driven by declining availability of agricultural and



coastal livelihoods, results in an oversupply of unskilled labour in the cities. Many migrants end up in informal sectors, such as construction or domestic work, where wages are low and job security is virtually non-existent. Women, in particular, face additional barriers, such as wage disparities and unsafe working conditions. Simultaneously, urban labour markets struggle to absorb the growing number of workers, leading to underemployment and a reduction in average incomes. This oversaturation increases competition for low-paying jobs, perpetuating a cycle of poverty for both migrants and existing urban poor populations.

Bangladesh experiences, almost regularly, significant economic losses from frequent climate-related disasters such as cyclones, floods, and landslides. These events damage critical infrastructure, including roads, bridges, schools, and hospitals, disrupting economic activity and imposing recovery costs on both households and the government. Available estimates put climate-related disaster costs of Bangladesh at billions of dollars annually, diverting resources from development initiatives to disaster response and recovery.

For poor households, these disasters often lead to loss of productive assets, such as livestock or agricultural equipment, pushing them further into debt. The lack of adequate insurance mechanisms exacerbates their vulnerability, as they struggle to rebuild without receiving much external support.

Another related burden emerges from increased health expenditures resulting from climate hazards. The economic burden of climate-induced health impacts has significant impact on poor households. Rising temperatures, water contamination, and stagnant floodwaters contribute to the spread of diseases such as malaria, dengue, and diarrhea. Poor households often bear a disproportionate share of these costs, as they lack access to affordable healthcare services. Health-related economic shocks, such as the inability to work due to illness or the need to pay for medical treatment, significantly reduce household income and savings. These expenses can trap households in poverty and perpetual indebtedness, especially in the absence of social safety nets.

At the macroeconomic level, climate change undermines Bangladesh's development trajectory. Losses in agricultural productivity, infrastructure damage, and disaster recovery costs strain public resources and hinder long-term economic growth. Furthermore, the country's dependence on external aid for climate adaptation reduces fiscal autonomy, limiting its ability to invest in broader economic reforms.

Climate change also creates uncertainty for foreign and domestic investments, particularly in sectors vulnerable to climate and environmental shocks. This can lead to slower industrial growth, reducing job creation and widening economic inequalities. In effect, economic interactions between climate change and poverty highlight a self-reinforcing cycle of vulnerability and economic distress in Bangladesh. To address these challenges, a multi-pronged approach is necessary, including investments in climate-resilient infrastructure, access to affordable credit for vulnerable sectors, and the development of sustainable livelihoods. By integrating climate adaptation into economic planning, Bangladesh can mitigate the economic impacts of climate change and foster a more resilient and inclusive economy.

Linking climate adaptation with poverty reduction

The analysis of climate change and poverty nexus as well as the wide range of consultations carried out under the present study collectively provide a consistent vision that greater mutual recognition and alignment of the climate agenda and poverty reduction initiatives would benefit the outcomes for each of the two concerns. The need is to adopt a structured approach towards moving from the understanding of addressing the climate-poverty nexus to putting into practice climate change and poverty reduction targeted policies, strategies and actions for achieving what specific actions are



required in practice. For Bangladesh, the crucial challenge is to accomplish the above at the national level, taking into consideration local-level needs, challenges and implementation initiatives. In order to realise the synergies, Bangladesh needs to focus on an approach that is built covering a few strategic considerations.

The approach to be adopted needs to be both inclusive and sustainable to help set priorities and focus on issues of trade-offs. This will achieve outcomes that are more equitable and effective in responding to climate change and poverty. In addition, social inclusion including the ‘leave no one behind’ and inclusive imperatives agenda -- that prioritise the needs of the most vulnerable and extreme poor – along with empowerment of the affected populations have to be considered as fundamental ingredients. Furthermore, environmental sustainability is an imperative as well. In practice, these are compatible with the ‘climate justice’ perspective, which considers ethical and political dimensions of climate change, and proposes actions towards recognising and addressing existing inequality in the distribution of impacts of climate change. The climate impacts of poverty reduction and development also need to be considered in terms of how best to promote improved well-being and reduce inequality, while not increasing overall mitigation needs.

In order to be effective, the approach also needs to incorporate both institutional and operational aspects. On the one hand, Bangladesh may have to introduce a range of institutional changes to integrate poverty and climate responses within existing (or new/modified) institutions at all levels, to ensure greater effectiveness in implementation. On the other, operational considerations are important for addressing the climate-poverty nexus in an integrated manner. This requires, for example, utilisation of available tools, such as climate vulnerability and poverty assessments and building an enabling environment for effective coherence and coordination along with the means for implementation, e.g. capacity-development and accountability frameworks.

The above approach can be designed for implementation at both national and subnational levels. In practice, the change process towards more connected and integrated approaches needs to work simultaneously at both levels. This would cover projects and programmes at the grassroots level in local communities that would be linked to macro-level policies relating to climate adaptation, as well as poverty reduction. Furthermore, the principle of subsidiarity – that planning, decision-making, implementation and monitoring would have to take place at the lowest (local) level that is feasible in the country – would be a central component of national level policy coherence and coordination. Appropriately-scaled monitoring and accountability mechanisms are needed to ensure functionality and allow for correction, as and when necessary and appropriate.

In particular, the above is aligned with the ‘climate-resilient development pathways’ approach as articulated in the IPCC’s Fifth Assessment Report: “A climate-resilient pathway for development is a continuing process for managing changes in the climate and other driving forces affecting development, combining flexibility, innovativeness, and participative problem solving with effectiveness in mitigating and adapting to climate change” (Denton et al., 2014: 1106).

Broad transmission channels

The important issue is to acknowledge that the effects of climate change on poverty and inequality, as identified above, are transmitted through three major channels – social, economic and political – that work in a society and their associated characteristics. For example, the economic channel may work through reduction of private resources available to the poor and disadvantaged groups in society. In an unequal society with a large number of people living in poverty, the poor and disadvantaged groups have less assets and income from their own resources; and hence they are more exposed and susceptible to climate hazards along with less capability to cope and recover. Similarly, the social



channel is captured by the rich and the influential section in society and remains highly biased towards these interest groups. Hence, during climate disasters, the social channel remains mostly unresponsive to the needs and requirements of the poor and disadvantaged sections in society. The political channel, on the other hand, works through the state power. In an unequal society, the privileged sections (owning most of the productive assets and enjoying state power and privileges, both legally and illegally) usually capture and/or acquire dominating influence on the functioning of the state, and hence can dictate policies to serve their interests.

As a consequence, more public (state) resources are deployed for the protection of their interests against climate hazard, while leaving the poor and disadvantaged groups with the residuals. The political channel thus contributes towards rising poverty and inequality that further aggravate environmental degradation and climate hazards (Boyce, 2003). In reality, social decisions are not based on maximisation of aggregate 'utilities' that accrue from a particular decision to different sections of people in society. Rather, public decisions in an unequal society, where state power is captured by vested interest groups, are determined by the weighted sum of 'utilities', in which the 'utilities' of the rich, powerful vested interest groups are given much higher weights.

In Bangladesh, the reality brings out the fact that GHG-emission intensive activities mostly serve the needs and comforts of the rich and privileged groups in society; moreover, they have the ability to protect themselves from the adverse effects of climate change through enjoying the disproportionately large proportion of the benefits of protection and adaptation measures. As a result, in the highly unequal and poverty-ridden Bangladesh society, public policies usually leave the poor and disadvantaged sections in society more exposed and susceptible to climate hazards. The adaptation policies thus most often benefit these advantaged groups much more than the poor and can be quite pervasive.

Climate Change: Political and Cultural Fallouts

For effectively dealing with the climate crisis -- a truly global phenomenon -- collective actions are required at both global and national levels although these are burdensome and costly. Further, climate change hazards are extremely unequally distributed across countries and the impacts extend beyond the environmental and economic realms; and significantly influence political and cultural dynamics across countries. Being a highly climate vulnerable country, political and cultural fallouts of climate change in Bangladesh are profound, covering issues of governance, identity, migration, social justice, and resilience. Climate change affects all dimensions of the country's development agenda causing significant changes in governance and institutional landscape. Over the last few decades, both government and non-government initiatives (e.g. by civil society organisations (CSOs) and NGO-MFIs) at the grassroots level to deal with climate change challenges have produced extensive knowledge and practices to help local communities adapt to the changing environment. At the national level, the government's major initiatives such as the National Adaptation Programme of Action (NAPA) and Bangladesh Climate Change Strategy and Action Plan (BCCSAP) along with two financing mechanisms -- Bangladesh Climate Change Trust Fund (BCCTF) and Bangladesh Climate Change Resilience Fund (BCCRF) -- are in operation to respond to climate change challenges. The CSOs and NGO-MFIs are also active development partners in the climate change arena.

Despite these efforts, Bangladesh still requires an effective, flexible and decentralised institutional framework to deal with the challenges of decision-making, planning and implementation of local level programmes and adaptive measures to address climate change hazards. The current structure is highly centralised and fragmented resulting in ineffective resource allocation and management systems, and biased towards project-oriented planning instead of resource-based planning (Koudstaal



et al. 1999; MoEF, 2007). Likewise, the adaptation activities are mostly confined to the pilot scale by the government agencies, CSOs, NGO-MFIs, and private research organisations, showing limited capacity to integrate the innovations and lessons learned into national and local development planning processes and practices (Rahman et al., 2007; Mitchell, Tanner, and Wilkinson 2006).

Increased pressure on public spending: Currently, the government spends around 6–7 per cent of its annual budget on adaptation, about 75 per cent of which comes from domestic sources. However, scaling up adaptation measures as outlined in the National Adaptation Plan (2023–2050) would require at least seven times the current spending. Thus climate change places immense pressure on limited budgetary resources and challenges the government's capacity to respond effectively and provide relief and rehabilitation to climate change affected populations. The government's ability to manage resources for adaptation and disaster response is highly strained, leading to political dissatisfaction and heightened sufferings of the affected communities. At the subnational (district/upazila) level, local government could establish monitoring, evaluation and learning systems to ensure ownership, transparency and accountability for adaptation initiatives. Similarly, local CSOs and NGO-MFIs could set up accessible feedback mechanisms that would enable local communities to share their experiences of adaptation interventions with the local government. This will help build trust between communities and local governments and improve the effectiveness of adaptation measures, including local development and resilience plans.

Climate-induced displacement and migration: As sea levels rise, millions of people living in low-lying coastal areas are at risk of displacement. It is estimated that by 2050, Bangladesh could see 20 million people displaced due to climate change. The displacement is likely to increase pressure on urban centres, leading to overcrowding, excessive pressure on inadequate infrastructure, and social unrest. As displaced populations struggle to find secure living conditions, there may be political pushback against the arrival of climate migrants, exacerbating social tensions. As a result of climate-induced displacement, many people may seek refuge in other countries creating challenges as countries negotiate the treatment and rights of climate refugees.

Supporting the communities most at risk of climate impacts requires transitioning away from fossil fuels. Yet in Bangladesh, the transition to a climate-resilient and low-carbon economy could negatively impact vulnerable individuals and communities whose livelihoods may be affected by changes in the practices of carbon-intensive sectors. Dialogues between employers, trade unions, workers and government are necessary to ensure a just transition that can help to up-skill or re-skill current employees in the affected enterprises. In the agriculture sector, which employs a large proportion of the population, policies that reduce emissions and increase resilience need to be planned carefully so as not to adversely affect vulnerable communities in rural areas of the country.

Challenges in allocating relief and rehabilitation assistance to affected communities: In times of climate-induced crises, corruption in the distribution of relief materials and rehabilitation assistance can exacerbate political tensions. There are concerns that aid and resources do not always reach the most vulnerable communities due to inefficiencies, corruption, or political favouritism. This could undermine public trust in political institutions and intensify political divisions.

Loss of traditional livelihoods: Climate change has increasingly been affecting traditional livelihoods, particularly those reliant on agricultural activities, fishing, and coastal traditional activities. Many rural people in Bangladesh depend on farming and fishing for survival. Rising salinity levels and the destruction of coastal ecosystems due to rising sea levels and cyclones are threatening these activities, leading to loss of cultural practices tied to land and water. The decline of these local specialised activities could weaken the cultural identity of the communities that rely on these resources. Loss and damage is often categorised as economic or noneconomic, although the two categories are



interconnected. Economic loss and damage can be assigned a monetary value. What constitutes noneconomic loss and damage depends on communities' living experiences, values and perspectives; and can include negative impacts on cultural heritage, human health and mobility, indigenous knowledge, and biodiversity. Climate change is pushing more people from rural, agricultural communities into urban centres, particularly Dhaka, which is already one of the fastest-growing cities in the world. This mass migration could result in a shift in cultural norms as rural traditions mix with urban lifestyles. At the same time, rural communities face the loss of their cultural roots as they adapt to life in crowded urban environments, which often lack the social and cultural support systems of rural areas.

Cultural heritage and disappearance of coastal communities: As coastal communities face displacement due to rising sea levels and flooding, they risk losing their cultural heritage. Traditional practices, festivals, and local identities that are closely tied to specific geographical locations may be wiped out. For example, the famous floating villages in the coastal areas, home to many indigenous and local groups, are being forced to relocate as their ancestral lands become uninhabitable. The loss of these communities and their cultural practices represents significant cultural fallout for the country. Bangladesh's coastal regions are home to unique cultural practices and ecosystems that attract both domestic and international tourism. The loss of culturally significant landscapes, like the Sundarbans (home to Royal Bengal Tigers), could negatively impact the cultural heritage and economic well-being of coastal communities, which are heavily dependent on tourism.

Preservation of indigenous knowledge: Indigenous communities in Bangladesh, particularly tribal communities in the Chittagong Hill Tracts (CHT), marginalised indigenous communities in the plains and coastal areas, possess unique knowledge related to sustainable agriculture and fishing, and natural resource management. With climate change threatening their ways of life, there is a risk that this traditional knowledge could be lost. These indigenous communities have to be placed at the forefront of advocating for climate action, and their experiences could help shape future policies on climate resilience and adaptation.

Cultural adaptation to new norms: Climate change may often require shifts in cultural practices, particularly regarding resource use and consumption. For example, in agricultural communities, farmers may need to adopt new crop varieties or change their farming practices to adapt to changing climatic conditions. These changes may face resistance, as traditional ways of life are deeply embedded in cultural norms. There could be a cultural conflict between preserving traditional practices and adopting new, climate-resilient technologies.

Role of women and gender inequality: In Bangladesh, climate change impacts such as floods, cyclones, and droughts disproportionately affect women, who are typically more vulnerable due to social and economic inequalities. While women have been crucial in community-level adaptation efforts, gender inequalities often limit their full participation in climate resilience initiatives. This situation could create social pressures and reinforce traditional gender roles, hindering progress towards gender equality.

Climate justice movements: Bangladesh is one of the countries most affected by climate change, despite very little contribution to global GHG emissions. Such disparities have sparked debates on 'climate justice' – the idea that wealthier, industrialised countries that have historically emitted the most GHGs should bear the proportionate responsibility in funding climate adaptation and mitigation efforts in vulnerable countries. The political fallout includes calls for climate reparations and demands for global action to tackle climate change.

Heightened public activism: In recent years, there has been a growing movement for environmental justice and climate activism in Bangladesh. Young people, particularly through social media, have



increasingly been urging for more government action on climate change, including better disaster preparedness, investments in green infrastructure, and more ambitious carbon reduction targets. This activism has spurred a more vocal public discourse on climate change, shifting cultural attitudes towards sustainability and environmental protection.

Overall, the political and cultural fallouts of climate change in Bangladesh are profound and wide-ranging. Political instability, internal and international migration, erosion of traditional livelihoods, and loss of cultural heritage all contribute to the complexity of Bangladesh's climate crisis. At the same time, there is a growing sense of resilience within communities, with efforts to adapt and mitigate the impacts of climate change at the grassroots level. However, for these efforts to succeed, national and international support, effective governance, and recognition of the cultural significance of climate action are crucial. Addressing these challenges in a way that respects Bangladesh's unique cultural heritage and fosters social justice are the keys to navigating the political and cultural fallouts of climate change.

Poverty Updates

Until the 1970s, household income (or expenditure) was the commonly used yardstick to measure poverty, based on expenditures needed to access basic necessities such as food, fuel, accommodation, and clothing. Over time, this unidimensional economic indicator has been supplemented by more complex approaches. The basic needs approach was proposed in 1976 (ILO World Employment Conference 1976) which focused on a range of human needs beyond food and shelter, including social services such as healthcare and education. While providing a more complete picture of people's wellbeing, the basic needs approach still remained consumption oriented.

In the 1980s, Amartya Sen put forward the argument that 'poverty is a complex and multidimensional concept'. Freedom and capabilities to achieve wellbeing are the ones that matter, rather than the minimum needed for physical survival (Sen, 2001).

Building on these concepts, United Nations Development Programme (UNDP) introduced the Human Development Index (HDI) in 1990. The HDI takes a multidimensional approach to poverty by examining different measures of deprivation to provide a single, composite number for each country. The annual Human Development Reports, which use the HDI, provide a way to compare countries, but often miss out important differences within countries and among different population groups. Men and women, for example, may experience deprivation differently. Economic wellbeing may not necessarily translate into greater freedoms for women and girls, indigenous peoples, persons with disabilities, and other marginalised groups.

In response to these critiques, UNDP introduced new ways to measure wellbeing in 1995, including a Gender Empowerment Measure, which considered women's representation in national parliaments, economic decision making positions, and women's share of income. Some environmental dimensions of poverty, such as availability of clean water and sanitation, and protection from mosquito-borne diseases like malaria, were reflected under the Millennium Development Goals (MDGs), emerging from the Millennium Declaration adopted by the UN General Assembly in 2000. However, environmental sustainability and hazards such as pollution from chemicals, waste, motor vehicle emissions, and climate change effects were not adequately reflected.

More recently, specific dimensions of poverty, such as lack of access to water or energy, have been considered in these measurements. The 2020 UNDP Human Development Report brought a planetary lens to its assessment, considering countries' respective carbon emissions and material footprints. The result is a new index: Planetary Pressures Adjusted Human Development Index. Based on this new integrated measure, more than 50 countries previously ranked as 'very high' in terms of human development lost that status due to their dependence on fossil fuels and high consumption of raw



materials.

Trends in Bangladesh's national poverty

Poverty in Bangladesh has declined remarkably since the early 2000s, as a result of decades of accelerated economic growth and rapid socioeconomic development. It is widely recognised that, after independence in 1971, Bangladesh's poverty rate was extremely high estimated at more than 80 per cent in 1972. According to the Household Income and Expenditure Survey (HIES) data, national poverty headcount rate has declined to 18.7 per cent in 2022 (Table 2.2).

Table 2.2: Poverty headcount rates in Bangladesh

	% of population below upper poverty line					% of population below lower poverty line				
	2000	2005	2010	2016	2022	2000	2005	2010	2016	2022
National	48.9	40.0	31.5	24.3	18.7	34.3	25.1	17.6	12.9	5.6
Urban	35.2	28.4	21.3	18.9	14.7	19.9	14.6	7.7	7.6	3.8
Rural	52.3	43.8	35.2	26.4	20.5	37.9	28.6	21.1	14.9	6.5

Source: HIES reports, various years

The national poverty headcount rate declined by nearly 62 per cent (30 percentage points) between 2000 and 2022. In 2000, nearly 49 per cent of Bangladesh's population was poor (per capita consumption below the upper poverty line) as compared with 19 per cent in 2022. The percentage decline in poverty rate was almost similar in urban (58 percent) and rural areas (61 percent).

A notable feature of recent poverty reduction is a sizeable decline in the incidence of extreme poverty. The percentage of population under the lower poverty line -- the threshold for extreme poverty -- fell by nearly 84 per cent (or 20 percentage points) between 2000 and 2022. A fall of 81 per cent (or 16 percentage points) occurred in urban areas and 83 per cent (31 percentage points) in the rural areas (Table 2.2). The percentage decline in extreme poverty rate is thus more than that in the poverty rate, which shows higher growth in per capita consumption for the bottom two deciles.

During the period, the fall in poverty headcount rates has been large enough to significantly reduce the number of people living in poverty and extreme poverty. The numbers of population below the upper poverty line and lower (extreme) poverty line declined by nearly 31 million and 34 million respectively between 2000 and 2022. However, it must also be remembered that an estimated 31 million Bangladeshis still live below the (upper) poverty line in 2022, and nearly 10 million among them live below the lower or extreme poverty line.

The depth (poverty gap) and the severity (squared poverty gap) of poverty have shown significant improvements as well; falling to 3.8 per cent and 0.9 per cent respectively for the upper poverty line in 2022 (BBS, 2022). The rates of decline are similar for both urban and rural areas.

The above trends suggest significant improvement among those living below the poverty line. A fall in poverty gap indicates that the average consumption of the poor has improved, while a decline in squared poverty gap implies more equitable distribution of consumption among the poor. These improvements have also taken place at similar rates for the urban and rural poor.

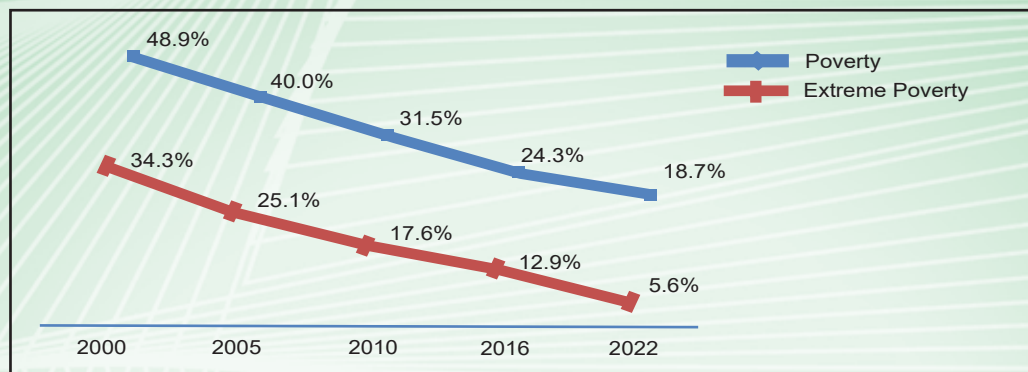
It may, however, be noted that, while the rural-urban gap in poverty rate is narrowing down, the gap still remains considerable. The rural poverty rate in 2022 is 20.5 per cent compared with the urban poverty rate of 14.7 per cent. Thus, although the rural areas account for about 68 per cent of the total population of Bangladesh, they are home to more than 76 per cent of the poor people in the country. Since these poverty rates are measured by consumption based indicators in Bangladesh, rapid growth in



consumption is the primary contributing factor.

However, since there exists a large disparity in the initial distribution of consumption between the poor and the non-poor, even similar growth rates for all consumption groups would necessarily imply an increase in the average size of the gap in consumption between the poor and the non-poor.

Figure 2.1: Poverty and extreme poverty headcount in the 2000s



Source: BBS, HIES, various years.

Despite the recorded progress in poverty reduction so far, the pace of job creation and poverty reduction seems to have slowed over the last decade -- a period that witnessed faster economic growth. As the country is rapidly urbanising, its rural and urban areas did not experience similar poverty reduction rates in the past. The poverty rates fell in both rural and urban areas, but the speed of reduction was much slower in urban Bangladesh.

The rural areas reduced poverty impressively, accounting for the major share of poverty reduction although poverty fell more slowly among households engaged in agriculture than among households working in rural nonfarm activities. In the case of urban areas, poverty reduction was mainly driven by welfare gains among households engaged in manufacturing and construction. However, job creation in manufacturing is seen to have slowed down in recent years, limiting the number of households that benefit from manufacturing growth.

Overall, recent poverty reduction has continued to be delivered by changes in labour income rather than transfers. However, one worrisome development is that income inequality, as measured by the Gini index, has been rising in a persistent manner which reached 0.499 at the national level in 2022, turning the income distribution extremely unequal in Bangladesh. The regional poverty gap also continues to remain high. The stronger progress of poverty reduction in the more advanced regions has widened the gap between these and the lagging regions. This is driven by the fact that structural transformations are slow in the lagging regions, with most of the fast growing and job creating sectors concentrated in the relatively advanced regions.

Since the early 2020s, Covid-19 pandemic reversed the progress in poverty reduction which also disproportionately affected the poor mainly through job losses and reduced earnings, especially among women. Although employment levels have somewhat improved in recent years, earnings have not bounced back to pre-pandemic levels as yet. Concerns further remain high for the poor and vulnerable groups due, among others, to persistently high inflation (at around 10 per cent) especially of the basic food items.

Along with raising the levels of income and access to basic services, enhancing social protection measures and financial inclusion are two important strategies for reduction in poverty and inequalities in Bangladesh. With the vast majority of the workforce engaged in informal employment, enhancing the coverage of social protection is critical and is a smart investment



for addressing poverty. Bangladesh needs to adopt an inclusive development path that will bring down the incidence of poverty to acceptable levels. For the purpose, Bangladesh needs to overcome the current challenges faced by the economy after the 'August Revolution' in 2024 to ensure rapid recovery from the socioeconomic disruptions, generate rapid growth and development, create productive and remunerative employment, adopt broad-based strategy of inclusiveness, and pursue a sustainable development pathway that is resilient to disaster and climate change. Further, early return to democratic governance and building resilience amid heightened uncertainty are necessary for ensuring conducive macroeconomic fundamentals necessary for inclusive and equitable development.

Moreover, recent data suggests that the earlier trend in poverty is somewhat reversing. The World Bank highlights that the extreme poverty rate—defined as living on less than \$2.15 per day—dropped from 12.9 per cent in 2016 to 5.6 per cent in 2022. However, more recent assessments indicate a rise, with the rate increasing to 6.1 per cent in 2023-24 and projected to rise to 7.0 per cent by 2024-25 (World Bank, 2023).

This rise in the poverty rate could result in an additional 3.57 million people falling below the extreme poverty line between 2021-22 and 2024-25. The rise in poverty is linked to factors such as slowing economic growth, job losses, and wage cuts, particularly in the industrial and service sectors. Additionally, persistent high inflation has reduced purchasing power, disproportionately impacting low-income families. Despite efforts by the present interim government, the country continues to face many challenges, including a slow growth (estimated by the World Bank at 3.3 per cent in 2024-25), escalating inflation, continued vulnerabilities in the financial sector, heightened social instability and instability in the law and order situation. Production level in all sectors has been hampered by disruptions in raw material imports, increased energy prices, and shortages in availability of power and gas. On the demand side, high inflation and growing uncertainty have dampened private consumption and investment. The trade deficit has narrowed due to reduced imports and steady export performance. Inflation has not been tamed, driven by higher government-controlled energy prices and currency depreciation.

To tackle these challenges, structural reforms are necessary to ensure, among others, financial sector stability, more favourable business environment to attract domestic and foreign investments, and greater domestic resource mobilisation. These reforms are essential for Bangladesh to revitalise its poverty reduction efforts and sustain long-term economic growth.

Poverty at sub-national level: Poverty Map 2022

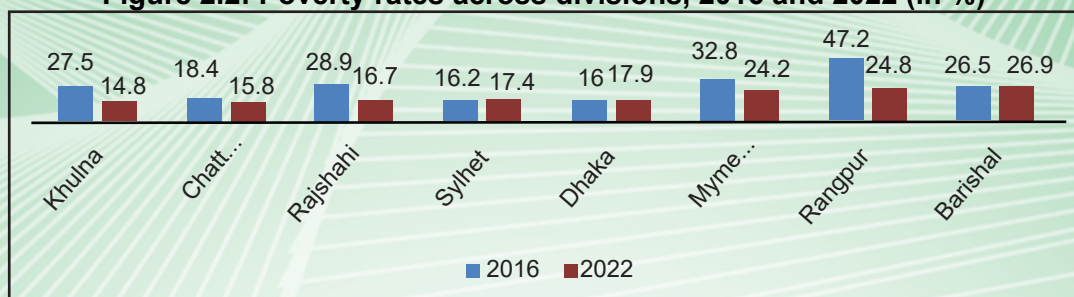
The Poverty Map of Bangladesh 2022 provides a detailed spatial picture of poverty distribution throughout the country, shedding light on regional disparities and the socioeconomic factors that drive such disparities. The map helps to pinpoint areas with concentrated poverty to help design more effective and targeted interventions. The 2022 Poverty Map highlights stark regional differences in poverty levels across Bangladesh. The national poverty rate is estimated at 20.3 per cent, with rural communities facing greater poverty hardships compared with urban areas. The rural poverty rate is estimated at 22.6 per cent, while urban areas have a lower poverty rate of 17.1 per cent.

The Poverty Map 2022 shows marked relationships between climate hazards and vulnerabilities on the one hand, and poverty incidence on the other. In the case of eight administrative divisions, Barisal is identified as having the highest poverty incidence. It may be added that Barisal belongs to the coastal region and is routinely subjected to natural disasters including floods, cyclones and salinity intrusion. Historically, Rangpur division was characterised by highest poverty incidence due to floods, river erosion and chronic seasonal food shortages commonly known as Monga. However, significant progress in poverty reduction is noted in Rangpur, where the poverty rate dropped from 47.2 per cent



in 2016 to 25 per cent in 2022. In contrast, Barisal experienced a slight increase in poverty rate -- from 26.5 per cent in 2016 to 26.9 per cent in 2022 (Figure 2.2).

Figure 2.2: Poverty rates across divisions, 2016 and 2022 (in %)



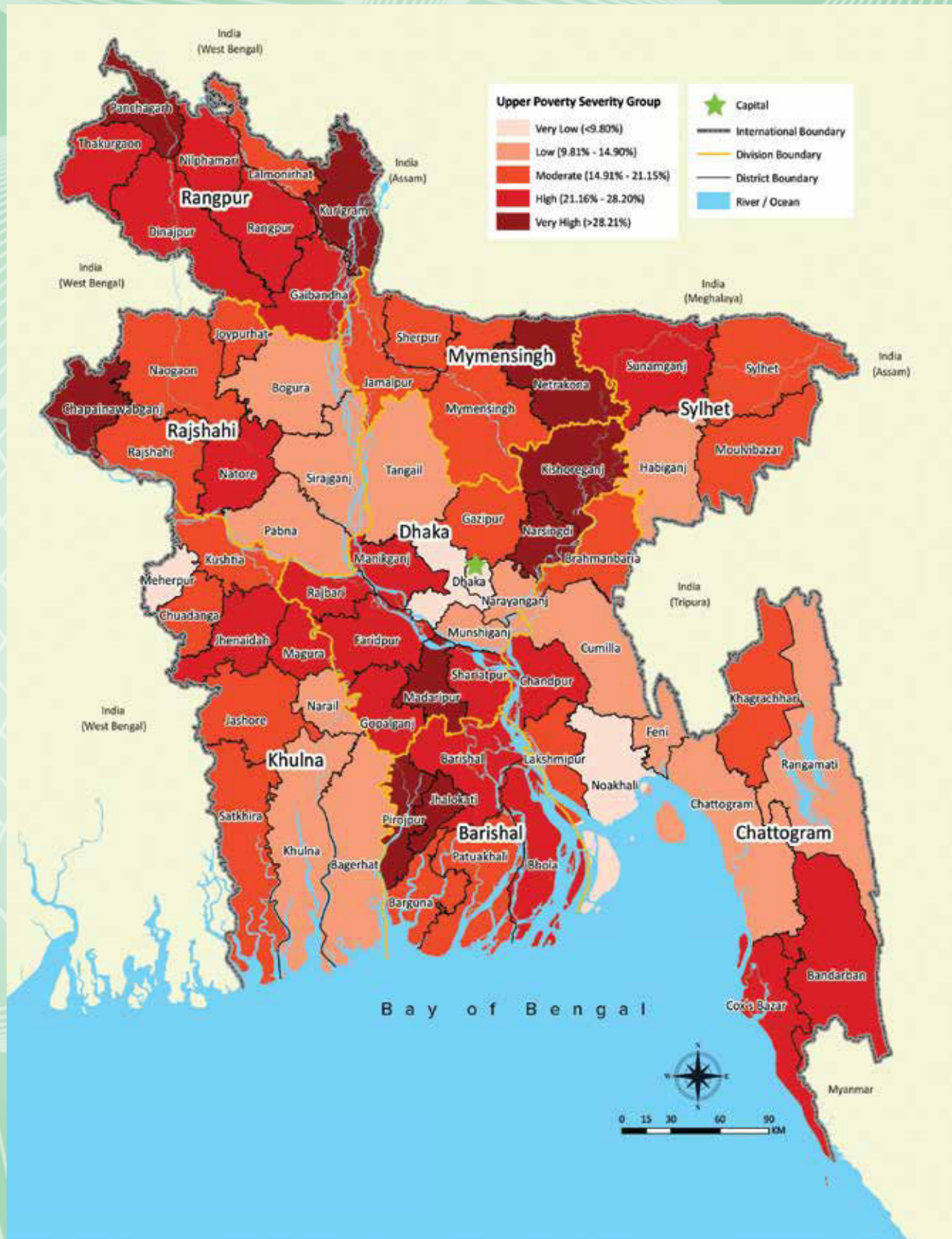
Source: BBS (2025), Poverty Map of Bangladesh 2022.

Using the small area estimation method and drawing information from the 2022 HIES and 2022 Population and Housing Census, BBS has published estimates of poverty rates across all districts and upazilas of the country. For the districts, 2022 Poverty Map shows noticeable shifts in the extent of incidence of poverty at the district level compared with similar analysis based on 2016 HIES and earlier population census reports. In the case of the earlier Poverty Map, Shariatpur, Mymensingh, Sherpur, Gopalganj, Rajbari, Kurigram, Netrokona, Barisal, Faridpur, Madaripur, and Sirajganj were among the most impoverished districts of the country. In 2022 Poverty Map, new districts such as Narsingdi, Pirojpur, Kishoreganj, Chapai Nawabganj, Jhalokati, and Panchagarh have emerged as poverty hotspots. Meanwhile, Shariatpur, Rajbari, Gopalganj, Faridpur, and Sirajganj have witnessed significant improvements and are no longer included among the most poverty affected districts of the country. However, Madaripur, Netrokona, and Kurigram continue to remain impoverished over these years.

This shifting poverty landscape across the districts, as revealed in the Poverty Maps, reflects the combined impacts of a host of contributing factors including, for instance, impacts of targeted policies and programmes, differential effects of climate change, and geographical and locational factors. The progress in poverty reduction can thus be attributed to both government and nongovernment (including microfinance sector) efforts in tackling poverty, food insecurity and other deprivations. On the other hand, worsening poverty situation in Barisal underscores, among others, the growing influence of climate change in coastal regions. Once considered as ‘the granary of Bengal’, Barisal now faces rising salinity levels, declining crop yields, and increasing climate-related challenges, forcing many residents to abandon traditional livelihoods and fall deeper into poverty.

The unequal distribution of wealth and opportunities has also contributed to these shifts. For example, Noakhali currently has the lowest poverty rate at 6.1 per cent, whereas Madaripur suffers from an alarming poverty rate of 54.4 per cent, nearly triple the national average of 18.7 per cent. Such disparities are likely to be the consequences of spatially uneven development initiatives, unequal access to socioeconomic opportunities, and many other factors that contribute to inequalities. The above indicates the contribution of multiple factors that drive

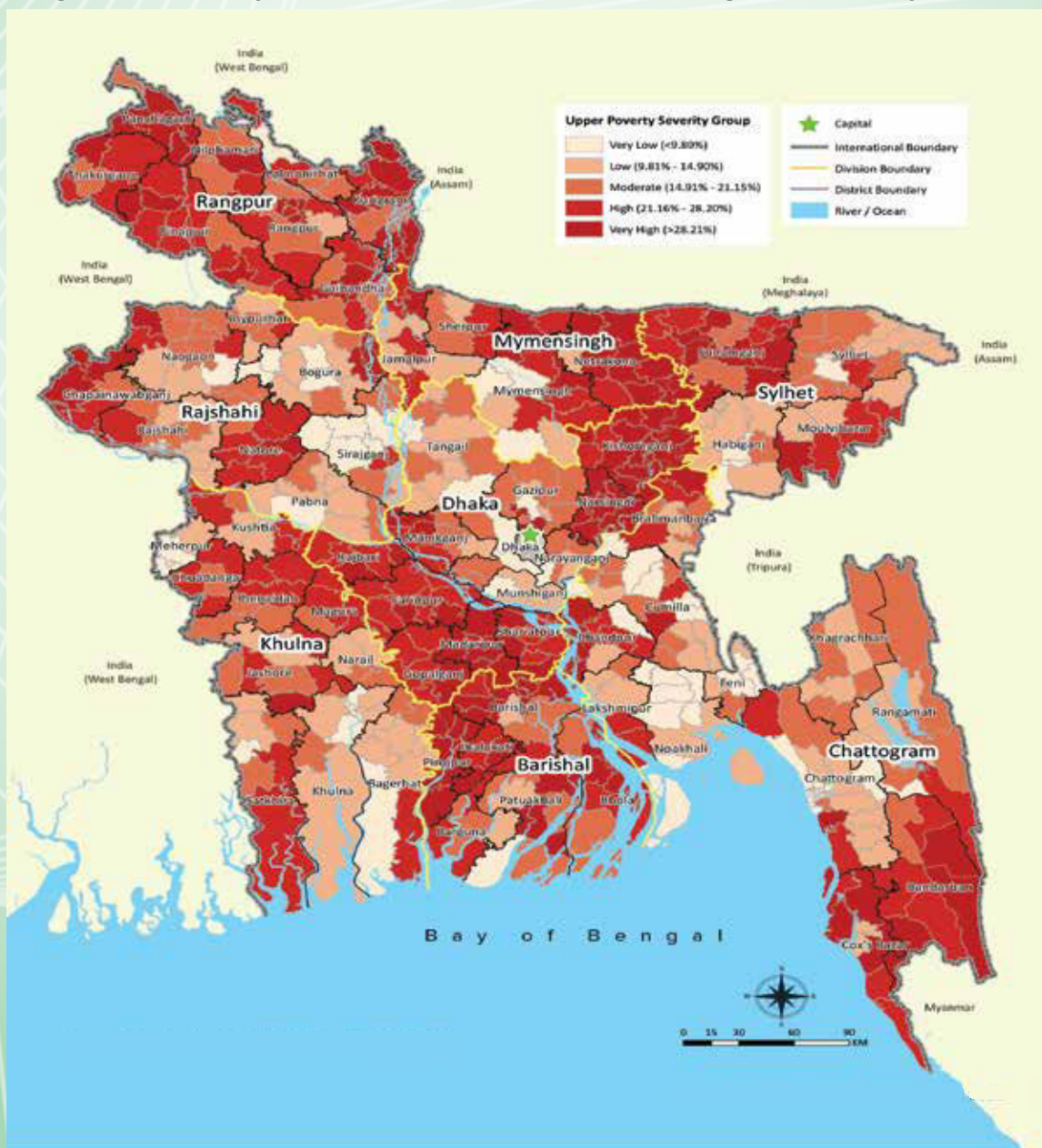




Source: BBS, 2025

the spatial disparities in poverty across Bangladesh. In particular, the rural households heavily depend, in the presence of limited opportunities for pursuing profitable nonfarm activities, on agriculture and related activities for their livelihood and prosperity. As such, the rural households are more susceptible to poverty, particularly in regions that are vulnerable to climate change. Flood-prone and coastal areas, particularly in the eastern, central and coastal regions of the country, experience higher poverty rates due to frequent natural disasters like cyclones and floods, which lead to repeated economic disruptions and displacement. In urban areas, while poverty rates are generally lower, rapid urbanisation has led to the expansion of informal settlements (bastees). Migrants from rural areas often settle in these slums, where they face poverty along with poor living conditions, limited job opportunities, inadequate sanitation, and restricted access to essential services like education and healthcare.

Figure 2.4: Poverty estimates at the upazila level (using upper poverty line), 2022



Source: BBS, 2025



Upazila-level poverty estimates and climate vulnerability

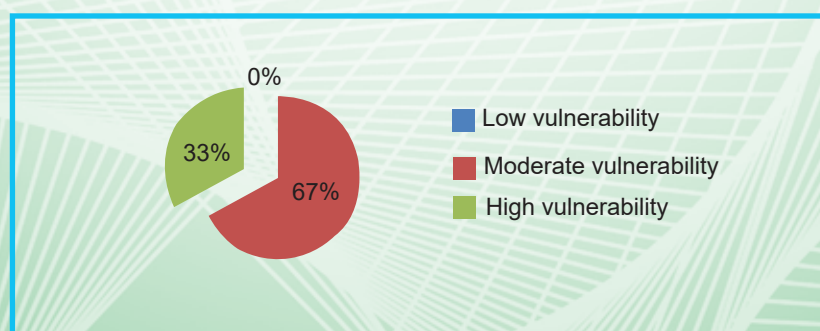
As indicated above, the BBS Poverty Map of Bangladesh 2022 provides a detailed spatial picture of poverty distribution at the upazila level throughout the country. In this section, the 30 most poverty-stricken upazilas in Bangladesh have been categorised according to their level of climate vulnerability. The upazilas have initially been grouped into five poverty quantile based on the headcount ratio (HCR). The first (HCR < 9.80 per cent) and second (9.81 per cent ≤ HCR ≤ 14.90 per cent) quantile represent very low and low levels of poverty, while the third (14.91 per cent ≤ HCR ≤ 21.15 per cent) indicates moderate poverty. The fourth (21.16 per cent ≤ HCR ≤ 28.20 per cent) and fifth (HCR > 28.20 per cent) quantile reflect high and very high levels of poverty respectively, highlighting significant economic challenges that necessitate targeted development efforts. In this analysis, out of the country's 495 upazilas, 30 with the highest levels of poverty have been considered in relation to their climate vulnerability.

Based on risk mapping for climate vulnerability across 487 upazilas in Bangladesh, the severity of climate vulnerability among the most poverty-stricken upazilas has been considered. These upazilas have been classified using a Vulnerability Index (VI), calculated by incorporating multiple climate-induced disaster indicators, including: storm surge inundation (m), inundation due to riverine flooding, One-day maximum rainfall (mm), salinity intrusion due to sea level rise (per cent), drought, cold waves, heat waves, hailstorms, flash floods and river floods. In the initial classification, upazilas have been assigned a vulnerability score ranging from 1 to 5, as 1 (no/very low), 2 (low), 3 (moderate), 4 (high) and 5 (very high) respectively. The Vulnerability Index has been determined using the Principal Component Analysis (PCA) of various risk maps illustrating vulnerability levels. Finally, the upazilas are grouped into three clusters based on their overall vulnerability- -- (1) low, (2) moderate and (3) high vulnerability. This classification helps in identifying the most at-risk regions, allowing policymakers to develop targeted strategies to mitigate both poverty and climate-related risks.

Figure 2.5 presents data on relationship between climate vulnerability and poverty in upazilas in Bangladesh, based on 2022 Poverty Map findings. It categorises the highest 30 poverty-stricken upazilas into three levels of climate vulnerability: low Vulnerability, moderate vulnerability and high vulnerability. None of the most poverty-affected upazilas fall into the low climate vulnerability category. The majority (67 per cent) of the most poverty-stricken upazilas experience moderate climate vulnerability while the remaining 33 per cent of these upazilas face high climate vulnerability.

The above indicates that poverty in Bangladesh is predominantly concentrated in locations (upazilas) having moderate to high climate vulnerability. This highlights the need for targeted interventions in these locations/regions to address both economic hardship and climate risks.

Figure 2.5: Relationship of climate vulnerability with poverty at upazila level



Source: Authors' compilation



Additionally, by examining the most poverty-stricken upazilas, the upazila-wise scenarios can be analysed. Table 2.3 provides an econometric insight into the intersection of extreme poverty and climate vulnerability across the 30 most poverty-stricken upazilas in Bangladesh. The poverty quintile (Q5) and headcount ratio (HCR) illustrate severe economic deprivations, with the highest HCR observed in Dasar (63.2 per cent). Notably, 67 per cent of these upazilas fall under moderate climate vulnerability, while 33 per cent face high climate vulnerability, highlighting the strong overlap between poverty and climate risk. The Total Vulnerability Index (TVI), derived from multiple climate-induced disaster indicators, varies significantly, with the highest risk observed in Bishwambharpur (TVI = 28) of Sunamganj district and Borhanuddin (TVI = 28) of Bhola district. The econometric implication suggests a potential causal relationship where higher climate vulnerability exacerbates poverty, requiring targeted policy interventions. Furthermore, locations with higher climate vulnerability (such as Madaripur Sadar, Durgapur, and Khaliajuri) tend to have high TVI scores, reinforcing the need for climate adaptation strategies alongside poverty alleviation programmes.

Table 2.3: Poverty status and climate vulnerability at upazila level

Sl. No.	District	Upazila	Poverty Quintile (2022)	2022 HCR Upper (%)	Status of climate vulnerability (Low=0-1, Moderate=1-2, High=2-5)	Total vulnerability index
1	Madaripur	Dasar	Very High (Q5)	63.2	Moderate	17
2	Mymensingh	Haluaghat	Very High (Q5)	59.6	Moderate	19
3	Madaripur	Kalkini	Very High (Q5)	56.3	Moderate	17
4	Madaripur	Rajoir	Very High (Q5)	56.0	Moderate	15
5	Madaripur	Shibchar	Very High (Q5)	55.1	Moderate	15
6	Jhalokati	Nalchhity	Very High (Q5)	53.8	Moderate	17
7	Mymensingh	Gouripur	Very High (Q5)	52.9	High	20
8	Madaripur	Madaripur Sadar	Very High (Q5)	50.0	High	21
9	Narsingdi	Belabo	Very High (Q5)	49.5	Moderate	18
10	Panchagarh	Boda	Very High (Q5)	48.2	Moderate	18
11	Pirojpur	Pirojpur Sadar	Very High (Q5)	47.7	Moderate	15
12	Narsingdi	Raipura	Very High (Q5)	47.6	Moderate	13
13	Netrakona	Durgapur	Very High (Q5)	47.6	High	21
14	Kishoreganj	Mithamain	Very High (Q5)	47.4	Moderate	14
15	Kishoreganj	Nikli	Very High (Q5)	47.3	Moderate	13
16	Netrakona	Khaliajuri	Very High (Q5)	47.2	High	23



Sl. No.	District	Upazila	Poverty Quintile (2022)	2022 HCR Upper (%)	Status of climate vulnerability (Low=0-1, Moderate=1-2, High=2-5)	Total vulnerability index
17	Sunamganj	Bishwambharpur	Very High (Q5)	46.7	High	28
18	Brahmanbaria	Nasirnagar	Very High (Q5)	45.9	Moderate	16
19	Netrakona	Netrakona Sadar	Very High (Q5)	45.8	High	21
20	Kishoreganj	Itna	Very High (Q5)	45.0	High	25
21	Chapainawabganj	Shibganj	Very High (Q5)	44.6	Moderate	14
22	Dinajpur	Bochaganj	Very High (Q5)	44.6	Moderate	19
23	Bhola	Borhanuddin	Very High (Q5)	44.2	High	28
24	Cox's Bazar	Chakaria	Very High (Q5)	43.3	High	24
25	Narsingdi	Narsingdi Sadar	Very High (Q5)	43.1	Moderate	13
26	Rangpur	Haragachh	Very High (Q5)	42.0	Moderate	13

Source: Authors' estimation

Such regional disparities in poverty and their spatial shifts call for adoption of inclusive development efforts along with equitable resource distribution, infrastructure development for creating strategic growth linkages, and adoption of diversified economic activities. Additionally, targeted investments in education, healthcare, and nonfarm and manufacturing activities are crucial for closing the inter-district poverty gaps.

The 2022 Poverty Map further highlights the necessity of adopting region-specific strategies for addressing poverty. In the rural areas, policies need to focus on improving infrastructure and productive nonfarm livelihoods, promoting climate-resilient agricultural techniques, strengthening social protection measures, and enhancing access to quality education and healthcare services. In urban areas, efforts need to concentrate on upgrading slum conditions, broadening social safety nets, and fostering skill development to help the urban poor to integrate into the formal economy.

Furthermore, the findings emphasise the importance of climate adaptation, particularly in disaster-prone regions. Investments in flood control infrastructure, cyclone shelters, and sustainable farming practices can help mitigate several adverse effects of climate change on vulnerable populations.

Overall, the critical insights into the country's poverty dynamics, as indicated above, suggest significant progress; but these also highlight both persistence and varying spatial nature of poverty in a society that is highly unequal and is becoming more unequal as it moves ahead. Within this structurally uneven and inequitable structure, while some regions have made significant strides in reducing poverty, others continue to struggle with poverty and deprivations due to climate vulnerabilities, economic disparities, and uneven development interventions. Addressing these challenges require comprehensive and region-specific policies that cover climate change and environmental risks, promote economic diversification, and ensure social inclusion. By doing so, Bangladesh can strengthen its poverty



reduction efforts and foster sustainable, equitable and inclusive development to create a prosperous society for all.

Multidimensional Poverty Index in Bangladesh

The global multidimensional poverty index (MPI) is based on the Alkire-Foster (AF) methodology, utilising a multidimensional measurement approach. It is calculated using the most recent data from sources such as the Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS) and various national surveys. The MPI comprises three dimensions and ten indicators. Each dimension is weighted equally, and within each dimension, all indicators share equal weight. Individuals who do not meet the deprivation threshold for an indicator are considered deprived in that specific aspect.

A person is classified as multidimensionally poor, or MPI poor, if he/she experiences deprivation in at least one-third of the weighted MPI indicators. This means that an individual is considered MPI poor if their weighted deprivation score is 33.33 per cent or higher. According to the AF methodology, the MPI is determined by multiplying the incidence of poverty (H) by the average intensity of poverty (A).

Here, H represents the proportion of the population that is multidimensionally poor, while A denotes the average share of dimensions in which poor individuals experience deprivation. Consequently, the MPI formula, $MPI = H \times A$, captures both the prevalence of poverty and the extent of deprivation among the poor. A summary of Bangladesh's global MPI statistics is provided in Table 2.4, differentiating between national, rural, and urban areas. Additionally, the table presents headcount ratios for two other poverty cutoff ranges. Individuals with deprivations in 20–33.33 per cent of the weighted indicators are classified as vulnerable to poverty, whereas those deprived in 50–100 per cent of the indicators are considered to be in severe poverty.

Table 2.4: Global MPI in Bangladesh

Area	MPI	H, %	A, %	Vulnerable, %	Severe poverty, %	Population Share, %
National	0.104	24.6	42.2	18.2	6.5	100
Urban	0.060	14.5	41.6	14.7	3.4	21.6
Rural	0.116	27.4	42.3	19.2	7.3	78.4

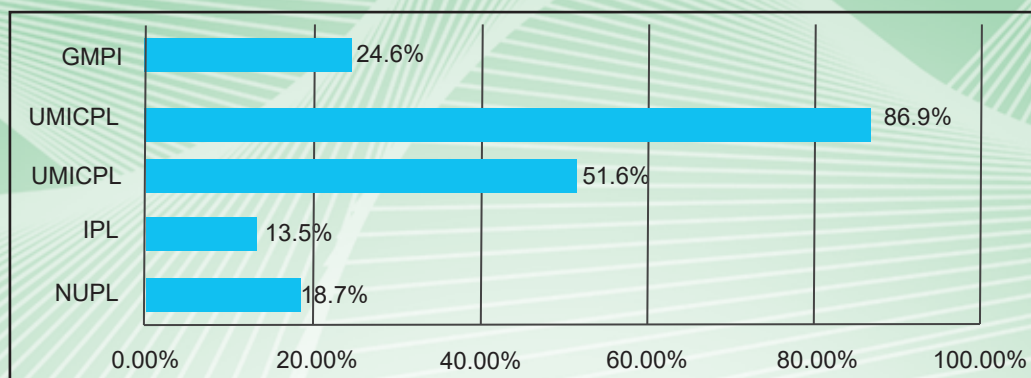
Source: OPHI 2024, Global MPI Country Briefing 2024: Bangladesh (South Asia).

Alkire, Kanagaratnam and Suppa (2024a,b) based on MICS year 2019.

Figure 2.6 illustrates a comparison between the global MPI headcount ratio and monetary poverty measures for Bangladesh. The MPI headcount ratio indicates the proportion of the population identified as MPI poor, based on data from the 2019 MICS for Bangladesh. The figure also displays the percentage of people classified as poor according to the World Bank's international poverty line of US\$2.15 per day (2017 PPP), equivalent to Bangladeshi Tk. 60 (2016). Additionally, it includes poverty estimates based on the lower-middle-income country threshold of US\$3.65 per day (2017 PPP), equivalent to Tk. 101.90 (2016), and the upper-middle-income country threshold of US\$6.85 per day (2017 PPP), equivalent to Tk. 191.30 (2016). Lastly, the percentage of individuals considered poor according to Bangladesh's national upper poverty line is taken from the Household Income and Expenditure Survey (HIES) 2022.



Figure 2.6 : Headcount ratios in Bangladesh under different poverty measures



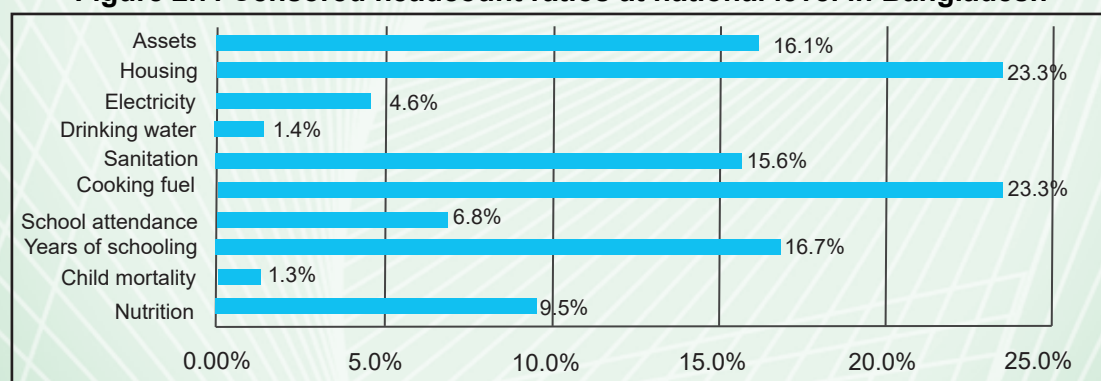
Note: GMPI is global MPI (2019); UMICPL is upper middle income country poverty line US\$6.85 (2017 PPP) 2016; LMICPL is lower middle income country poverty line US\$3.65 (2017 PPP) 2016, IPL is international poverty line US\$2.15 (2017 PPP) 2018, and NUPL is national upper poverty line based on HIES 2022

Source: OPHI 2024, Global MPI Country Briefing 2024: Bangladesh (South Asia).

Composition of Multidimensional Poverty

The MPI computation methodology has a key feature known as dimensional breakdown, which enhances the usefulness of global MPI. This feature allows for the calculation of the percentage of the population that is multidimensionally poor while also experiencing deprivation in specific indicators. This measure is referred to as the censored headcount ratio of an indicator. Figure 2.7 presents the censored headcount ratio for each indicator at the national level in Bangladesh.

Figure 2.7: Censored headcount ratios at national level in Bangladesh



Source: OPHI 2024, Global MPI Country Briefing 2024: Bangladesh (South Asia).

Alkire, Kanagaratnam and Suppa (2024a) based on MICS year 2019.

Subnational analysis

Beyond measuring multidimensional poverty at the national and urban-rural levels, the MPI can also be calculated at the regional level to highlight disparities across different regions. Table 2.5 provides a summary of the global MPI statistics for various administrative divisions in Bangladesh. The table's last column displays the population share of each division, and the population-weighted divisional values for MPI, H, and A collectively sum up to the national figures.



Table 2.5: Global MPI in Bangladesh by administrative divisions

Administrative division	MPI	H, %	A, %	Vulnerable, %	Severe poverty, %	Population Share, %
Barisal	0.125	29.4	42.6	23.0	7.5	5.7
Chittagong	0.114	25.8	44.1	19.3	8.4	19.4
Dhaka	0.079	19.0	41.5	17.1	4.7	24.2
Khulna	0.063	15.9	39.4	17.5	2.4	11.5
Mymensingh	0.163	37.7	43.4	18.7	11.6	7.3
Rajshahi	0.097	24.0	40.2	17.0	4.5	13.1
Rangpur	0.105	26.0	40.5	17.5	5.0	11.4
Sylhet	0.160	35.7	44.9	18.9	13.3	7.5

Source: OPHI 2024, Global MPI Country Briefing 2024: Bangladesh (South Asia).

Alkire, Kanagaratnam and Suppa (2024b) based on MICS year 2019

Bangladesh's rapid progress achieved in poverty reduction over the last more than five decades is no doubt impressive; yet, the country has a long way to go -- in the context of the Fourth Industrial Revolution (4IR) -- to fulfill the aim of expanding the richness of human life and creating fair opportunities and choices for all people. The relevant development agenda needs to hold that people must be given more freedom and opportunities through developing their abilities and giving them a chance to utilise them. Educating a girl would no doubt build her skills, but it will of little use to improve her welfare if she does not have access to quality jobs in the labour market. For the next decade, the key policy agenda for Bangladesh is to ensure a more rapid and comprehensive transition to more inclusive development that systematically addresses:

- Problems of inequalities;
- Gaps in key social indicators including education, health and nutrition across different social groups and left-behind and marginalised communities; and
- Discriminatory institutions and norms including lack of empowerment of the disadvantaged/marginalised communities.

Such a transition towards inclusive development requires a shift in the country's development paradigm to bring changes in the growth pattern such that the poor, low-income and marginalised households can have higher than average income growth; and the government can install effective redistribution policies favouring these poor and marginalised communities and expand new avenues of economic and social opportunities for the poor and disadvantaged communities.



3

Rural Climate Hazards and Climate Change Policies in Bangladesh

“Smallholders manage over 80 per cent of the world’s estimated 500 million small farms and provide over 80 per cent of the food consumed in a large part of the developing world, contributing significantly to poverty reduction and food security. Yet small-scale farmers often live in remote and environmentally fragile locations and are generally part of marginalized and disenfranchised populations”

(IFAD and UNEP, 2013, p. 10)

Bangladesh, being extremely vulnerable to climate change, faces worsening disaster risks and rising severity of such events. While climate change has and will continue to affect the entire country, the most serious climate change disasters are seen in vulnerable areas which are mostly rural locations where the poor and disadvantaged populations are exposed to heightened deprivations and inequalities. Along with impacts on production and productivity in agriculture and the rural economy at large, climate change effects are transmitted through various other channels, such as behavioural risk factors forcing rural populations to adapt to extreme weather events in terms of work efforts, adverse impact on health and productivity growth (e.g. output growth, mortality rates, out-migration, human capital formation); constant need of reconciling climate change with employment opportunities and agricultural demand/supply conditions; heightened food insecurity with implications beyond agriculture, necessitating water planning and other adjustments in production patterns; extensive damages from more frequent and larger floods to nonfarm rural economy; and many others.

The relationship of gender, climate change and vulnerability is significant in rural areas...

The relationship of gender, climate change and vulnerability is also significant in rural areas. Climate change causes impacts that adversely and disproportionately affect women. There exist vast gender differences among the small farmer dominated agriculture in the presence of male-dominant rural culture. The gender biased socioeconomic factors significantly threaten the livelihoods of women when combined with the larger threat of climate change.

Rural women face greater vulnerability to floods and other natural disasters that are caused by climate change. Moreover, rising frequency of these extreme events necessitates a shift of emphasis from relief and response to preparedness and availability of resources to reduce identified vulnerabilities. The gender differences in vulnerabilities and inequalities of climate change are magnified through women's lack of land and property rights, discrimination in decision-making processes, poverty and lack of adequate knowledge about climate change adaptation.

In practice, issues of culture and belief have impact on adaptive capacity and thus resilience of rural individuals and communities to climate change. Further, the tendency to adapt depends on well-being status of households. The rural poor are more likely to have less incentives, knowledge, resources and skills to adapt to climate change. In the coastal and other high climate change prone regions of Bangladesh, migration concerns may lead to climate change-related emergencies. Such movement of populations—climate refugees—from climate-prone areas to less affected regions may emerge as a challenging reality in future for a high population density country such as Bangladesh. Similarly, aging populations can also become a source of potential vulnerability in the rural areas for which proactive planning for climate change to bridge the gap between vulnerability and sustainability in terms of infrastructure, support programmes and services that appeal to and are utilised by these aging populations can be useful.

In rural Bangladesh, the above concerns are no doubt real in the context of climate change. Moreover, probably the most critical concern for climate change is its impact on the role of agriculture – overwhelmingly dominated by small farmers -- who are most seriously affected by climate change.



Climate Change and Bangladesh Agriculture

Bangladesh is facing a profound, visible and dangerous climate change consequences...

Bangladesh faces a more profound, visible, and dangerous climate impact compared with other developing countries. Due to the country's geographical location, population density, and economic structure, Bangladesh will suffer the negative effects of climate change to the extreme. In practice, climate change is causing significant changes in the country's ecology and people's lifestyles, as evidenced by numerous statistics. The average temperature in Bangladesh has significantly increased in line with the global increases in average temperature. According to the International Centre for Climate Change and Development (2020), Bangladesh experienced a 1.24°C increase in average temperature between 1976 and 2019. Temperatures have risen by around 1.37°C during the summer, which has serious impacts on agriculture, environment and public health. Winter temperatures have also dropped, negatively impacting crop cycles and natural ecosystems. As a result, farmers are forced to change their cropping patterns and sowing schedules. This results in reduced productivity and inferior crop quality.

Rising temperatures cause significant environmental and economic impacts due to the country's low altitude and diverse climate...

The impact of temperature increase has been made more alarming by geographical location of Bangladesh. Rising temperatures cause significant environmental and economic impacts due to the country's low altitude and diverse climate. Rising temperatures cause water levels in aquifers to decrease, reducing freshwater supplies, thereby increasing risks to the agricultural system.

The public health in Bangladesh has also been significantly impacted by these two-way temperature fluctuations. The danger of heat illness and heat-related conditions like dehydration, heatstroke, and heat-related heart diseases are rising as summer temperatures rise. On the other hand, changes in winter temperatures increase the risk of respiratory diseases, especially among the children and elderly. There is also a risk of increased outbreaks of malaria, dengue, and other mosquito-borne diseases as warmer temperatures increase the mosquito breeding grounds.

Bangladesh's coastal areas are at risk, especially from rising sea levels. The country is one of the lowest-lying countries in the world, making even a small rise in sea level dangerous for large parts of the country. According to Bangladesh Meteorological Department (2019), between 1961 and 2018, sea level has risen by an average of 3.3 millimeters per year. However, the rate is higher in coastal areas, ranging from about 5 to 7 mm.

About 30 million people in the coastal areas are directly affected by this sea level rise. The main livelihood of the people of this region depends on agriculture, fishing, and salt cultivation. But rising sea levels are causing salinisation of agricultural land, which is significantly reducing crop production. In addition, fresh water sources are becoming saline, which is causing problems in meeting the water needs of people. Salinity is also causing species shifts in fisheries, negatively impacting local economies.

The incidence and intensity of cyclones in Bangladesh have increased significantly due to the impact of climate change.

The incidence and intensity of cyclones in Bangladesh have increased significantly due to the impact of climate change. Although cyclones are a common natural disaster in Bangladesh, they have increased in number and intensity in recent years, posing a serious threat to the country's coastal areas.



Climate change is causing an increase in sea surface temperature in the Bay of Bengal, leading to the formation of cyclones. It is seen that a 1°C increase in sea surface temperature could increase the strength of cyclones by about 10 per cent. As a result of this warming, cyclones are increasing in number and becoming more intense. Cyclones may become more frequent and more intense in the future if current climate change trends continue. Experts fear that by 2050, the number of cyclones may almost double and, as a result, life in the coastal areas of Bangladesh may be further disrupted.

People, especially in the Ganges-Brahmaputra-Meghna River Basin areas, are losing their habitat every year due to river erosion. About 60,000 to 70,000 people lose their homes and cultivable lands due to river erosion every year

As a result of increase in the sea level, the level of river erosion in the coastal areas of Bangladesh has also been increasing. People, especially in the Ganges-Brahmaputra-Meghna River Basin areas, are losing their habitat every year due to river erosion. About 60,000 to 70,000 people lose their homes and cultivable lands due to river erosion every year; while about 6,000 to 8,000 hectares of land is lost to rivers every year (CEGIS, 2021). Significant changes have also occurred in the pattern of rainfall in Bangladesh. Rainfall during the monsoon season increased by about 8 percent between 1958 and 2018 (BUET-IWFM, 2018).

Further, flooding has become more common in several regions of the country as a result of changes in rainfall pattern. The 1988 flood was the worst in Bangladesh's history, inundating 68 per cent of the country's land area and causing large number of human deaths and extensive destructions of infrastructure, ecology and the economy. Droughts also become a common occurrence immediately after such disasters.

A major challenge created by climate change is the disruption of the country's agricultural production, directly affecting the country's fragile food security. The agricultural economy mostly depends on production of the staple food crop, rice, and other crops like wheat, maize, vegetables, oilseeds and many other crops. However, rising temperatures, erratic rainfall, and other climatic changes are seriously impacting the country's traditional agricultural production system evolved over the centuries.

In Bangladesh, almost all farmers are involved in the production of rice (the primary food crop) along with other crops. It is apprehended that an average of 10 per cent reduction in rice production is likely to occur due to rising temperatures (FAO, 2019). Most importantly, Boro (the major variety which produces around two-thirds of total production) rice production could decline by about 17 per cent by 2050. The increase in temperature affects the harvesting time and yield of rice as its flowering period is shortened by warmer temperatures, making the grains lighter and less nutritious. As a consequence of these changes, the country's food security remains at great risk.

Another significant food crop is wheat; and its production could decrease by around 32 per cent as a result of climate change (FAO, 2019). Rising temperatures reduce wheat seed germination and shorten the harvest period. As a result, yield also decreases significantly. Another major problem in wheat is disease and insect attack. Rising temperatures lead to increased outbreaks of new diseases and pests, which hamper wheat production. These impacts of climate change are not limited to rice and wheat alone; vegetables, fruits, and other cash crops are also affected including production of onions, garlic, potatoes, and various types of vegetables. Along with reduction in yields due to rising temperatures, the quality of crops also declines reducing the competitiveness of farmers in the market.

A major aspect of the impact of climate change on the country's agricultural system is decline in soil fertility. Unpredictable rainfall and high temperatures deplete soil moisture and quality, which might eventually cause a serious agricultural disaster. In order to regenerate the soil, more fertilisers and other agricultural inputs are used, which raises farming costs and lowers yields (Mujeri and Mujeri, 2020).



Climate change puts millions of people in the coastal areas at danger of losing their properties, becoming displaced and turning into climate refugees...

Climate change puts people living in coastal areas at danger of losing their properties. It is estimated that by 2050, 13 to 15 million people may be displaced and become climate refugees in Bangladesh (World Bank, 2020). The rehabilitation of such a large number of climate refugees could be a huge challenge for Bangladesh.

It is also likely that climate change will directly affect the economy of Bangladesh. The country's GDP could decline by about 2 per cent by 2050 if the effects of climate change are not effectively addressed (World Bank, 2020). Agriculture, fisheries, textiles and readymade garments (RMGs) -- which are the main drivers of the country's economy -- are all likely to suffer, creating adverse impacts on economic growth and overall development resulting in higher unemployment along with increased poverty and inequality.

It thus becomes clear that the effects of climate change -- that include unpredictable changes in rainfall patterns bringing droughts, heat waves, and flooding -- are likely to make extreme weather more frequent. These destructive events hit the country's overwhelmingly dominated small farmers harder making the impact on agriculture more severe over time. Thus the most impoverished and worst affected are the marginal and small farmers including traditional fishing communities, livestock rearers, and others who mostly rely on agriculture and natural resources for their livelihoods. Women farmers in particular, who face greater difficulties accessing land, finance, and other inputs, face the greatest risks to their fragile livelihoods.

The ways in which climate change affects agriculture is a major factor that drives rising poverty and inequality in Bangladesh...

The ways in which climate change affects agriculture is a major factor that drives rising poverty and inequality in Bangladesh. The worst effects of climate change on agriculture are no doubt unpredictable changes in temperature (both averages and extremes), and availability of water (volume of precipitation -- too much destructive rain, and drought). Moreover, climate change widens the range of attack of pests and diseases exposing agriculture to additional and unfamiliar risks. Some of these concerns are already visible in Bangladesh. Small farmers are the most vulnerable to climate change and the resulting volatility of commodity prices. Although they are least responsible for GHG emissions responsible for the changes that make agriculture -- on which their livelihoods depend -- more and more difficult.

Agriculture in Bangladesh is now experiencing unpredictable rainfall. When this comes in terms of unusually heavy rains, this has devastating effects, such as eroding top soil, washing away nutrients and destroying productive areas. Several soil protection measures may be explored in specific contexts, e.g. by applying organic fertiliser, planting trees to help reduce erosion, add nitrogen to improve soil quality, build stone walls and other structures to reduce water run-off, recharge groundwater, maintain moisture in growing areas, and reduce erosion. The farmers may be trained in system of rice intensification (SRI), which reduces chemical fertilisers that release powerful GHGs when applied to croplands.⁵

At the global level, food production is particularly sensitive to climate change, because crop yields depend directly on climatic conditions (e.g. temperature and rainfall patterns). Higher temperatures will lead to large declines in cereal (e.g. rice and wheat) production around the world (Stern, 2006). Indirect effects on crops include increased amounts of carbon dioxide (a greenhouse gas) in the air; this can help plants to grow (photosynthesis) and reduce the amount of moisture lost from leaves. But like

⁵ Land use in rural housing needs special attention since conversion of land for rural housing was almost double (0.68 million acres) during 1996-2008 compared with 0.35 million acres in 1984-1996. See, Agricultural Census 2008.



warmth, it will only benefit agriculture in the short term, as other indirect effects on crops such as drought, flooding, less moisture in soils and an increase in pests and diseases will lead to less food being produced from farmland (Stern, 2006). Further to these effects, forestry due to drier and hotter conditions will face increased risk of fire damage (Williams, 2002).

Although fisheries may be initially boosted by warmer waters, but in the longer term increased carbon-dioxide in the air will cause more carbon-dioxide to become dissolved in the oceans and seas which will make them more acidic; and this will reduce the overall fish quantity (Stern 2006). Livestock farming will also be threatened by increased animal diseases and the cost of straw or grain to feed them as crop harvests decrease (Williams, 2002). Thus overall global warming is a big threat to human food supply across the world. However, people at highest risk live mostly in Asia and Africa especially in countries like Bangladesh, where declines in harvest are likely to be greatest, dependence on agriculture is highest, and where the incidence of poverty is highly concentrated.

Despite rapid structural transformation over the last few decades, the Bangladesh economy still significantly depends on agriculture with nearly two-thirds of the population engaged (directly or indirectly) on agricultural activities for livelihoods. Since the impact of climate change on agriculture in Bangladesh is likely to be widespread and more devastating than any other sector, there could be serious impacts on crop yields, fisheries resources and other agricultural outputs having significant consequences on food security and livelihoods of the people.

Climate Change and Declining Availability of Cultivable Land

Bangladesh is a land-scarce country where per capita cultivated land is less than 15 decimals. Moreover, around one per cent of the country's cultivable land is being converted to non-agricultural uses every year. Such a high rate of conversion of agricultural land into non-agricultural uses poses a major challenge since this would hamper agricultural, especially rice, production creating adverse impacts on food security and nutrition. It is, therefore, worthwhile to take a closer look at the extent and determinants of such conversion of land use from agricultural to non-agricultural uses. The country's Agricultural Census and Surveys provide useful information for analysing these issues.

Whatever may be the underlying reasons, the fact remains that between the 35-year period of 1984 and 2019, total cultivated land in the country has declined by 1.52 million acres (from 20.16 million acres in 1984 to 18.64 million acres in 2019) i.e. by about 0.3 percent per annum...

A comparison of cultivated area between 1984 and 1996 shows that the area has declined from 20.16 million acres in 1984 to 17.77 million acres in 1996 i.e. by 2.39 million acres which is about 12 per cent over the 12-year period. In other words, the loss of cultivable area between 1984 and 1996 due to non-agricultural uses (such as construction of housing, rural infrastructure, and others) was about one per cent of cultivated land per annum (nearly 200,000 acres) over the period. In this context, figures in later years show that the area has increased to 19.07 million acres in 2008 i.e. by 1.3 million acres which is about 7 per cent (0.6 per cent annually) over the 12-year period (Table 3.1). However, total cultivated area has again declined to 18.64 million acres in 2019 showing a decline of 0.43 million acres over a period of 11 years. This changing availability of cultivated land is probably due to: (i) net impact of bringing more cultivable waste and water lands into crop cultivation and loss of land to non-agricultural uses; and (ii) impact of changes in the definition of rural areas over the period.



Table 3.1: Changes in land use pattern in rural Bangladesh, 1984-2019

Land use	Agricultural Census (thousand acres)				Changes in land area (thousand acres)			
	1983-84	1996	2008	2019	Between 1984 and 2019	Between 1984 and 1996	Between 1996 and 2008	Between 2008 and 2019
Operated area (all farm holdings)	22,678	19,957	22,305	21,727	-951 (-4.19%)	-2721 (-12.00%)	+2348 (+11.76%)	-578 (-2.59%)
Homestead area (all holdings)	966	1318	2166	2801	+1835 (189.95%)	+352 (36.44%)	+848 (64.33%)	+635 (29.31%)
Cultivated area (all farm holdings)	20,157	17,771	19,070	18,636	-1342 (-7.54%)	-2386 (-11.84%)	+1299 (+7.30%)	-434 (-2.27%)

Note: Figures in parentheses indicate the percentage changes over the specified periods.

Source: BBS, Census of Agriculture, different years

Whatever may be the underlying reasons, the fact remains that between the 35-year period between 1984 and 2019, total cultivated land in the country has declined by 1.52 million acres (from 20.16 million acres in 1984 to 18.64 million acres in 2019) i.e. by about 0.3 per cent per annum. This alarming decline in availability of cultivable land needs policies to arrest and, if possible, reverse the trend through, for example, ensuring more profitable rates of return from farming activities relative to non-farm activities, imposing tax for conversion of farm land into non-agricultural uses, discouraging conversion of cultivable land into other uses through imposing zoning restrictions and/or other measures on transferring and sale of such land, and adopting proper land use planning, especially those related to housing in rural areas.⁶

The government has formulated the National Land Use Policy in 2001 keeping in view the competing use of land for food production, rural housing, urbanisation and environmental protection. The Policy emphasises efficient and sustainable use of land for food security and economic use of land for housing, physical infrastructure and construction and other purposes. In the face of declining availability of cultivable land, long-term solution needs appropriate measures to enhance productivity of land through improved farming practices, efficient use of inputs and better research-extension linkages along with wider dissemination of modern technology. These issues become more critical in the face of adverse impacts of climate change on both land availability and its productivity in agriculture.

Climate Change Impacts on Small Farmers

The necessity of addressing sustainability in Bangladesh agriculture rests not only on ensuring the productive capacity well into the future while attending to food and nutrition security of the expanding human population—there is also a need to consider these requirements in the context of climate change. There seems to exist a relationship between increased risks and the share of rural population who earn their livelihoods in agriculture, especially related to variability introduced by climate change. The solution to the issues needs to be locally designed and specific to particular rural areas for reasonably and effectively addressing the climate change impacts. Even in Bangladesh, with a small geographic area, characteristics of rural areas vary significantly along with the nature of impact of climate change. Further, adaptability, vulnerability, and resilience are difficult to quantify, making climate change planning efforts significantly difficult.

⁶Land use in rural housing needs special attention since conversion of land for rural housing was almost double (0.68 million acres) during 1996-2008 compared with 0.35 million acres in 1984-1996. See, Agricultural Census 2008.



There seems to exist a relationship between increased risks and the share of rural population who earn their livelihoods in agriculture, especially related to variability introduced by climate change...

The perception of climate change as a challenging issue is less realised in rural than in urban areas, along with less appreciation of the anthropogenic (human-caused) sources of climate change. The key to solving this problem of perception and awareness requires connecting climate change concerns to the real and well-understood concerns surrounding agriculture and the rural economy. Ideally, awareness leads to adaptation, which leads to enhanced resilience in the rural areas. Awareness on potential hazards and exposure to past hazards are likely to enhance receptivity to acting appropriately in the face of hazard events.

At present, agriculture itself is at a crossroads in Bangladesh. With rapid structural transformation and rising productivities in industry and services (especially in tradable services activities), agriculture and the rural economy is somewhat lagging behind in raising productivities along with accompanying trend towards climate change impacts and environmental degradation and worsening food scarcity.

In reality, marginal and small farmers in Bangladesh face an asymmetry in power relations vis-à-vis medium and large farmers in relation to their access to land, water, credit, other inputs and support services provided by the government. The difficulty of their livelihoods becomes further challenging by the impacts of climate change, which include not only changes in the physical and natural world -- in particular weather impacts on agricultural practices -- but also price volatility when small farmers bring their products to the markets. In particular, extreme hazard events such as floods create relatively more extreme effects for small farmers, causing economic damage due to lost yields, displacement, and homelessness, among others. Because small farmers in rural areas are limited in their resources to respond to changes in climate hazard events, they are highly vulnerable to such impacts; that may result in their entire loss of production and wage employment in agriculture or under threat for their livelihoods and survival.

Generally, marginal and small farmers lack social influence; this creates a culture of sharing information with one another among themselves -- forming useful informal forum for mutual learning and decision-making. This can be very effective if accurate information is shared related to climate change issues. This shows that increasing social capital is helpful for enhancing preparedness on and resilience to climate change in rural areas of Bangladesh.

Usually, small farmers -- and rural population in general -- undergo a variety of individual and community vulnerabilities. These vulnerabilities may be related to their small land holding itself (e.g. land availability or quality, land title, and/or availability of water, and inputs) and to their individual situation, such as a lack of credit or savings, or concerns about continuity of vulnerabilities and disaster planning.

Land conversion may make rural areas more susceptible to climate change for which the small farmers are likely to suffer the most. For instance, the importance of land availability for crop production in a land scarce country like Bangladesh, fertility of land and land cover are extremely important in the country. The conversion and degradation of rural lands can pose a serious threat to the small farmers in particular. Moreover, this creates economic instability resulting in heightened vulnerability due to additional impacts of climate change.

The nexus between rural communities and the government provides opportunities for improving trust and increasing adaptive capacity of small farmers and rural residents in general through enhanced involvement and ensuring good governance.



As for climate change and small farmers, the key consideration is to treat social welfare as a public good worthy of support irrespective of neoliberal economic considerations...

Since rural areas and small farmers are massively affected by climate change, there are clear needs to address these effects. For example, poor healthcare services in rural areas contribute to vulnerability and there is a need to explore the interactions between climate change and public health more effectively in view of the continually evolving interfaces and the role of gender in adoption of climate change adaptation strategies. Instead of pursuing a growth alone strategy, approaches are needed that focus on welfare of small farmers and rural residents which would take into consideration the need to move away from what are fundamentally unsustainable practices. The strategies need to make food and ecological security endogenous along with sustainable management of natural resources, resilient responses to disasters, and explicit consideration of inequality and market failures.

As for climate change and small farmers, the key consideration is to treat social welfare as a public good worthy of support irrespective of neoliberal economic considerations. Partnerships with nongovernment organisations-microfinance institutions (NGO-MFIs), civil society organisations (CSOs) and other local level institutions are likely to reinforce these efforts and serve the interests of all community segments including small farmers.

In the context of Bangladesh, in addition to climate change, the potential for sustainability is also undermined by the fundamentally unequal and widening divide between the rich and the poor as well as rural and urban areas. As such, specific attention is needed on raising the living standards of the poor; alongside addressing the short-term implications of climate change that are already affecting the poor and the climate vulnerable regions. The differences between immediate considerations and long-term ecological change concerns constitute a dilemma for countries like Bangladesh: climate change is a price that the country pays although its contribution to the process is negligible, and the country will eventually lose much more if climate change is not addressed appropriately now.

The fact is that the poor small farmers and the rural communities earn their livelihoods by living closest to the impacts of climate change in many respects in Bangladesh. Essentially, they are the providers of critical early warnings to the sustenance of human civilisation. Being the primary losers of climate change impacts, these populations need necessary assistance not only in view of their deprivations and lack of capacity to deal with the climate change hazards, but also their unique role in ensuring the nation's food security and nutrition. In this regard, a proactive strategy towards climate change and small farmers is essential for Bangladesh.

Locational Analysis of Climate Change Parameters

The results of analysis of long-term temporal and spatial changes in climate variables (e.g. temperature, rainfall, sunshine duration and humidity) in Bangladesh provide useful insights in designing climate change policies at the regional level. These results are based on data from the Bangladesh Meteorological Department (BMD) and Bangladesh Water Development Board (BWDB). The underlying analytical framework consists of a regional climate model (named Providing Regional Effects of Climates for Impact Studies, PRECIS) and the potential impact of projected climate change on selected agricultural crops (as revealed by a crop growth model called Decision Support System for Agro-technology Transfer, DSSAT) (see, IWFM, 2012).

The study shows that the observed daily maximum and minimum temperatures at 34 locations in Bangladesh over the period 1948-2010 exhibit increasing trends of 1.20 C in mean annual temperatures over a century which has doubled to 2.40 C during 1980-2010. The analysis also shows that the trends have changed significantly in recent periods, especially during pre-monsoon and monsoon seasons (Table 3.2). In the case of annual mean temperature for the period 1980-2010, location-specific increase varies between 0 and 6.40 C per century with the northern region



experiencing higher rate of increase relative to mid-western and eastern hilly regions.

The analysis also indicates that the annual maximum mean temperature has also started rising since the 1980s and is estimated at 2.940 C per century since 1980. Disaggregated analysis further shows that the trends have become steeper since 1980 for all months except November. The minimum temperatures show an increasing trend as well, with an estimated value of 1.910 C per century since 1980.

Table 3.2: Changes in seasonal mean temperatures in Bangladesh, 1948-2010

Season	Trend in °C /century, average of the country's 34 stations	
	1948-2010	1980-2010
Winter (December-February)	1.2	1.2
Pre-monsoon (March-May)	0.7	3.2
Monsoon (June-September)	1.2	2.7
Post-monsoon (October-November)	2.0	1.5
Annual (January-December)	1.2	2.4

Source: IWFM 2012

The PRECIS projected future temperature has a much higher trend of 4.60 C per century. Moreover, it is seen that in contrast to the current higher rate of increase of temperature in the country's northern region, the western and central parts of the country could experience more warming in future. The analysis of measured rainfalls indicates the absence of any significant change and trend at the country level. However, significant changes in annual regional rainfalls are reported with increasing trend in the north-west (Rangpur, Dinajpur) and south-west (Jessore, Khulna, Satkhira) regions and significant declines in the south-central and south-east (Faridpur, Comilla, Barisal) regions.

The analysis on sunshine duration shows that winter, pre-monsoon, monsoon and post-monsoon sunshine durations are declining during each decade over Bangladesh with an overall annual decrease of 5.3 per cent per decade in the country. Further, the rates increase from south to north and east to west. The rapidly declining rates of availability of sunshine are sources of great concern especially for agriculture and health sectors. On the other hand, humidity has increasing trends in the pre- and post-monsoon and winter seasons while the trend is declining in the monsoon season.

The simulations with the crop growth (DSSAT) model show that many crops (especially wheat) are vulnerable to climate change in Bangladesh. Among the irrigated rice varieties, boro rice (country's largest rice crop) is more vulnerable to climate change than aman rice. The coastal region and the haor basin might become more vulnerable to climate change than the central floodplain and the high barind area. In addition, mustard, onion, lentil, chili, potato, peas and many other winter vegetables as well as mango and other seasonal fruits have become vulnerable to climate hazards. While climate hazards and their impacts are more generic in nature, their adverse impacts are further accentuated by other localised effects, many of which are attributed at least partly to climate change such as flash flood; delayed drainage and hail storms in haor areas; salinity, cyclone, storm surge and tidal flooding in coastal areas; extreme weather and water shortage for irrigation in barind area which affect crop agriculture in the country.



Climate Change Adaptation

Adapting to changes is a basic human response and Bangladesh needs to adapt to the inevitable effects of the changing climate. Adaptation to climate change is therefore the process through which the country's population will be able to reduce the negative effects of climate on their health and well-being and adjust their lifestyles to new situations. The essence is to get better prepared for climate change through not fighting it but learning to live with it. It is important to recognise that adaptation actions are an essential and often overlooked part of the response to climate change; however, these are not substitutes for mitigation actions.

In principle, there could be a number of approaches that could be adopted in response to climate change. For example, adaptation to climate change in the coastal zone may involve retreat, accommodation and protection. A strategy of retreat in the coastal areas would mean resettling the inhabitants in safer places while accommodation would mean the people continue to live in vulnerable areas but accept the risk, for example, of greater flooding and adapt through converting their crop farms into fishponds. On the other hand, a strategy of protection would mean defending vulnerable areas, economic activities and natural resources against climate hazards through, for example, building dykes, embankments and sea walls in coastal areas.

Modifying agriculture...

Modifying agricultural production to the threats of climate change is a potentially useful adaptation strategy for Bangladesh. A system of rice farming is practiced in some parts of the country that involves sowing two varieties of rice in the same field, one that needs eight months to mature but which can survive a relatively long period under water during floods along with a non-flood resistant variety which can produce the yield in only four months. The early crop is harvested while the long duration crop is still growing; later on the second crop is harvested. The system means that flooding is less likely to do much damage to the long duration rice crop.

'Wet bed no-tillage' is an adaptation that is used after loss of the transplant aman rice crop due to tidal surge flooding. After flooding, water recedes slowly from the crop field and keeps soil muddy such that proper sowing of the next crop and traditional land preparation is hardly possible. Under the adaptation strategy, relatively quick growing maize is cultivated before the next winter boro rice crop is sown. Its advantage is that it can produce food, fuel and fodder for communities and make valuable use of the land and compensate to some degree for the flood losses. The wet bed no-tillage adaptation technique is also used for potato cultivation after transplant aman rice is lost due to flash flooding.

In Bangladesh, baira (also known as floating garden) is one of the best known agricultural adaptation techniques and takes the form of 'hydroponics' which means growing plants in nutrient containing water but without soil. Although rice straw has been the main item for making a baira initially, it is now replaced by water hyacinth plant. Initially, a bamboo pole is placed over a floating bed of water hyacinth; then more water hyacinth and other rotting aquatic plants or plants that grow in water are pulled together. After a week or so, more decomposable plants like water hyacinth from the water bodies are piled on the top while bamboo poles are used to keep the baira in place. Either a ball or cushion made from aquatic plants or coconut husks are then used to make a bed ready for seed planting. Mostly, summer or winter vegetable seedlings are cultivated on baira for sale and it rises and sinks with the floodwater. As floods are likely to cover larger areas on a more regular basis due to climate change, this technique may be more widely replicated in areas subject to flooding.

Intercropping is a practice of farming in which two different crops are cultivated in alternate rows, and in terms of agro-forestry a line of trees or shrubs separates small strips or fields of crops. In Bangladesh, the main use of intercropping has been for mulberry morus sp. which is a promising crop for dry areas, can grow well throughout the year, and is resistant to drought. Mulberry is mainly cultivated for the silk industry as silkworm larvae bombyx mori are reared to produce silk cocoons by feeding them mulberry



leaves. The silk industry is a labour-intensive industry providing jobs for both males and females in Bangladesh. In addition, mulberry fruit can be harvested along with rice in the monsoon season, wheat/mustard/garlic/chickpea in winter, and mung bean in pre-kharif season can be intercropped with it.

Further, alley cropping is a specific intercropping technique that is useful for improving poor soils, providing fodder for livestock, protecting the soil from heavy rainfall, and helping to trap irregular rainfall in the soil although this is not suitable for dry areas. Alley cropping is a simple way of combining tree-growing with crops, that is, rows of leguminous tree species that are able to obtain the nutrient nitrogen from the air are planted about 5 metres apart, on sloping ground following the contours and in-between the rows of trees, crops or vegetables are grown as usual. The trees, ideally of mixed species are planted close together so they form a hedge, which is cut down to 20-30 cm whenever it reaches 1-2 metres in height. The cuttings can be used for animal fodder or compost.

Cassava *manihot esculenta* and yams *dioscorea* spp. can be suitable for cultivation as a famine-reserve crop on highland soils if they do not become waterlogged, especially on the high Barind Tracts where there are moderately light textured soils. These crops are drought resistant, can be cultivated with little water and can be grown on homestead land and raised cultivation platforms to provide families with an emergency food reserve in case of need.

In Bangladesh agriculture, one of the factors that lead to higher emissions is the expanding use of nitrogen fertilisers and manure to meet the increasing demand for food and ensure food and nutrition security of the population. It is important therefore to take realistic actions to reduce GHG emissions from crop production. For the purpose, several effective ways may be considered for reducing GHGs through changing farming practices. One option is to reduce the excessive use of chemical fertilisers, pesticides and other chemicals. It is also important to apply chemical fertilisers, compost or manure directly into the soil, digging it in, as well as applying only the amount needed, as too much fertilising leads to excess nutrients which soil bacteria releases into the air as GHGs. Organic techniques such as using compost instead of chemical fertiliser result in less production of GHGs. Another way of reducing reliance on chemical fertilisers and raising soil fertility is to grow leguminous crops in rotation with other crops. These crops absorb nitrogen from the air through their roots to add nutrients to the soil. The improved strains of nitrifying bacteria that live in roots of these plants may also be profitably harnessed. It is observed that innovative practices such as using bacteria stored in peat as stuck to the seeds at times of planting with a natural adhesive such as 'rice water' can increase yields by nearly twice without chemical fertiliser, manure or compost inputs. The Bangladesh Institute for Nuclear Agriculture (BINA) has developed beneficial strains of nitrifying bacteria, known as bio-fertiliser for groundnut, chick pea, soya beans, cow peas/borboti, musorie and kassurie lentils/dals (Sattar, 1997). With these techniques, GHG emissions can be reduced along with increasing crop harvests.

In the case of rice, the major crop, different cultivation techniques may be used to reduce GHG emissions. In the cultivation of wetland rice, soils emit significant quantities of methane. However, emissions during the growing season can be significantly reduced by various practices such as, draining wetland rice once or several times during the growing season especially by keeping the soil as dry as possible and avoiding water logging outside the rice growing season; adding compost, manure and other organic fertilisers in the dry season, not the wet season; and using rice straw for biogas. In southern Bangladesh, where much of rice cultivation relies on ground water irrigation, there are concerns for arsenic contamination of ground water which reduces yields and poses threats to human health. Thus growing rice under 'aerobic' or moist rather than wet conditions may be preferred as there exists evidence that growing rice under dryer conditions may actually increase the harvest.

Meanwhile, success has been achieved in developing saline tolerant rice varieties through testing traditional varieties that used to be grown in soils with a high salt content. Supporting adaptation techniques also include leaving the lands fallow for some seasons and then washing away the saline topsoil during the early monsoon rains, digging deep canals in the field to drain the saline water away,



and use of organic matter (rice husks) to improve soil texture (Hettige, 2007).

Adapting rice cultivation in drought conditions...

In Bangladesh, transplant aman is the major rice crop in the Barind Tracts under rainfed conditions, but the crop is frequently affected by drought at different stages of growth in varied intensities. Normally, farmers start preparing seedbeds with the first rains in early-June and transplant the seedlings in early-July. Often, transplanting is delayed by about a month due to delayed onset of monsoon resulting in the crop facing drought conditions during October/November; these weather patterns are likely to become more problematic with climate change. In this situation, farmers require an alternative seedbed method so they can start producing seedlings in June/July, even if there is delayed onset of monsoon (Selvaraju et al, 2006).

Under such circumstances, a number of adaptation techniques can be adopted. One option is to adopt 'mat type seedlings in trays' that requires less seed, water, labour and seedbed area. In addition, seedlings become healthy and uniform in growth, uprooting of seedlings is relatively easy with less labour and cost involved, and seedlings can be protected from drought. Another alternative is to use 'dry bed method'. Under the method, seedbeds are prepared by raising the soil to a height of about 5-10 cm, a layer of half-burnt paddy husk or saw dust is then distributed on the nursery bed mainly to facilitate uprooting and then dry seed or seeds that just sprouted are sown in rows. Seedlings are short and strong, have longer root system than wet bed and are ready in 25 days. The 'dapog' method may also be used in which the ground surface is covered with banana leaves with the mid-rib removed, polyethylene sheets or any flexible material to prevent seedling roots from penetrating to the bottom soil layer. Then the seed bed is covered with a thin layer of burnt paddy husk or compost. Sowing with pre-germinated seeds uniformly on the seed bed to a thickness of two to three seeds follows and afterwards the germinating seeds are splashed with water and pressed down by hand or with a wooden flat board for three to four days to prevent uneven growth.

The cultivation of rice may also be modified using other techniques. For example, in irrigated areas, food security can be improved by using the System of Rice Intensification (SRI) that can increase rice harvests by 50-100 per cent. The adoption of direct-seeded rice can allow more reliable adoption of rabi crops on residual moisture immediately after the rice harvest, such as chickpeas, mustard and other drought-tolerant and high-value crops. An earlier rice harvest can also be achieved by planting early-maturing rice varieties for which drought tolerant rice varieties can be used. If transplant aus rice can be harvested early, there is a possibility of growing another crop of short-duration such as chini atap fine rice (Selvaraju et al, 2006).

In addition, vegetable gardens or 'kitchen gardens' at the household level can be promoted as a means of improving community nutrition and providing improved food security in the face of climate change. This insulates especially the poor households from rising costs of vitamin rich vegetables, especially following disasters when costs increase rapidly, even in areas not directly affected by disasters. The usefulness of vegetable gardens can be further improved by encouraging types and varieties of vegetables which grow well under changed conditions due to climate change; for example, saline or salt water tolerant vegetable gardens in southwest Bangladesh.

The use of organic manures and composts may be used to improve the fertility and water-holding capacity of the soil. In Bangladesh, water hyacinth *eichhornia crassipes* is a commonly available raw material that makes good compost. The application of organic manure or compost is an important climate change adaptation measure since soil applied with organic manure/compost can supply water to plants for 11-12 days even without rain whereas soil without adequate organic manure holds water for only 7 days in the Barind Tracts (Selvaraju et al, 2006). The crop planting and harvesting times may also be adjusted in recognition of the changing climatic conditions.

Vermiculture, which is the cultivation of worms to aid composting, speeds up production of usable compost and improves its quality. Vermi-compost is cheaper to produce than chemical fertilisers, does



not harm the environment as it is natural, reduces weeds, improves soil aeration, improves soil texture, improves fertility, promotes better root growth, improves nutrient uptake by crops, makes transplantation of seedlings easier, and improves the water/moisture holding capacities of soils which is an important climate change adaptation activity.

Similarly, the introduction of green manure crops into the existing rice cultivation system can improve the fertility and water-holding capacity of the soil. In the Barind Tracts, there is an opportunity to introduce green manure crops which could be ploughed into the soil when 50-55 days old just before transplanting of aman rice. The most suitable green manure crop for the purpose is *sesbania rostrata*, a leguminous plant that can obtain nitrogen from the air (Selvaraju et al, 2006). In other areas of the country, *sespinia* known in Bangla as shola is grown and then ploughed into the soil as green compost; this being a tall crop which can withstand flooding.

Protecting agricultural activities...

The adaptation strategy of preventing adverse effects is anticipatory and often requires large-scale investments. The building of protective embankments or polders to prevent excessive flooding of agricultural lands is an example of such an adaptive strategy. On the other hand, river or canal bank stabilisation through planting of various tree species (including fruit and fodder producing species) along the banks and allowing reeds to grow along the margins of rivers, ditches and canals is a form of adaptation that plays a vital role in slowing down water erosion which is a major threat to homes and agricultural lands in Bangladesh. Species such as *hijal* and *karoch* when planted along river banks indirectly prevent erosion by combating the wave actions that destroy homesteads.

Coastal or riverside belts of salt tolerant trees including mangroves are an important adaptation to reduce the erosive impact of wave action and saltwater intrusion. Such afforestation benefits communities by protecting fresh water supply from salt water and providing harvestable mangrove for firewood. Further, they generate income from the sale of mature mangrove trees for timber and create a carbon sink to mitigate climate change. Belts of trees in dryer inland areas such as those planted along roadsides are also a useful adaptation since, by reducing wind flows across fields, they reduce evapo-transpiration from crops and the soil which prevents water loss.

Manual closing of soil cracks is one way to protect fields in locations where soils are clayey such as in Barind or Modhupur Tracts. Once surface cracks are formed, they become wider and quickly expose the subsurface, leading to higher rate of evaporation and percolation of subsequent rainfall. Traditionally, the farmers stir the surface soil manually to avoid development of early cracks when the soil is nearing saturation. Such a practice is locally known as *ghata ghati*, which avoids the development of cracks for a few days, even without rain and may be encouraged as a way to minimise the impact of dry spells during aman rice season.

Irrigation in the dry areas is an important climate change adaptation that may be done at a community level like the construction of small dams across streams (e.g. rubber dams) or digging or re-excavating mini-ponds. In Bangladesh's dry northwest where the water table lies deep below the clay soils, large scale irrigation is practiced by the Barind Multipurpose Development Authority (BMDA) through re-excavating canals, ponds and other water bodies as rainwater reservoirs; extending irrigation facilities through rainwater conservation; irrigating crops using deep tube wells (DTWs) for groundwater extraction; and channeling water inland from the Ganges/Padma River for irrigation via a pipe line to the Sharmongla Canal. The BMDA has successfully increased crop yields, expanded employment opportunities including creation of year round demand for wage labour rather than as a seasonal occupation.



Livestock and fisheries activities...

Improving livestock productivity is quite popular as a climate change adaptation in many countries including Bangladesh as livestock provides food, income and security. Although local breeds are considered hardy but these are low in productivity; so cross breeding with non-native breed is preferred as these maintain resilience as well as increase meat and milk production. The training of local people as para-vets has complimented these efforts by improving animal health.

The loss of livestock during natural disasters is relatively high in the coastal areas; often they also suffer from lack of food. The planting of acacia along the roadside as a climate change adaptation measure can be effective as its leaves and fruit can be fed to livestock, its branches used for fencing and it produces good timber. The possibility of establishing 'fodder banks' may also be explored for creating sustainable impacts.

Increasing salinity in many inland areas may also require fish farmers to adapt by switching to salt tolerant species. In the coastal areas, many rice paddies are being converted to shrimp farms as salinity pushes further inland from the coast. Although this has been a profitable adaptation in Bangladesh with shrimp export emerging as an important foreign exchange earning commodity, there are significant disadvantages in environmental terms due to its current practice. Shrimp culture relies heavily on collection of wild fry with hatchery operations in a small number of businesses. The collection of wild shrimp fry involves non-target species also being caught but then discarded and in some areas mangroves have been cleared to make shrimp farms. There are also concerns in terms of their impact on the poor as shrimp farms employ less people than rice cultivation, so that when rice paddy is converted to shrimp farms many day labourers lose their jobs. Salinity can also increase in lands of small and poor farmers next to shrimp farms due to the flow of saline water and village livestock that used to graze rice stubble after harvest, also suffer due to lack of grazing.

Climate Change Adaptation at Local Level

The adaptation techniques, as discussed above, indicate that there are many options to deal with climate change challenges at the grassroots level and many more can be developed using traditional knowledge, available technologies and experiences in other countries of the world. A major challenge, however, is to mobilise the organisations to disseminate the ideas and experiences and undertake research to determine the future and present effects of climate change more accurately at the local level. In this context, although Bangladesh is both highly exposed and sensitive to the impacts of climate change, one big advantage that the country has is the existence of a number of unique 'social assets' that can help to adapt to climate change.

One of these 'social assets', whose strengths still remain to be fully explored, is the existence of a dynamic, diverse and well-organised microfinance sector having extensive outreach infrastructure especially in the rural areas...

One of these 'social assets', whose strengths still remain to be fully explored, is the existence of a dynamic, diverse and well-organised microfinance sector having extensive outreach infrastructure especially in the rural areas. The NGO-MFIs in Bangladesh have strong community linkages and are guided by a social mission for removing poverty and empowering women and members of disadvantaged communities. These local level institutions can be effectively engaged to undertake climate change vulnerability assessments and action plans in their respective working areas including engaging in advocacy for climate change adaptation.

At present, microfinance is an established component of socioeconomic life in over 70,000 villages in Bangladesh and about 40 million people actively participate in microfinance activities of which over 85 per cent are women. In addition to microfinance services, NGO-MFIs provide a variety of non-financial services to the poor households, including training on farm and nonfarm income generating activities,



institution building, education, health and sanitation, awareness on social issues, climate change adaptation and disaster relief and reconstruction activities.

In particular, analysis on the impact of microfinance on household wellbeing through exploring the relationship between microfinance and climate change adaptation in the disaster prone areas provides useful policy implications for the country. One study, conducted by InM, examines the impact of ex-ante access to microfinance by households to cope with munga (seasonal starvation) in North-West Bangladesh. The study shows that without ex-ante access to finance, households would have resorted more to 'erosive' coping strategies that put long-term household wellbeing at risk. Another study by InM examines how access to microfinance impacts coping and recovery in response to three catastrophic cyclones -- Sidr, Aila, and Mahasen -- that struck South-West Bangladesh in 2007, 2009 and 2013 respectively. The results indicate that damages to the household dwellings followed by loss of income generating activities are the major consequences of cyclones. The study finds that access to microfinance and savings has a higher impact on poverty alleviation than access to credit alone, and that with access to savings as well as credit and insurance services, households are much better off and more resilient.

It is apparent, therefore, that the NGO-MFIs in Bangladesh make important contributions to disaster risk reduction and adaptation both directly through their relief, recovery and adaptation programmes and indirectly through providing financial services. In fact, the concept of 'adaptation-oriented' microfinance may be used for those microfinance programmes that retain focus on poverty reduction but are also engineered to maximise their adaptation benefits. The key elements of adaptation-oriented microfinance are: flexibility and customisation including voluntary savings products, sufficient access to liquidity for MFIs to support their members through extreme climate change events, loans packaged with training and extension on adaptation technologies (e.g. agricultural products and production methods suited to the increasing drier conditions in the north and areas experiencing salinisation in the south), appropriate financing for physical infrastructure (e.g. hazard-resistant housing, rainwater harvesting, water filtration systems, etc.) at household and community levels, micro-insurance products with acceptable premiums that cover real risks faced by households and that incentivise risk mitigation, and a focus on outreach to the most climate-vulnerable communities, especially those in remote, ecologically fragile areas.

For the disaster and climate resilient households and communities in Bangladesh, idiosyncratic and catastrophic shocks severely impact the lives and livelihoods of the poor and marginal segments of the population. Even shocks that would only mildly affect upper- and middle-income households can dramatically reduce the meagre assets of poorer households, eliminate their income sources, reduce consumption, and thus adversely affect their ability to improve social and economic wellbeing. These households have no access to formal insurance, so that they are forced to borrow from formal/informal sources, withdraw their small savings, or sell productive and non-productive assets to cushion the shocks. These strategies are still inadequate and, over the long-term, can lead to deeper poverty.

In view of the above, it is useful if full use can be ensured of NGO-MFIs' 'social assets' – trust relationships with the communities, extensive delivery infrastructure, culture of experimentation and learning, expertise in rural development and other aspects of their social mission – for disaster risk reduction and climate change adaptation.

Long Term Trends in Climate Change Vulnerability

The vulnerability to climate change, both at individual and community levels, largely depends on three important parameters: (i) physical and climatic settings of specific location; (ii) magnitude, duration and frequency of hazards associated with climate change; and (iii) socioeconomic status of the household and the community. For Bangladesh, information on long term climatic trends is scarce and inadequate in terms of spatial coverage, number of key climatic variables, temporal coverage and other



characteristics needed for comprehensive and reliable analysis. Furthermore, both nationally representative and local level (e.g. union or lower) information are not available to devise appropriate policy measures and plan of action at the grassroots level related to climate change vulnerability.

Since crop production is the most significant rural activity and will continue to remain so in the near future, any adverse impact of climate change will affect crop agriculture depending on agricultural practices, changes in climatic parameters, links between changed climatic characteristics and crop productivity, socioeconomic settings of the rural communities, and other relevant variables in the climate change impacted locations. Since cropping practices and climate change impacts vary across locations (e.g. haors, coastal areas, floodplains, and uplands), local and field level information is required to analyse the vulnerability of different crops in different locations at different times.

For Bangladesh, available future climate change scenarios are available based mostly on atmospheric and atmospheric-oceanic general circulation models and regional climate models. These models are useful in predicting future climate change impacts, but still there exist significant uncertainties in predicted climates especially in regional climates. In addition, there persist large inter-model differences in predicted impacts. This shows the importance of evaluating past spatial and temporal changes in understanding likely climate change impacts in future. However, there are only a few studies on analysis of past climate changes due to data and other constraints.

One study by Ahmad et.al. (1996) shows a rise of 0.50 C in average temperature in Bangladesh over the past hundred years. Another study, using the long term monsoonal rainfall pattern as recorded in 12 stations, reports no overall trend in seasonal total rainfall in the country (Rahman et.al 1997). On the other hand, analysing the temperature and rainfall data of the Ganges delta within Bangladesh, Mondal and Wasimi (2004) in their analysis indicate an increasing trend of 0.50 C and 1.10 C per century in day-time maximum and night-time minimum temperatures respectively. On the other hand, the analysis on rainfall data does not show any appreciable overall trend in critical period rainfall although slightly rising trends in winter, pre-monsoon and summer rainfalls are noted. They, however, conclude that water scarcity in the dry season might increase and the critical period might become more critical in future. A study by the SAARC Meteorological Research Centre, over the period 1961-1990, shows an increasing trend of mean maximum and minimum temperatures in some seasons and decreasing in the case of others (SMRC, 2003). Moreover, the study reports a significant increase in the trend of annual mean maximum temperature. The study also reports noticeable regional variations.

The above studies, however, do not characterise climatic variables at the local level which is needed for assessing community risks and crop vulnerability. In a study by the International Rice Research Institute (IRRI) in the Philippines, Peng et.al. (2004) report a 10 per cent decline in rice yield per 10 C rise in growing season night temperature since increased surface temperature tends to release more carbon from the top soil which reduces the soil fertility. Overall, it is suggested that increasing stress on water and other resources induced by climate change could lead to substantial decline in potential for cereal production in Bangladesh.



Climate Change Strategy, Policies and Action Plan

Considering the deep concerns of climate change and environmental issues, Bangladesh has adopted a number of policy initiatives over the years. This is reflected in the detailed policy frameworks, including the National Environment Policy (1992); National Forestry Policy (1994); Energy Policy (1995); National Fisheries Policy (1998); National Policy for Safe Water and Sanitation (1998); National Agricultural Policy (1999); National Water Policy (1999); National Water Management Plan (2004); National Land Use Policy (2001); Bangladesh Climate Change Strategy and Action Plan (2009); and National Bio-Safety Framework (2010).

National Adaptation Plan of Action...

Bangladesh adopted the National Adaptation Plan of Action (NAPA) on Climate Change in 2005 which was updated in 2009 including the Bangladesh Climate Change Strategy and Action Plan (BCCSAP). Both these policy guidelines highlight two basic principles: (i) integrated approach to socioeconomic development and climate change management; and (ii) pursuit of low carbon development pathway.

Under the BCCSAP framework, resources are channeled through NGOs for community level climate actions under the Community Climate Change Project (CCCP). The CCCP covers adaptation projects that aim at enhancing the capacity of selected communities to increase their resilience to the adverse impacts of climate change.

The CCCP has formulated its Operational Manual (OM), Environmental Management Framework (EMF), Social Management Framework (SMF), and other manuals and guidelines for the participating NGOs. The objective of enhancing the capacity of selected communities to increase their resilience to the adverse impacts of climate change is pursued through establishing effective grant financing mechanism in the Palli Karma-Sahayak Foundation (PKSF), the implementing agency, to channel funds to NGOs. This new and innovative approach to finance community-based adaptation interventions in climate vulnerable areas covers three components: (i) Community Climate Change Adaptation Fund; (ii) Knowledge Management, Monitoring and Evaluation, and Capacity Building; and (iii) Project Management.

The CCCP provides financial assistance to selected NGOs to implement sub-projects focused on community-based climate change adaptation activities. The aim is to sustain, strengthen, and scale up the development of grassroots mechanism for communities to increase their resilience to the impacts of climate change; strengthen community capacity for climate resilient planning for combining investments in hard and soft adaptation options; and develop social policy interventions to take a better account of climate risks. The adaptation options to climate change through adjusting people's lives to expected changing climate scenarios in the short, medium and long-term are explicitly taken into account in the interventions. For the purpose, community mechanisms are emphasised under which groups of climate vulnerable people who are aware about the impact of climate change and knowledgeable about adaptation activities are involved. The community mechanisms are established at the field level through a number of activities, such as beneficiary group formation in the community and awareness raising sessions through group meetings. Besides, every beneficiary is a member of a community group who actively participate in monitoring, procurement and other processes under the sub-projects.

Bangladesh Climate Change Strategy and Action Plan...

The Bangladesh Climate Change Strategy and Action Plan (BCCSAP) provides the basis of all efforts to combat climate change. The Strategy prioritises adaptation and disaster risk reduction, and addresses low carbon development, mitigation, technology transfer, and provision of adequate finance.



While the world is currently facing an existential threat due to climate change, the problems are particularly acute for the low-lying countries and Bangladesh is one of these highly vulnerable countries. Bangladesh's formal response to climate change started with a policy paper by the Climate Change Cell, Comprehensive Disaster Management Programme, Department of Environment. The paper drew attention to the severity of the crisis faced by Bangladesh. Further, climate change impacts turned more serious due to environmental degradation (World Bank, 2018).

Towards addressing the challenges, the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) was adopted in 2008 as the basis of all efforts to combat climate change. The strategy prioritises adaptation and disaster risk reduction, and addresses low carbon development, mitigation, technology transfer, and the provision of adequate finance. The BCCSAP has been built on six pillars:

-  Food security, social protection and health: Ensure that the poorest and most vulnerable in society, including women and children, are protected from climate change and that all programmes focus on the needs of this group for food security, safe housing, employment and access to basic services, including health.
-  Comprehensive disaster management: Further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities.
-  Infrastructure: Ensure that existing assets (e.g., coastal and river embankments) are well-maintained and fit-for-purpose and that urgently needed infrastructure (e.g. cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change.
-  Research and knowledge management: Predict likely scale and timing of climate change impacts on different sectors of the economy and socioeconomic groups to underpin future investment strategies and to ensure that Bangladesh is networked into the latest global thinking on climate change.
-  Mitigation and low carbon development: Evolve low carbon development options and implement these as the country's economy grows over the coming decades.
-  Capacity building and institutional strengthening: Enhance capacity of government ministries and agencies, civil society and private sector to meet the challenges of climate change.

The Action Plan has worked out the details of the programmes and sub-programmes to be implemented along with identifying potential sources of finance. The programmes have been identified applying a participatory framework and adopting indigenous knowledge and technology wherever appropriate. These also build on the past efforts of adaptive responses.

The experience of Bangladesh strongly suggests that one of the best ways to adapt to climate change is to involve the people at the grassroots level in all these efforts. It is also proven that the country's people are very enterprising and innovative. As a matter of fact, they have been living with disasters for long. Adapting to changing situations is a familiar traditional practice in the country. What is important is to carry out detailed scientific studies, make the people aware of the impending dangers, and develop -- adopting their traditional knowledge and experience -- effective methods of adaptation.

As climate change adaptation action is mostly local, the need for Bangladesh is to link organised and local adaptation strategies and approaches. This will provide a better understanding of the ways of improving coping and adaptation strategies by climate change impacted communities. This is also likely to provide support towards creating an environment that would make such practices sustainable and more effective by fostering participation, empowering participants, and incorporating indigenous knowledge.



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Within the broader framework, Bangladesh has adopted a medium-term strategy and has developed plans and policies to implement the Strategy. For the purpose, several actions have been undertaken.

 **National Environment Policy 2018:** The National Environment Policy 2018 is a refinement of the Environment Policy 1992, in order to ensure sustainable development and bring the environment into the mainstream of national development through reflecting the issues of protection and improvement of environment and biodiversity. The issues are considered within an integrated policy framework for the protection and improvement of the environment in order to provide guidelines for all environmental activities stated in other policies.

Ecologically Critical Areas (ECAs) Management Rules 2016: A total of thirteen biodiversity-significant areas, which are ecologically vulnerable and degraded, have been declared as ECAs in order to stop continuous degradation. Considering the value of these ecosystems, Ecologically Critical Areas Management Rules 2016 has been promulgated for proper management and improvement of the ecosystems. The rules set out several committees namely: National ECA Committee, District ECA Committee, Upazila and Union ECA Committee in different tiers for management of the ECAs. Bangladesh enjoys a rich diversity of flora and fauna in a wider range of ecosystems. Both the people and the economy are heavily dependent on biological resources for their lives and livelihoods. The cultural heritage, rural lifestyles and traditional healthcare have long been attached to the services provided by biodiversity. To ensure that the rich biodiversity is conserved and used sustainably, the National Biodiversity Strategy and Action Plan (NBSAP) 2016 reflects actions and strategies for implementation, in line with global targets and the country's Biological Diversity Act 2017.

 **Bangladesh Biological Diversity Act 2017:** The Bangladesh Biological Diversity Act 2017 has been enacted in order to materialise the constitutional obligation of biodiversity conservation as well as the country's global commitment under the United Nations Convention on Biological Diversity. The Act facilitates conservation activities in all tiers of local government and at the grassroots level through the formation of biodiversity committees, along with establishing biodiversity register and biodiversity fund. For strengthening the biosafety regulatory regime, National Biosafety Framework (NBF) has been established, along with a GMO (genetically modified organism) detection laboratory. As a party to the Cartagena Protocol on Biosafety, Bangladesh is working towards fulfilling the commitments including the use of risk assessment to inform decision making on the use of GMOs, and supporting efforts to ensure public awareness on biosafety.



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- Formulation of National Oil and Chemical Spill Contingency Plan (NOSCOP): Being a river floodplain dominant country, there is excessive traffic movement in the waterways -- inland, along the coast and marine. The pollution from blow-out, collision, stranding, and other inland and marine accidents can threaten marine life including marine fisheries on the coast, inter-tidal zones and in the deep sea; coastal mangroves and vegetation; fisheries including aquatic life in rivers, floodplains and wetlands; agricultural products; inland and sea birds; recreational beaches; and tourism with subsequent loss of revenue. The country's coast, its EEZ (exclusive economic zone) in the Bay of Bengal -- an area of high sea within the national maritime border -- is close to multiple international shipping routes that expose the country to possible spillage incidents. The additional ship-breaking activities, the proximity of oil, petroleum, and chemical processing industries on the coastal belt, all present substantial commercial activity and hazards that may cause spillage. The National Oil and Chemical Spill Contingency Plan (NOSCOP) helps to combat water pollution both in the inland water and in the coastal and marine water.
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- Improved Management in Wildlife Conservation and Protection: A number of measures have been adopted to implement the Wildlife (conservation and security) Act 2012. The Wildlife Conservation Master Plan 2015-2035 provides a long-term plan to improve the conservation of wildlife in Bangladesh. Bangladesh Tiger Action Plan (2018-2027), Bangladesh Elephant Conservation Action Plan (2018-2027), Bangladesh Vulture Conservation Action Plan (2016-2025) have also been adopted.
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- Bangladesh Delta Plan 2100: The Bangladesh Delta Plan (BDP) 2100 charts out the broad development strategies which the country can adopt as it moves towards the end of the 21st century. It offers long-term strategies and interventions that would ensure food and water security, economic progress, and environmental sustainability while reducing the threats of natural disasters. Developing resilience to climate change by adopting a set of forward-looking integrated strategies, which are both holistic and multi-dimensional in nature, is imperative for Bangladesh. The BDP 2100 harnesses an approach of Adaptive Delta Management (ADM) along with a strong focus on the issues associated with climate change, such as rise in global temperatures, erratic rainfall patterns, rise in sea levels, etc. The Plan provides pathways of development under two distinct policy options: business as usual (BAU) and the Delta Plan (DP). Under the BAU policy option, impact of climate change will be unmitigated, resulting in increased natural hazards and lower long-run growth – as the efficiency of capital falls owing to lower agricultural production, greater health hazards and increased pressure of urbanisation. On the other hand, under DP policy option, effects of climate change are expected to be minimised, and associated adaptation measures are planned, which will help achieve higher economic growth. Under DP policy, Bangladesh will achieve upper middle-income country status by 2031 and is likely to become a high-income country by 2041. The BDP 2100 links integrated water resources management (IWRM) to economic growth, as water is essential for sustainability of the delta. Key components of IWRM cover the impacts of climate change, food and water security, economic and social progress, knowledge development, expansion of forest and tree area, biodiversity conservation, crop production, etc. Additionally, the alignment helps to pursue goals that are critical for long-run sustainable development, such as, ensure safety from climate change related disasters; address efficiency gaps in water usage and security; ensure the conservation of wetlands and develop an integrated system; attain optimal use of land and water resources; and create institutions that can generate cooperation which is necessary for in-country and trans-boundary water resource management. Collectively, they are all aligned with the aims of SDGs.





National Adaptation Plan and other recent initiatives: The initiative to formulate the National Adaptation Plan (NAP) has begun in 2019 along with the process to update the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009. Bangladesh has submitted the nationally determined contribution (NDC) which aims to reduce GHG emissions by 5 percent from business-as-usual (BAU) levels by 2030, or 12 million tonnes of CO₂eq in the power, transport and industry sectors. Under conditional contributions of financial and technological support from developed countries, Bangladesh might further reduce GHG emissions by an additional 10 percent from BAU levels by 2030 or 24 million tonnes CO₂eq in these three sectors. Besides, the Climate Investment Plan has been prepared in 2017. The Climate Fiscal Framework (CFF) has also been operationalised which provides the principles and tools for climate fiscal policy-making (CFP), helping to identify the supply and demand side of climate fiscal funds, and to ensure that CFP is transparent and sustainable in the longer term.

These include, for example:

The relevant strategic thrust and policy framework indicate that Bangladesh recognises climate change as a major challenge to the country's sustainable and inclusive development. So far, the country has made significant efforts in adapting to the hazards and spends about 5-6 percent of its annual budget on climate change-sensitive activities. It has also set specific targets for environment management (Table 3.3).

Table 3.3: Core targets for environmental management

Targets	Base Year (2018)	Target (2041)
Share of urban population in total population (%)	30	80
Urban households with tap water connectivity (%)	40	100
Urban households with water-sealed sanitary toilets (%)	42	100
Urban households with modern sewerage connection (%)	N/A	100
Rural households with tap water connectivity (%)	0	50
Rural households with water-sealed sanitary toilets (%)	0	50
Rural households with safe sewerage connection	0	100
Incidence of absolute poverty (%)	24	<3%
Percentage of population living in slums (%)	55	0
Percentage of urban centres with waste water treatment facilities	N/A	100
Core environmental spending (% of GDP)	1	3.5
Spending by environment coordinating entity (% of GDP)	0.005	0.5
Application of 'polluter pays' principle (% of cases)	0	100
Carbon tax (% of fuel prices)	0	15
Green area for Dhaka – major cities (square metres/million people)	N/A	5-12
Disaster readiness(%)	N/A	100
Urban water bodies compliance with water quality standards (%)	0	100
Air quality (annual average, µg/m ³ PM 2.5)	86	40
Percentage of cities flood-free with proper drainage	0	100
Percentage of land degraded	18	5
Area under forest cover (% of land) [base year 2015]	14.1	20
Protection of Habitat and Biodiversity International Ranking	Bottom 5%	Top 30%
Environmental Performance Index International Ranking	Bottom 5%	Top 30%

Source: GoB (2020: 473)



Future Pattern of Agriculture and Potential Implications

The future pattern of Bangladesh's agriculture system will significantly depend on how the climate change challenges are addressed today. There is a potential for even more negative outcomes if GHG emissions are not effectively addressed globally and the farmers are not supported to adapt to climate change (Mujeri and Mujeri, 2021, 2022).

If temperatures continue to climb and there are no technological advances, rice yields in Bangladesh could drop significantly; wheat and maize production may also decline, pushing up food prices. As a consequence, more people could be pushed into poverty and malnutrition.

To avoid the worst possible outcomes, Bangladesh needs to:

-  Implement adaptation measures and urge big polluters to reduce emissions: To minimise the worst effects of climate change on agriculture, Bangladesh needs to take realistic steps to reduce the impacts of climate change through adaptation and other viable options. This needs to be supported by global action to reduce GHG emissions by big polluters to specified levels by 2030 to ensure that temperature increases do not exceed 1.5 degrees Celsius.
-  Strengthen social protection: The need is to introduce universal social protection and provide safety nets especially to address the immediate food insecurity and malnutrition crisis in places hit hardest by climate change.
-  Raise voice in global platforms for fair compensation: As Bangladesh is one of the worst affected countries by the climate crisis, it is only natural that rich polluting countries must compensate low-income countries like Bangladesh for the damages and losses they have been causing them due to climate change. This will specifically assist the small farmers and disadvantaged communities to recover and adapt their production systems to changing realities.
-  Prepare for future climate shocks: Adequate preparations are needed to help the climate vulnerable farmers and other producers so that they are better prepared to overcome climate change hazards, for which financial, technical and other assistance are needed for communities at risk. This will help provide them, ahead of climate disasters, with early warning systems so that they can prepare themselves and ensure that local communities and organisations can lead the response to disasters.
-  Build new and more responsive production systems: For success, the need is to build a more gender responsive, just, resilient and sustainable production system at the heart of climate response. This will ensure small producers (many of whom are women) participate in discussions about adapting to and surviving from climate change hazards. No doubt, Bangladesh's agriculture and food system of the future require adequate investments in sustainable agriculture that supports local food production efficiently and contributes towards preserving the planet as well.

Accelerating Transition to Renewable Energy

From the climate change perspective, a shift towards generating environment friendly electricity from renewable energy sources is a priority. Institutional framework for renewable energy was not available before 2008; and the renewable energy policy was adopted in 2009. According to the policy, an institution was planned to be established to serve as a focal point for the promotion and development of sustainable energy, renewable energy, energy efficiency and energy conservation. Accordingly, the Sustainable and Renewable Energy Development Authority (SREDA) was established in 2014 under the Sustainable and Renewable Energy Development Authority Act 2012 to facilitate sustainable energy



i.e. renewable energy development as well as increase energy efficiency. According to the law, SREDA was established for effective utilisation and conservation of renewable energy both in public and private sectors. To monitor and co-ordinate renewable energy and efficiency of energy related issues, different agencies are working with SREDA. A total of 19 renewable energy based projects (13 solar park projects, two solar irrigation projects, three wind projects and one waste to energy project) are now under implementation.

Renewable energy (RE) is the energy that is obtained from renewable resources, which are naturally restocked on a human timescale, such as sunlight, wind, rain, tides, waves and geothermal heat. At present, renewable energy in Bangladesh mostly comes from biogas, hydro power, solar and wind. Bangladesh has set a target to generate 2,000 MW of electrical power from renewable energy by the early 2030s. The total electricity generation from such sources is about 404 MW at present. The target of renewable energy generation is 20 per cent of the total electricity generation by 2030. Initiatives have been taken to produce 30 MW power from renewable energy from Dhaka, 60 MW from Rangunia, 3 MW from Sharishabari, 55 MW from Gangachhara, 200 MW from Mymensingh, 20 MW from Cox's Bazar and 200 MW from Sun Edition Solar project at Teknaf. In addition, processes are underway to install Solar Home Systems (SHSs) at Kaptai, Hatia, Thakurgaon, Ishwardi and Sirajganj.

Rural electrification through solar photovoltaic (PV) technology is promising and becoming popular in Bangladesh. The SHSs are highly decentralised and particularly suitable for remote, inaccessible areas; therefore, the business of solar power system has been introduced by both governmental and nongovernmental organisations. Solar power systems are contributing a huge amount of energy and changing the current energy requirements, especially in rural areas of Bangladesh. At present there are about 30 organisations conducting solar energy businesses in Bangladesh. Grameen Shakti first introduced low cost solar systems to the rural people in 1996 and in 1997, BRAC, an NGO, launched Solar Energy Programme for sustainable development. Nevertheless, Bangladesh is still far behind many countries in terms of access to solar electricity.

Prospects of renewable energy

The prospect of RE in Bangladesh is promising, especially in the case of solar energy. However, for the near future, RE is expected to remain annexed to the current energy scenario dominated by the non-renewable conventional means. Still, RE can play an important role in reaching the consumers especially outside the national grid or in places where grid connection is likely to be delayed. The present scenario of RE sources shows that there is a great opportunity for Bangladesh to meet its overall power demand by utilising its available RE prospects properly. If it can make the best use of its available RE sources, then it can emerge as the major source of clean energy of the country. It is high time for Bangladesh to look forward and work with these RE sources to produce electricity rather than depending wholly on conventional methods.

For the purpose, more emphasis is needed on RE such as solar energy as it is the emerging renewable energy sector in Bangladesh which has potential to meet a significant share of the energy and power demand of the country's population. Other renewable energy sources can also play a vital role to meet daily power demand. With the help of these resources, Bangladesh can generate electricity to meet the rapidly rising power demand in future. As the climate hazards are intensifying and the stock of fossil fuel is decreasing in the country, more emphasis is needed on renewable energy through making the best use of available renewable energy sources to harness clean energy for electricity and to protect the environment. The potential of solar energy and biomass is enormous in Bangladesh and people have already started to harness energy from these sources. What is required is to create a more conducive environment and encourage the people to use renewable based electricity. For the purpose, lowering of dependency on imported solar panels through establishment of local industries having assembling



facilities of good durable materials is necessary for further operation and maintenance of RE at rural areas. In addition, soft loan for the poor and ultra-poor rural residents along with rational incentive for off grid consumers may be considered. Subsequently energy efficiency programmes could also be implemented in this regard. Solar power generation (photovoltaic, solar thermal) has enormous potential, but the solar power generation cost is more than five times higher than the power generation cost by conventional power generation. Cost minimisation through adoption of new technologies is required for wide spread acceptance of solar energy in the rural areas. To attract private power producers, incentives and possible tariff adjustment is necessary where applicable.

Bangladesh's National Solar Energy Action Plan has introduced measures to shift the renewable energy policy. This aims for up to 40 giga-watts (GW) to be installed by 2041. This is accompanied by medium roll-out of 25 GW and a business as usual outcome of 8 GW. Consequently, its 40 GW target needs much higher efforts than at present to achieve the target compared with the existing renewable energy's capacity in Bangladesh. Recent figures show that renewable energy only makes up 3 per cent of the national energy mix. However, if successful, it will be made up of the following: (i) 16 GW from solar hubs; (ii) 4 GW from electric utilities; (iii) 5 GW from private developers; (iv) 2.5 GW from irrigation pumps; and (v) 12 GW from rooftop installations.

Thus, the potential for a swift transition and a diversified renewable energy mix is present in the country. For example, utilising only 1 per cent of the Kaptai dam's water surface for floating solar would generate nearly 500 MW of solar capacity. Additionally, unexplored potential for land can be found along riverbanks and reclaiming areas in the Meghna estuary. Furthermore, according to the National Renewable Energy Laboratory (NREL), there is over 20,000 km² of land where wind speeds range between 5.75 and 7.75 m/s. This equals to a potential of over 30,000 MW.

Moreover, as Bangladesh is among the worst-affected countries from climate change, there are risks facing coastal land and territories bordering riverbanks which are subjected to constant erosion and flooding. These challenges are forcing people to relocate and complicate renewable energy network development and policy. To make a quick turnaround in the national power system, Bangladesh has to solve several additional challenges. There is also a lack of incentives for private investors including: inadequate coordination among ministries, procedural difficulties, limited budget allocation to the RE-based projects, slow technological adoption, lack of awareness and application of green building policies, lack of grid infrastructure with enhanced demand and capacity.

Nevertheless, the transition towards the renewable energy sector in Bangladesh will further accelerate the country's development, keep energy access reliable and affordable, and improve healthcare and quality of life along with reducing its contribution to GHG emissions in a humble way. Further, a key enabler for Bangladesh's renewables transition is the support from global organisations. Bangladesh can take advantage of the interest-free credits to fund its renewable energy projects. There are also many other initiatives among its partnering organisations with the goal to help promote the renewable energy transition in Bangladesh.



4

Climate Change and Poverty Nexus: Glimpses from Ground Realities

“There is a complex interaction between poverty and climate change. The reduction of poverty can allow populations to better respond to disasters and reduce vulnerability to climate change impacts. However, climate change responses that do not consider poverty can be ‘maladaptive’, potentially making poverty worse and climate change responses less effective”

(FAO. 2019, P.8).

At the ground level, climate change and poverty nexus can be interpreted in terms of the direct and disproportionate impact of climate change on the poor and impoverished communities, where extreme weather events like floods, droughts and cyclones severely disrupt livelihoods, destroy assets, and push the people further into poverty due to their limited capacity to adapt to these disasters. The impact of these events makes them highly vulnerable to climate-related disasters. In effect, climate change acts as a ‘threat multiplier’ for these already poor and marginalised populations. The key to addressing the challenges is to develop and implement evidence-based pro-poor policies, strategies and programmes that promote inclusive growth and sustainable livelihoods; supported by actions to increase the resilience, adaptive and coping capacity of these poor and vulnerable communities to climate change. In order to achieve this, the need is to adopt an integrated ‘climate-poverty approach’ to support policy development and actions by the policymakers and local level institutions as well as the communities and households themselves. In practice, the approach has to integrate insights from many perspectives, covering not only climate and poverty aspects, but also gender, food security, disaster response, resilience, and, more importantly, the climate vulnerable community perspectives. This is necessary to internalise the results of synergies and linkages between climate change adaptation, poverty reduction and livelihood security actions.

4.1 Types of Natural Calamities in Sample Locations

Bangladesh is highly vulnerable to a range of natural calamities due to its geographical location and climatic conditions. Various regions of the country frequently experience floods, cyclones, river erosion, droughts, and other hazards that significantly impact the livelihoods and wellbeing of the population. Understanding the distribution and impact of these natural disasters across different regions is crucial to effective disaster management and policy planning.

This chapter provides glimpses from the ground level of the types and extent of natural calamities affecting households in different purposively selected districts of Bangladesh specifically for the present study. By examining the percentage of households impacted, we aim to provide insights into the regional disparities in vulnerability and the need for targeted interventions to enhance resilience and recovery efforts.

Table 4.1 presents the percentage of households affected by different types of natural calamities across the seven selected districts in Bangladesh: Chuadanga, Naogaon, Bhola, Sunamganj, Kurigram, Satkhira, and Bagerhat. It highlights the regional variation in vulnerability to specific disasters. In Chuadanga, 100 per cent of the affected households experienced extreme temperatures, while Naogaon reported 100 per cent of its affected households experiencing drought. Bhola was exclusively impacted by cyclones, affecting 100 per cent of its vulnerable households. Cyclone impact was also significant in Satkhira (95 per cent) and Bagerhat (77.5 per cent), contributing to a total of 38.93 per cent across all districts. Sunamganj witnessed the entire impact from flash floods, affecting 100 per cent of the households. Riverbank erosion was a major concern in Kurigram, affecting all impacted households, and to a lesser extent in Bagerhat (22.5 per cent), leading to an overall impact of 17.5 per cent. Salinity intrusion was reported only in Satkhira, affecting 5 per cent of households, contributing minimally to the total impact (0.7 per cent). Overall, the data underscores the diverse nature of natural calamities in Bangladesh and the importance of adopting region-specific disaster management strategies.



Table 4.1: Percentage of households affected by different types of natural calamities, by district (%)

	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Extreme temperature	100	0	0	0	0	0	0	14.29
Drought	0	100	0	0	0	0	0	14.29
Cyclone	0	0	100	0	0	95	77.5	38.93
Flash flood	0	0	0	100	0	0	0	14.29
Riverbank erosion	0	0	0	0	100	0	22.5	17.5
Salinity	0	0	0	0	0	5	0	0.71

Source: Field survey 2024, InM

4.2 Monthly Occurrence of Natural Calamities across Sample Locations

Table 4.2 illustrates the distribution of natural calamities across different months in the sample locations, highlighting the seasonal patterns of extreme temperature, drought, cyclones, flash floods, riverbank erosion, and salinity. The impact of extreme temperature is observed exclusively in May, affecting 100 per cent of the cases reported (n=40). Droughts are most prevalent in April, affecting 97.5 per cent of the reported cases, with a minor occurrence in June (2.5 per cent). Cyclone also peaks in May, impacting 100 per cent of the cases (n=109), indicating a strong seasonal pattern. Flash floods are confined to June, affecting all reported cases (100 per cent). Riverbank erosion shows a more spread-out pattern, with impacts recorded from February to November, peaking in September (18.4 per cent), followed by July (14.29 per cent) and August (10.20 per cent). Salinity intrusion is noted only in May, affecting 100 per cent of the reported cases (n=2). The absence of impacts in January, March, and December suggests a distinct seasonality in natural calamities, with the majority of occurrences concentrated from April to September. These findings underscore the importance of seasonal preparedness and targeted disaster management strategies in Bangladesh.

Table 4.2: Affected month of natural calamities (in percent)

Months	Extreme temperature (n=40)	Drought (n=40)	Cyclone (n=109)	Flash flood (n=40)	Riverbank erosion (n=49)	Salinity (n=2)
January	0	0	0	0	0	0
February	0	0	0	0	2.04	0
March	0	0	0	0	0	0
April	0	97.50	0	0	0	0
May	100	0	100	0	8.16	100
June	0	2.50	0	100	0	0
July	0	0	0	0	14.29	0
August	0	0	0	0	10.20	0
September	0	0	0	0	18.37	0
October	0	0	0	0	8.16	0
November	0	0	0	0	2.04	0
December	0	0	0	0	0	0

Source: Field survey 2024, InM

4.3 Natural Calamities and Average Time Span from the Survey

Table 4.3 presents the average time span from the year of occurrence to the survey period for various natural calamities, highlighting the distribution of these events over different time frames. The data indicates that extreme temperature and drought events, each with a sample size of 40, predominantly occur very recently, with 100 per cent of cases falling within the 0–1 year range. Cyclones, with a larger sample size of 109, show a more varied distribution; 57.8 per cent occurring within 0–1 years, while the



remaining 42.2 per cent happening 2–3 years ago, suggesting a relatively recent but more spread out pattern. Flash floods (n=40) and riverbank erosion (n=49) exhibit different trends; only 10 per cent of flash floods taking place in the last year, while 90 per cent occurring 2–3 years ago. Riverbank erosion incidents are also mostly a recent phenomenon, with 12.24 per cent in the last year and 85.72 per cent 2–3 years ago, and a small fraction (2.04 per cent) occurring 3–4 years ago. Salinity-related events, though limited in sample size (n=2), are evenly split between the 0–1 year and 2–3 year categories. Overall, the table suggests that while some natural calamities like extreme temperatures and droughts tend to be more immediate in nature, others like cyclones, flash floods, and riverbank erosion exhibit a broader time span in their occurrences.

Table 4.3: Average time span from the year of occurrence to the present for natural calamities

Average time span (in years)	Extreme temperature (n=40)	Drought (n=40)	Cyclone (n=109)	Flash flood (n=40)	Riverbank erosion (n=49)	Salinity (n=2)
0-1	100	100	57.80	10	12.24	50
2-3	0	0	42.20	90	85.72	50
3-4	0	0	0	0	2.04	0

Source: Field survey 2024, InM

4.4 Socioeconomic Characteristics of Sample Households

The socioeconomic characteristics of households play a crucial role in understanding the impact of climate change on poverty, as they influence a community's resilience and ability to adapt to environmental challenges. Key factors such as income levels, education, occupation, land ownership, and access to resources determine how severely households are affected by climate-related events and their capacity to recover. Households with limited financial resources, lower educational attainment, and restricted access to adaptive measures are often more vulnerable to the adverse effects of climate change, such as extreme weather events, crop failures, and resource scarcity. Analysing these socioeconomic aspects provides valuable insights into the intersection of climate change and poverty, helping to identify targeted strategies for building resilience and reducing vulnerability among the most at-risk communities.

4.4.1 Gender Composition of Household Head

Table 4.4 illustrates the distribution of household heads by gender across seven districts: Chuadanga, Naogaon, Bhola, Sunamganj, Kurigram, Satkhira, and Bagerhat. The data reveals a significant male dominance in household headship, with 87.86 per cent of households headed by men overall. Chuadanga stands out with exclusively male-headed households (100 per cent), while the lowest proportion of male heads is observed in Sunamganj (75 per cent). Conversely, female-headed households represent only 12.14 per cent of the total, with notable variations between districts. Sunamganj has the highest percentage of female-headed households at 25 per cent, followed by Satkhira (22.5 per cent) and Kurigram (15 per cent). In contrast, districts like Chuadanga and Naogaon report either no female heads or a very small proportion (5 per cent). These variations suggest that cultural, social, or economic factors might influence the gender distribution of household headship across different regions. The overall trend of male-dominated households highlights potential gender disparities in decision-making authority and access to resources, which could have implications for addressing vulnerabilities and empowering women at the household level.



Table 4.4: Distribution of head of the households by gender and districts

Sex of Household Head (%)	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Female	0	5	2.5	25	15	22.5	15	12.14
Male	100	95	97.5	75	85	77.5	85	87.86

Source: Field survey 2024, InM

4.4.2 Age Composition of Household Head

Table 4.5 presents the average age of household heads across seven districts. The overall average age of household heads is 45.99 years, indicating that most heads are in their mid-to-late 40s. Among the districts, Chuadanga has the oldest average age at 52.65 years, suggesting a higher proportion of senior household heads compared with other regions. In contrast, Satkhira has the youngest average age at 43.3 years, closely followed by Naogaon (43.63 years) and Kurigram (44.4 years). The relatively narrow range of average ages across the districts points to a consistent pattern of middle-aged individuals leading households. This demographic information is crucial for understanding the decision-making capacities, resource management, and potential vulnerabilities of households, as age can influence both economic productivity and adaptability to challenges such as climate change and economic stress.

Table 4.5: Average age of household head by districts

Age and Education	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Average Age of household head (years)	52.65	43.63	47.6	44.75	44.4	43.3	45.6	45.99

Source: Field survey 2024, InM

4.4.3 Primary Occupation of Household Head

Climate change poses a significant threat to Bangladesh, a country highly vulnerable to environmental hazards due to its geographic location, dense population, and reliance on climate-sensitive sectors. As rising temperatures, irregular rainfall, and frequent natural disasters disrupt livelihoods, understanding the link between climate change and occupational vulnerability is essential for formulating effective adaptation strategies. The primary occupation of household heads, particularly in agriculture, fisheries, and day labour, plays a crucial role in determining how communities cope with and adapt to these challenges. This connection underscores the need for targeted policies that support resilient livelihoods and sustainable development for the most at-risk populations.

Table 4.6 illustrates the distribution of household heads by their primary occupation across seven districts: Chuadanga, Naogaon, Bhola, Sunamganj, Kurigram, Satkhira, and Bagerhat. The data reveals that wage earning is the most common occupation, accounting for 42.86 per cent of household heads overall, with particularly high proportions in Kurigram, Bagerhat, and Sunamganj (55 per cent, 55 per cent, and 50 per cent, respectively). Self-employment in agriculture is the second most prevalent occupation at 32.86 per cent, with Bhola (57.5 per cent) and Satkhira (45 per cent) having the highest shares of agricultural self-employment, indicating a strong reliance on farming activities in these districts. Self-employment in non-agricultural sectors is less common, comprising 22.14 per cent of household heads, with Chuadanga and Naogaon showing relatively higher levels (35 per cent each). Occupations categorised as "others" are rare, representing only 2.14 per cent overall, and are observed solely in Chuadanga (5 per cent) and Sunamganj (10 per cent). The distribution highlights the diversity



of livelihood strategies, with some districts showing a stronger focus on agriculture while others lean more towards wage employment, suggesting the need for region-specific policies to support household income and resilience.

Table 4.6: Distribution of head of households by main occupation and districts

Household Head's Main Occupation	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Self-employment in agriculture	35	20	57.5	22.5	32.5	45	17.5	32.86
Self-employment in non-agriculture	35	35	17.5	17.5	12.5	10	27.5	22.14
Wage earning	25	45	25	50	55	45	55	42.86
Other occupation	5	0	0	10	0	0	0	2.14

Source: Field survey 2024, InM

4.4.4 Education Level of Household Head

The education level of household head plays a vital role in shaping their understanding of climate change and their ability to adopt effective adaptation strategies. Educated heads are more likely to access information, implement sustainable practices, and make informed decisions to protect their livelihoods from climate-related risks. Conversely, limited education can hinder awareness and responsiveness, increasing vulnerability to the adverse impacts of climate change. Analysing the education of household heads thus provides key insights into the capacity of communities to cope with and adapt to environmental challenges.

Table 4.7 presents the educational attainment of household heads across seven districts: Chuadanga, Naogaon, Bhola, Sunamganj, Kurigram, Satkhira, and Bagerhat. The data indicates that primary education is the most common level of education among household heads, with 45 per cent overall, and is particularly high in Chuadanga (72.5 per cent) and Naogaon (67.5 per cent). However, a significant proportion of household heads are illiterate, making up 39.29 per cent of the total, with the highest rates in Kurigram (65 per cent), Bhola (60 per cent), and Bagerhat (55 per cent). Secondary education is achieved by only 11.07 per cent of household heads, with Satkhira showing the highest proportion at 25 per cent. Higher levels of education are rare; only 2.5 per cent have completed higher secondary education, 1.43 per cent hold an honors degree, and less than 1 per cent have a master's degree. The low levels of higher education and significant rates of illiteracy suggest limited access to education and potential challenges in adopting advanced livelihood strategies and adaptive measures, emphasising the need for educational improvements to enhance community resilience and socioeconomic development.

Table 4.7: Distribution of head of households by education and districts

Household Head's Education	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Primary	72.5	67.5	30	42.5	27.5	50	25	45
Secondary	2.5	17.5	5	2.5	5	25	20	11.07
Higher Secondary	0	2.5	2.5	0	0	12.5	0	2.5
Honors	2.5	0	2.5	0	0	5	0	1.43
Masters	0	0	0	2.5	2.5	0	0	0.71
Illiterate	22.5	12.5	60	52.5	65	7.5	55	39.29

Source: Field survey 2024, InM



Box 4.1: Heightened Vulnerability to Climate Change – Perils of a Poor Woman

Sajeda Khatun (not her real name), a 31-year-old woman, hails from Saheber Alga village in Ulipur in the district of Kurigram. In 2012, she married Shah Alam; now they have two sons and two daughters. Her husband used to work as a daily wage labourer; and also in brick kilns on a seasonal basis. Although the earnings were relatively low, they somehow managed the six-member family living in a small dwelling on their own homestead land. Sajeda used to grow vegetables in the homestead and rear a few chicken and duck as well as two goats. She also earned some money through working as maid in the houses of the well-off villagers. As time passed, they also arranged the marriage of their eldest daughter. Life seemed to be moving along smoothly for Sajeda and her family.

Things, however, changed suddenly when river erosion started to grasp lands alongside the riverbanks of the mighty Teesta River. Within a short period, the erosion affected Sajeda's homestead as well, since it was located near the riverbank. Gradually, the entire homestead land was swept away by the river; and they lost their only asset and became homeless. With no place to go, Sajeda turned to her relatives for help, and they offered her a small piece of land on which she could build a dwelling to live with her family. But as she was settling down in the new place, a dark phase in her life started to unfold.

Soon after moving to the new place, Sajeda's husband fell seriously ill and was no longer able to work. Afterwards, he was admitted to the hospital, where the doctors diagnosed problems with his kidneys. Since Sajeda's husband was the only major earning member of the family, along with his illness, the family's earnings also dried up leading to severe financial strain in the family. The whole family started to struggle for survival in addition to meeting the treatment cost of Sajeda's ailing husband.

For meeting the survival needs, Sajeda's young children had to look for odd jobs to earn some money to help their mother. In desperation, Sajeda approached the local member of the Union Parishad and applied for a Vulnerable Group Development (VGD) card, hoping it would help her feed the family. Luckily, she got the VGD card.

Despite receiving the support, Sajeda's financial conditions remained mostly unchanged. She was unable to meet her husband's medical expenses. It emerged that she had to choose between either feeding her children or paying for her husband's treatment, but she could not do both. Being in a helpless situation, she asked herself, "What should I do now? How can I save my children? Where can I get the money for my husband's treatment?". She was utterly distressed and there was nobody to help her during the crisis. But how Sajeda can abandon the fight that started with the river erosion, aggravated by the climate change effects.

Meanwhile, without any change in her life, Sajeda's fight is still going on. She is passing through the harsh reality—caught in a dilemma -- fighting her husband's illness and struggle for bringing up and educating her children -- in the midst of her powerlessness to change her fate for better.

4.4.5 Marital Status of Household Head

Table 4.8 shows the marital status of household heads across seven districts: Chuadanga, Naogaon, Bhola, Sunamganj, Kurigram, Satkhira, and Bagerhat. The data reveals that the vast majority of household heads are married, comprising 90.71 per cent of the total, with the highest proportions observed in Chuadanga (97.5 per cent), Naogaon (92.5 per cent),



and Bhola (92.5 per cent). Unmarried household heads are relatively rare, accounting for only 2.5 per cent overall, with small representations in districts like Sunamganj and Satkhira (5 per cent each). Divorce is almost nonexistent among household heads, with only 0.36 per cent reported in Kurigram. Meanwhile, 6.43 per cent of household heads are widowed, with the highest incidence in Sunamganj (17.5 per cent) and notable figures in Bagerhat (10 per cent) and Naogaon (7.5 per cent). The significant proportion of married household heads suggests a traditional household structure, while the higher percentage of widowed heads in some districts may indicate vulnerabilities linked to economic and social support systems, especially for female-headed households.

Table 4.8: Distribution of household head by marital status and districts

Household Head's Marital status	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Married	97.5	92.5	92.5	77.5	90	95	90	90.71
Unmarried	2.5	0	2.5	5	2.5	5	0	2.5
Divorce	0	0	0	0	2.5	0	0	0.36
Widow/Widower	0	7.5	5	17.5	5	0	10	6.43

Source: Field survey 2024, InM

4.4.6 Household Size

Household size is an important demographic factor shaping the socioeconomic dynamics of communities in Bangladesh. Understanding the distribution and trends in household size is critical to policymakers and development practitioners, as it affects resource allocation, poverty levels, and access to essential services like healthcare, education, and financial support.

Table 4.9 provides an overview of household sizes across seven districts: Chuadanga, Naogaon, Bhola, Sunamganj, Kurigram, Satkhira, and Bagerhat, with an overall average household size of 4.96 members. The most common household size category is 3–5 members, accounting for 54.64 per cent of households, with Naogaon (67.5 per cent) and Bagerhat (62.5 per cent) showing particularly high proportions in this range. Households with 6–8 members represent 28.57 per cent of the total, with Bhola (35 per cent) and Kurigram (35 per cent) reporting the highest shares in this category, suggesting a tendency towards larger families in these regions. Smaller households with 1–2 members are less common, comprising 11.07 per cent overall, with Chuadanga having the highest proportion at 15 per cent. Large households of 9–14 members are relatively rare, making up only 5.71 per cent of the total, and are most frequently seen in Bhola (15 per cent). The average household size varies by district, with Bhola having the largest average at 5.73 members and Bagerhat the smallest at 4.43 members. These variations in household size reflect differences in family structure, economic conditions, and possibly cultural practices across the districts, which could influence resource allocation and vulnerability to economic or environmental stresses.

Table 4.9: Percentage of household by average household size and districts

Household Size (number)	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
1-2	15	7.5	12.5	12.5	7.5	10	12.5	11.07
3-5	52.5	67.5	37.5	57.5	52.5	52.5	62.5	54.64
6-8	27.5	20	35	27.5	35	32.5	22.5	28.57
9-14	5	5	15	2.5	5	5	2.5	5.71
Average HH Size by districts	4.6	4.55	5.73	4.88	5.1	5.48	4.43	4.96

Source: Field survey 2024, InM



4.4.7 Earning Members of Household

The number of earning members in a household is a critical indicator of its economic stability and resilience. Households with multiple income earners are generally better positioned to manage financial risks, invest in education, healthcare, and adapt to unexpected challenges such as economic downturns or climate-related impacts. In contrast, those relying on a single or no income earner face greater vulnerabilities, often struggling to meet basic needs and build savings. Understanding the distribution of earning members across different regions provides valuable insights into household income diversity, financial security, and the broader socioeconomic dynamics influencing poverty and development.

Table 4.10 presents the distribution of earning members per household across seven districts: Chuadanga, Naogaon, Bhola, Sunamganj, Kurigram, Satkhira, and Bagerhat. The majority of households (66.07 per cent) have a single earning member, with particularly high proportions in Bagerhat (77.5 per cent), Naogaon (75 per cent), and Bhola (75 per cent). Households with two earning members account for 28.21 per cent overall, with Chuadanga showing the highest proportion at 47.5 per cent, suggesting a slightly more diversified income base in that district. The presence of three earning members is relatively rare, representing only 5 per cent of households, with small but consistent proportions across most districts. Households with no earning members or as many as four are extremely uncommon, each comprising just 0.36 per cent of the total, observed only in Sunamganj. The prevalence of single-income households highlights a potential vulnerability to economic shocks, as reliance on a single earner can limit financial stability and adaptive capacity, especially in the face of climate-related and economic challenges. Strengthening livelihood opportunities to diversify income sources could be crucial for enhancing resilience in these communities.

Table 4.10: Number of earning member of household by districts

No. of earning member	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
0	0	0	0	2.5	0	0	0	0.36
1	45	75	75	62.5	70	57.5	77.5	66.07
2	47.5	17.5	20	27.5	25	37.5	22.5	28.21
3	7.5	7.5	5	5	5	5	0	5
4	0	0	0	2.5	0	0	0	0.36

Source: Field survey 2024, InM

4.5 Asset Ownership of Households

4.5.1 Land ownership

Climate change poses a significant threat to the livelihoods of rural households in Bangladesh, a country highly vulnerable to rising sea levels, unpredictable rainfall, and increased frequency of natural disasters. As agriculture remains the primary source of income for a substantial portion of the rural households, changes in climate patterns directly impact land productivity, crop yields, and, consequently, the socioeconomic stability of the rural communities. The intricate relationship between climate change and land holdings has led to challenges such as land degradation, salinity intrusion, and displacement, exacerbating the struggles of smallholder farmers who lack the resources to adapt effectively. Understanding the impact of climate change on land ownership and agricultural practices is, therefore, crucial for developing targeted policies that promote resilience and sustainable livelihoods for households across rural Bangladesh.



The data collected under the study and presented in Table 4.11 highlights significant regional disparities in land ownership and its value across different districts in Bangladesh. Bhola has the largest average owned agricultural land size per household at 0.68 acres, while Bagerhat has the smallest at just 0.002 acres. In terms of land value, Chuadanga and Naogaon exhibit the highest average values for agricultural land, with BDT 5.47 lakh and BDT 4.88 lakh per acre, respectively, whereas Bagerhat shows the lowest at BDT 0.010 lakh. Homestead land sizes vary less drastically, with Bhola again leading at 0.17 acres per household, but Chuadanga and Naogaon show higher values per acre. The presence of fallow land is minimal across the regions, with a negligible size and value, indicating limited unused land resources. Overall, the total average owned land size is highest in Bhola (0.85 acres) and lowest in Bagerhat (0.04 acres), reflecting both geographic and economic disparities. Additionally, the total land value is highest in Chuadanga (BDT 9.96 lakh per acre) and Naogaon (BDT 9.97 lakh per acre), suggesting a higher per-acre land value compared with other regions. This variation underscores the influence of regional factors such as soil fertility, market accessibility, and vulnerability to climate impacts on land holdings and their economic worth.

Table 4.11: Average owned land size (in Acre) and value (in lakh BDT)

Types of land holdings	Districts							Total
	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	
Average owned agricultural land size (Acre)	0.18	0.20	0.68	0.05	0.40	0.49	0.002	0.29
Average owned agricultural land value (in lac BDT.)	5.47	4.88	4.05	0.32	0.41	3.85	0.010	2.71
Average owned homestead land size (Acre)	0.07	0.07	0.17	0.11	0.12	0.06	0.03	0.09
Average owned homestead land value (in lac BDT.)	4.49	5.10	1.51	1.30	0.40	0.79	0.37	1.99
Average fallow land size (Acre)	0.01	0.01	0.02	0	0	0	0	0.01
Average fallow land value (in lac BDT.)	0.24	0.38	0.05	0	0	0	0	0.09
Average total owned land size (Acre)	0.25	0.27	0.85	0.16	0.52	0.55	0.04	0.38
Average total owned land value (in lac BDT.)	9.96	9.97	5.55	1.62	0.81	4.64	0.38	4.71

Source: Field survey 2024, InM



4.5.2 Total asset ownership

Table 4.12 reveals notable variations in total asset holdings per household across different districts in Bangladesh, with land assets constituting the most significant share of total assets. Chuadanga and Naogaon lead in land asset values, with BDT 995.80 and BDT 997.48 thousand respectively, indicating stronger land-based wealth compared with other regions, while Bagerhat shows the lowest at BDT 38.43 thousand. Housing assets also vary, with Chuadanga having the highest average value (BDT 197.33 thousand) and Bagerhat the lowest (BDT 40.35 thousand). Livestock and poultry assets are particularly valuable in Naogaon and Bhola, contrasting with minimal holdings in Bagerhat. Forestry resources and agricultural equipment are relatively minor but show slight regional differences. Ornaments represent a significant portion of non-land assets in Satkhira (BDT 47.88 thousand). Financial assets are highest in Chuadanga and Naogaon, reflecting stronger savings and/or investments. The total asset value per household is highest in Chuadanga (BDT 1,429.27 thousand) and lowest in Bagerhat (BDT 128.63 thousand), indicating stark economic disparities. Liabilities, however, are relatively modest across districts, with the highest in Sunamganj (BDT 67.63 thousand). These findings underscore the diverse economic profiles of districts, shaped by differences in land holding values, livestock resources, financial assets, and level of indebtedness.

Table 4.12: Average value of asset holdings by districts

Assets (in thousand BDT)	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Land asset	995.80	997.48	555.35	162.50	81.18	463.79	38.43	470.65
Housing value	197.33	66.35	67.75	111.33	116.88	68.63	40.35	95.51
Livestock /poultry value	56.18	102.86	103.66	5.39	90.92	29.55	1.15	55.67
Forestry resource value	4.43	7.68	11.45	5.10	1.40	2.98	2.15	5.02
Agricultural equipment value	14.78	5.35	0.69	0.75	2.03	1.89	0.38	3.70
Value of own business resources	13.86	11.50	0.91	2.95	0.40	2.52	3.67	5.12
Transport value	23.42	10.24	11.05	2.60	6.65	2.59	3.86	8.63
Ornaments value	37.39	26.36	8.78	10.01	11.78	47.88	9.40	21.66
Financial asset	26.38	26.46	4.09	2.96	0.68	11.61	4.97	11.02
Total Assets	1429.27	1283.67	796.01	371.20	364.73	682.79	128.63	722.33
Liabilities	59.71	29.38	32.29	67.63	52.83	51.36	24.28	45.35

Source: Field survey 2024, InM

4.5.3 Disaster impact on asset ownership pattern

In Bangladesh, a country which is highly susceptible to natural disasters, the pattern of asset ownership among households undergoes significant changes following different disaster events. Disasters frequently lead to the loss or devaluation of critical assets, including land, livestock, housing, and financial savings, thereby disrupting livelihoods and deepening poverty. Smallholder farmers and low-income households are particularly vulnerable, who are often forced to sell productive assets at low prices to cope with immediate disaster needs or rebuild their houses and restore livelihoods.



Additionally, the increased frequency and intensity of climate-induced disasters accelerate the depletion of assets, reducing the capacity of households to recover sustainably. Understanding the patterns of these changes is essential for designing targeted interventions that can enhance resilience and ensure more equitable and sustainable asset ownership in disaster-prone regions of Bangladesh.

Figure 4. highlights the impact of disasters on asset ownership across different districts in Bangladesh, showing both immediate losses and subsequent recovery. It is seen that, one month prior to onset of the disaster, the average asset value per household was highest in Chuadanga (BDT 14.27 lakh) and lowest in Bagerhat (BDT 1.18 lakh). Immediately after the disaster, all districts experienced a decline in asset values, with Bhola witnessing the most significant drop from BDT 6.97 lakh to BDT 5.07 lakh, indicating severe damage and asset losses. Conversely, Sunamganj saw a slight increase, suggesting either effective immediate response measures or low variations in disaster impact. At present with passage of time, asset values have generally recovered or, in some cases, even exceeded pre-disaster levels in most districts, particularly in Bhola (BDT 7.96 lakh) and Bagerhat (BDT 1.29 lakh), highlighting some degree of resilience and recovery efforts. However, the slow and uneven pace of recovery in districts like Naogaon and Kurigram suggests persistent challenges in rebuilding assets. Overall, the findings emphasise the differential impact of disasters on asset ownership and the varied recovery capacities across regions, underlining the need for tailored disaster response and recovery strategies.

Box 4.2: Fighting Floods in Haor Region – A Woman's Tale

Helena Begum, a 48-year-old woman, lives in the disaster-prone haor region in Sunamganj district. Since her childhood, she has been facing immense struggles with repeated floods that characterise worsening climate change impacts in the haor region. She lives with her husband along with two sons in a small village, which is routinely flooded almost every year with the sudden onslaught of river water coming from the upper stream in India. Her husband is paralysed over the last eight years due to an accident which he unfortunately met with while working in a construction site in Dhaka. With her ailing husband and two sons, Helena had to bear the entire responsibility of managing the household. With no other assets except their homestead, there had been no source of income for the family, Helena discovered herself in an increasingly difficult situation, with no income to manage the family.

In the midst of dire challenges for survival, Helena began working as a day labourer on other's farms. The wages that she received was, however, even not enough to meet the bare minimum food and other basic needs of her family. Despite their struggles, both her sons were determined to continue their education—elder one was in secondary school, and the other was in primary school.

While the struggle was going on, suddenly a devastating flash flood completely destroyed their home in June 2022. With no shelter, no income, and an ailing husband, Helena had no other option but to take shelter in her parents' house. She continued to work as a day labourer; while also managing to support the education of their sons despite her overwhelming financial burden.

At such a critical juncture of her life, Helena sought advice from her uncle, who was a skilled tailor. He encouraged her to learn tailoring to supplement her income. Eager to bring about a change in her fate, Helena agreed and began learning the craft under her uncle's guidance. Gradually, she improved her skills; and her dedication and hard work paid off good dividends. She borrowed some money from the local NGO-MFI to buy a sewing machine and some initial capital to help start her tailoring business.

Despite her newly acquired skills, Helena had to struggle to expand her business. After repayment of the previous loan, Helena again took a bigger loan with which she bought fabrics and other materials to build a stock of different materials and expand the tailoring business. Her dedication and quality of tailoring gained reputation in the village; and gradually people from neighbouring villages also started purchasing from her tailoring outlet. Soon, Helena was earning a steady income of around BDT 600 to 700 a day, and for the first time in her life, she began to see a way out of her hardships.

Within a year, Helena had saved enough money to build her new home. At one corner, she opened her tailoring shop as well. Gradually, she bought another sewing machine and trained one young woman of her village to work as a co-worker in the shop for which she was paid monthly salary. Helena is now a successful



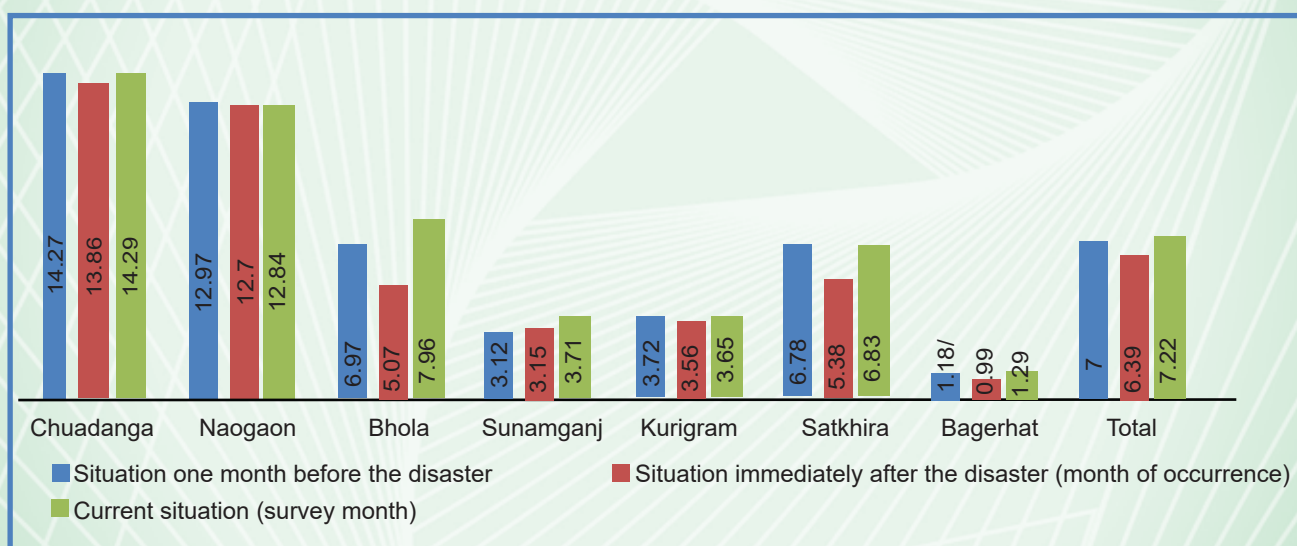
woman entrepreneur and many of the village women have now become inspired to start their own businesses. Her sons are pursuing their education well—her eldest one is preparing for the HSC examination, while the younger one is reading in grade seven.

The success story of Helena – turning from a climate-induced flood evicted destitute to a successful entrepreneur – and her struggled journey have earned recognition and admiration of the community. She is now cited as an example of perseverance and hard work -- a case of transformation of a dependent woman to a successful entrepreneur -- who creates jobs for other women to help them in need. More importantly, she has motivated other rural women to become self-reliant and empowered within the family and in the community.

Helena's dream is to see her sons to grow up, get educated and become successful human beings and responsible citizens. Her transformation provides a powerful testament to the impact of resilience, hard work, and determination.

No doubt, Helena's journey provides a fascinating example of overcoming the adversities of climate change. From the depths of poverty and hardship, she has turned herself to become a symbol of hope and empowerment; proving that with determination within a supporting environment, it is possible to turn one's life around.

Figure 4.1: Changes in asset ownership due to the disaster across different districts (in lakh BDT)



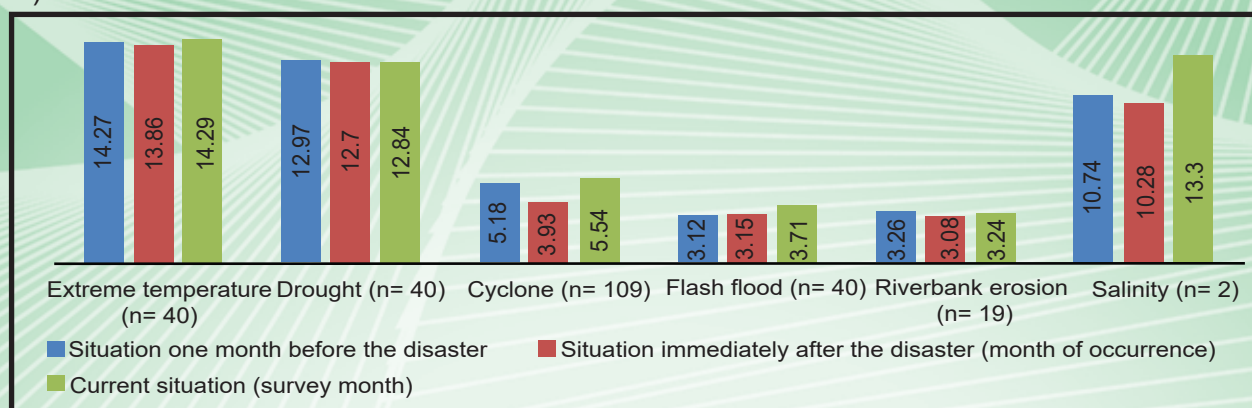
Source: Field survey 2024, InM

4.5.3 Changes in asset ownership across different types of natural calamities

Figure 4.2 illustrates how different types of natural calamities affect asset ownership in rural Bangladesh, revealing varied impacts and recovery patterns. For extreme temperatures and drought, the changes in asset values are minimal, indicating relatively low and short-term damages, with values recovering to pre-disaster levels or slightly higher at present (BDT 14.29 lakh for extreme temperature and BDT 12.84 lakh for drought). Cyclones cause the most significant immediate asset loss, with values dropping from BDT 5.18 lakh to BDT 3.93 lakh, but recovery efforts over time seem to have led the asset value to exceed pre-disaster levels to reach BDT 5.54 lakh. Flash floods and riverbank erosion also show a modest decrease in asset values immediately after occurrence, but a partial or near-complete recovery is evident, especially for flash floods (from BDT 3.12 lakh to BDT 3.71 lakh). Overall, the findings highlight that, while some calamities cause severe immediate losses, recovery is uneven across disaster types, underscoring the need for disaster-specific resilience strategies.



Figure 4.2: Changes in asset ownership due to the disaster across different natural calamities (in lakh BDT)



Source: Field survey 2024, InM

4.6 Income of households

4.6.1 Average monthly income of households

Climate change poses a significant threat to the livelihoods and monthly incomes of households in rural Bangladesh. The majority of the population relies on climate-sensitive sectors like agriculture, fisheries, and informal labour income, making them particularly susceptible to the adverse effects of shifting weather patterns, salinity intrusion, and crop failures. These climate-induced disruptions not only reduce agricultural productivity and employment opportunities but also lead to increased costs of food, healthcare, and disaster recovery, further straining household incomes. Smallholder farmers and low-income communities face the dual challenge of declining earnings and limited resources to adapt to these changes. Understanding the complex relationship between climate change and household income is therefore essential for designing effective policies that enhance resilience and promote sustainable livelihoods in rural Bangladesh.

The data in Table 4.13 highlights significant regional variations in the sources and levels of monthly household income across different districts in Bangladesh. Bhola has the highest total average monthly household income (BDT 23,596), driven primarily by substantial earnings from the agriculture sector (BDT 13,456), suggesting a strong reliance on agriculture. In contrast, Bagerhat has the lowest total income (BDT 12,769), with minimal agricultural income (BDT 45), indicating a limited agricultural base. Income from non-agricultural sectors is relatively evenly distributed, with Chuadanga leading at BDT 7,198, reflecting diversified livelihoods beyond farming. Wage income forms a major part of household earnings across all districts, with Sunamganj showing the highest average wage income (BDT 9,300), suggesting a significant dependency on the labour market. Additionally, income from other sectors is notably high in Sunamganj (BDT 5,467), possibly due to fisheries or remittances, compared with other districts where this income source remains modest. Overall, the findings underscore the diverse economic structures of districts, with some heavily reliant on agriculture and others more dependent on wages and non-agricultural activities, highlighting the need for region-specific economic policies to improve income resilience against climate impacts. The data also reveals significant disparities in average monthly household incomes across different districts in Bangladesh, highlighting the diverse economic structures and income sources. Overall, the findings indicate that districts with diversified income sources tend to have higher total incomes, emphasising the importance of promoting multiple livelihood options to enhance income stability and resilience against economic shocks.



Table 4.13: Average monthly income of households by districts

Income	Chuad anga	Naoga on	Bhola	Sunamg anj	Kurigra m	Satkhira	Bagerhat	Total
Income from agricultural sector	5283	3918	13456	1275	10325	8373	45	6097
Income from non-agricultural sector	7198	5636	3333	4875	3650	3641	5601	4848
Income from wage	6590	7445	6493	9300	8613	4801	6588	7118
Income from others sector	900	110	315	5467	403	908	536	1234
Total income	19971	17110	23596	20917	22990	17724	12769	19297

Source: Field survey 2024, InM

4.6.2 Impact of disasters on household incomes

Table 4.14 highlights the significant fluctuations in household incomes across different districts in rural Bangladesh due to the impact of disasters. One month prior to the disaster, households in Bhola had the highest average income (BDT 20,746), followed by Kurigram (BDT 18,825) and Chuadanga (BDT 19,907), while Bagerhat had the lowest income (BDT 12,392). Immediately after the disaster, all districts experienced a decline in average household income, with Bagerhat showing the sharpest drop to BDT 8,114, indicating a severe impact on livelihoods, possibly due to its reliance on sectors vulnerable to disasters. Despite the disasters, income levels have started to recover over time and, during the survey month, average household income in Bhola (BDT 23,596) and Kurigram (BDT 22,990) show significant rebounds, surpassing pre-disaster income levels. On the other hand, Bagerhat and Satkhira lag behind, with income levels remaining lower than the levels prior to the disaster, reflecting longer recovery times needed in these districts. Overall, the table highlights the varying recovery patterns, with some regions demonstrating greater resilience while others continue to struggle with the aftermath of the disaster.

Table 4.14: Changes in household income earning due to the disaster across different districts

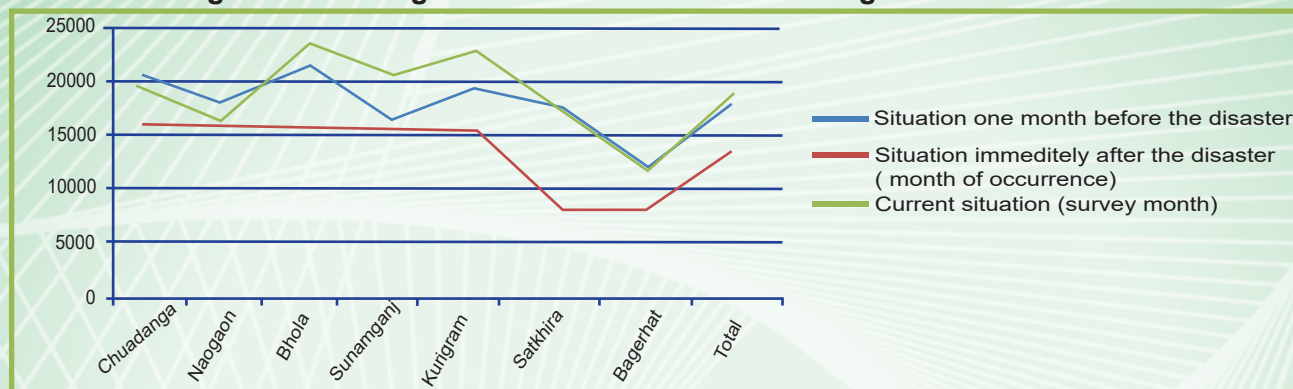
Changes in income earning in different times	Chuad anga	Naoga on	Bhola	Sunamg anj	Kurigra m	Satkhira	Bagerhat	Total
Situation one month before the disaster	19907	17425	20746	16247	18825	17154	12392	17528
Situation immediately after the disaster (month of occurrence)	16585	16121	16239	16271	16090	7951	8114	13910
Current situation (survey month)	19971	17110	23596	20917	22990	17724	12769	19297

Source: Field survey 2024, InM



Figure 4.3 highlights that natural disasters cause an immediate and sharp decrease in average household income, as seen in the months following the disaster. However, the rate and extent of recovery differ among districts. Some regions, like Bhola and Kurigram, demonstrate greater resilience, with household income levels surpassing pre-disaster levels in the current situation, suggesting better recovery strategies and stronger economic buffers. In contrast, other regions such as Bagerhat and Satkhira struggle to regain their previous income levels, indicating that these areas face prolonged recovery due to factors like dependence on volatile agriculture, limited access to recovery resources, or slower economic rehabilitation. The pattern underscores the uneven nature of recovery and the need for targeted disaster relief and resilience-building efforts in more vulnerable regions.

Figure 4.3: Changes in household income earning due to the disaster



Source: Field survey 2024, InM

4.6.3 Impact on household income across different natural calamities

Table 4.15 reveals the varying impacts of different natural calamities on average household income across rural Bangladesh, highlighting both immediate losses and recovery patterns. Extreme temperatures and droughts lead to a moderate income decline, with income levels returning to or slightly above the pre-disaster levels (BDT 19,971 for extreme temperature and BDT 17,110 for drought), indicating that these disasters have less long-term economic impact. In contrast, cyclones cause a more significant drop in income from BDT 16,971 to BDT 10,945, but recovery is evident, with income rising to BDT 18,293, showing some resilience. Flash floods and riverbank erosion initially cause minimal changes or slight income increases (for flash floods BDT 16,247 to BDT 16,271), but both exhibit substantial recovery, with income rising to BDT 20,917 for flash floods and BDT 21,138 for riverbank erosion, suggesting impact of recovery strategies. Salinity, though based on limited data (n=2), shows a sharp decline in income immediately after the disaster, but it recovers close to pre-disaster levels (BDT 26,735). Overall, these findings indicate that while some calamities result in temporary income drops, others lead to more significant disruptions, with varying recovery rates across districts.

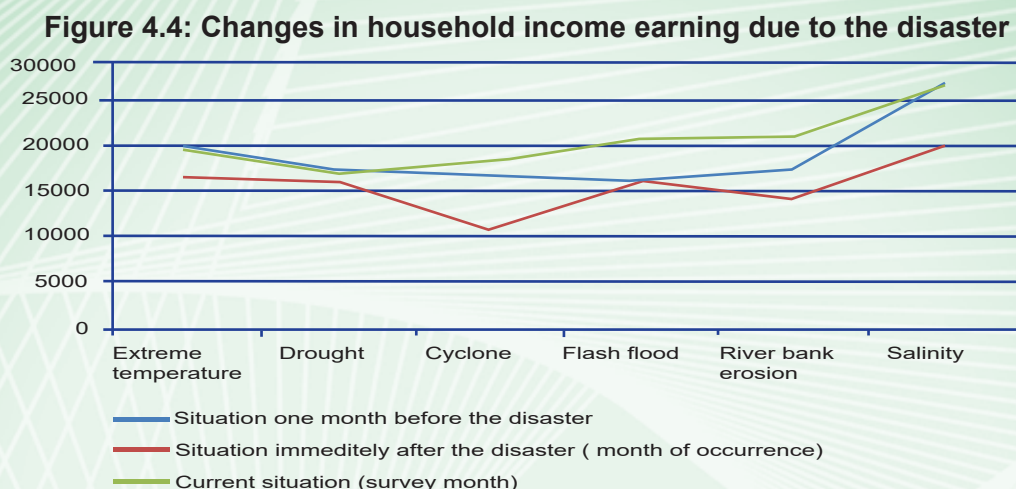
Table 4.15: Changes in household income earning due to the disaster across different natural calamities

	Situation one month before the disaster	Situation immediately after the disaster (month of occurrence)	Current situation (survey month)
Extreme temperature (n=40)	19907	16585	19971
Drought (n=40)	17425	16121	17110
Cyclone (n=109)	16971	10945	18293
Flash flood (n=40)	16247	16271	20917
Riverbank erosion (n=49)	17571	14334	21138
Salinity (n=2)	26918	20190	26735

Source: Field survey 2024, InM



Figure 4.4 illustrates changes in household income across different types of disasters, comparing three phases: one month prior to the disaster, immediately after the disaster, and the current situation (survey month). Immediately after the disaster, income levels drop significantly for all disaster types, with the steepest declines observed for drought and flash floods. Over time, income levels generally recover, with the current situation showing substantial improvements, especially in areas affected by salinity and riverbank erosion, where incomes have even surpassed pre-disaster levels. However, recovery remains uneven, with drought and flash flood-affected areas still lagging behind pre-disaster income levels.



Source: Field survey 2024, InM

Box 4.3: Reality of Struggle and Resilience in Coastal Bangladesh

Bipul (not his real name) lives in a small village named Kanainagar on the bank of Pasur River in Mongla upazila of Bagerhat district. His father, like most other villagers, was very poor and used to lead an impoverished life by catching fish from the river. Amongst his six children, Bipul was the fifth. Since his childhood, Bipul was well-known for his honesty, fearlessness, and bravery. Despite being slim and medium in physical structure, he used to fight in his own way for justice for which everybody loved him. Bipul got admitted to the local school but had to abandon his studies when he was in grade seven due to poverty. His father's meagre income was simply not enough for survival of the family. Hence, Bipul gave up schooling to look for odd jobs to supplement the family income. The responsibility fell on Bipul alone since, by this time, his two elder brothers got married and moved to different places to set up their own families. Bipul was left with his parents and three sisters fighting for survival.

Over the next five years, Bipul and his father fought relentlessly to survive against all odds; fortunately, his three sisters got married during this period and they left home to live with their husbands.

In early 1990, Bipul got married with Eliza (not her real name) in accordance with his parent's choices. Within around two years of his marriage, his parents left this world in quick succession leaving Bipul and Eliza to build their future by themselves. This left Bipul totally perplexed without any clue as to how to move forward for a better future.

Almost without any financial capital, Bipul started a small fish business with the encouragement and support from his wife Eliza; both hoping to build a better future. They worked relentlessly for eight long years, and gradually the business began to see the light of success and started making profits. With increasing returns from the fish business, Bipul and Eliza reconstructed their small dwelling to fulfill their long cherished dream of owning a home. Over time, they also accumulated savings from the business to purchase some land for cultivation. The land was rented-out to a landless farmer of his village from which they started to receive their share of rice and other crops produced in the land.

At long last, Bipul and Eliza started to see their days of happiness and better living; and they felt contented that their bad days were over. Meanwhile, they were blessed with a daughter which fulfilled their hopes for a joyful future.



Their time of happiness continued; fish business was booming; and income from farming also increased. Gradually, they were blessed with two more daughters. They started their schooling; Bipul and Eliza decided to support their education as long as needed to get them educated and skilled enough to get good formal jobs. Along with the daughters, Bipul and Eliza started to spend their days happily. Looking back, Bipul and Eliza – somewhat exhausted both physically and mentally after long years of struggle for a better life -- recalls their struggling days under the sun's heat and salty water's brightness. Now they enjoy a stable livelihood with three beautiful daughters, surrounded by relatives and friends; and satisfied with the life that they enjoy.

But, as the saying goes, happiness is always short-lived. For the family, an unexpected period of crisis began in 2022 with 'Bulbuli' -- a massive and terribly destructive cyclone -- that struck the coastal region of Bagerhat and surrounding areas. Bipul and Eliza lost whatever they had built over the years including their dwelling and household belongings, fish business, and all hard-earned assets and property. They suddenly turned into poppers overnight.

Experiencing the cyclone disaster for the Bipul family had been terrifying and devastating, characterised by howling winds, torrential rain, storm surges, and widespread destruction. This had left the entire community feeling extremely vulnerable. The community faced significant loss of life and property due to flooding, uprooted trees, and damaged infrastructure; the most intense experience occurred during the 'eye of the storm' where there was a brief calm before the storm's destructive force returned, with the overall experience accompanied by fear, anxiety, and a struggle to secure safety in the face of extreme weather conditions.

Bipul still recalls several key aspects of his cyclone disaster experience: **Intense winds:** High-speed winds causing significant damage to dwellings, tearing off roofs, uprooting trees, and flinging debris through the

air. **Heavy rainfall:** Torrential rain leading to flooding, inundating homes and communities, and disrupting transportation. **Storm surge:** A rapid rise in sea level due to the cyclone's low pressure, causing significant coastal flooding and inundation. **Noise and chaos:** The loud roar of the wind, crashing waves, and the sound of debris hitting structures had been overwhelming. **Fear and anxiety:** The uncertainty and danger of the cyclone caused significant stress and fear for Bipul's family and among other villagers. **Evacuation challenges:** Difficulty in evacuating to safer locations due to flooded roads, transportation disruptions, and limited shelter options. **Post-disaster impacts:** Damage to homes and infrastructure, disruption of essential services like water and sanitation services and electricity, outbreaks of diseases, and long-term economic impacts.

Narrating his experience, Bipul says, "It's the strength of the cyclone that directly affects the level of destruction that we suffer. Since we live in the coastal region, we are particularly vulnerable to storm surges and flooding". Regarding preparation and response, Bipul maintains, "Adequate warning systems, evacuation plans, and community preparedness can significantly mitigate the impact of cyclones".

Bipul and his family are yet to recover fully from the damages of the disaster that had left them in passing sleepless nights. His fish business has been destroyed, salinity has intruded into his lands, and his livelihood is destroyed. Bipul has somehow reconstructed his dwelling by taking a housing loan from the local NGO-MFI and borrowed some money from the local money lender to re-start his fish business. But the borrowed capital is too small to start it at a scale large enough to meet the family's essential needs and it will take years for the land to get back fertility to grow crops; as such there were no alternatives left for Bipul other than to desperately look for opportunities to earn some extra income for the survival of the family and send their daughters back to school again. Looking at the sky with wobbly eyes, Bipul sighs in despair; but he never gave it up.

In early 2023, his honesty and bravery was rewarded, and Bipul got the job of the night guard with a monthly salary of BDT8,500 in a local organisation that helped him a lot during this difficult situation. Despite their old age, both Bipul and Eliza along with their three daughters are still fighting to overcome the perils of the cyclone that struck them two years back. They have not given it up yet. While departing, Bipul asked: "Can you tell me one thing. I have heard from the members of local NGO-MFI that these cyclones are the results of climate change which is happening due to human interventions with the nature. They tell us that it is the life style of the people in the developed countries that are doing the greatest harm while we are suffering from the disasters created by climate change although we are not responsible for it. Can you tell me: why should we suffer for their wrong doings? Is this justice?". We had no answer.



4.7 Impact of Climate Change on Food Security

In Bangladesh, a significant portion of the workforce is engaged in agriculture, with approximately 40-45 per cent of the labour force directly or indirectly involved in the sector, which also contributes around 11-14 per cent to the country's GDP. Although agriculture provides livelihoods for many rural communities, the sector faces significant challenges originating from climate change. In particular, food insecurity is a significant issue, driven by factors such as increasing temperatures, unpredictable rainfall patterns, and a rising occurrence of natural disasters like floods, cyclones, and droughts. In addition to food security challenges, climate change significantly impacts health status in Bangladesh. The country already faces numerous health concerns, including high levels of malnutrition, infectious diseases, and elevated maternal and infant mortality rates. These problems are being made worse by climate change in a number of ways (Brown and Funk, 2008). For instance, increasing exposure to heat waves and other extreme weather conditions increases the risk of infectious diseases, including diarrhea and respiratory illnesses (Costello et al., 2009; Friel et al., 2011). In addition to floods brought on by climate change, waterborne illness epidemics are being triggered by the exposure of humans to tainted water sources. In fact, malnutrition rates in Bangladesh have increased as a result of climate change, especially among children under the age of five (Faruque et al., 2016). Overall, there are multiple ways through which climate change, food security, and health are intertwined in Bangladesh. Climate change causes new problems to emerge and makes old ones worse, especially in the rural and disaster prone areas.

In this section, 'food security' is explored in terms of 'food accesses'. A household is considered as food-secure if it has the capability to access the required food through adequate level of income. Although estimating household food security is a complex issue as 'household' itself has different connotations, Table 4.16 shows that prior to the occurrence of a disaster, 87.5 per cent of the households could afford three full meals, with only a small percentage having fewer meals a day. During the disaster, there was a notable shift, with 15 per cent of households having only one meal a day, 21.8 per cent having two meals, while only 18.2 per cent could afford three half meals a day. At present, 80.7 per cent of the households are back to three full meals, with some still having fewer meals.

Thus the disaster creates a significant impact on meal frequency in most districts, leading to a decrease in the number of households having three full meals a day, with many households having fewer meals or even going without food. However, recovery does take place with time in many cases, but some other locations continue to face food insecurity, with a notable number of households having fewer than three full meals a day.

Table 4.16: Percentage of households with number of meals by districts

District	One month prior to disaster				During disaster period					At present (December 2024)			
	Only one meal in a day	Only two meals	Three times half meals	Three times full meals	Sometimes without meal	Only one meal in a day	Only two meals	Three times half meals	Three times full meals	Only one meal in a day	Only two meals	Three times half meals	Three times full meals
Chuadanga	0	0	0	100	0	0	0	0	100	0	0	0	100
Naogaon	0	0	0	100	0	0	0	0	100	0	0	0	100
Bhola	0	0	20	80	0	15	47.5	37.5	0	0	5	10	85
Sunamganj	0	0	5	95	0	10	30	47.5	12.5	0	0	17.5	82.5
Kurigram	2.5	0	0	97.5	0	2.5	12.5	12.5	72.5	2.5	0	0	97.5
Satkhira	0	2.5	10	87.5	12.5	30	37.5	17.5	2.5	0	2.5	25	72.5
Bagerhat	2.5	7.5	35	55	15	47.5	25	12.5	0	0	17.5	55	27.5
Total	0.71	1.43	10	87.86	3.93	15	21.79	18.21	41.07	0.36	3.57	15.36	80.71

Source: Field survey 2024, InM

Table 4.17 shows that during the disaster period, the overall nutrition situation worsened, with 36.8 per cent of households experiencing food insufficiency for 1-2 days, 28.2 per cent for 3-10 days, 26.4 per



cent for 3-10 days, and 8.57 per cent for over 10 days. Before the crisis period, on average, 87.5 per cent of households in all districts never experienced insufficient meals, with small fractions experiencing food shortages for a few days. At present although the situation improved to some extent, with 76.07 per cent of households no longer experiencing food insufficiency. However, there are still a notable percentage of households experiencing food insufficiency, with 12.5 per cent facing it for 1-2 days, 7.5 per cent for 3-10 days, and 3.9 per cent for over 10 days. In Chuadanga and Naogaon, 100 per cent of households never experienced insufficient meals during all three periods under consideration. This suggests that these districts have stable access to food throughout the entire period. Other districts, such as Bhola, Sunamganj, Kurigram, Satkhira, and Bagerhat, indicate significant increases in food insufficiency during the disaster, with improvements occurring afterwards, although some households continue to experience food insecurity. The disaster clearly creates a disruptive impact on food availability, but many households seem to recover, while households in some districts (like Satkhira and Bagerhat) continue to face challenges with food security.

Table 4.17: Percentage of households having inadequate food by districts

Districts	One month prior to disaster				During disaster period				At present (December 2024)			
	Never	Hardly (1-2 days)	Sometimes (3-10 days)	Often (10+ days)	Never	Hardly (1-2 days)	Sometimes (3-10 days)	Often (10+ days)	Never	Hardly (1-2 days)	Sometimes (3-10 days)	Often (10+ days)
Chuadanga	100	0	0	0	90	10	0	0	100	0	0	0
Naogaon	100	0	0	0	100	0	0	0	100	0	0	0
Bhola	95	2.5	2.5	0	0	45	50	5	72.5	15	12.5	0
Sunamganj	70	10	12.5	7.5	2.5	67.5	17.5	12.5	52.5	27.5	12.5	7.5
Kurigram	95	5	0	0	55	40	5	0	95	5	0	0
Satkhira	87.5	2.5	5	5	7.5	25	60	7.5	77.5	12.5	2.5	7.5
Bagerhat	65	17.5	12.5	5	2.5	10	52.5	35	35	27.5	25	12.5
Total	87.5	5.36	4.64	2.5	36.79	28.21	26.43	8.57	76.07	12.5	7.5	3.93

Source: Field survey 2024, InM

Table 4.18: Percentage of Households having no food during meal in a day by districts

Districts	One month prior to crisis				During disaster period				At present (December 2024)			
	Never	Hardly (1-2 days)	Sometimes (3-10 days)	Often (10+ days)	Never	Hardly (1-2 days)	Sometimes (3-10 days)	Often (10+ days)	Never	Hardly (1-2 days)	Sometimes (3-10 days)	Often (10+ days)
Chuadanga	100	0	0	0	100	0	0	0	100	0	0	0
Naogaon	97.5	0	0	2.5	97.5	0	0	2.5	97.5	0	0	2.5
Bhola	100	0	0	0	15	45	35	5	82.5	12.5	5	0
Sunamganj	87.5	10	2.5	0	27.5	60	12.5	0	77.5	17.5	5	0
Kurigram	95	5	0	0	75	22.5	2.5	0	95	5	0	0
Satkhira	92.5	7.5	0	0	20	37.5	40	2.5	82.5	15	0	2.5
Bagerhat	72.5	22.5	2.5	2.5	20	7.5	32.5	40	47.5	37.5	10	5
Total	92.14	6.43	0.71	0.71	50.71	24.64	17.5	7.14	83.21	12.5	2.86	1.43

Source: Field survey 2024, InM

During the disaster, significant increases in food insecurity occur, with 24.6 per cent of households going without food for 1-2 days, 17.5 per cent for 3-10 days, and 7.1 per cent for more than 10 days. On average, 92.1 per cent of households in all districts never faced food insufficiency prior to the crisis, with only small shares of households experiencing food shortages for a few days. However, at present, there have been some improvements, with 83.2 per cent of households having food every day. On the other hand, 12.5 per cent households face food insufficiency for 1-2 days, 2.9 per cent for 3-10 days, and 1.4 per cent for more than 10 days (Table 4.18).



Table 4.19 demonstrates the effects of climate change on access to protein sources like fish and meat, showing a significant reduction in their consumption during the disaster period along with gradual recovery in some districts. However, fish and meat consumption levels have not fully returned to their pre-crisis levels in many districts, reflecting ongoing challenges in food security and nutrition.

Table 4.19: Percentage of households consuming fish/meat during a month on average

Districts	One month prior to disaster				During disaster period				At present (December 2024)			
	Almost daily	1-2 days a week	1-2 days a month	Occasionally	Almost daily	1-2 days a week	1-2 days a month	Occasionally	Almost daily	1-2 days a week	1-2 days a month	Occasionally
Chuadanga	47.5	42.5	10	0	45	42.5	10	2.5	47.5	42.5	10	0
Naogaon	60	35	5	0	60	35	5	0	60	35	5	0
Bhola	45	40	15	0	0	10	57.5	32.5	20	55	25	0
Sunamganj	25	65	7.5	2.5	7.5	32.5	32.5	27.5	17.5	65	15	2.5
Kurigram	27.5	70	2.5	0	12.5	70	15	2.5	22.5	75	2.5	0
Satkhira	47.5	47.5	2.5	2.5	10	40	30	20	30	60	10	0
Bagerhat	20	55	25	0	5	15	32.5	47.5	5	57.5	35	2.5
Total	38.93	50.71	9.64	0.71	20	35	26.07	18.93	28.93	55.71	14.64	0.71

Source: Field survey 2024, InM

Prior to the disaster, on average, 38.9 per cent of households consumed fish or meat almost daily while during the disaster, around 20 per cent of households consumed fish or meat almost daily indicating a significant reduction in access to protein consumption. At present, there is some recovery, with 28.9 per cent of households consuming fish or meat almost daily, and 55.7 per cent consuming 1-2 days a week, although the overall consumption level is still below the pre-disaster levels.

Table 4.20 shows the changes in daily food availability in various districts over two different time periods. During the disaster period, nearly 38 per cent of households mentioned that they had experienced reduced food availability, 34.1 per cent faced uncertain availability, while 26.2 per cent reported no change. Only 1.8 per cent reported increased availability, probably reflecting widespread disruption in food supply chain. At present, 41.6 per cent of households indicate reduced food availability, 44.1 per cent report no change, and 7.9 per cent face uncertain availability. A small portion (6.5 per cent) report increased availability, suggesting that while there has been some recovery, many households continue to experience challenges with food security. The table further highlights that the disaster significantly disrupts the food supply chains, along with some recovery in several districts. However, many areas, especially in Bhola, Satkhira, and Bagerhat districts, still face challenges in achieving food security, indicating the long-term impact of the disaster on local food availability (Table 4.20).

Table 4.20: Changes in daily food availability

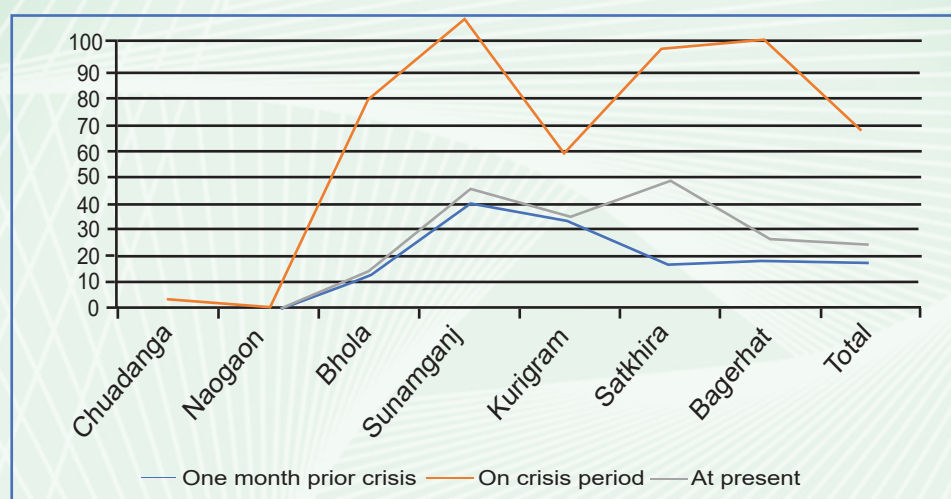
Districts	During crisis period				At present (December 2024)			
	Increased Supply	Decreased Supply	Uncertain Supply	No Change in Supply	Increased Supply	Decreased Supply	Uncertain Supply	No Change in Supply
Chuadanga	0	5	12.5	82.5	0	0	12.5	87.5
Naogaon	0	0	5	95	0	0	5	95
Bhola	0	46.15	53.85	0	0	79.49	0	20.51
Sunamganj	0	50	47.5	2.5	20	40	2.5	37.5
Kurigram	12.5	42.5	42.5	2.5	17.5	42.5	12.5	27.5
Satkhira	0	65	35	0	5	55	12.5	27.5
Bagerhat	0	57.5	42.5	0	2.5	75	10	12.5
Total	1.79	37.99	34.05	26.16	6.45	41.58	7.89	44.09

Source: Field survey 2024, InM



Figure 4.5 shows the impact of the climate induced disaster on food consumption across different districts. During the disaster, there had been a marked increase in the number of households forced to having less expensive and/or inferior quality food items. However, after the disaster, the numbers generally dropped, although some districts (e.g. Sunamganj, Satkhira, and Bagerhat) still show significant percentages of households continuing to consume cheaper foods, indicating a long-lasting impact on ability to purchase nutritious and good quality food items. Prior to the disaster, 15.9 per cent of the households used to take less expensive/low quality food items. During the disaster, more than half of the households were affected by the disaster, and forced to consume cheaper/low quality food items. At present, 22.8 per cent of the households are taking these foods indicating a drop from the disaster period but still a significant percentage of households take these cheaper food items after the disaster.

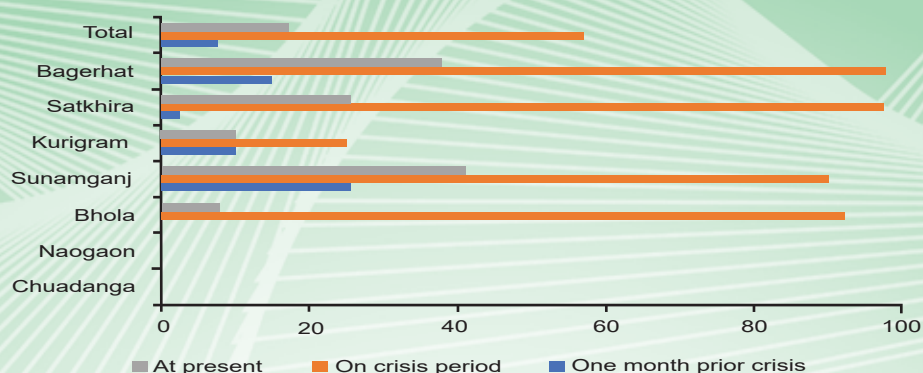
Figure 4.5: Percentage of households forced to consume less expensive/low quality food items during disaster



Source: Field survey 2024, InM

In general, food crisis refers to a situation where households have limited access to food, either because of scarcity or affordability. Figure 4.6 shows how severe and long-lasting the impact of climate change induced disaster can be on household food security in these regions. Prior to the disaster, the percentage of households facing a food crisis was generally low across the districts, with some exceptions like Sunamganj (25.6 per cent) and Bagerhat (15 per cent). But during the disaster, the percentage of households facing food crisis spiked dramatically in almost all districts, especially in Bhola (92.1 per cent), Satkhira (97.4 per cent), and Bagerhat (97.5 per cent). After the disaster, the percentage of households facing food crisis decreased, but it remains significant in certain districts. Sunamganj, Satkhira, and Bagerhat still have a large number of households facing food insecurity, showing that the effects of the disaster linger even after it has passed.

Figure 4.6: Percentage of households facing food crisis



Source: Field survey 2024, InM

Table 4.21 highlights how coping strategies for accessing food evolve throughout the disaster period, with many households reducing intake and seeking help from neighbours during and after the disaster. Prior to the disaster, a significant majority of households in most districts reported no food crisis, with some households already eating less or relying on dry food. During the disaster, many households resorted to eating less or relied on dry food, along with borrowing of food items from well off neighbours becoming more common in some districts (e.g., Kurigram and Bagerhat). Even after the disaster, many households continued to eat half the amount, while borrowing remained high in districts like Bagerhat, Satkhira, and Sunamganj.

Table 4.21: Coping strategies for managing food crisis

District	One month prior to disaster				During disaster period				At present (December 2024)			
	No crisis	Eat half amount	Eat dry food	Borrow from neighbor	No crisis	Eat half amount	Eat dry food	Borrow from neighbor	No crisis	Eat half amount	Eat dry food	Borrow from neighbor
Chuadanga	83.33	0	0	16.67	83.33	0	0	16.67	83.33	0	16.67	0
Naogaon	100	0	0	0	100	0	0	0	100	0	0	0
Bhola	83.33	16.67	0	0	2.78	2.78	94.44	0	50	12.5	37.5	0
Sunamganj	64.29	17.86	3.57	14.29	2.78	75	16.67	5.56	48.28	31.03	3.45	17.24
Kurigram	73.33	6.67	0	20	27.78	11.11	11.11	50	66.67	13.33	0	20
Satkhira	80.77	7.69	7.69	3.85	0	30.77	69.23	0	45.16	16.13	12.9	25.81
Bagerhat	37.5	12.5	25	25	0	7.5	92.5	0	6.25	18.75	25	50
Total	72.63	10.53	5.26	11.58	9.94	24.86	58.56	6.63	48.65	18.02	11.71	21.62

Source: Field survey 2024, InM

Table 4.22: Perspectives on food price trends (% of households)

Districts	One month prior to disaster				During disaster period				At present (December 2024)			
	Low	Medium	High	Unchanged	Low	Medium	High	Unchanged	Low	Medium	High	Unchanged
Chuadanga	0	8.11	2.7	89.19	2.7	8.11	29.73	59.46	0	8.11	83.78	8.11
Naogaon	0	10	0	90	0	35	0	65	0	2.5	97.5	0
Bhola	0	23.68	60.53	15.79	0	0	100	0	0	0	100	0
Sunamganj	13.89	55.56	0	30.56	0	16.22	83.78	0	0	41.67	52.78	5.56
Kurigram	2.7	81.08	13.51	2.7	0	16.22	83.78	0	0	21.62	75.68	2.7
Satkhira	5	42.5	45	7.5	0	22.5	77.5	0	0	5	92.5	2.5
Bagerhat	0	51.28	48.72	0	0	0	100	0	0	0	100	0
Total	3	38.58	24.72	33.71	0.37	14.18	67.54	17.91	0	10.86	86.52	2.62

Source: Field survey 2024, InM



Prior to the disaster, many households across most districts perceived food prices as either unchanged or normal, with a smaller proportion perceiving them as high. During the disaster, there was a notable shift, with a large number of households across all districts perceiving food prices as high (Table 4.22). At present, a significant portion of households continue to perceive food prices as high, indicating that the disaster has had a long-lasting effect on food affordability, and the price trend remains elevated even after the disaster has passed. Table 4.23 highlights how the perception of risk in food production has evolved, with a shift towards higher risk during and after the crisis in most regions. The lasting effects of the disaster on food production are evident in the continued perception of high risk across most districts.

Table 4.23: Assessment on risk in food production (% of households)

Districts	One month prior to disaster				During disaster period				At present (December 2024)			
	Low	Medium	High	Unchan- ed	Low	Medium	High	Unchan- ed	Low	Medium	High	Unchan- ed
Chuadanga	2.5	2.5	0	95	0	2.5	15	82.5	2.5	2.5	12.5	82.5
Naogaon	0	0	0	100	0	0	0	100	0	0	10	90
Bhola	0	28.95	52.63	18.42	0	0	100	0	0	2.63	97.37	0
Sunamganj	22.5	35	2.5	40	2.5	50	42.5	5	7.5	47.5	17.5	27.5
Kurigram	13.51	62.16	16.22	8.11	2.63	47.37	47.37	2.63	0	43.24	32.43	24.32
Satkhira	5	22.5	65	7.5	2.5	0	97.5	0	12.5	5	82.5	0
Bagerhat	0	47.5	52.5	0	0	0	100	0	0	0	100	0
Total	6.18	28	26.91	38.91	1.09	14.13	57.25	27.54	3.27	14.18	50.18	32.36

Source: Field survey 2024, InM

4.7.1 Impact on health and hygiene

Table 4.24 shows the changes in water sources due to the disaster, reflecting how households adapted to shifting water availability during and after the disaster period. Prior to the disaster, the primary source of water in most districts was tube wells, with varying dependency on rainwater, ponds, and other sources. However, during disaster period, there was an increased reliance on haors/rivers/beels in some districts (e.g. Bhola and Bagerhat) and a notable rise in purchased water in areas like Satkhira. At present, tube wells remain the primary source in most districts, although rainwater continues to be crucial in areas like Satkhira and Bagerhat.

Table 4.24: Sources of water for daily uses

Districts	Tube well	Pond	Well	Haor/ river/ beel	Rain water	Flood water	Purchased water	Others
One month prior to disaster								
Chuadanga	100	0	0	0	0	0	0	0
Naogaon	100	0	0	0	0	0	0	0
Bhola	56.41	35.9	2.56	0	5.13	0	0	0
Sunamganj	100	0	0	0	0	0	0	0
Kurigram	100	0	0	0	0	0	0	0
Satkhira	2.5	0	0	0	97.5	0	0	0
Bagerhat	0	32.5	2.5	0	65	0	0	0
Total	65.47	9.71	0.72	0	24.1	0	0	0
During disaster period								
Chuadanga	100	0	0	0	0	0	0	0
Naogaon	100	0	0	0	0	0	0	0
Bhola	10.26	35.9	2.56	38.46	12.82	0	0	0



Districts	Tube well	Pond	Well	Haor/river/beel	Rain water	Flood water	Purchased water	Others
Sunamganj	87.5	0	0	5	0	7.5	0	0
Kurigram	100	0	0	0	0	0	0	0
Satkhira	0	0	0	0	72.5	0	17.5	10
Bagerhat	0	20	2.5	42.5	30	0	5	0
Total	56.99	7.89	0.72	12.19	16.49	1.08	3.23	1.43
At present (December 2024)								
Chuadanga	100	0	0	0	0	0	0	0
Naogaon	100	0	0	0	0	0	0	0
Bhola	61.54	30.77	2.56	0	5.13	0	0	0
Sunamganj	100	0	0	0	0	0	0	0
Kurigram	100	0	0	0	0	0	0	0
Satkhira	2.5	0	0	0	92.5	2.5	2.5	0
Bagerhat	0	22.5	2.5	0	75	0	0	0
Total	66.31	7.53	0.72	0	24.73	0.36	0.36	0

Source: Field survey 2024, InM

Figure 4.7 shows the overall temporary increase in boiled/clean water consumption during the disaster, but it returned to the pre-disaster levels by December 2024. One of the main reasons for the increase in the consumption of boiled or purified water during the disaster may be that many households were staying in shelter homes, where they had access to mineral or filtered water.

Figure 4.7: Percentage of household drinking boiled/pure water

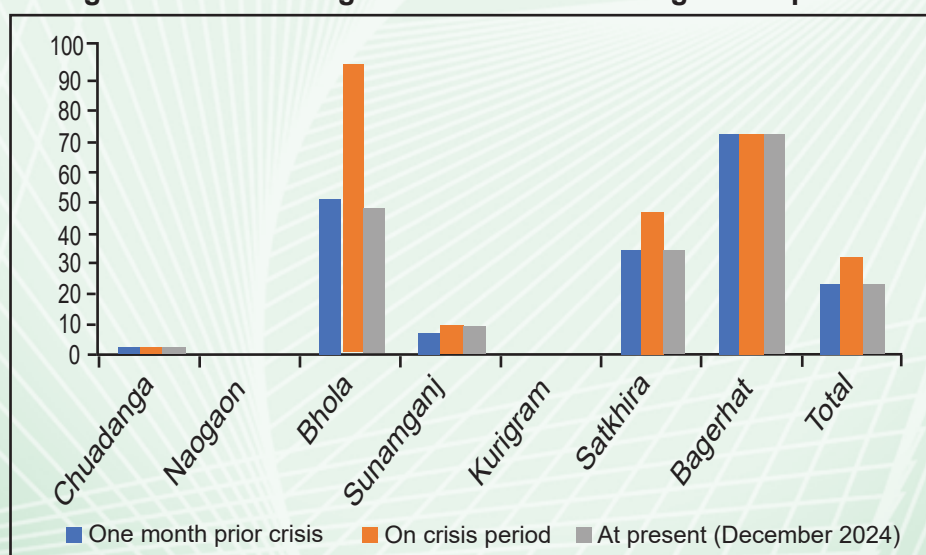


Table 4.25 shows that during the disaster period, households across various districts experienced significant disruptions to their regular water sources, with many relying on purchased water or having to collect water from far away. After the disaster, some districts returned to using their regular water sources, but in many cases, especially in Sunamganj, Satkhira, and Bagerhat, households still had to rely on distant sources or purchased water. The impact of the disaster on water availability has been particularly severe in Bhola and Bagerhat, where many households faced complete depletion or submergence of their water sources.



Table 4.25: Change in sources of water supply during disasters (%)

District	Remaining unchanged	Submerged	Depleted	Forced to consume purchased water	Collect from sources far away
One month prior to disaster					
Chuadanga	100	0	0	0	0
Naogaon	100	0	0	0	0
Bhola	59.46	13.51	8.11	5.41	13.51
Sunamganj	53.85	0	0	0	46.15
Kurigram	50	0	0	0	50
Satkhira	80	0	0	15	5
Bagerhat	62.5	17.5	12.5	5	2.5
Total	72.36	4.36	2.91	3.64	16.73
During disaster period					
Chuadanga	100	0	0	0	0
Naogaon	100	0	0	0	0
Bhola	5.26	65.79	23.68	2.63	2.63
Sunamganj	15	22.5	0	0	62.5
Kurigram	50	0	0	0	50
Satkhira	10	32.5	2.5	50	5
Bagerhat	2.5	57.5	25	15	0
Total	40.43	25.27	7.22	9.75	17.33
At present (December 2024)					
Chuadanga	100	0	0	0	0
Naogaon	100	0	0	0	0
Bhola	57.89	2.63	0	21.05	18.42
Sunamganj	51.28	0	0	0	48.72
Kurigram	50	0	0	0	50
Satkhira	67.5	0	2.5	22.5	7.5
Bagerhat	47.5	5	0	25	22.5
Total	67.75	1.09	0.36	9.78	21.01

Source: Field survey 2024, InM

4.8 General perception of rural households on climate change

The general perception of the rural households on climate change, as is expected, is shaped mostly by locational climate variability and includes extreme and more frequent heat waves, overall warmer winters, reduced and unpredictable rainfalls and more severe and recurrent floods and cyclones. These perceptions at the household level vary widely depending on factors such as geography, education, socioeconomic status, and access to information. Further, the more directly these households are affected by climate change, the more they are concerned about climate change and seek solutions. Table 4.26 shows the perceptions of the sampled households across various districts regarding impacts of climate change. It is seen that there is a noticeable lack of knowledge among many households, with 20.4 per cent across all locations expressing their ignorance about climate change. Among those who are aware, weather changes and extreme temperatures are the most cited observed impact. However, it is also seen that some locations, particularly coastal or flood-prone districts such as Sunamganj and Bagerhat, are more affected by extreme weather events such as flash floods and sea-level rise. One positive development is the rising awareness and knowledge about climate change across the households, with a strong reliance on electronic media (e.g. TV) and information sharing with neighbours. In fact, digital and social media platforms are working as an important source of climate knowledge. Traditional sources like newspapers and health workers are less common in the studied



areas, showing the evolution of information channels and the critical role that digital platforms are playing in educating the public about climate change.

Table 4.26: Perceptions of rural households on climate change

District	Changes in weather pattern	Extreme temperatures	Excessive rainfalls	Drought	Continual catastrophe	Sea level rise	Flash floods	All types of impacts	Not aware of climate change
Chuadanga	62.5	25	0	0	0	0	0	12.5	0
Naogaon	50	47.5	0	0	0	0	0	2.5	0
Bhola	5	0	0	0	5	0	7.5	37.5	45
Sunamganj	0	7.5	25	0	7.5	0	27.5	7.5	25
Kurigram	5	20	12.5	7.5	2.5	0	20	0	32.5
Satkhira	7.5	2.5	7.5	0	20	2.5	5	50	5
Bagerhat	2.5	0	0	0	5	25	2.5	30	35
Total	18.93	14.64	6.43	1.07	5.71	3.93	8.93	20	20.36

Source: Field survey 2024, InM

More than two-thirds of the respondents in the studied areas believe that all types of natural disasters are deepening in the country due to the impact of climate change. This indicates a strong recognition of the link between climate change and extreme weather events including natural disasters in the country. However, a significant portion of the rural households are still unaware about the dangers of climate change, suggesting that more and targeted efforts are needed to enhance awareness and knowledge of the rural people about climate change and its direct effects on weather events along with mitigation and adaptation measures necessary at the local level.

4.9 Health related issues

Table 4.27 shows that more households in the aggregate have suffered from various types of diseases during the climate induced disasters and afterwards relative to the pre-disaster period. Despite wide variations across different districts, the overall percentage of households suffering from common diseases remains somewhat stable at the post-disaster level. The finding suggests that, in many districts, the incidence of disasters has increased the number of households suffering from common diseases, and that the number has not significantly decreased in the post disaster period.

Table 4.27: Percentage of households suffering from common diseases by district

District	One month prior to the disaster	During the disaster period	Post disaster period (December 2024)
Chuadanga	90	90	90
Naogaon	60	60	60
Bhola	5	10	7.5
Sunamganj	12.5	15	12.5
Kurigram	2.5	2.5	5
Satkhira	12.5	12.5	17.5
Bagerhat	15	22.5	20
Total	28.21	30.36	30.36

Source: Field survey 2024, InM

Regarding the treatment cost related to diseases, Table 4.28 shows that one month prior to the disaster, the average treatment cost was BDT 1,153 per household. During the disaster period, the average cost increased to BDT 1,526 which has further increased to BDT 1,965 during the post disaster period.



Medical expenses have generally increased during the disaster in most districts, reflecting increased healthcare demands and/or higher costs due to the incidence of disaster. During the post-disaster period, while some districts have witnessed lower costs (like Bhola and Kurigram), others have continued to experience elevated costs (e.g. Sunamganj, Satkhira, and Bagerhat). Bagerhat and Sunamganj show the most drastic increases, especially after the disaster period. This suggests that disasters have significant effects on healthcare costs, but the recovery to normalcy remains uneven across districts.

Table 4.28: Average treatment cost on common diseases per household

District	One month prior to disaster	During crisis period	Post disaster period (December 2024)
Chuadanga	1,480	1,517	1,465
Naogaon	510	574	518
Bhola	2,000	2,050	1,500
Sunamganj	3,000	2,183	3,480
Kurigram	3,000	3,000	1,750
Satkhira	323	1,494	1,950
Bagerhat	325	3,283	7,850
Total	1,153	1,526	1,965

Source: Field survey 2024, InM

The study findings suggest that, on average, about one-third (37.1 per cent) of the households that were affected by the disasters suffered from different types of diseases, with diarrhea and fever emerging as most common across many districts (Table 4.29). In particular, diarrhea is the most common illness across districts emerging from the disasters, which is especially high in Satkhira (53.9 per cent) and Bhola (44.4 per cent). Skin diseases are significant in Bhola (33.3 per cent), and dehydration and exhaustion related diseases due to extreme high temperatures are reported in Chuadanga (10.5 per cent) and Naogaon (10.3 per cent), pointing to the high human sufferings of the disasters. It is seen that around 92 per cent of the households had to consult with physicians for their treatment.

Table 4.29: Type of diseases faced by the households due to disasters

Disease	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Diarrhea	28.95	10.34	44.44	12.5	0	53.85	28.57	26.92
Dysentery	2.63	3.45	0	0	0	0	0	1.92
Malaria	0	0	0	0	0	7.69	0	0.96
Skin diseases	2.63	3.45	33.33	0	0	0	0	4.81
Cold/Cough	18.42	20.69	11.11	0	0	23.08	28.57	18.27
Fever	15.79	37.93	11.11	62.5	0	7.69	0	23.08
Typhoid	7.89	6.9	0	0	0	0	14.29	5.77
Asthma	2.63	0	0	25	0	0	0	2.88
Dengue	2.63	6.9	0	0	0	0	0	2.88
Chicken pox	2.63	0	0	0	0	0	0	0.96
Respiratory diseases	2.63	0	0	0	0	0	0	0.96
Waterborne or foodborne diseases	0	0	0	0	0	7.69	14.29	1.92
Dehydration	2.63	0	0	0	0	0	0	0.96
Heat exhaustion	10.53	10.34	0	0	0	0	0	6.73
Snake bite	0	0	0	0	0	0	14.29	0.96

Source: Field survey 2024, InM



Table 4.30 shows the sources of medical and healthcare services availed by households for different diseases across various districts. The overall finding shows that village ‘doctors’ (mostly semi-trained) are the most frequently consulted healthcare service providers during all time periods, especially during and after the disaster. Prior to the disaster incidence, village doctors were the most commonly consulted source (87.2 per cent), followed by private hospitals (5.8 per cent) and registered doctors (3.2 per cent). During the disaster period, there is some increase in reliance on private hospitals (15.8 per cent) and decrease on village doctors (68 per cent), along with a notable increase in visits to government hospitals (5.1 per cent). During the post disaster period, village doctors continue to remain as the most frequently consulted source (81.3 per cent), followed by private hospitals (7.6 per cent) and registered doctors (4.7 per cent). The use of government hospitals is generally low, except during the disaster period in Naogaon. Local pharmacies show minimal use across all districts, especially when compared with more direct medical sources like doctors and hospitals.

Table 4.30: Types of physician/sources consulted for different diseases by households

District	Government hospital	Private hospital	Village doctor	Registered doctor	Local pharmacy
One month prior to disaster (per cent)					
Chuadanga	0	80	20	0	0
Naogaon	7.14	0	71.43	7.14	14.29
Bhola	0	0	96.77	3.23	0
Sunamganj	4	4	92	0	0
Kurigram	0	0	90	0	10
Satkhira	0	10.71	78.57	10.71	0
Bagerhat	0	3.03	96.97	0	0
Total	1.28	5.77	87.18	3.21	2.56
During disaster period (per cent)					
Chuadanga	33.33	15.38	51.28	0	0
Naogaon	50	0	39.47	2.63	7.89
Bhola	0	0	71.79	2.56	25.64
Sunamganj	7.41	3.7	88.89	0	0
Kurigram	0	0	90	0	10
Satkhira	0	12.5	78.13	0	9.38
Bagerhat	7.69	2.56	74.36	2.56	12.82
Total	15.81	5.13	67.95	1.28	9.83
Post disaster period (December 2024) (per cent)					
Chuadanga	0	83.33	16.67	0	0
Naogaon	6.67	0	73.33	6.67	13.33
Bhola	0	0	100	0	0
Sunamganj	7.69	7.69	80.77	3.85	0
Kurigram	0	0	90.48	0	9.52
Satkhira	3.13	12.5	68.75	15.63	0
Bagerhat	8.33	5.56	83.33	2.78	0
Total	4.09	7.6	81.29	4.68	2.34

Source: Field survey 2024, InM

Diarrhoea, cold/cough, and skin diseases are commonly reported in several districts, suggesting that these are significant health concerns after disasters. Cold/cough and fever are the most prevalent, especially in Kurigram and Satkhira. Typhoid, asthma, heat exhaustion, and chicken pox have much lower reported incidences, indicating they may not be as affected by disasters in comparison to other diseases like diarrhea or cold-related diseases. The general pattern shows that infectious diseases and respiratory problems increase the most after disasters (Table 4.31).



Table 4.31: Increase in diseases and health problems due to climate related disasters

Disease	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Diarrhea	33.33	0	29.41	16	0	12.9	26.32	22
Dysentery	0	25	5.88	16	0	6.45	2.63	6.67
Malaria	0	0	2.94	0	0	0	2.63	1.33
Skin diseases	33.33	25	20.59	4	33.33	0	0	10
Cold/cough	20	25	20.59	24	66.67	38.71	47.37	32.67
Fever	6.67	0	8.82	24	0	32.26	15.79	17.33
Typhoid	0	0	2.94	0	0	0	0	0.67
Asthma	0	0	0	4	0	0	0	0.67
Malnutrition	0	0	0	0	0	6.45	2.63	2
Chicken Pox	0	0	2.94	0	0	0	0	0.67
Respiratory diseases	0	0	0	4	0	0	0	0.67
Dehydration	6.67	0	0	0	0	0	0	0.67
Headache	0	0	5.88	4	0	0	0	2
Heat exhaustion	0	25	0	0	0	0	0	0.67
Others	0	0	0	4	0	3.23	2.63	2

Source: Field survey 2024, InM

Table 4.32 shows that children are the most affected members in households in most districts, with the highest percentage in Kurigram (100 per cent), followed by Naogaon (77.3 per cent) and Sunamganj (59.1 per cent). Females are also significantly impacted, especially in Chuadanga (23.5 per cent) and Bhola (34.3 per cent). Males tend to have a lower impact across most districts, with the highest percentage in Satkhira (16.7 per cent). The elderly are less affected overall, with only Satkhira (3.3 per cent) and Chuadanga (8.8 per cent) showing notable percentages. The combined group of females and children is more affected in Chuadanga (14.7 per cent) and Bagerhat (20.5 per cent).

Table 4.32: Degree of impact of disasters on different household members (per cent)

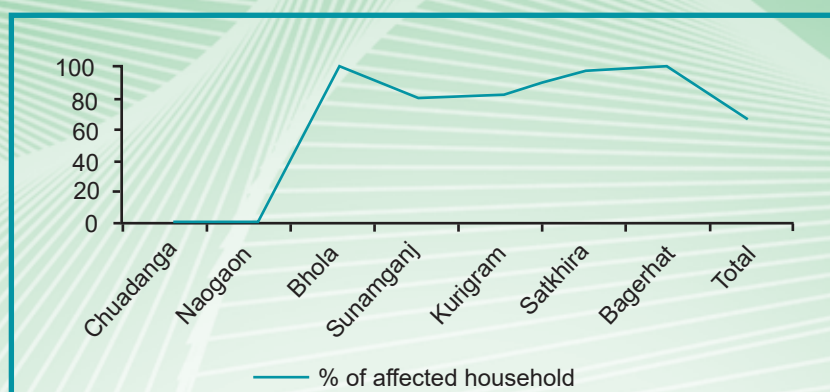
District	Children	Females	Males	Elderly	Both females and children
Chuadanga	38.24	23.53	14.71	8.82	14.71
Naogaon	77.27	13.64	0	9.09	0
Bhola	42.86	34.29	11.43	0	11.43
Sunamganj	59.09	27.27	13.64	0	0
Kurigram	100	0	0	0	0
Satkhira	46.67	33.33	16.67	3.33	0
Bagerhat	46.15	30.77	2.56	0	20.51
Total	50.27	27.57	9.73	3.24	9.19

Source: Field survey 2024, InM

Figure 4.8 shows that around 66 per cent households were affected and there was significant impact on sanitation due to climate induced disasters. Bhola and Bagerhat report the highest impact on sanitation, with 100 per cent of households in these districts affected.



Figure 4.8: Impact of disasters on sanitation (percentage of affected households)



The impact of disasters on sanitation facilities varies depending on specific circumstances. Toilets not flushing (43 per cent) is the most common sanitation related problem across all districts, followed by broken toilets (34.9 per cent). A relatively small proportion of households face issues related to open defecation (1.2 per cent).

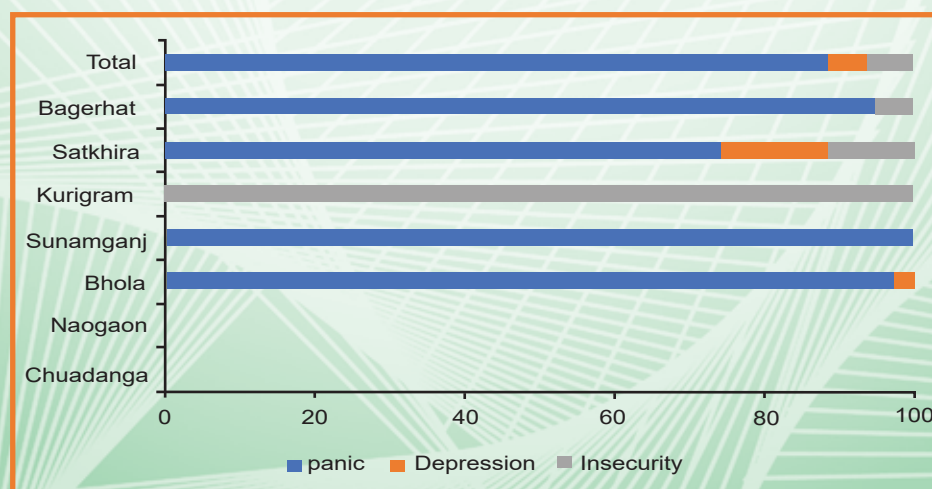
Table 4.33: Impact on sanitation facilities due to disasters (per cent of households)

District	Filled in septic tank	Broken toilet	Toilet not flushing	Unusable toilet	Open defecation
Chuadanga	0	0	0	0	0
Naogaon	0	0	0	0	0
Bhola	10	35	32.5	22.5	0
Sunamganj	22.58	35.48	32.26	6.45	3.23
Kurigram	8.7	69.57	21.74	0	0
Satkhira	7.89	21.05	68.42	2.63	0
Bagerhat	12.5	27.5	50	7.5	2.5
Total	12.21	34.88	43.02	8.72	1.16

Source: Field survey 2024, InM

Figure 4.9 shows that panic is the most prevalent mental health issue during disasters, affecting a significant proportion of households (88.8 per cent) in most districts. Depression is less common, while insecurity appears to be particularly prominent in Kurigram. Around 6 per cent of the households across all districts report insecurity as a mental health issue due to disasters.

Figure 4.9: Effect of disasters on mental health (%)



Source: Field survey 2024, InM



4.10 Climate Crisis and Coping Mechanisms of Poor Households

In Bangladesh, climate change and environmental crises threaten the life and livelihoods of millions of people, particularly in coastal and low-lying areas, leading to their forced displacement and migration, loss of livelihoods, food insecurity -- pushing these people further into poverty. Being a low income and highly climate vulnerable country, Bangladesh has, over the years, developed various coping mechanisms to climate crisis, including community-based adaptation strategies and improved infrastructure and policy initiatives to build resilience. As a matter of fact, through innovative solutions such as floating agriculture, cyclone shelters, and mangrove restoration, Bangladesh still continues to adapt and mitigate the impacts of climate change.

Table 4.34 provides the percentage distribution of sampled households experiencing various climate-induced crises across six most climate vulnerable districts in Bangladesh. Extreme temperature is a significant issue in Chuadanga (90 per cent), while drought is predominantly reported in Naogaon (92.5 per cent). Cyclones severely affect Bhola (95 per cent), Satkhira (85 per cent), and Bagerhat (85 per cent). Flash floods are a major crisis in Sunamganj (97.5 per cent), while riverbank erosion is most prevalent in Kurigram (97.5 per cent). Salinity intrusions are observed in Satkhira (5 per cent), whereas sea level rise is mainly reported in Bagerhat (10 per cent). Excessive rainfall is a minor crisis, affecting a small percentage of households in Chuadanga (5 per cent). These findings highlight the wide-scale geographical variations in climate-related challenges, with the coastal districts mostly facing cyclones and sea level rise, while inland districts experiencing droughts and extreme temperatures.

Table 4.34: Percentage distribution of households affected by different types of climate crises across districts

Type of crisis	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Extreme temperature	90	2.5	0	0	0	0	0	13.21
Drought	0	92.5	0	0	0	0	0	13.21
Cyclone	5	5	95	0	0	85	85	39.29
Flash flood	0	0	2.5	97.5	2.5	0	5	15.36
Riverbank erosion	0	0	2.5	2.5	97.5	10	0	16.07
Salinity	0	0	0	0	0	5	0	0.71
Sea level rise	0	0	0	0	0	0	10	1.43
Excessive rainfall	5	0	0	0	0	0	0	0.71

Source: Field survey 2024, InM

4.10.1 Climate crisis related damages of households

Table 4.35 presents the percentage distribution of households affected by various types of losses across different districts. Destruction of homestead is the most widespread damage, affecting 58.2 per cent of households overall, with Sunamganj (97.5 per cent), Bhola (80 per cent), and Satkhira (85 per cent) reporting relatively high impacts. Loss of land due to river erosion is most prevalent in Kurigram (40 per cent), while waterlogging significantly affects Satkhira (15 per cent). Destruction of plants/crops is particularly high in Naogaon (17.5 per cent) and Bhola (27.5 per cent). Decline in household income is a major concern, affecting 28.2 per cent of households overall, with Naogaon (70 per cent) and Chuadanga (57.5 per cent) facing the greatest impacts. Long-term medical expenses are notable in Chuadanga (17.5 per cent) and Naogaon (12.5 per cent), while degradation of sewage infrastructure is highest in Bhola (20 per cent) and Satkhira (20 per cent). Death of earning member of households is relatively rare, reported only in Chuadanga (2.5 per cent). These findings highlight significant regional



disparities in household vulnerabilities, with several districts facing more severe challenges related to infrastructure damage, income loss, and environmental disasters.

Table 4.35: Percentage distribution of households affected by different damages across districts

Type of damage	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Death of earning member	2.5	0	0	0	0	0	0	0.4
Loss of land due to river erosion	0	0	0	2.5	40	2.5	0	6.4
Waterlogged land	0	0	0	0	0	15	0	2.1
Damage to homestead	5	5	80	97.5	60	85	75	58.2
Degradation of sewage infrastructure	2.5	0	20	0	0	20	17.5	8.6
Destruction of plants/crops	12.5	17.5	27.5	0	0	5	0	8.9
Loss of business and income generating assets	5	0	5	0	0	7.5	5	3.2
Long-term medical expenses	17.5	12.5	0	0	0	0	0	4.3
Decline in household income	57.5	70	15	0	0	12.5	42.5	28.2
Others	0	0	0	2.5	0	0	5	1.1

Source: Field survey 2024, InM

4.10.2 Crisis coping mechanisms

When a household faces a climate related crisis, it adopts different mechanisms available at its disposal to overcome the crisis. Table 4.36 shows the percentage distribution of households that faced different crises and specific coping strategies that they adopted across different districts. The most common coping mechanism is the use of past savings (41.8 per cent), with the highest reliance observed in Chuadanga (57.5 per cent) and Satkhira (50 per cent). Informal loans are also widely used (18.6 per cent), particularly in Bhola (42.5 per cent) and Bagerhat (32.5 per cent). Microfinance also plays a significant role in Satkhira (55 per cent) and Bagerhat (25 per cent), while selling cattle is notable in Bhola (22.5 per cent) and Satkhira (10 per cent). Assistance from relatives is availed by 7.9 per cent of households, with the highest reliance in Sunamganj (25 per cent). Government and private assistances are minimal, each contributing only for 0.4 per cent of households. Alarming, 23.6 per cent of households do not have any option available to resolve the crises, with the highest in Sunamganj (42.5 per cent), Kurigram (47.5 per cent), and Naogaon (40 per cent), indicating severe economic vulnerability in these areas. Meanwhile, 27.5 per cent of households, particularly in Bagerhat (15 per cent), could not adopt any mechanism to cope with the crisis. These findings highlight disparities in coping capacities, with some districts relying more on financial instruments while others struggle in the absence of any effective crisis coping mechanism at their disposal.



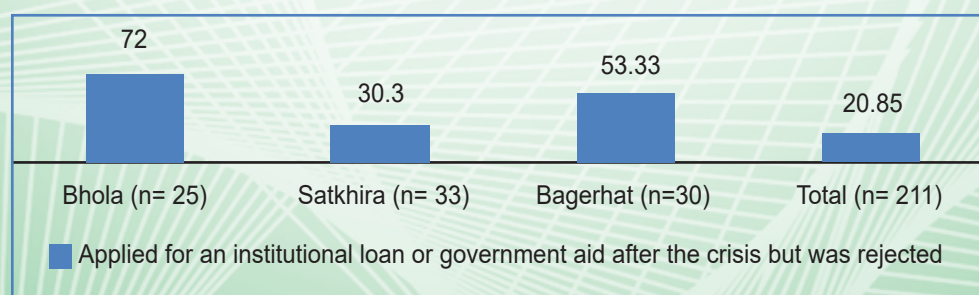
Table 4.36: Percentage distribution of households by different coping mechanisms

Coping mechanism	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Use of past savings	57.5	50	25	35	47.5	50	27.5	41.8
Help from relatives	10	5	0	25	5	0	10	7.9
Government assistance	2.5	0	0	0	0	0	0	0.4
Private assistance	0	0	0	0	0	2.5	0	0.4
Informal loans	2.5	0	42.5	10	20	22.5	32.5	18.6
Microfinance loan	2.5	7.5	12.5	20	0	55	25	17.5
Selling crops in advance	0	0	5	0	0	0	0	0.7
Selling labour in advance	0	0	0	0	2.5	0	0	0.4
Selling household cattle	2.5	5	22.5	0	2.5	10	0	6.1
Selling other household assets	0	2.5	0	0	0	2.5	0	0.7
Use of assistance from neighbours/well off peoples	0	0	0	0	0	0	2.5	0.4
Could not adopt any coping mechanism	5	2.5	2.5	0	0	5	15	27.5
No fixing of crisis and live with it	17.5	40	5	42.5	47.5	2.5	10	23.6

Source: Field survey 2024, InM

4.10.3 Access to institutional loan and/or government assistance after crisis

Figure 4.10 presents the percentage of households who had applied for an institutional loan or government assistance after a crisis struck but were unsuccessful in receiving loan/assistance. Overall, 20.9 per cent of the applicants faced rejection, with Bhola experiencing the highest rejection rate at 72 per cent, followed by Bagerhat (53.3 per cent) and Satkhira (30.3 per cent). In contrast, households in Chuadanga, Naogaon, Sunamganj, and Kurigram did not report any rejections, as all applicants in these districts either did not apply or successfully received loan/assistance. The majority of households (79.2 per cent) did not face rejection, indicating either successful applications or a reluctance to seek institutional support. The high rejection rates in Bhola, Bagerhat, and Satkhira highlight potential barriers to accessing formal financial assistance in these areas, which may exacerbate post-crisis vulnerabilities.

Figure 4.10: Rejection rate for an institutional loan or government assistance after crisis

Source: Field survey 2024, InM



4.10.4 Reasons for rejection of institutional loan after crisis

Table 4.37 outlines the reasons for rejection of applications by households for institutional loans and/or government assistance after crisis. The most common reason (for loan) is a lack of collateral, cited by 56.8 per cent of rejected applicants, with Bhola (83.3 per cent) being the most affected, followed by Satkhira (40 per cent) and Bagerhat (37.5 per cent). Landlessness is the second major factor, affecting 36.4 per cent of rejected applicants, particularly in Satkhira (60 per cent) and Bagerhat (56.3 per cent). Previous loan defaults accounted for 6.8 per cent of rejections, primarily in Bhola (11.1 per cent) and Bagerhat (6.3 per cent). These findings indicate that households without assets or landownership face significant challenges in accessing formal financial support (loan), with Bhola, Satkhira, and Bagerhat experiencing the highest levels of exclusion. The lack of collateral requirements appears to be a major barrier, underscoring the need for more inclusive financial assistance mechanisms for vulnerable communities.

Table 4.37: Reason for rejection of institutional loans

Reason for rejection	Bhola (n=18)	Satkhira (n=10)	Bagerhat (n=16)	Total (n=44)
Lack of collateral	83.33	40	37.5	56.82
Landless	5.56	60	56.25	36.36
Previous loan default	11.11	0	6.25	6.82

Source: Field survey 2024, InM

4.11 Poverty Status of Households

As a low-lying, densely populated nation, Bangladesh faces increasing threats from climate hazards creating significant socioeconomic repercussions especially on the poor and low income households. Moreover, the resulting environmental changes exacerbate existing socioeconomic inequalities, disproportionately affecting the poor, who rely on climate-sensitive livelihoods such as farming, fishing and other natural resource intensive occupations. Frequent floods, cyclones, and droughts destroy homes, reduce crop yields, and limit access to essential resources, pushing millions further into poverty. This section explores the profound impact of climate change on poverty in Bangladesh, highlighting the urgent need for sustainable adaptation strategies to protect the vulnerable communities and ensure their long-term resilience.

Table 4.38 presents the self-assessment of poverty status by the households themselves across the seven sample districts of Bangladesh, highlighting significant regional disparities. The highest proportion of households identifying as "not poor" is found in Naogaon (62.5 per cent) and Chuadanga (55 per cent), while Satkhira (7.5 per cent) and Bagerhat (0 per cent) report the lowest. On the other hand, Bhola (45 per cent), Sunamganj (55 per cent), and Bagerhat (77.5 per cent) have notably high percentages of people who consider themselves "always poor," with Satkhira (60 per cent) also showing severe poverty levels. The category "sometimes poor" is most prevalent in Chuadanga (42.5 per cent) and Kurigram (17.5 per cent), indicating financial instability in these areas. Seasonal poverty, though less common overall, is highest in Bhola (17.5 per cent) and Satkhira (17.5 per cent). These findings suggest that while some regions experience relatively lower poverty levels, others, particularly Bagerhat and Satkhira, face severe and persistent poverty challenges.



Table 4.38: Self-assessment on poverty status of households (in percent) by districts

Poverty status	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
Not poor	55	62.5	20	22.5	45	7.5	0	30.36
Sometimes poor	42.5	27.5	17.5	12.5	17.5	15	20	21.79
Always poor	2.5	7.5	45	55	32.5	60	77.5	40
Seasonal poor	0	2.5	17.5	10	5	17.5	2.5	7.86

Source: Field survey 2024, InM

4.11.1 Causal factors of poverty

Poverty in Bangladesh is a complex issue influenced by a combination of economic, social, and environmental factors. Despite significant economic growth in recent years, a large share of the population still struggles with inadequate income, unemployment, and limited access to education, healthcare and other basic services. Key reasons for poverty include lack of opportunities and gainful employment, political instability, lack of industrial diversification, and rural underdevelopment. Additionally, frequent natural disasters such as floods and cyclones, driven by climate change, further disrupt livelihoods, especially for those dependent on agriculture. Socioeconomic inequalities and insufficient social safety nets also contribute to the persistence of poverty, making it essential for sustainable development policies to address these underlying causes.

Table 4.39 highlights the primary reasons (as perceived by the households) for poverty across seven districts in Bangladesh, revealing variations in perceived causes. The most common reason cited is the lack of earning opportunities, affecting 100 per cent of respondents in Kurigram and over 70 per cent in Sunamganj, Satkhira, and Bhola, indicating widespread unemployment or underemployment. Lack of land or property is a significant factor in Naogaon (85.7 per cent) and Chuadanga (72.2 per cent), but much less relevant in Bhola (3.6 per cent) and Kurigram (0 per cent). No education or skills contributes to poverty for a quarter of respondents in Bhola (25 per cent) but is not a major factor in most other districts. Poor health is the least cited reason overall, with only small percentages in Bhola (3.6 per cent), Sunamganj (3.3 per cent), and Bagerhat (2.6 per cent). These findings suggest that while job scarcity is the leading cause of poverty in most areas, landlessness plays a crucial role in some districts, and lack of education is a moderate factor in a few regions.

Table 4.39: Reasons to be poor by districts (%)

Reason	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
First reason								
Lack of earning opportunities	11.11	14.29	67.86	73.33	100	72.97	66.67	65.17
No land/property	72.22	85.71	3.57	23.33	0	13.51	23.08	23.03
No education/skills	16.67	0	25	0	0	13.51	7.69	10.11
Poor health	0	0	3.57	3.33	0	0	2.56	1.69

Source: Field survey 2024, InM

4.11.2 Nature of assistance received by poor households after disaster

Table 4.40 illustrates the nature of government and NGO-provided assistance received after disaster by poor households across the sample districts in Bangladesh. Government support is primarily provided in the form of food (80.3 per cent) and monetary assistance (19.7 per cent), with food assistance most



prevalent in Satkhira (100 per cent), Kurigram (90 per cent), and Bagerhat (80 per cent). Microcredit is the most common form of NGO support (94.4 per cent), with all recipients in Chuadanga, Sunamganj, Kurigram, and Bagerhat benefiting from it. Education support from NGOs is minimal (5.6 per cent), recorded only in Satkhira (11.1 per cent). Healthcare support and free treatment/medicine from both government and NGOs are absent, indicating a gap in healthcare-related assistance. These findings suggest that while food aid and microcredit are the dominant forms of assistance, healthcare services and education support remain largely unaddressed.

Table 4.40: Nature of assistance provided by government/NGOs for poor households after disaster

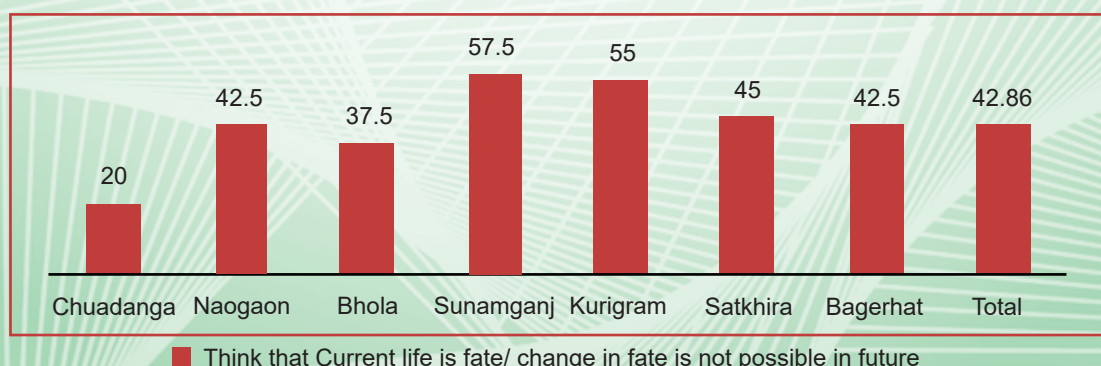
Districts	Government assistance			NGO assistance			
	Food	Money	Free healthcare service/ medicine	Micro credit	Educa tion	Healthcare services	Free treatment/ medicine
Chuadanga	33.33	66.67	0	100	0	0	0
Naogaon	0	100	0	0	0	0	0
Bhola	62.5	37.5	0	0	0	0	0
Sunamganj	75	25	0	100	0	0	0
Kurigram	90	10	0	100	0	0	0
Satkhira	100	0	0	88.89	11.11	0	0
Bagerhat	80	20	0	100	0	0	0
Total	80.3	19.7	0	94.44	5.56	0	0

Source: Field survey 2024, InM

4.11.3 Self-assessment on poverty perception

Figure 4.11 presents the perceptions on fate and poverty status of the disaster-affected poor households in the seven sampled districts of Bangladesh. Overall, 42.9 per cent of respondents have strong negative perceptions and believe that their poverty status is unlikely to change in future, while 57.1 per cent are optimistic and believe in improvements in the future. The pessimistic perception is most prevalent in Sunamganj (57.5 per cent) and Kurigram (55 per cent), indicating a sense of hopelessness in these regions. In contrast, disaster-affected poor households in Chuadanga (80 per cent) and Naogaon (57.5 per cent) have higher optimism, with a majority believing their situation can be improved. These findings suggest that while many individuals hold onto hope for a better future, a significant share, particularly in Sunamganj and Kurigram, feel trapped in poverty, which is more likely to adversely impact their motivation for economic and social mobility.

Figure 4.11: Self-assessment on poverty perception by disaster-affected poor households



Source: Field survey 2024, InM



4.11.4 Self-assessment on social fabrics in local community

Self-assessment by disaster-affected poor households on social fabrics in their respective community life across seven districts indicate that 69.6 per cent of all respondents feel their social life is "as normal as others", while 27.1 per cent experience "limited" social participation, and 3.2 per cent consider it as "very limited" (Table 4.41). Chuadanga (100 per cent), Naogaon (97.5 per cent), and Satkhira (87.5 per cent) report the highest perception relating to normalcy in social life, indicating better social integration. In contrast, Sunamganj (67.5 per cent) and Kurigram (47.5 per cent) have high proportions of people experiencing "limited" social interaction, indicating higher degree of social exclusion. Only Sunamganj (17.5 per cent) and Kurigram (5 per cent) report "very limited" social life, highlighting severe social restrictions for these poor households in these areas. These findings suggest that while most of these people in poverty are somehow able to maintain a sense of normalcy in social life, certain regions, particularly Sunamganj and Kurigram, experience significant social limitations, possibly due to acute economic hardships and stringent societal barriers and exclusions.

Table 4.41: Self-assessment on social fabrics in local community

Status	Chuadanga	Naogaon	Bhola	Sunamganj	Kurigram	Satkhira	Bagerhat	Total
As normal as others	100	97.5	70	15	47.5	87.5	70	69.64
Limited	0	2.5	30	67.5	47.5	12.5	30	27.14
Very limited	0	0	0	17.5	5	0	0	3.21

Source: Field survey 2024, InM

4.11.5 Incidence of social harassment due to poverty

Poverty often leads to social harassment, as economically disadvantaged households face discrimination, exploitation, and social exclusion. In many societies, the poor individuals are vulnerable to workplace abuse, child labour, human trafficking, and domestic violence due to their financial instability. Women and children from low-income backgrounds are particularly at risk, facing gender-based violence and limited access to justice. Poverty also forces many into unsafe living conditions, where they are more exposed to crime and social stigma. Addressing these issues requires comprehensive efforts, including socioeconomic empowerment, education, and stronger legal protections to ensure dignity and security for all.

Table 4.42 presents the incidence of social harassment faced by both male and female members of disaster-affected poor households across the seven districts covered under the study. Overall, 4.6 per cent of respondents report social harassment faced by male members, while only 0.4 per cent report harassment of female family members, indicating that men experience the problem more frequently. The highest reported harassment of male family members is in Sunamganj (12.5 per cent) and Bhola (10 per cent), while other districts report minimal or no such incidents. Harassment of female family members is rare, with only 2.5 per cent in Sunamganj reporting such experiences. In all other districts, both men and women overwhelmingly report no experiences of social harassment. These findings suggest that social harassment due to poverty is not a widespread issue in most regions, although some pockets, particularly in Sunamganj and Bhola, experience higher incidences, possibly due to regional socioeconomic conditions.



Table 4.42: Incidence of social harassment due to poverty (in percent)

Districts	Social harassment of any male family member		Social harassment of any female family member	
	Yes	No	Yes	No
Chuadanga	0	100	0	100
Naogaon	0	100	0	100
Bhola	10	90	0	100
Sunamganj	12.5	87.5	2.5	97.5
Kurigram	0	100	0	100
Satkhira	5	95	0	100
Bagerhat	5	95	0	100
Total	4.64	95.36	0.36	99.64

Source: Field survey 2024, InM

4.11.6 Sexual harassment

Table 4.43 presents the incidence of sexual harassment experienced by male and female family members of disaster-affected poor households across the seven sampled districts. Overall, 0.36 per cent of respondents reported sexual harassment of male members, while no respondent reported incidents involving female members. The only district where any case of sexual harassment was reported is Sunamganj (2.5 per cent for males), while all other districts reported no such incidents for either gender. The complete absence of reported sexual harassment cases for females suggests either a lack of occurrences or potential underreporting due to social stigma or fear from the social elites. These findings indicate that sexual harassment is perceived as a minimal issue in these areas, although the isolated case in Sunamganj highlights the need for continued vigilance and awareness.

Table 4.43: Incidence of sexual harassment of disaster-affected poor household members (in percent)

Districts	Sexual harassment of any male family member		Sexual harassment of any female family member	
	Yes	No	Yes	No
Chuadanga	0	100	0	100
Naogaon	0	100	0	100
Bhola	0	100	0	100
Sunamganj	2.5	97.5	0	100
Kurigram	0	100	0	100
Satkhira	0	100	0	100
Bagerhat	0	100	0	100
Total	0.36	99.64	0	100

Source: Field survey 2024, InM



Box 4.4: Climate Change Struggle of an Impoverished Rural Community

Abul Kalam (not his real name) is a small farmer who has been living in Shikdar Char for the last 17 years. He lives along with his wife, three daughters and one son. Kalam lost his ancestral home and all lands 17 years ago due to river erosion; he became homeless, landless with no income and nowhere to go. At that time, Kalam, along with many other farmers of his and neighbouring villages – who lost everything to river erosion -- settled in this area, taking possession of government khas land.

Shikdar Char is located by the Tentulia River, which erodes land across its banks almost regularly as a consequence of climate change related natural disasters. The residents of the area have to face recurring disaster damages mostly caused by storms and cyclones. Kalam and his family are severely affected by these calamities. As a matter of fact, Kalam and other residents of Shikdar Char face harsh living conditions of one sort or another every year.

The area, where Kalam lives, is surrounded by rivers, but lacks embankments. Whenever there is a depression in the Bay of Bengal, the water of the Tentulia River swells, flooding the low-lying areas, and the strong winds and cyclones destroy houses and vegetation. In May 2022, cyclone 'Bulbuli' and in May 2024, cyclone 'Remale' caused extensive damages in the region including destroying Kalam's dwelling and household assets. All fishes from his three ponds, covering two acres of land, were swept away. Moreover, about 80 trees, both small and large, around his house and ponds were destroyed. Due to the remoteness of the location, the fallen trees can only be used as firewood. Additionally, the intrusion of saline water makes it impossible to carry out fish farming or grow crops. Kalam explains, "If I could remove salinity from the ponds and soil, I would be able to resume fish farming and increase production of watermelon and coriander. But, it is difficult and costly. Moreover, the problem may emerge again with the onslaught of another cyclone and disaster. We are really helpless".

After the disasters, Kalam had to borrow money to rebuild his dwelling and meet the survival needs. Still, he has not been able to repay the loan fully. His only son works as a day labourer, but due to his young age, he could earn only a little. Financial constraints have prevented Kalam to provide formal education to his son and daughters.

Kalam adds, "Shikdar Char is an underdeveloped and isolated location. The people here lack access to education, health services, clean water, hygienic sanitation, and protection of life and property". In the entire location, little if any government and non-government initiatives are visible. Moreover, local government representatives do not come forward to undertake any development programmes here. In addition, like all other disaster-affected people in the location, Kalam is also deprived of any assistance for post-disaster rehabilitation.

The NGO-MFIs are also reluctant to expand their operations in such a remote location where most of the inhabitants are extremely poor and deprived in all respects. Additionally, high-interest rates of informal moneylenders and NGO-MFIs make the people hesitant to take loans. Kalam believes that the first step in helping the people of this area is to spread the network of the safety nets programmes of the government. Moreover, if the riverbanks around Shikdar Char could be raised with embankments, it would provide protection from natural disasters, allowing them to resume fish farming and crop production, thus improving their economic conditions.

He further adds that due to climate change, natural disasters that occur in this region pose significant risks, and there is no safe shelter nearby. Whenever a cyclone or flood occurs, they have to rely on divine protection. During these times, there is no available option to protect livestock, poultry, trees, or crops, and they have to leave everything behind and seek shelter in safer places. Kalam urges the government to construct local shelter centres, healthcare facilities, and embankments to provide safety and security. He suggests that the one-storied local primary school could be converted into a cyclone centre by building



additional floors.

Kalam and his fellow villagers have been made destitute by the impact of climate induced disasters. He says with a bulky voice, “It is impossible for anyone to survive while fighting against the nature. All humans are responsible for destroying the global climate for which we are paying high costs in terms of our living and livelihood. We have to realise, when a natural disaster strikes, nobody can resist it. So we have to save the environment and minimise the climate change hazards. That’s the only way of our survival”.

4.12 Impact on education

The effects of climate change induced disasters on education of affected rural households are multi-faceted and have both direct and indirect consequences on household welfare. Climate change has significant and far-reaching consequences on education as the country is highly vulnerable to the impacts of climate-related events like floods, cyclones, droughts, and sea-level rise. Several important climate change induced impacts work through the following channels:

Disruption of school infrastructure: Frequent flooding, particularly in low-lying areas like the coastal regions and river basins, leads to the destruction of school buildings, making it difficult for schools to remain functional. Educational institutions in coastal region are particularly vulnerable to damages from cyclones and storm surges. School buildings and educational equipment may be totally or partially destroyed, and access to education may remain disrupted for weeks or months. Similarly, prolonged rains or harsh weather conditions can cause damage to school infrastructure, making them unsafe for children.

Increased dropout rates: Climate change-induced displacement due to floods, river erosion, or coastal storms forces many households to relocate and/or migrate to other regions in search of safety. As a result, children may be forced to drop out of schools or may have to forego education to join the workforce often as child labour to supplement household income for survival.

Economic pressure: The economic impact of climate change (e.g. loss of livelihoods due to crop failure or damage to fish and livestock farming) can force children to work, especially in rural areas, rather than attend schools. This leads to higher dropout rates, particularly among girls.

Impaired learning environment -- Quality of education: Increased temperatures, poor sanitation, and waterborne diseases (e.g. diarrhoea, cholera) due to floods can negatively affect students’ health, leading to frequent absences and decreased focus during school hours. This undermines the quality of education.

Psychological stress: Exposure to climate-related disasters, such as floods, cyclones, or droughts, leads to trauma and psychological stress for students, which can impair their learning capabilities and overall well-being.

Impact on girls’ education -- Gender disparities: Climate change exacerbates gender inequalities in education. Girls are more likely to be pulled out of school due to climate impacts, particularly in rural or poverty-stricken areas. For example, when households face economic stress due to crop failure or flooding, girls are more likely to stay at home to help with household chores or care for younger siblings, reducing their access to education.

Increased vulnerability: During and after climate-induced disasters, girls become more vulnerable to exploitation, early marriage, or trafficking, further reducing their educational opportunities and welfare.

Impact on educational facilities and resources: Floods and storms may lead to loss of educational materials such as destroying textbooks, teaching materials, and other resources, hindering the teaching



and learning process. Lack of timely availability of required resources may further limit students' opportunities to succeed academically.

The survey under the present study provides the impact of disasters on educational outcomes in terms of student dropouts by gender across different districts, categorising them into temporary or permanent during, and after the disasters. Table 4.44 shows that female students tend to show a more significant impact, with higher numbers of permanent dropouts compared with male students. In general, male dropouts remain low, with no male students dropping out in many districts prior to and during the disaster period, or during the post disaster period. However, some male dropouts do appear in districts like Kurigram and Sunamganj during post disaster period, with an equal split between temporary and permanent ones.

Table 4.44: Category of dropouts from school by gender and districts (per cent)

District	During disaster period				Post disaster period (December 2024)			
	Boys		Girls		Boys		Girls	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Chuadanga	100	0	100	0	0	0	0	0
Naogaon	0	0	0	0	0	0	0	0
Bhola	0	100	0	0	0	100	0	0
Sunamganj	0	100	0	100	0	100	0	0
Kurigram	50	50	0	0	50	50	0	0
Satkhira	0	100	100	0	0	100	0	0
Bagerhat	0	0	0	100	0	0	0	100
Total	27	73	50	50	10	90	0	100

Source: Field survey 2024, InM

The disaster period witnessed a higher percentage of male students dropping out, particularly at the primary education level. During the post disaster period, the male dropout rate has significantly decreased, with no male dropouts in many districts. However, female students experienced a greater impact, with primary education being the most affected level during the disaster, especially in Sunamganj and Kurigram. During the post disaster period, female dropout rates at the secondary education level remain high in Satkhira, while other districts show recovery or minimal dropouts (Table 4.45).

Table 4.45: Dropout rates at primary and secondary education levels by gender and districts (per cent)

District	During disaster period				Post disaster period (December 2024)			
	Male		Female		Male		Female	
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary
Chuadanga	75	25	0	0	0	0	0	0
Naogaon	20	80	0	0	0	0	0	0
Bhola	100	0	0	0	100	0	0	0
Sunamganj	25	75	0	0	40	60	0	0
Kurigram	100	0	100	0	100	0	0	0
Satkhira	0	100	0	100	0	100	0	100
Bagerhat	100	0	0	0	0	0	0	0
Total	47.37	52.63	33.33	66.67	44.44	55.56	0	100

Source: Field survey 2024, InM

The main reasons for student dropouts are socioeconomic, physical and other related interruptions due to incidence of disaster, compulsion to involve in petty jobs to supplement household income, forced



migration due to disaster, loss of interest to continue education mainly due to family obligations, arranged marriage by parents especially for young girls due to economic/social reasons, and similar other factors. Prior to the disaster period, dropouts were primarily due to the compulsion to enter into the informal labour market to earn supplementary income particularly in Chuadanga and Satkhira, and loss of interest to continue education. During the disaster period, the main reason for dropouts shifted to loss of interest to continue education, followed by compulsion to earn incomes and forced migration. During the post disaster period, earning supplementary family incomes remains the primary reason for dropouts in Sunamganj, while loss of interest continues to be significant in Satkhira. On the other hand, forced migration became a more prominent issue in Kurigram (Table 4.46).

Table 4.46: Reasons for dropouts from educational institutions (per cent)

District	Various interruptions caused by disaster	Earn supplementary income for household	Forced migration	Loss of interest to continue education	Arranged marriage by parents for socioeconomic reasons	Others
One month prior to the disaster						
Chuadanga	0	66.67	0	33.33	0	0
Naogaon	20	40	0	20	20	0
Bhola	100	0	0	0	0	0
Sunamganj	0	0	0	0	0	0
Kurigram	0	0	0	0	0	100
Satkhira	0	50	0	50	0	0
Bagerhat	0	0	0	100	0	0
Total	15.38	38.46	0	30.77	7.69	7.69
During disaster period						
Chuadanga	0	50	0	50	0	0
Naogaon	0	0	0	0	0	0
Bhola	100	0	0	0	0	0
Sunamganj	20	40	0	40	0	0
Kurigram	25	0	25	50	0	0
Satkhira	0	33.33	0	66.67	0	0
Bagerhat	0	0	0	0	0	100
Total	18.75	25	6.25	43.75	0	6.25
Post disaster period (December 2024)						
Chuadanga	0	0	0	0	0	0
Naogaon	0	0	0	0	0	0
Bhola	100	0	0	0	0	0
Sunamganj	20	60	0	20	0	0
Kurigram	33.33	0	33.33	33.33	0	0
Satkhira	0	33.33	0	66.67	0	0
Bagerhat	0	0	0	0	0	100
Total	23.08	30.77	7.69	30.77	0	7.69

Source: Field survey 2024, InM

Overall, the ground level evidence shows that climate change induced disasters pose a serious threat to education in rural Bangladesh. Such disasters disrupt essential educational soft and hard infrastructure, increase dropout rates, impair the learning process, and exacerbate gender inequalities. Above all, such disasters trigger a loss of interest in continuing education for the children and forced marriages of young girls due to socioeconomic reasons especially for those belonging to the extreme poor households blocking their path to upward mobility. Addressing these challenges needs more focussed attention on building climate-resilient schools, improving disaster preparedness, and incorporating climate change education into the curricula. These efforts will contribute towards reducing



vulnerability of the education system to climate events along with preparing the students to meet future climate induced challenges and help the communities to adopt climate-resilient practices.

4.13 Impact on housing and shelter

The impact of climate change related disasters on housing and shelter is significant, especially in these vulnerable regions of Bangladesh. The effects are multifaceted, impacting the safety, durability, and affordability of housing of these poor rural residents. In the absence of proper adoption of climate-resilient housing strategies in these vulnerable locations, households residing in these rural areas lack stronger and durable homes, possess deficient infrastructure, do not have secure housing in the face of the changing climate, and do not have relocation plans for those most at risk.

Table 4.47 provides an overview of the damages to housing structure due to disasters across various districts. During the post disaster period, most districts have reported a reduction in the number of homes with significant damages. For example, Chuadanga and Naogaon report no damaged houses at all, indicating that households in these districts have fully recovered from the damages. The types of damages caused by the disaster primarily involve structural features, such as broken walls, damaged ceilings, and partly damaged section of the housing structure. This is particularly the case in districts like Bhola, Sunamganj, and Satkhira. Even during the post disaster period, some damages persist in districts like Kurigram, where 20 per cent of homes still have partial damages and 6.7 per cent have ceiling damages. Although the situation is improving, there exist districts like Kurigram and Satkhira that still face significant damages, requiring long-term rebuilding and support.

Table 4.47: Types of damages of housing structure due to disasters (% of households)

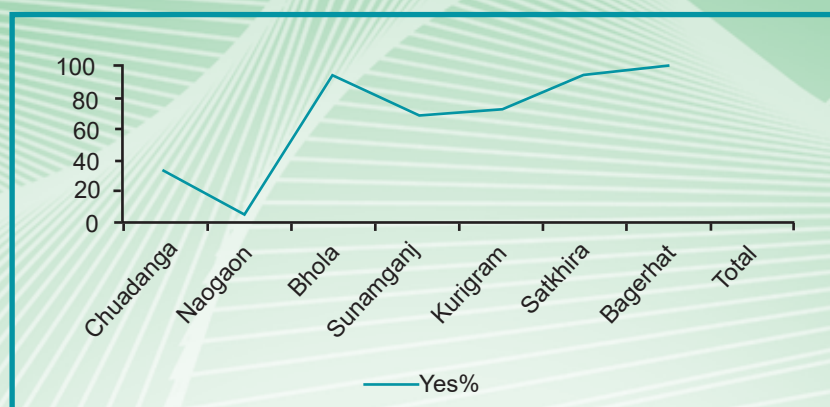
District	Broken wall	Broken balcony	Partial damage to housing structure	Damage to ceiling	No damage done	Completely destroyed housing structure	Others
During disaster period							
Chuadanga	0	0	0	0	100	0	0
Naogaon	0	0	0	0	100	0	0
Bhola	5	10	47.5	30	5	0	2.5
Sunamganj	2.5	2.5	67.5	25	0	2.5	0
Kurigram	0	0	15.79	0	2.63	68.42	13.16
Satkhira	5	7.5	57.5	30	0	0	0
Bagerhat	2.5	2.5	60	25	7.5	0	2.5
Total	2.34	3.52	38.67	17.19	25	10.55	2.73
Post disaster period (December 2024)							
Chuadanga	0	0	0	0	100	0	0
Naogaon	0	0	0	0	100	0	0
Bhola	0	3.23	3.23	0	93.55	0	0
Sunamganj	0	0	4	0	96	0	0
Kurigram	0	0	20	6.67	6.67	46.67	20
Satkhira	5	5	5	15	70	0	0
Bagerhat	0	0	0	0	93.33	3.33	3.33
Total	0.56	1.12	3.35	2.23	86.03	4.47	2.23

Source: Field survey 2024, InM

Figure 4.12 shows that 69.3 per cent of the households across all districts received disaster warning prior to the onset of the disaster, while the rest were not aware of it. This shows that the disaster preparedness and warning systems are not functioning well in different districts which are most prone to climate change vulnerability, and improvements are necessary to help mitigate the impact of future disasters.



Figure 4.12: Percentage of households receiving any warning prior to disaster



Source: Field survey 2024, InM

Table 4.48 presents the sources of aid and/or assistance to repair damages of housing structure during the disaster period across different districts. It appears that NGO-MFIs are a major source of assistance across most districts, particularly in Bhola, Satkhira, and Bagerhat.

Table 4.48: Source of aid and assistance for repairing damaged housing structure (% of households)

District	During disaster period			
	Government	Private	NGO-MFIs	Others
Chuadanga	.	.	.	.
Naogaon	.	.	.	.
Bhola	0	0	50	50
Sunamganj	16.67	50	16.67	16.67
Kurigram	0	100	0	0
Satkhira	0	0	100	0
Bagerhat	0	0	100	0
Total	5.56	27.78	50	16.67

Source: Field survey 2024, InM

Building houses at higher level of the homestead land is the most common practice to minimise damages from disasters that specifically focuses on floods and heavy rainfalls along with ensuring safety from water-related disasters. Shelter preparation to withstand disaster damages is significant in districts like Chuadanga. Environmental measures, such as planting of selected tree species, are more common in Satkhira and Sunamganj (Table 4.49).

Table 4.49: Safety measures adopted for housing structure for mitigating disaster damages (% of households)

District	Building houses at higher level of homestead land	Building shelters consistent with the nature of disaster	Planting selected tree species around the homestead	Others
Chuadanga	0	60	40	0
Naogaon	66.67	33.33	0	0
Bhola	92.31	7.69	0	0
Sunamganj	71.43	0	28.57	0
Kurigram	55.56	22.22	0	22.22
Satkhira	58.33	8.33	25	8.33
Bagerhat	81.82	9.09	9.09	0
Total	66.67	15	13.33	5

Source: Field survey 2024, InM



4.14 Impact on availability of and access to financial services

Climate change induced disasters have a significant impact on availability of and access to financial services by affected rural households in Bangladesh. These climate-related impacts can disrupt the key dimensions of availability of financial products and services and associated delivery channels.

The present survey shows that the percentage of rural households accessing loans significantly increased in Kurigram and Sunamganj during the disaster period. However, use of loan products by households shows a declining percentage during the post disaster period. The share of households having savings is higher in Naogaon and Bhola, especially before the onset of the disaster. The percentage of households holding savings remains rather consistent, but disruptions are observed in Sunamganj and Satkhira during the disaster. Mobile financial services (MFS) are more widely used prior to the disaster, especially in Chuadanga, Naogaon, and Satkhira, where the usage is above 30 per cent. However, this dropped slightly during the disaster period and fluctuated thereafter. Many households use multiple financial services, particularly loans and MFS or savings and MFS. This reflects a reliance on multiple financial tools, potentially to diversify risk and ensure continued access to essential financial services during periods of disaster (Table 4.50). A significant portion of the households do not use any financial services, particularly during the period prior to the disaster, with Sunamganj showing the highest percentage of non-users (72.5 per cent). The field survey highlights the vulnerability of households to financial service disruptions due to the disasters, especially in rural areas. While access to services like loans, savings, and MFS is essential for economic resilience, the fluctuating usage during disasters underscores the need for improved financial infrastructure, particularly MFS and loan facilities, to ensure financial inclusion and stability, especially in disaster-prone areas.

Table 4.50: Type of financial services accessed by the rural households (% of households)

District	Loans, formal and informal	Savings, formal and informal	Mobile financial services	Both loans and savings	Both savings and mobile financial services	Both loans and mobile financial services	Both loans, savings and mobile financial services	Non-users of all financial services
One month prior to disaster								
Chuadanga	5	7.5	40	5	22.5	0	12.5	7.5
Naogaon	0	0	50	5	25	0	20	0
Bhola	2.5	25	20	22.5	2.5	0	2.5	25
Sunamganj	22.5	2.5	2.5	0	0	0	0	72.5
Kurigram	30	7.5	0	0	0	0	0	62.5
Satkhira	0	0	37.5	22.5	20	7.5	5	7.5
Bagerhat	7.5	15	37.5	27.5	2.5	0	0	10
Total	9.64	8.21	26.79	11.79	10.36	1.07	5.71	26.43
During disaster period								
Chuadanga	2.5	7.5	40	5	20	0	15	10
Naogaon	0	0	50	5	25	0	20	0
Bhola	7.5	20	15	22.5	7.5	0	2.5	25
Sunamganj	40	5	5	0	0	0	0	50
Kurigram	55	10	0	0	0	0	0	35
Satkhira	0	0	37.5	20	12.5	22.5	2.5	5
Bagerhat	2.5	10	37.5	32.5	5	2.5	0	10
Total	15.36	7.5	26.43	12.14	10	3.57	5.71	19.29



District	Loans, formal and informal	Savings, formal and informal	Mobile financial services	Both loans and savings	Both savings and mobile financial services	Both loans and mobile financial services	Both loans, savings and mobile financial services	Non-users of all financial services
Post disaster period (December 2024)								
Chuadanga	5	5	30	15	20	0	17.5	7.5
Naogaon	0	0	40	5	25	0	30	0
Bhola	5	27.5	15	22.5	2.5	0	2.5	25
Sunamganj	37.5	2.5	2.5	0	0	0	0	57.5
Kurigram	37.5	5	0	0	0	0	0	57.5
Satkhira	2.5	0	37.5	10	12.5	25	5	7.5
Bagerhat	5	12.5	37.5	25	2.5	7.5	0	10
Total	13.21	7.5	23.21	11.07	8.93	4.64	7.86	23.57

Source: Field survey 2024, InM

To cope with disasters, households mainly rely on loans and past savings (Table 4.51). The lack of insurance claims indicates the non-existence of insurance coverage and a lack of knowledge on insurance. It would be extremely beneficial to improve the awareness on and access to insurance services, as well as promote multiple and user friendly savings mechanisms that can help the households to cope with disasters without depleting their meagre productive resources, such as livestock animals and land. During the disaster period, Kurigram and Sunamganj had the highest percentage of households taking loans (76.9 per cent and 70.8 per cent respectively), indicating that loans were an important coping strategy for many households. This pattern remained consistent or even increased slightly during the post disaster period, with Naogaon showing a high shift to taking loans (100 per cent) after the disaster. Use of savings was the most common coping strategy across all districts. Claiming insurance was relatively low across all districts, with Bagerhat being the only district showing a slight increase in claims (2.7 per cent) during the post disaster period, though still very low. The overall trend shows that most households do not rely on insurance as a coping strategy.

Table 4.51: Coping mechanism using financial services (% of households)

District	During disaster period			Post disaster period (December 2024)		
	Accessing loan products	Using past savings	Claiming insurance coverage	Accessing loan product	Using past savings	Claiming insurance coverage
Chuadanga	0	100	0	50	50	0
Naogaon	66.67	33.33	0	100	0	0
Bhola	48.39	51.61	0	51.61	48.39	0
Sunamganj	70.83	29.17	0	58.33	41.67	0
Kurigram	76.92	23.08	0	66.67	33.33	0
Satkhira	69.44	30.56	0	65.38	34.62	0
Bagerhat	64.1	35.9	0	56.76	40.54	2.7
Total	58.43	41.57	0	61.11	38.1	0.79

Source: Field survey 2024, InM

Table 4.52 highlights the financial interventions provided by the government and other non-government financial institutions to support the communities affected by disasters and emphasises how some of these interventions, especially quick loan disbursements continue to provide much needed assistance in recovery efforts after the disaster.



Waiver of loan instalments and disbursement of interest-free loans are limited during and after the disaster. Only a few districts had substantial support from these mechanisms, and it appears that the flow of financial services has decreased over time. Collateral-free loans were more prominent in the earlier phases of the disaster (especially in Kurigram and Bhola) but are less common during the post disaster period. Quick loan disbursements seem to have been the most widely available service, with Sunamganj, Kurigram, and Bagerhat benefiting from the service both during and after the disaster.

Table 4.52: Types of specialised financial services received for recovering from disaster (% of households)

District	During disaster period					Post disaster period (December 2024)		
	Waiver of Loan Installments	Disbursement of interest-free loan	Disbursement of collateral-free loan	Waiver of dead person loans	Quick loan disbursement	Waiver at loan installments	Disbursement of collateral-free loan	Quick loan disbursement
Chuadanga	.	.	.	.	.	.	.	.
Naogaon	.	.	.	.	.	.	.	.
Bhola	0	0	25	0	75	0	25	75
Sunamganj	28.57	0	0	14.29	57.14	33.33	0	66.67
Kurigram	9.09	18.18	27.27	0	45.45	0	50	50
Satkhira	0	14.29	0	0	85.71	0	0	100
Bagerhat	0	0	0	0	100	0	0	100
Total	9.09	9.09	12.12	3.03	66.67	3.57	14.29	82.14

Source: Field survey 2024, InM

In recent years, MFS and agent banking have spread rapidly opening up new and digital opportunities in accessing financial services in rural areas. These services are efficient and provide scope for financial inclusion for the poor rural inhabitants. The survey shows that Bhola, Satkhira, and Bagerhat faced significant problems with availability of agent banking outlets during the disaster period. However, the situation has improved during the post disaster period. Rural households in Sunamganj and Kurigram faced more internet-related challenges, and the challenge continues to persist in the post disaster period as well. Chuadanga and Naogaon had consistent challenges in the 'Others' category but reported no significant problems with agent banking or internet connectivity. In conclusion, while the problem related to availability of agent outlets has decreased over time, internet connectivity remains a prominent challenge, particularly in vulnerable districts like Sunamganj and Kurigram (Table 4.53).

Table 4.53: Challenges in using MFS and agent banking services by rural households (% of households)

District	During disaster period			Post disaster period (December 2024)		
	Non-availability of agent outlet	No internet connectivity	Others	Non-availability of agent outlet	No internet connectivity	Others
Chuadanga	0	0	100	0	0	100
Naogaon	0	0	100	0	0	100
Bhola	94.59	2.7	2.7	76.47	17.65	5.88
Sunamganj	60	40	0	71.43	28.57	0
Kurigram	87.5	12.5	0	86.67	13.33	0
Satkhira	92.5	7.5	0	83.33	16.67	0
Bagerhat	92.11	7.89	0	78.57	21.43	0
Total	69.09	11.82	19.09	52.76	14.17	33.07

Source: Field survey 2024, InM

No doubt, climate change induced disasters pose significant challenges for availability of and access to financial services for the rural households especially in climate vulnerable regions in Bangladesh,



seriously affecting their crisis coping efforts after the disasters. The increased risk of natural disasters, particularly for vulnerable populations, exacerbates the financial vulnerability of both households on the demand side and institutions on the supply side. This points out to the urgent need for a coordinated response from both financial institutions and regulatory bodies to address climate change related financial vulnerabilities and ensure that the financial system remains robust and inclusive in the face of climate change impacts. These challenges also create opportunities to innovate and build a more resilient and sustainable financial system that can support climate adaptation and mitigation efforts in the country.

4.15 Policy Implications

As is well known, poverty is a dynamic and multidimensional phenomenon in every society. It is the outcome of interactions of social, economic, political, and climate change induced hazards and environmental processes; coupled with individual and community characteristics and historical circumstances. The characteristics of the poor or being poor vary within the country as well as among different regions of the country. In Bangladesh, it is increasingly being recognised that, along with other drivers of poverty, climate change poses a serious threat to the country's poverty reduction efforts. Climate change threatens to frustrate the accomplishments of development efforts that have been achieved over the last several decades since the country's independence in 1971. It also prolongs the existing poverty cycles, increases inequalities, deepens food insecurity, and delays poverty reduction process including the goal of achieving sustainable and inclusive development.

In Bangladesh, as can be seen from the ground realities presented above, most of the poor people's livelihoods are highly dependent on climate-sensitive sectors and they lack the basic infrastructure for climate resilient housing and livelihoods or the links for accessing basic services at the community level. In addition, many of them live in areas that are highly vulnerable to climate change and prone to climate-induced hazards. As a result, they are affected by disasters disproportionately. In other words, for these people, poverty exacerbates, and is exacerbated by, the impact of climate change. It is increasingly evident from the above findings as well as many other studies in Bangladesh and other developing countries that the nexus between climate change and poverty are complex, multifaceted, and context-specific. More specifically, it is seen that the poverty reduction process can be delayed because of climate change if it is not addressed properly.

At the macro level, Bangladesh faces a twin challenge towards ensuring sustainable development: (i) expanding economic opportunities for all in the context of a growing population; and (ii) addressing climate induced and environmental challenges which, if left unaddressed, could undermine the people's abilities to seize the emerging opportunities. In the face of pressing socioeconomic and climate change related challenges, national efforts (with required support from the global community) are of critical importance to promote sustainable development in Bangladesh. .

Further, many of the SDG targets are linked to climate change one way or the other. Of these, SDG13 specifically addresses the issue of climate change, which underscores an additional threat that adds to, interacts with, and can reinforce existing risks, placing additional strains on the livelihoods and coping strategies of the poor. Unless concrete and urgent steps are taken to reduce vulnerability and enhance adaptive capacity of the poor people, and unless these actions are mainstreamed into all development strategies for poverty eradication and sustainable development, it will be difficult to meet the cherished development goals of the country.

Climate resilience therefore has to be articulated as one of the major cross-cutting issues in the pathways to prosperity for all people in Bangladesh. In this context, special focus is needed for the marginalised and intersectional groups who are more at risk to climate hazards, such as char dwellers,



ethnic minorities, Dalits, persons with disabilities, elderly people and people of third gender. In Bangladesh, climate-induced hazards result in both slow-onset and rapid onset natural disasters such as tropical cyclone, high tidal and storm surge, floods, and increased salinity in water as well as in the soil. These hazards are all too common in the climate vulnerable locations covered under the primary survey of the present study, affecting the already marginalised groups even more badly and further increasing their vulnerabilities and social inequalities.

These climate-induced hazards damage their houses, crops, cattle/poultry and fish ponds, community infrastructures (roads, educational and religious institutions), tube wells, farming equipment, natural assets (arable land and water bodies) and human assets (e.g. health, skills and children's education) with short- and long-term implications. The present study also shows that climate-related disasters affect social relations within the communities. Relief efforts after disasters, for example, can disrupt social harmony and trust in the rural settings.

The glimpses of ground realities of the present study also reveals that climate affected people apply their own resilience strategies, but these often prove inadequate in the face of the increasing severity and scale of climate-related disasters. Rain water harvesting of households with the basic household structure, raising household plinth, keeping a little food, for instance, do little to protect against cyclone, tidal surge or flooding. Very few can save their assets during such hazards. These vulnerabilities to climatic shocks, however, vary from household to household, depending on their capacity to withstand, cope with or adapt to such hazards or disasters. Those who fail to cope will obviously fall further down the poverty line, unless their resilience is built through well-planned interventions to tackle climate change impacts.

To build such resilience, the key is to focus on sustainable climate change adaptation – such that any intervention must focus on ways of securing well-being, strengthening adaptive capacity, and addressing the root causes of the vulnerabilities of these poor groups. Further, adaptation to climate change in many instances may also need to reduce social vulnerability at household and community levels. The approach needs to improve human capital, reinforce physical capital, help the poor to gain access to natural capital, strengthen financial capital and build social capital – all aimed at reducing social vulnerabilities of the poor households to climate change effects. Accordingly, the framework needs to assess livelihood capitals (human, social, natural, financial, physical), which influence vulnerability to shocks, underlying trends and seasonality. In this context, it is important to realise that livelihood strategies are determined through these capitals, and these determine outcomes such as income, well-being, and food security, among others.

Considering the need for mainstreaming, all relevant activities have to be climate-smart and climate resilient. The key is to apply climate lens to undertake any activity related to livelihood development, nutrition improvement or for addressing other aspects of multidimensional poverty within a gender-sensitive and disability-friendly framework. In particular, for designing effective interventions, the issue of climate change will have to be aligned with other components, such as livelihoods and enterprise development, nutrition, community mobilisation, gender, market system development and policy advocacy.



5

Key Findings and Recommendations

“The impacts of 1.5 °C of warming would disproportionately affect disadvantaged and vulnerable populations through food insecurity, higher food prices, income losses, lost livelihood opportunities, adverse health impacts and population displacements. Some of the worst impacts on sustainable development are expected to be felt among agricultural and coastal dependent livelihoods, indigenous people, children and the elderly, poor labourers, poor urban dwellers in African cities, and people and ecosystems in the Arctic and Small Island Developing States”

(Roy et al., 2018, p. 447).

As this Report indicates, the world faces major challenges in finding effective ways to deal with poverty, along with climate change. Despite recent advances in understanding the links between climate change and poverty, there remains a need to improve the coherence and coordination of policies, as well as institutional, financial and practical linkages between climate responses (mitigation and adaptation) and poverty reduction initiatives, in order to reach the goals of the Paris Agreement and strengthen interactions among the SDGs. This is particularly crucial for Bangladesh since policies and actions, if not coherently designed and implemented, may create unintended negative impacts – such as, climate responses contributing to rising poverty, and development actions resulting in less efficient climate adaptation responses. The climate change and poverty nexus discussed in this Report has been presented keeping these aspects in view.

Using a participatory approach, the Report provides insights from different types of climate change impacts and poverty perspectives in Bangladesh, leading to inclusion not only of climate and poverty aspects, but also inequalities, gender, food security, disaster response and resilience, among others. This opens up the avenues for identifying strong opportunities to improve the ways in which policies and actions have to be designed and delivered in Bangladesh -- which can lead to greater alignment of efforts towards cohesion, effectiveness and efficiency leading to more equitable and sustainable development and improved climate adaptation outcomes.

Key Findings and Messages

In recent years, poverty and inequality has emerged as a persistent issue in the climate change agenda around the globe. In general, it is a part of the 'climate justice' issue, which in turn is a particular case of 'environmental justice' agenda.⁷ In this context, the hard reality is that there exist stark differences across countries regarding the responsibility for causing climate change and the consequent responsibility for mitigation (and adaptation) efforts. The Rio principle of 'common but differentiated responsibility (CBDR)' was adopted to resolve the issue; but, in the absence of a just solution, the issue still continues to dominate the global discussion on climate change. In contrast, within-country poverty and socioeconomic inequalities have received much less attention in related discussions. However, the issue is significant requiring urgent and equitable solution for a climate vulnerable country like Bangladesh. The fact is that even people in low income Bangladesh differ widely regarding their GHG emissions, and hence those (e.g. richer segment in society) who contribute more towards climate change hazards should be appropriately taxed to share the adaptation burden for the poor and disadvantaged who contribute little but bear the disproportionately large share of the impacts of climate hazards.

At the ground level in Bangladesh, the Report holds that the climate change and poverty nexus refers to the direct and disproportionate impact of climate change on the poor and impoverished communities, where extreme weather events like floods, droughts and cyclones severely disrupt livelihoods, destroy assets, and push the people further into poverty due to their limited capacity to adapt to these disasters.

⁷ Climate justice links human rights and development to achieve a human-centred approach, safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and its impacts equitably and fairly. Climate justice is informed by science, responds to science and acknowledges the need for equitable stewardship of the world's resources. The core principles of climate justice are rooted in the frameworks of international and regional human rights law. These include: Respect and protect human rights; Support the right to development; Share benefits and burdens equitably; Ensure that decisions on climate change are participatory, transparent and accountable; Highlight gender equality and equity; Harness the transformative power of education for climate stewardship; and Use effective partnerships to secure climate justice. Environmental justice, on the other hand, is a social movement that aims to ensure that all people have fair access to the environment and its resources. It also seeks to address health disparities that can arise from environmental hazards.



The impact of these events makes them highly vulnerable to future climate-related disasters. In effect, climate change acts as a 'threat multiplier' for these already poor and marginalised populations. The key to addressing the challenges is to develop and implement evidence-based pro-poor policies, strategies and programmes that promote inclusive growth and sustainable livelihoods; as well as to increase the resilience, adaptive and coping capacity of these poor and vulnerable communities to climate change. In order to achieve this, the need is to adopt an integrated 'climate-poverty approach' to support policy development and actions by the policymakers and local level institutions including the communities and households themselves. In practice, the Report highlights that the approach has to integrate insights from many perspectives, covering not only climate and poverty aspects, but also gender, food security, disaster response, resilience, and, more importantly, the climate vulnerable community perspectives. This is necessary to internalise the results of synergies and linkages between climate adaptation, poverty reduction and livelihood security actions.

The evidence gathered in the Report emphasises that poverty is a dynamic and multidimensional phenomenon. It is the outcome of interactions of social, economic, political, and environmental processes; individual and community characteristics; and historical circumstances, among others. As such, the characteristics of the poor or being poor vary within the country itself as well as across different regions of the country. Further, the Report indicates that, in Bangladesh, along with other drivers of poverty, climate change poses a serious threat to poverty reduction efforts. Climate change threatens to frustrate the accomplishments of development efforts that have been achieved over the last several decades since independence of the country. It also prolongs the existing poverty cycles, increases inequalities, deepens food insecurity, and delays the poverty reduction process and sustainable development efforts.

As can be seen from the ground realities provided in the Report, most of the poor people's livelihoods in Bangladesh are highly dependent on climate-sensitive sectors and they lack the basic infrastructure for dwellings or for accessing basic services at community level. In addition, many of them live in areas that are highly vulnerable to climate change and prone to climate-induced hazards. As a result, they are affected by disasters disproportionately.

In other words, poverty exacerbates, and is exacerbated by, the impact of climate change. It has become increasingly evident from the findings of the Report that the nexus between climate change and poverty are complex, multifaceted, and context-specific in a country like Bangladesh. It is seen that the poverty reduction process can be delayed because of climate change if it is not addressed properly.

Overall, it is seen that, towards ensuring sustainable development, Bangladesh faces a twin challenge: (i) expanding economic opportunities for all especially in the rural areas in the context of a growing population; and (ii) addressing climate change and environmental challenges which, if left unaddressed, could undermine people's abilities to seize these opportunities. In the face of pressing economic and environmental challenges of the country, well-articulated national efforts (along with required support from the global community) are of critical importance to promote sustainable development in Bangladesh.

Further, many of the SDG targets are linked to climate change one way or the other. Of these, SDG13 specifically addresses the issue of climate change, which underscores an additional threat that adds to, interacts with, and can reinforce existing risks, placing additional strains on the livelihoods and coping strategies of the poor. Unless concrete and urgent steps are taken to reduce vulnerability and enhance adaptive capacity of the poor people, and unless these actions are mainstreamed into all development strategies for poverty eradication and sustainable development, it will be difficult to meet the cherished development goals of the country.



The Report brings out the urgent priority that climate resilience has to be seen as one of the major cross-cutting issues of the pathways to prosperity for the poor in Bangladesh. In this context, the findings also highlight that special focus is needed for the marginalised and intersectional groups who are more at risk to climate hazards, such as char dwellers, ethnic minorities, Dalits, persons with disabilities, elderly people and people of third gender. In Bangladesh, climate-induced hazards result in both slow-onset and rapid onset natural disasters such as tropical cyclone, high tidal and storm surge, floods, and increased salinity in water as well as in the soil. These hazards are all too common in the climate vulnerable locations covered under the primary survey of the present Report, affecting the already marginalised groups even more badly and further increasing their vulnerabilities and social inequalities.

The Report highlights that these climate-induced hazards damage their houses, cattle/poultry sheds, community infrastructures (roads, educational and religious institutions), tube wells, farming equipment, poultry and livestock, natural assets (arable land and water bodies) and human assets (including health, skills and children's education) with short- and long-term implications. The study also shows that climate-related disasters affect social relations within the communities. Relief efforts after disasters, for example, may also disrupt social harmony.

The study also reveals that climate affected people apply their own resilience strategies, but these often prove inadequate in the face of the increasing severity and scale of climate-related disasters. Rain water harvesting of households with the basic household structure, raising household plinth, keeping a little food, for instance, do little to protect against cyclones, tidal surge or flooding. Very few can save their assets during such hazards. These vulnerabilities to climatic shocks, however, vary from household to household, depending on their capacity to prevent, cope with or adapt to such hazards or disasters. Those who fail to cope (or have inadequate coping ability) obviously fall further down the poverty line, unless their resilience is built through well-planned interventions to tackle climate change impacts.

To build such resilience, the key is to focus on sustainable climate change adaptation – such that any intervention must focus on ways of securing well-being, strengthening adaptive capacity, and addressing the root causes of the vulnerabilities of these poor groups. Further, adaptation to climate change in many instances may also need to reduce social vulnerability at household and community levels. The approach needs to improve human capital, reinforce physical capital, help the poor to gain access to natural capital, strengthen financial capital and build social capital – all aimed at reducing social vulnerabilities of the poor households to climate change effects. Accordingly, the framework needs to assess livelihood capitals (human, social, natural, financial, physical), which influence vulnerability to shocks, adverse trends and seasonality. In this context, it is important to realise that livelihood strategies are determined through these capitals, and these determine outcomes such as income, well-being, and food security, among others.

Considering the need for mainstreaming in rural Bangladesh, all relevant activities have to be climate-smart and climate-resilient. The key is to apply climate lens to undertake any activity related to livelihood development, nutrition improvement or for addressing other aspects of multidimensional poverty within a gender-sensitive and disability-friendly framework. In particular, for designing effective interventions, the issue of climate change will have to be aligned with other components, such as livelihoods and enterprise development, nutrition, community mobilisation, gender, market system development and policy advocacy.



Box 5.1: Some credible measures

Big changes will be achieved by:

- Increasing energy efficiency and electrification in transport, buildings and industry.
- Reducing Methane e.g. by reducing food waste.
- Increasing natural carbon capture as much as possible, including stopping deforestation and increasing afforestation.
- Agreeing on a carbon price.

Major Issues and Challenges

The Report highlights that the relationship between climate change and poverty (as well as inequality) in Bangladesh is characterised by a 'vicious cycle', in which relatively high initial poverty and inequality cause greater sufferings and disproportionate losses of income and assets of the poor due to climate hazards, resulting in greater and deeper subsequent poverty and inequality in society. The analysis indicates that climate hazards exert the disproportionate effects on the poor through three major channels: (i) increased exposure of the poor and disadvantaged groups to climate hazards, (ii) increased susceptibility of the poor to damages caused by climate hazards, and (iii) decreased ability of the poor to cope with and recover from the damages. While the above channels are critical, location-specific transmission mechanisms are important to assess for policy purposes. Such an effort will also help identify the information gaps; as well as classify, present and use the gathered information in a uniform and coherent manner within a comprehensive scope.

Global perspectives

Recent estimates suggest that global poverty reduction has slowed to a near standstill -- with 2020-2030 seems to be emerging as a 'lost decade'. Overall, 8.5 per cent of the global population – almost 700 million people – lives on less than \$2.15 per day at present, which is the extreme poverty line for low-income countries. Three-quarters of all people in extreme poverty live in Sub-Saharan Africa or in fragile and conflict-affected countries. Thus, global poverty and inequality are issues that affect millions of people around the world. On the other hand, 44 per cent of the global population – around 3.5 billion people – lives on less than \$6.85 per day at present, the poverty line relevant for the upper middle income countries.

It terms of inequality, the world's richest 1 per cent own 44 per cent of the world's wealth, while almost half of the world's population subsist on less than \$5.50 a day. The reality also shows that the average person's consumption of oil and other resources is up to 30 times higher in rich countries compared with a similar person in the poor countries. Further, among the poor, women are more likely to be in low-paid or unpaid occupations, while female-headed households are among the world's poorest. In developing countries, a child born in a poor household is twice as likely to die before the age of five compared with a child born in a nonpoor household.

In reality, human beings currently live in a highly unequal world, where the lack of food and other basic necessities of a large majority are a symptom of deeper systemic and structural inequalities. Under these circumstances, solving global climate change and environmental challenges needs to consider the nature and scale of consumption and other requirements of all humans around the world. Climate change, biodiversity loss, land degradation, pollution, and other aspects of global climate and environmental changes are not only climate and environmental problems; they also have economic, social and cultural dimensions.



From the climate change and environmental perspectives, both poverty and unsustainable patterns of production and consumption are key drivers of environmental degradation. At the same time, climate change and environmental degradation contribute to rising poverty. While no easy solution is available, the key message is that poverty and climate change (and environment) needs to be addressed simultaneously.

Climate change-environment-poverty interactions: Global concerns

The relationships between climate change, environment and poverty have been widely debated and analysed over the centuries, possibly with Thomas Malthus's early 19th century writings about population growth, poverty, and the degradation of natural resources. At the world's first major global conference on the environment, the 1972 UN Conference on Human Environment in Stockholm, inequality among nations was acknowledged and actions were proposed to support developing countries with financial and technological assistance to meet environmental challenges. The 1987 World Commission on Environment and Development (WCED) popularised the definition of sustainable development in its report, 'Our Common Future', as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs'. This definition introduces an intergenerational element to decision making about development and highlights responsibility to others, including future generations.

The articulation of the relationship between climate change, environment and poverty further evolved through subsequent global conferences and action plans. The 1992 Rio Declaration and Agenda 21 adopted at the Rio Earth Summit proposed policies on conservation and protection of resources which should consider those who depend on those resources for their livelihoods. Failure to do so could have an adverse impact on both the poor and the environment. Principle 5 of the Rio Declaration on relationship between poverty and sustainable development has been reflected in Principle 7 of the Programme of Action adopted at 1994 International Conference on Population and Development (ICPD). Principle 16 of Beijing Declaration, adopted at 1995 Fourth World Conference on Women, has also been built on the Rio Declaration, with added emphasis on the importance of women in achieving poverty eradication and sustainable development. The 2002 Johannesburg Plan of Implementation, adopted at the World Summit on Sustainable Development highlights poverty reduction as "the greatest global challenge facing the world today and an indispensable requirement for sustainable development, particularly for developing countries" (paragraph 7).

Ten years later, the outcome document of UN Conference on Sustainable Development (Rio+20), 'The Future We Want', recognises that there has been uneven progress in achieving both sustainable development and poverty eradication (paragraph 19). 'The Future We Want' also calls for negotiations on a set of universal sustainable development goals that should address and incorporate in a balanced way all three dimensions of sustainable development (social, economic, and environmental) and their interlinkages (paragraphs 246-247)— a call that ultimately led to the UN General Assembly's adoption of the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs) in 2015. The 2030 Agenda, building on the outcomes of the earlier conferences and the lessons learned from implementation of the MDGs, sets out a framework of commitments that combine climate change related environmental and poverty eradication concerns more explicitly, along with 169 targets and 231 unique indicators for measuring progress.

New and continuing challenges

Despite decades of intense efforts towards bringing together climate change, environment and poverty agendas within a comprehensive framework to address the interlinked challenges, poverty still remains widespread, climate change hazards are mounting and the Earth's ecosystems are near collapse. From



a global perspective, any major collapse in the ecosystem will make all countries and everyone poorer. In other words, greater exclusion and higher sufferings due to climate change hazards is more likely to lead the countries to put greater emphasis on short-term resource management choices, at the cost of adoption of hard choices to reduce GHG emissions and damages to the environment to ensure long-term environmental quality. Moreover, the vexing debate persists at the global level as to whether the poor countries are ‘victims’ or ‘agents’ of environmental degradation. Nevertheless, the overlap between poverty and environment agendas is clearly vivid in the case of global climate change.

According to the UN estimates, the direct economic losses from disasters hit almost USD 3 trillion during 1998 to 2017, with climate-related disasters accounting for 77 per cent of the total (UN, 2019). Over the period, climate-related and geophysical disasters claimed an estimated 1.3 million lives. More than 90 per cent of all disasters were caused by floods, storms, droughts, heat waves, or other extreme weather events exacerbated by climate change. Economic losses resulting from climate change-related disasters are much higher in poorer countries (UN, 2019: 23).

Poverty is a major underlying driver of disaster risk, and the low-income countries and poor people experience a disproportionate share of damage and loss of life attributed to climate change. Hotter temperatures, rising sea levels, extreme weather events, and other impacts of climate change affect every country, with the severest impacts mainly hitting the least developed countries and small island developing states. Extreme weather patterns—resulting in prolonged drought and floods—exacerbate existing inequities.

Disasters kill 130 people for every one million people in low-income countries compared with 18 per one million in high-income countries. The World Bank estimates that climate change will drive 68 million to 135 million people into poverty by 2030, particularly in Sub-Saharan Africa and South Asia—the regions where most of the global poor are concentrated (World Bank, 2020). If GHG emissions are not reduced to the safe limit now, the compounded effects will render many parts of these regions inhabitable.

Countries of the global North have long considered that emerging economies have a responsibility to play their part in adopting stricter standards for GHG emissions. On the other hand, these countries argue that, despite their increased GDP, many of their people are still poor and they should not be denied economic opportunities. They highlight that rich countries have effectively ‘outsourced’ their emissions to the manufacturing centres of the global south, while they enjoy the freedom to import these products (Cléménçon, 2012).

Nevertheless, it is clear that climate change affects both the environmental and anti-poverty agendas (Roe, 2008). This realisation also disrupts the fiction that human ingenuity and technology would be able to resolve any problems in future, given adequate levels of development. Camps for refugees (e.g. Rohingyas) and internally displaced people can have large environmental footprints, particularly when they lack essential services, like water, sanitation, and other basic necessities.

Need for preserving glaciers

Globally, glaciers are melting at a pace that is anything but glacial. In the Himalayas, Karakoram and Hindu Kush mountain ranges of South Asia, the pace is even faster than the global average. Experts estimate that 80 per cent of the region’s glaciers will disappear by the start of the 22nd century. That loss would mean a dramatic reduction in the amount of water available for drinking, growing food and combatting diseases in the region. The critical need is to preserve glaciers, an essential water source for billions of people around the world. Glaciers in the Hindu Kush and Himalayas feed three large rivers in South Asia – the Indus, Ganges and Brahmaputra. These rivers support the livelihoods of over 750 million people in South Asia including Bangladesh. They also replenish the groundwater, which is essential for drinking as well as food and energy production. The effects of climate change on glaciers



will impact millions of families and communities. As glaciers melt, changes will occur in the timing and volume of water flow in the three river basins. These shifts will lead to reduced crop yields, lower incomes for families, and increased food insecurity, particularly for children who are vulnerable to malnutrition. The shifts in patterns of water flow can also increase the risk of floods and landslides, which could force people to migrate, disrupting lives and communities. There is also the possibility that water scarcity could trigger conflicts. There needs to be much more focus on generating evidence about the reduction in river flows due to glacial retreat. Climate change and the importance of sustainable practices also are an important part of awareness raising and education. In addition, governments need to strengthen policies and regulations that guide sustainable use of shared water resources and promote environmental protection and climate action. Finally, everyone needs to conserve and use water wisely. It is a finite resource.

Climate Change and Poverty: Bangladesh Perspectives

Poverty and inequality are persistent issues for analysis in the climate change agenda of Bangladesh, especially since the country is extremely vulnerable to climate change hazards and the number of people living in poverty still exceeds 30 million. In general, it is a part of the global 'climate justice' issue which, in turn, is related to 'environmental justice'. The Rio principle of 'Common but Differentiated Responsibility (CBDR)' provides a framework to resolve the 'burden' issue at the inter-country level. In contrast, within-country inequality issue has not received much attention so far in Bangladesh and most other developing countries. It is true that people within a country differ regarding their GHG emissions, and hence equity demands that the mitigation burden needs to be distributed according to GHG contribution of individuals (e.g. Chakravarty et al. 2007).⁸

In view of the practical and other difficulties, the global discussion of climate burden continues to be measured in terms of aggregates or averages of GHG emissions at the country level. Furthermore, the within-country inequality regarding the impact of climate change has received very little attention in Bangladesh and most other countries.

As is well known, like in most other countries, the impact of climate change in Bangladesh was focused initially on the physical side, i.e. impact of climate change on the nature including environment and ecology. Over time, the social impact started to receive attention; and evidence was produced regarding the relationship between climate change and poverty and livelihood.

Effects on poverty and livelihood

The broader social impacts of climate change and their feedback effects have received increasing attention over the last few decades. The World Bank (2002) report presented at the 8th Conference of the UNFCCC noted that climate change was making achievement of the millennium development goals (MDGs) difficult by reducing access to drinking water, decreasing food security, and creating adverse health effects, especially in climate change prone countries like Bangladesh. Several later studies highlight that climate change is likely to increase poverty due to its effects on agriculture, flooding, malnutrition, water resources and health especially in low income countries (see, for example, Stern Report, 2007).

The 2007/2008 Human Development Report devotes an entire chapter on issues of vulnerability and risks arising from climate change especially in countries like Bangladesh (UNDP, 2008). Additionally, World Bank's Global Monitoring Report 2008, titled 'MDGs and the Environment: Agenda for Inclusive and Sustainable Development', points to potential impacts of climate change on poverty and

⁸One proposal is to set a GHG emission cut-off and impose mitigation burden on all individuals who are above the cut-off level. One challenge, however, is to overcome the difficulties in measuring GHG emission at the individual level.



development especially in developing countries (World Bank, 2008). In addition, there are other studies that analyse a wide range of impacts of climate change on poverty (see, Brainard et al., Eds, 2009). Many studies focused on poverty impacts in specific regions or in specific sectors, such as agriculture (see for example, Ahmed et al. 2009; Müller et al. 2011).

Over time, the focus also shifted From broad evidence of the effects of climate change on poverty towards assessing the mechanisms through which these effects are transmitted. In this context, the concept of shared socioeconomic pathways (SSP) has been applied to consider the human development aspects of climate change. These efforts identify four channels through which households could move in and out of poverty – prices, assets, productivity, and opportunities. The key is to examine the effects of climate change on each of these pathways (see, Hallegatte et al. 2014; Lichenko and Silva, 2014). The synthesis of the findings on the relationships between climate change and poverty in different countries may be summarised as ‘complex, multifaceted, and context-specific’.

More specifically, Hallegatte et al. (2016) provides comprehensive guidelines on how to derive maximum synergies between poverty reduction policies and climate change mitigation and adaptation policies through reinforcing each other. In this context, one may also note the gradually increasing focus on human dimensions of climate change impact in the IPCC periodical Assessment Reports (AR), particularly on dynamic interaction between climate change, livelihoods, and poverty.

One may, however, note that -- despite the complex, multifaceted, and context-specific nature of the interactions between climate change, environmental degradation and poverty – the relevant issues have not been adequately researched in Bangladesh so far to draw specific policies and action agendas, especially keeping within-country inequalities and characteristics in view.

Rapidly worsening impact of climate change especially on poverty and inequality in Bangladesh indicates the need for a reassessment of strategies of how we eradicate poverty while also contributing towards the planetary emergency of climate change:

- Reducing the current level of excessive resource consumption by the wealthiest 10 per cent of the country’s population would significantly contribute towards graduating the large majority of the poor from poverty and help ensure that Bangladesh’s contribution to GMG emissions remains within safe boundaries.
- The government needs to adjust its indicators of progress currently measured mostly in terms of economic indicators focused on gross domestic product (GDP) and similar fundamentals to cover indices of national wellbeing that include not only decent jobs and basic social indicators but also the status of the poorest and marginalised as well as the state of environment.
- Sustainable poverty eradication in Bangladesh is directly and strongly linked to the quality of management of the country’s ecosystem and the goods and services that the system provides. The relevant policies need to adopt environmental sustainability as a central objective to eradicating poverty.

Features of Bangladesh’s responses

Bangladesh’s response to climate change and its impacts was driven both by the government and the vibrant civil society of the country. Over the last two decades, the government’s role in combatting climate change and its impacts has evolved; and became more focused on addressing the pertinent issues of climate disaster in the country.

Bangladesh has also become increasingly active in international negotiations within the framework of



UNFCCC, COPs and other relevant forums. Moreover, the country has adopted measures to develop strategic partnerships with least developed countries (LDCs) and G77 group of countries in demanding from the developed countries science dictated mitigation actions towards controlling global warming and adequate climate finances to help the developing countries, particularly the most climate vulnerable and resource-poor countries including Bangladesh. Bangladesh is an important member of the climate vulnerable forum (CVF), which plays an important role in highlighting climate change related sufferings of the member countries and demanding necessary responses from the international community.

In terms of formulation of policies and action programmes and enactment of Acts on various aspects of environment, climate change and related issues, Bangladesh has developed a multifaceted regime over the last few decades. However, despite good progress in adoption of specific policies, action programmes and support measures, proper implementation of the strategic measures at the ground level has always remained a challenging task. Moreover, these actions need regular amendments and adjustments in order to respond to newly emerging realities and insights on climate change related issues which still remain an unresolved issue.

The truth is that mitigation is not a priority issue for Bangladesh. As noted earlier, Bangladesh's total annual GHG emission is miniscule. Even if the country does not emit at all, it will make little, if any, impact on intensifying global climate change and its associated impacts.

Worldwide, a leading sector in terms of GHG emission is the energy sector. As such, an urgent global priority is to fast track transition to renewable energy from using traditional fossil fuel based energy generation. However, for Bangladesh, the need is to carefully analyse the feasibility of such a transition based on the country's realities. At present, solar and hydro- electricity together accounts for less than 3 per cent of the total annual electricity generation of the country. In reality, Bangladesh has no scope for additional hydro electricity generation. Also, the country has a limited wind power possibility. The only major option is solar energy. But, one must also consider significant land requirement of the option that may involve diversion of agricultural land creating adverse impact on achieving the critical food security goals of the country. The need is to carefully determine how much land can be switched to solar electricity generation without adversely affecting food production and food security of the country. This is probably the most critical issue in deciding how much and how fast a switch to solar power should be planned and implemented without adversely affecting food security considerations. Moreover, since mitigation is not a priority issue for Bangladesh, the country's energy policy should continue to remain integrated taking into account different sources of energy including gas, biomass, coal, furnace oil, and other traditional ones as well as the renewables, with the optimal mix determined by availability of access to different sources and cost considerations as well as their implications for food security, poverty and sustainable development of the country.

Nevertheless, although mitigation is not incumbent on Bangladesh in view of its status as a low income country and an insignificant contributor to climate change, the country has pledged to reduce national GHG emissions through its NDC in order to express solidarity with the global efforts. As per the updated NDC, Bangladesh has proposed to reduce its national GHG emissions by 6.73 per cent by 2030 from the business as usual levels unconditionally and by another 15.2 per cent if required international financial support is available. It has been estimated that Bangladesh needs an amount of \$20 billion up to 2030 for fulfilling the unconditional commitment and another \$125 billion for meeting the conditional commitment (Ahmad, 2025). Although it will be difficult for Bangladesh to fulfill the above commitments if the required financial support is not available, Bangladesh needs to undertake all possible efforts to ensure that the required financial support is forthcoming for fulfilling at least the unconditional commitment.

No doubt, the priority for Bangladesh is adaptation, as losses, damages and health hazards are rising



due to climate change induced natural disasters which have been increasing both in frequency and adverse impacts. In fact, Bangladesh has always prioritised the implementation of adaptation actions to make up for the losses and damages and revitalise socioeconomic activities in areas affected by different natural disasters. Bangladesh Climate Change Trust (BCCT) has funded a total of 851 projects since its inception in 2010 up to 2023, largely on adaptation, at a cost of about \$490 million (Ahmad, 2025). But not all of these and other projects were efficiently implemented to achieve their desired outcomes due to a lack of priority considerations in the selection process and weaknesses in monitoring and implementation processes. However, on community based-adaptation, Bangladesh has achieved international recognition despite financial, technological and human capacity limitations. The innovative adoption of the process of government-nongovernment organisation (GO-NGO) cooperation has played a major role in this success. Available estimates indicate that, over the past several years, Bangladesh has been spending up to 1.5 per cent of its annual GDP through relevant ministries and other agencies (Ahmad, 2025). For a resource poor country like Bangladesh, such an extent of domestic mobilisation of climate finance is no doubt encouraging. The key, however, is to ensure proper selection and implementation of adopted action programmes in order to ensure desired outcomes for the adaptation process.

On the other hand, total foreign funds received by Bangladesh for climate actions have been about \$1 billion annually in recent years. The National Adaptation Plan (NAP) 2022 estimates that the annual funding requirement only for adaptation exceeds \$8 billion, the total amount being \$230 billion for the period 2020-2050. In addition, financial requirement for unconditional mitigation as per NDC is about \$2 billion annually. Overall, Bangladesh's current total annual critical need of climate finance including for adaptation and mitigation and related actions is estimated at \$12.5 billion per year (Ahmad, 2025). This shows that the annual climate finance available to Bangladesh from all available sources is well below the country's requirements and needs to be addressed urgently.

Major Recommendations

There are significant policy implications of the analysis presented in the Report. At a broad level, these policies can help to achieve several SDGs. The SDG1 and SDG11 call for 'no poverty' and 'reduction of inequalities' respectively while SDG13 deals with mitigation of climate change hazards. This Report shows that it is possible to address these three goals simultaneously within an integrated framework to derive maximum synergies. The key is poverty and inequality reduction, which also helps to contain the adverse effects of climate change. Moreover, through the feedback effects, these can address climate change itself. Thus, with the implementation of right policies on these issues, a 'virtuous cycle' may replace the present 'vicious cycle' in Bangladesh and across all countries of the world.

Despite significant reduction of poverty, Bangladesh still suffers from relatively high incidence of poverty along with widespread and rising inequalities, while the country is highly susceptible to climate change hazards. In such a situation, the distinction among 'exposure', 'susceptibility' and 'ability to cope and recover' highlighted in this Report is critical in formulating policies that can address different poverty and inequality enhancing effects in the context of climate change. As the Report emphasises, there are overlaps among these effects, and policies are needed that can address more than one of these effects simultaneously. In this context, the above distinction would be helpful in sequencing and targeting what needs to be addressed and what should be the entry point, since the issues are enormous, complex and context-specific. Also, it is important to recognise that these effects vary according to specific local contexts in each regions of Bangladesh and hence 'one-size-fits-all' policies are not pragmatic. Instead, it points to the necessity of designing and implementing policies and programmes based on deeper



analyses of local circumstances of specific regions of the country. Nevertheless, the important issue is to note that the linkages between poverty, inequality and climate change can be successfully exploited only if effective policies and programmes to reduce poverty and inequality are in place.

To summarise, the Report highlights that, in a highly climate change responsive country like Bangladesh, the approach to climate change and poverty needs to comprise of five strategic elements:

- Inclusive and poverty sensitive climate adaptation and mitigation (if feasible).
- Climate-sensitive poverty reduction initiatives.
- Maximum exploitation of cross-cutting and sectoral synergies.
- Desired coherence and coordination within and among institutions.
- Strengthening and supporting local initiatives.

Among the above, the first three strategic elements focus on improving the nexus among existing policy and institutional contexts. The first element is concerned primarily with climate-focused policies or institutions to bring poverty reduction considerations more fully into the climate agenda. On the other hand, the second one emphasises on better integration of the climate agenda with poverty and inclusive development-focused policy or institutions. The third strategic element puts emphasis on adoption of existing and new synergistic approaches that address the climate change and poverty nexus, that are included in sector-specific and broad-based institutions, policies and programmes that do not as yet explicitly address poverty reduction and climate change in an integrated manner.

The fourth and fifth strategic elements under the approach are more focused on monitoring and implementation, in recognition of the fact that addressing the climate-poverty nexus requires particular attention to (i) the institutional structure involved (including accompanying policies and programmes), and (ii) multiple geographical levels of intervention – covering national, regional and local (community) levels. In the context of this Report, the emphasis is on national and subnational (local) levels in Bangladesh.

The overall approach suggested in this Report is based on the above five strategic elements, including recommendations for institutional and policy improvements. Within the framework, some practical programmes and actions are indicated that could be considered as mechanisms to achieve the goals of each element, depending on their appropriateness in the context of specific locational situations. As such, these can be viewed at a number of different levels – national, regional, local and community levels. For instance, the above can be articulated as follows:

- ➡ A set of existing cross-cutting programmes which would provide complementary mechanisms to support the approach, along with creating synergies in implementation. More specifically, the programmes may include disaster risk reduction; social protection; resilience-building strategies and systems approaches (e.g. livelihood and food systems); climate finance; and environmental conservation, stewardship and ecosystem approaches. Some of these programmes are already in existence in different contexts in Bangladesh.
- ➡ The cross-cutting programmes, as well as other components of the approach, can draw on synergy-supporting tools, such as integrated climate change-poverty vulnerability assessment; resilience assessment; integrated monitoring; and poverty focused adaptation toolboxes.
- ➡ Regardless of the level and scale of implementation of the approach, the need is to make explicit appropriate pathways that would be followed over time, to reach the desired goals. This will ensure



the consideration of both short- and long-term dimensions, as well as prior recognition of the need for implementation at multiple levels (national and subnational), along with necessary scaling up and adjustments.

➡ Finally, the implementation of the approach requires consideration of the underlying social value systems, key socioeconomic considerations and risks, and a host of operational factors, such as financing and incentives, capacity-building and knowledge development, and awareness building, communications and information dissemination, and similar other factors responsible for creating a facilitating environment for effective implementation.

In Bangladesh, the need for, and the implementation of, an integrated climate change-poverty reduction approach such as the one proposed in this Report cannot be overemphasised. The approach is particularly relevant to local communities living in diverse climate change vulnerable locations in Bangladesh such as cyclone and flood prone areas, dry lands and other agro-ecosystems that are threatened by a changing climate, as well as dealing with poverty, deprivations and inequalities.

Indeed, whatever may be the location, the key for Bangladesh is to adopt an integrated approach and ensure necessary reforms towards improving policy, institutions, and programmes concerning the climate change and poverty nexus. For ensuring success under the approach, decision-making at all levels needs to be geared specifically to improving the effectiveness of local initiatives linking poverty reduction and climate responses. This would, among others, involve improving the engagement of local actors and communities, particularly in the disaster prone rural areas, with relevant policy institutions at various levels.

Looking Ahead

Climate change hazard, along with its interrelationships with environmental degradation and poverty are, no doubt, real having the capacity to create far reaching and devastating consequences. The traditional treatment of land, water, forests, biodiversity and the nature solely as 'resources' with the only purpose of serving the development aspirations of human beings, unfortunately, ignores the limits of the Earth's ecosystems; its potential carrying capacity relating to the effects of human activities and impact on climate change; and their role in ensuring critical life-supporting services. Moreover, one must also realise that there is no silver bullet to alleviating poverty without exceeding planetary boundaries and causing irreparable climate change and environmental damages.

Available global estimates highlight that the levels of food, energy, and household incomes are not likely to reach acceptable levels for all human beings across all countries of the world without overstepping the planetary boundaries. However, this may not be achievable at the high level which the world's richest countries enjoy under the present unacceptable and unequal global system; but curtailing the excessive resource consumption by the wealthiest 10 per cent of the world's population would allow the poor to emerge out of poverty and help ensure that the Earth remains within 'the safe and just space for humanity'. The policies may include luxury taxes on energy-hungry cars, private jets, second homes, yachts and similar items. There could also be tax breaks to encourage recycling, repairing, and reusing clothing and other consumer goods to avoid discarding them and buying new ones.

The global approach has to reflect the core of the 2030 Sustainable Development Agenda—a more equal world where everyone can enjoy the fruits of development.



Further, it may be emphasised that consumption and human wellbeing are not necessarily positively associated: fossil fuel consumption, for example, can be reduced, while still maintaining a good quality of life in many respects such as public health, life expectancy, and leisure time (Diamond, 2018).

For moving forward, one key aspect is to comprehensively measure and disseminate changes in poverty levels, climate change impacts and environmental transformations, along with their mutual interactions and relationships. While good progress along these directions has been made over the last few decades, more emphasis is needed on producing evidence-rich human development interventions to guide practical policies.

There is also a need to expand the indicators of measuring progress to include, in addition to gross domestic product (GDP) focused economic indicators, decent jobs and other indicators of human wellbeing including the status of the marginalised and disadvantaged populations as well as climate change and environment related indicators.

Moreover, policies are needed that treat climate change issues and environmental sustainability as central to eradicating poverty. No doubt, climate change is a long-term threat to the planet and a threat to livelihoods and human welfare. Competition over resources, rising threat of climate refugees and environment-related migration can lead to rising insecurity and conflicts, undermining poverty reduction. As such, eradicating poverty is directly linked to how climate change hazards are addressed; and how efficiently and effectively the ecosystems and the goods and services they provide are managed. For example, the wellbeing and livelihoods of rural communities, particularly rural women, depend heavily on the health and productivity of the land. Women's equal access to land and other resources, ownership, and control over household and community resources including land and other natural resources can lead to greater gender equality, higher agricultural productivity, better conservation of natural resources, and lead to inclusive growth and development—all essential to poverty eradication along with environmental conservation and climate change adaptation. The urgent need is to fix climate change and other long-term fragilities, inequalities and injustices. This is the time to fix these challenges, build a strong recovery, and seize the opportunity for change.

The present Report highlights the need for adopting an integrated policy approach towards addressing climate change and poverty nexus in Bangladesh. The Report also provides an outline of such an approach involving poverty and inequalities on the one hand and climate change on the other.

The Report maintains that the beginning of such an integrated approach may be made in Bangladesh by undertaking pilot projects in different types of climate hazard intensive locations supplemented by further compilation of relevant data and information in order to test the best modes for implementation of specific approaches. Such actions will help to meet the challenges of ensuring better linking of climate adaptation with poverty reduction initiatives under specific locational characteristics.

Finally, in the context of Bangladesh, it needs to be recognised that financial inclusion is a great enabler to build resilience for the people and businesses vulnerable to climate change and natural disasters. Over 80 per cent of the world's 1.4 billion adults without financial accounts reside in places at risk from climate change, intensifying their susceptibility to economic and environmental shocks. In Bangladesh as well, most of the financially excluded adults live in climate disaster prone rural areas, mostly in remote locations. Financial services enable individuals and businesses to invest in climate-resilient infrastructure, adopt sustainable agricultural practices, and implement energy-efficient technologies, thereby contributing to the reduction of climate change hazards. Moreover, availability of insurance and savings products accelerates recovery from many of the climate hazards. In fostering uptake and market development of financial products and services, policymakers can do better by addressing the range of risks that financial consumers may face; and through becoming responsive to new and changed consumer issues from innovative products and new providers. Effective financial consumer protection regulation and market conduct supervision assists in ensuring that uptake and usage of financial products and services are beneficial to consumers.



At the global level, the fact, however, remains:

- The lowest income countries produce one-tenth of emissions, but are the most heavily impacted by climate change.
- Vulnerable populations in these countries suffer damaging outcomes in terms of health, food and nutrition, water supply and sanitation, education and most other basic needs.

Despite these stark inequalities, developing countries like Bangladesh have a window of opportunities to put effective policies in place. In this context, the world stands on a crossroads regarding fighting the multiple challenges confronting humanity, the most pressing one being climate change. But, as the Report highlights, in line with other countries, the impacts of climate change vary greatly among regions and population groups in Bangladesh. No doubt, this climate crisis is a deeply unfair one, with the poor being disproportionately affected. Bangladesh, being a country with few resources, bears the greatest burden in terms of loss of life and property as well as adverse effects on investment and the economy. As the Report indicates, unchecked climate change would force millions of people to migrate within the country, pushing more people into poverty and unraveling decades of hard-won development achievements.

As the Report highlights, the impacts on the lives of the poor and vulnerable populations are many. For example, in the case of health, climate crisis severely jeopardises the realisation of universal health coverage (UHC) in various ways, including by compounding the existing burden of disease and by exacerbating existing barriers to accessing health services, often at times when they are most needed. Increased water shortages have an impact on water quality and cleanliness, and diarrhoea becomes more common. In terms of food security, the poor people are impacted the most by changes in food production, higher prices and changes in rural incomes as a consequence of impacts on agricultural productivity and prices driven up by either gradual changes in long-term climate trends or more frequent and severe natural disasters. The crop yield losses mean that food prices are higher on average. Similarly, access to water is already being threatened by climate change. Frequent droughts, increased evaporation and changes in rainfall patterns and run-off particularly impact water availability in many parts of the country. Under the circumstances, many households survive economic downturns brought on by decimated livelihoods through counter-productive means such as pulling their children out of school to save on fees and/or putting them to work to make up for lost income. Furthermore, climate change is a powerful driver of internal migration because of its impacts on people's livelihoods and loss of liveability in highly exposed locations. This will create millions of climate refugees through displacement. In addition, work-related hazards are likely to create adverse impact on productivity. For instance, excessive heat during work creates occupational health risks; it restricts a worker's physical functions and capabilities, work capacity and productivity.

Clearly, a climate catastrophe is looming large for Bangladesh as well as for the world at large. However, the good news is that humans still have the 'control of the wheel' and it is possible to avert the catastrophe and a good deal of its debilitating consequences. "But, for that to happen the world must come together without further loss of time and act on the basis of the dictates of science and conscience, rising above narrow national political and other interests" (Ahmad, 2025:12). In addition, the compulsion for all countries is to act in accordance with the principle of CBDR & RC. Bangladesh needs to further strengthen its efforts in COPs and other relevant international forums to highlight the fast deteriorating implications of climate change for the country and the people at large. The country also needs to work more closely with other climate vulnerable countries to exert the needed pressure on the developed countries and other large GHG emitting countries to work together for saving the planet Earth and its inhabitants by reducing GHG emissions enough to keep global warming limited to 1.5°C by the end of this century. Further, these countries need to work together to convince the international community to enhance adequately the international climate finance to support developing, resource-poor, and climate vulnerable countries to adapt to the fast worsening climate change impacts.



Nationally, Bangladesh needs to ensure the required coordination and implementation capacity to secure the best utilisation of available financial, technological and human resources, while trying to enhance the availability of these resources by taking effective and appropriate actions. For the purpose, several actions may be highlighted.

- Prioritise action programmes/projects considering the severity of the adversities caused by climate related disasters and anticipated robustness of the outcomes/benefits. However, it might be realistic to adjust the adopted priority ordering over regular intervals considering the impacts of natural disasters occurring each year. In terms of geographic locations, climate hotspots such as coastal belts, haors, islands, river banks prone to erosion and major flood-prone areas are likely to always remain in the priority list.
- Ensure full participation of the residents of the intervention areas at all stages of the intervention cycle from identification to implementation. They are the best 'consultants' to guide the design and implementation details to provide the desired outcomes.
- Ascertain proper coordination among authorities/agencies that are involved in designing and implementing respective interventions.
- Secure strict monitoring and evaluation to ensure that projects are implemented efficiently and timely without leakage of funds and other resources.

Overall, the message of the Report is loud and clear: Eliminating poverty and fighting climate change cannot be done in isolation – the two can much more easily be achieved if they are addressed together in Bangladesh. The country has a window of opportunities to build resilience and reduce short-term climate change impacts on poverty through development policies that are inclusive and climate-informed. This is particularly true for investments that involve high immediate costs, but are urgently needed to prevent lock-ins into carbon-intensive patterns, such as for urban transport, energy infrastructure or deforestation.

In particular, the structural transformation of the rural economy needs to be speeded up so that fewer agricultural workers are exposed to high temperatures, and less physical effort has to be expended in such conditions. Other important policy measures that can help are skills development, promotion of an enabling environment for sustainable enterprises, public investment in green infrastructure, and improved integration into global trade. The international community can help Bangladesh adapt to climate hazards by providing financial support, technological assistance and developing institutional capacity.

However, the threats to development and the eradication of poverty will only become complicated over time if there are no mitigation measures at the global level. This means that the global community must take immediate action to cut their emissions and strengthen two prime strategies: (i) Pay close attention to ways to reduce emissions that have positive effects on health, economy and development, such as using mini-grids and renewable energy sources in isolated areas or changing to energy-efficient light bulbs and appliances; and (ii) Assist adequately the climate vulnerable low income countries to protect the poor by enhancing social protection, resilience and coping capacity, sustainable livelihoods and other physical and human capital accumulation efforts, which may be paid for by energy taxes, elimination of fossil-fuel subsidies and other climate-friendly resource mobilisation efforts especially in the large GHG emitting countries.



Glossary

Adaptive capacity

The combination of strengths, attributes and resources available to an individual, community, society or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm or exploit beneficial opportunities (IPCC, 2012)

Climate change

Climate change refers to a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes (IPCC, 2018b).

Climate change adaptation

In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate (IPCC, 2014).

Climate risk

In the context of the assessment of climate impacts, the term risk is often used to refer to the potential for adverse consequences of a climate-related hazard, or of adaptation or mitigation responses to such a hazard, on lives, livelihoods, health and well-being, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence (IPCC, 2018b).

Climate variability

Variations in the climate (as measured by comparison with the mean state and other statistics such as standard deviations and statistics of extremes) at all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability) or to variations in natural or anthropogenic external forcing (external variability) (IPCC, 2014).

Conservation

The protection, care, management and maintenance of ecosystems, habitats, wildlife species and populations, within or outside of their natural environments, in order to safeguard the natural conditions for their long-term permanence (IUCN, undated).

Disaster

Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery (IPCC, 2012).



Disaster risk reduction

Disaster risk reduction is aimed at preventing new, and reducing existing, disaster risk and managing residual risk, all of which contribute to strengthening resilience and, therefore, to the achievement of sustainable development (UNISDR, 2017).

Ecosystem stewardship

A strategy to respond to and shape social–ecological systems under conditions of uncertainty and change to sustain the supply and opportunities for use of ecosystem services to support human well-being (Chapin et al., 2010).

Mitigation (of climate change)

A human intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC, 2014).

Nationally Determined Contributions (NDCs)

A term used under the United Nations Framework Convention on Climate Change (UNFCCC) whereby a country that has joined the Paris Agreement outlines its plans for reducing its emissions. Some countries' NDCs also address how they will adapt to climate change impacts, and what support they need from, or will provide to, other countries to adopt low-carbon pathways and to build climate resilience. According to Article 4 paragraph 2 of the Paris Agreement, each Party shall prepare, communicate and maintain successive NDCs that it intends to achieve. In the lead up to 21st Conference of the Parties in Paris in 2015, countries submitted Intended Nationally Determined Contributions (INDCs). As countries join the Paris Agreement, unless they decide otherwise, this INDC becomes their first Nationally Determined Contribution (NDC) (IPCC, 2018b).

Resilience

The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management (United Nations, 2016). The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation (IPCC, 2014, p.5).

Social protection

A set of policies and programmes that provide cash or in-kind support to help people manage risks by smoothing consumption, thereby preventing the adoption of negative risk-coping strategies and their impoverishing impact (Ulrichs et al., forthcoming).

Vulnerability

The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards (UNDRR, 2017). It is referred to as social vulnerability when the objects discussed are people (Adger, 1999). The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC, 2018b).



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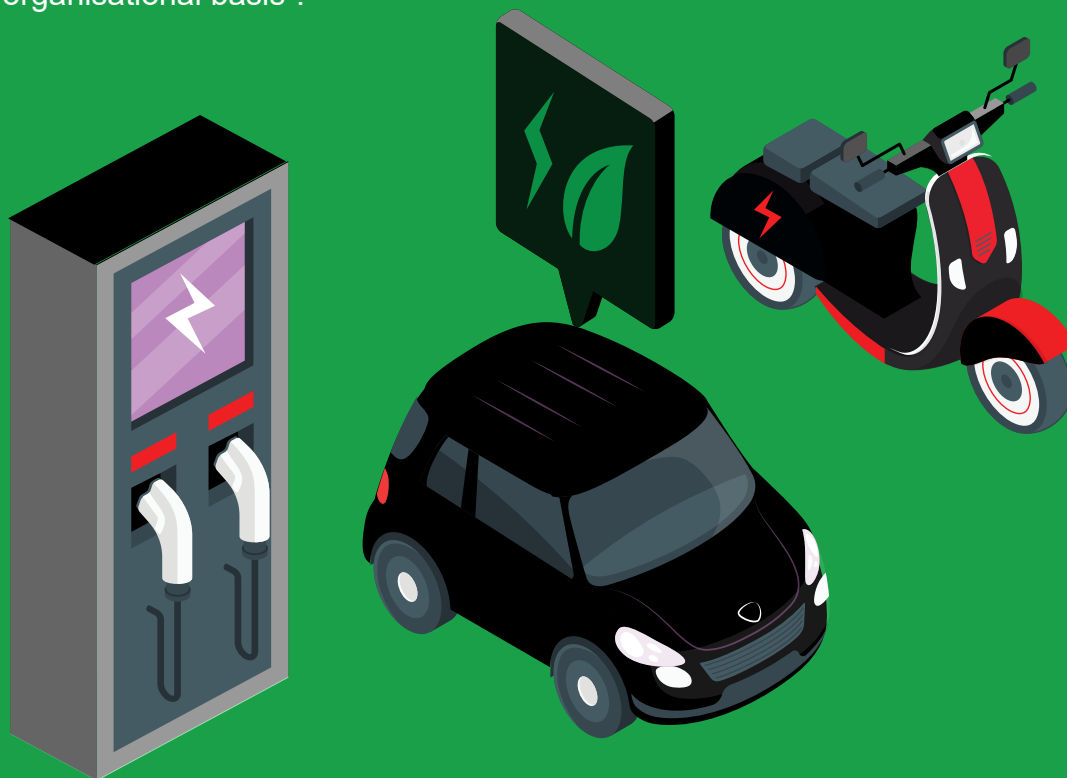


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One solution is to buy electric cars?!

Carbon Literacy is: "An awareness of the carbon dioxide costs and impacts of everyday activities and the ability and motivation to reduce emissions on an individual, community and organisational basis".



Bike 30 kg CO₂e

Coach 40 kg CO₂e

Train 64 kg CO₂e

Small electric car (driver only) 148 kg CO₂e

Small efficient petrol car (driver only) 237 kg CO₂e

Plane 368 kg CO₂e

Large SUV (driver only) 1.02 tonnes CO₂e



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